An Investigation on Agricultural Experts’ Attitudes about Entrepreneurship Potential of Nanotechnology

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ABSTRACT: A descriptive type of research was conducted to investigate Iranian agricultural experts’ attitudes towards entrepreneurship potential of nanotechnology. The total population was all agricultural experts working in research institutes through Iran. Using Cochran formula, 210 experts were selected based on proportionate random sampling. A questionnaire was developed by the researcher and used to collect data. The dependent variable for this study was experts’ attitude about entrepreneurship potential of nanotechnology which was measured by asking questions in Likert scale. Descriptive statistics were used to describe data and correlation coefficients were used to measure relationships between independent variables and experts’ attitudes towards entrepreneurship potential of nanotechnology. Results showed that there were relationship between attitude of respondents and some independent variables such as age, entrepreneurial spirit and job experience.

Key Words: Nanotechnology, Attitude, Agriculture Expert, Entrepreneurship, Iran.

INTRODUCTION

Nanotechnology today is regarded as a revolutionary technology that can help address key needs relating to energy, environment, health and agriculture in developing countries. Worldwide, there has been an increasing interest in nanotechnology as evident from the rising trends in investment and policy initiatives directed towards this end. Nanotechnology can enable cost effective solar and fuel cells with higher efficiency. Nanomaterials could also facilitate energy saving through nanomaterials aided efficient lighting (LEDs), nanocatalysts that improve combustion processes and also better insulation materials. Overall nanotechnology interventions could enable the successful development of renewable energy solutions and reduce our dependence on fossil fuels. Enhancement of agricultural productivity has been identified as the second most critical area of application of nanotechnology for attaining the Millennium Development Goals. Nanotechnology is believed to enhance agricultural productivity through genetic improvement and make crops more resistant to heat and water logging (Teri, 2010).

Agriculture has long dealt with improving the efficiency of crop production, food processing, food safety and environmental consequences of food production, storage and distribution. Nanotechnology provides a new tool to pursue these historically relevant goals (Scott & Chen, 2003).

In terms of environmental impacts, nanotechnological innovations may, in specific circumstances, either ameliorate or intensify existing levels of resource use, pollution emissions, soil and water degradation, and loss of biodiversity in particular instances. For example, nano-pesticides and precision farming may in some cases allow the more targeted and reduced use of chemical inputs on the farm. At the same time, nanotechnological innovations may facilitate the overall expansion of large-scale and resource-intensive systems of farming, food manufacturing and distribution, and the ecological problems associated with them (Scrinis & Lyons, 2010).

Nano-scale technologies also introduce novel forms of ecological and health hazards, such as the potential toxicity of nanoparticles used on the farm or added to processed foods and food packaging. Despite the enhanced level of precision associated with the nanotechnological manipulation of nature at the atomic and molecular level, there is nevertheless still a considerable lack of precision in understanding and being able to control the consequences of these nano-atomic level manipulations (Dupuy & Grinbaum, 2006; RCEP, 2008).
As with other new technologies, nanotechnology evokes enthusiasm and high expectations: for new progress in science and technology, new productive applications and economic potential (Renn & Roco, 2006). So many nations and firms around the world are also making substantial investments in nanotechnology to reap its potential benefits. Between 2001 and 2004, more than 60 countries established nanotechnology programs at the national level (Roco, 2011).

Perception is an important part of public understanding of science and technology and it could affect the technology role in life (National Academy of Sciences, 2000). Attitudes and views of people and experts can affect all aspects of technology development. In the case of nanotechnology, people’s knowledge about nanotechnology and the attitudes that they have toward it may affect the environment for research and development (especially support for public R&D funding), regulation, market acceptance of products incorporating nanotechnology, and, perhaps, the ability of nanotechnology to weather a negative event such as an accident or spill (Sargent Jr., 2012).

The results of a survey by Hart Research Associates in 2007 showed a strong positive correlation between familiarity with and awareness of nanotechnology and perceptions that benefits will outweigh risks (Hart, 2007).

The findings of a study by BMRB Social Research (2004) in Britain regarding the public’s knowledge of nanotechnology and their attitudes toward nanotechnology effect on quality of life showed that the public has a low knowledge of nanotechnology, influenced by age, gender and socioeconomic status.

Public understanding and attitudes may also affect the environment for R&D, regulation, and market acceptance of products incorporating nanotechnology (Sargent Jr., 2012).

Likewise, the views and opinions of experts on entrepreneurship in nanotechnology are important. So, the purpose of this study was to investigate the factors associated with attitudes of agricultural experts towards entrepreneurship potential of nanotechnology in Iran.

MATERIALS AND METHODS

This was an applied type research and a descriptive/correlative method was used. The total population of the study was all agricultural experts in 25 research institutes of the Ministry of Agriculture that were involved in the nanotechnology research and development (N=1226) and 210 experts were selected by Cochran formula, based on proportionate random sampling.

The instrument to collect the data was a structured questionnaire and in order to measure validity of the questionnaire, a panel of experts has reviewed. The reliability of questionnaire was measured by using cronbach alpha and computed alpha was about 0.84 that shows that the questionnaire was highly reliable.

The dependent variable for this study was experts’ attitude about entrepreneurship potential of nanotechnology which was measured by using Likert scale. The independent variables were individual, entrepreneurial spirit, educational field and scientific degree along with personal characteristics of respondents.

