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Full Length Research Paper

Role of public sector in developing agricultural biotechnology in Iran

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Agricultural experts in the field of biotechnology in Iran were surveyed in order to explore their perception about factors influencing the participation of public sector in developing agricultural biotechnology in Iran. Based on the results of the study, policy making, marketing, infrastructural, educational and research factors determined about 74% of variance of factors influencing the participation of public sector in developing agricultural biotechnology.

Key words: Biotechnology, agriculture, Iran, public sector.

INTRODUCTION

Population issues, food, health and safety are serious challenges that are subject to intense debates. In one hand, human are facing the destruction of basic resources such as water and soil and on the other hand, increasing world population and its negative consequences are considered serious threats to developing countries. In this regard, the key question is how the production threshold can overcome food security problems and poverty without destroying soil and water resource?

Over the past two decades, agricultural biotechnology has developed rapidly and world economy has become more globalised and liberalized. This has boosted private investment in agricultural research and technology, exposing agriculture in developing countries to international markets and the influence of multinational corporations. But the public sector still has a role to play, particularly in managing the new knowledge, supporting research to fill any remaining gaps, promoting and regulating private companies and ensuring their effects on the environment (Pinero, 2007).

Harnessing biotechnology and its applications for the benefit of the poor will require considerable attention in many areas, such as allocating additional public resources to agricultural research; accessing of resource poor farmers to biotechnology; improving the seed distribution and extension systems; building of capacity of the public sector in biotech R&D; educating public; approving policies and regulatory frameworks on biosafety, food safety and intellectual property rights (IPRs) and enhancing stronger public-private sector (Escaler, 2002).

There is a need for continued public sector investments from domestic and external resources and public and private partnership (Ozor, 2008).

Governments have a basic role in promoting and utilizing biotechnology and their role are more important in weak economies (Mugabe, 2002).

Despite the potential benefits of involving the private sector in international development, it is important to clarify that the private sector will not replace the role of the public sector in research generally and particularly in facilitating broad application of biotechnology in developing countries (Lewis, 1999).

The public sector continues to be largely responsible for knowledge management-that is, articulating national needs, matching them to scientific opportunities, mobilizing available technology, and adjusting them to farmers' needs (Pineiro, 2007).

It is important to point out that public sector contributes in developing biotechnology in the following ways (Maghsoudi, 2002):

1. Approving supportive policies such as tax incentives

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Table 1. Variables and their measurement scale.

Variable	Measurement scale
Policy making Factors	Five- point Likert
Infrastructural Factors	Five- point Likert
Marketing Factors	Five- point Likert
Educational Factors	Five- point Likert
Research Factors	Five- point Likert

and financial support for private sector;
2. Investing in basic research and applied biotechnology;
3. Training experts and experienced human resources;
4. Approving of regulation related to intellectual property rights;
5. Developing linkages between university and industry;
6.Creating a culture in the society that provide growth; and
7.Searching international markets for selling these products.

Public sector has a role in basic and strategic research and it can collaborate with private sector in assessing social and economic conditions. It could also facilitate the process of acquiring legal permission and providing infrastructural resources (Kameri et al., 2001).

Much of the developing societies today depend on public sector investments in agricultural research and extension, but budgets for the research have declined in many developing countries (Ozor, 2008).

The most common form of public support is loans and supportive mechanisms include tax breaks and technical and information assistance (Mohseni, 2008).

Shoemaker et al. (2001) reported that appropriate regulations would increase partnership between public and private sector. In the United States, public research centers are permitted to issue licenses for their inventions. Stevenson-Wydler law provides this oppor-tunity for public research institutions to develop mechanisms for distributing innovations.

The public sector should also both promote private investment and regulate private companies. Several policies can help encourage the private sector to invest in technologies that are relevant to farmers in developing countries. First, adequate intellectual property rights legislation can be put in place. This allows private companies to protect profits from their research, helping attract investors and promoting research. Second, tax and credit facilities can provide indirect economic incentives to investment. Third, setting up frameworks for turning new technologies, like seeds or agrochemicals, into commercial realities—for example consistent biosafety regulations, royalty agreements, profit sharing and reinvestment—can be used to encourage interactions between private firms and public institutions, supporting joint activities (Pineiro, 2007).

The current situation in agriculture sector in Iran cannot accommodate the growing needs for food production. The majority of farmers in Iran are subsistence farmers and the main barrier to empowering them is their lack of knowledge about new methods and technologies.

In Iran, beside the import of agricultural products, farmers as an important part of population need a significant support from government. The agriculture's biggest problem is the low level of productivity and lack of appropriate promotion of new technology such as biotechnology (Kefayatee, 2001).

In this regard, a radical approach to spread and promote the adoption of biotechnology by farmers is underway in Iran. 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).