To analyze the data collected, t-test and ANOVA (Analysis Of Variance) was used to compare the attitudes of different groups of agricultural experts, and correlation coefficients have been utilized which include spearman and Pearson test of independence through Statistical Package for Social Science (SPSS).

RESULTS

Based on the results, the majority of experts (57%) fell into the 31-40 age category. Approximately 33% were between the ages of 41 and 50, and 5.8% less than 30 years old with the remaining 4.2% of experts over age 50. Of course, this varied significantly from institute to institute. However, it seems that such an age distribution may have an effect on whether experts how think about entrepreneurship potential of nanotechnology, but following results show that differences in attitudes are due to some other variables.

Findings showed that 87.2% of experts were male and the rest (12.8%) were female. Experts were asked to indicate the number of years of job experience that they possessed. Years of job experience ranged from 2 to 30 years with the mean of 12.4. The findings also showed that entrepreneurial spirit of about 37% of experts was less than moderate (table 1).
Experts also were asked a series of questions to assess their attitude about entrepreneurship potential of nanotechnology. First and most obvious, experts were asked if nanotechnology is a unique opportunity for business development in the 21st century. The findings showed that 87.8% of the respondents surveyed agreed with this matter. Based on 12 statements that designed to measure experts' attitudes toward entrepreneurship potential of nanotechnology, more than 80% had appropriate attitude towards the subject. Moreover, the means of their perceptions about these statements were more than 4 which show their positive attitudes towards nanotechnology (table 2).

According to the findings, among the averages of the variable of experts' attitudes towards entrepreneurship potential of nanotechnology, significant difference was exposed when the two groups of male and female respondents are compared together. Based on the results of means comparing by t test, also there was a significant difference between two groups of experts who had a professional business as an extra job and those who did not (table 3).

The ANOVA results show that there is no significant difference between the experts' attitudes in different educational field towards entrepreneurship potential of nanotechnology. On the other hand, these results show that different groups which are grouped based on employment status have different attitude toward entrepreneurship potential of nanotechnology. Also, the attitudes of experts with different scientific degree have significant difference in level of 0.01 (table 4).
Table 4. The results of ANOVA according to independent variables

<table>
<thead>
<tr>
<th>Variables</th>
<th>Variance Between Groups</th>
<th>Variance Within Groups</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>educational field</td>
<td>29.72</td>
<td>4.87</td>
<td>1.21</td>
<td>0.213</td>
</tr>
<tr>
<td>employment status</td>
<td>37.48</td>
<td>2.60</td>
<td>6.15**</td>
<td>0.003</td>
</tr>
<tr>
<td>scientific degree</td>
<td>35.37</td>
<td>2.74</td>
<td>4.30**</td>
<td>0.006</td>
</tr>
</tbody>
</table>

*p<0.05   **p<0.01

Spearman and Pearson coefficient was employed for measurement of relationships between independent variables and experts’ attitudes towards entrepreneurship potential of nanotechnology. Table 5 displays the results which show that there were relationship between perception of respondents about entrepreneurship potential of nanotechnology and age, entrepreneurial spirit, job experience, research plans, amount of scientific papers and educational courses as independent variables (table 5).

Table 5. Correlation measures between independent variables and the attitude of agricultural experts

<table>
<thead>
<tr>
<th>Independent variables</th>
<th>Dependent variable</th>
<th>R</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>experts’ attitudes towards entrepreneurship potential of nanotechnology</td>
<td>0.187*</td>
<td>0.017</td>
</tr>
<tr>
<td>Entrepreneurial spirit</td>
<td></td>
<td>0.242**</td>
<td>0.001</td>
</tr>
<tr>
<td>Job experience</td>
<td>experts’ attitudes towards entrepreneurship potential of nanotechnology</td>
<td>0.158*</td>
<td>0.037</td>
</tr>
<tr>
<td>Research plans was done</td>
<td></td>
<td>0.239**</td>
<td>0.002</td>
</tr>
<tr>
<td>Amount of scientific papers</td>
<td></td>
<td>0.268**</td>
<td>0.000</td>
</tr>
<tr>
<td>Educational courses</td>
<td></td>
<td>0.360**</td>
<td>0.000</td>
</tr>
</tbody>
</table>

*p<0.05   **p<0.01

DISCUSSION

According to the results, majority of respondents had appropriate attitude towards the entrepreneurship potential of nanotechnology in agriculture sector. It was reported only 2 percent had a negative attitude about the subject. This can be because of innovative and creative nature of nanotechnology and its recent applications in agriculture sector. As Michelson (2008) believed that nanotechnology could solve some of the major problems in agriculture.

In comparing the attitudes of different groups of experts, it was found that there is significant difference between male and female experts’ attitude towards entrepreneurship potential of nanotechnology. Also, the experts who had a professional business hold a more positive attitude towards entrepreneurship potential of nanotechnology than other experts. These results showed that different groups which are grouped based on employment status or scientific degree have different attitude toward entrepreneurship potential of nanotechnology.

The findings of Correlation analysis also showed that there were relationship between perception of respondents about entrepreneurship potential of nanotechnology and age, entrepreneurial spirit, job experience, research plans, amount of scientific papers and educational courses. Therefore, it is suggested that in order to create a positive attitude in experts and to lead them to programs related to agricultural nanotechnology, various educational programs and in-service training strategies practiced by relevant governmental organizations and private sector could be useful to increase experts’ knowledge about applications of nanotechnology in agriculture and enhance their entrepreneurial spirit.

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