Iran like other developing countries, in order to have a better access to world markets in biotechnology, should consider issues such as access to market, intellectual property rights, risk management and effective control systems in managing the development of biotechnology.

MATERIALS AND METHODS

The methodology used in this study involved a combination of descriptive and quantitative research and included the use of factor and descriptive analysis as data processing methods.

The research population included agricultural biotechnology experts in the public and private sectors (N=66). The data was collected by interviewing the respondents and analyzed by using factor analysis technique.

Measuring respondents' attitudes towards role of public sector in developing biotechnology has been achieved largely though structured questionnaire surveys. The final questionnaire was divided into several sections. The first section was designed to gather information about personal characteristics of respondents. The second section dealt with questions about perception of respondents about factors influencing the development of biotechnology by public sector. Five factors were presented in a 5-point Likert format. The variables and their measurement scale are presented in Table1.

Content and face validity were established by a panel of experts consisting of faculty members at Science and Research Branch, Islamic Azad University, and some experts in the Biotechnology Research Institute. Minor wording and structuring of the instrument were made based on the recommendation of the panel of experts.

A pilot study was conducted to determine the reliability of the questionnaire for the study. Computed Cronbach's Alpha score was 94.0%, which indicated that the questionnaire was highly reliable.

To determine the appropriateness of data and measure the homogeneity of variables about factors influencing the participation of private sectors in developing agricultural biotechnology from the viewpoints of biotechnology experts in Iran, the Kaiser-Meyer-Olkin (KMO) and Bartlett's test measures were applied. These statistics show the extent to which the indicators of a construct belong to each other. KMO and Bartlett's test obtained for these variables show that the data are appropriate for factor analysis (Table 2). The Kaiser criterion also was utilized to arrive at a specific number of factors to extract. Based on this criterion, only factors with Eigen-

Table 2. Kaiser-Meyer-Olkin (KMO) measure and Bartlett's test to assess appropriateness of the data for factor analysis.

KMO	Bartlett's test of sphericity	
	Approximately chi	Square Significance
0.736	3.813×10^3	0.000

Table 3. Number of extracted factors, Eigen-values and variance explained by each factor.

Factor	Eigen-value	% of variance	Cumulative % of variance
Policy making	3.885	20.47	20.47
Research	2.828	14.87	35.34
Infrastructural	2.793	14.70	50.04
Marketing	2.755	14.50	64.54
Educational	1.976	10.40	74.94

values greater than one were retained.

RESULTS

The mean age of respondents was 36.8 years. 78% of experts were male and the rest were female. Experts were asked to report their educational backgrounds: 7.6% of respondents had bachelor degree; 43.9% of respondents had master's degree and 47% had completed their PhD degree. The mean of working experience for experts was 9.5 years. Less than half of them had a degree in biotechnology (45.5%).

The classification of the factors into five factors was displayed in Table 3. The factors were classified in infrastructural, policy making, technical, marketing and research.

KMO and Bartlet test were used to show the extent variables have correlation and dependence to each other. In factorial analysis when KMO is less than 0.5, data are not suitable for factorial analysis and when KMO is between 0.5 to 0.7, data are suitable for factorial analysis. KMO amount and meaningful level of Bartlett test indicated in Table 2 shows that they are very suitable for factorial analysis.

Table 3 represents components of each factor, as well as, portion of each factor from the total common variance. As one may observe, about 74.94% of total common variance is explained by these five factors, where the majority of it has been explained by the policy making factor.

The varimax rotated factor analysis is shown in Table 4. In determining factors, factor loadings greater than 0.50 were considered to be significant. As anticipated, the first factor accounts for 20.47% of variance and 5 variables were loaded significantly.

A relevant name for this on loading's pattern is "policy making factor". Eigen-value of this factor is 3.885, which is placed at the first priority among the factors influencing participation of public in developing biotechnology in Iran.

The second factor contains 5 variables relating to "research factor". The Eigen-value for this factor is 2.828 which explain 14.87% of the total variance. The name assigned to the third factor is "infrastructural factor". This factor with Eigen-value of 2.793 explains 14.70% of the total variance of factors influencing the participation of public sector in developing biotechnology. The forth factor is associated mostly with the variables related to "marketing factors". These variables explain 14.50% of total variance. The last factor was "educational factor" with 10.40% of variance of factors influencing the participation of public sector in developing agricultural biotechnology

DISCUSSION

A wide range of factors influences the development of agricultural biotechnology in Iran. Public sector plays an important role in the development of new technology in developing countries. Based on the perception of biotechnology experts, five factors determined about 74% of variance of factors influencing the participation of public sector in developing agricultural biotechnology.

The findings show that policymaking factor had the most important role in persuading public sector to develop biotechnology in agriculture sector. This result is in accordance with the findings of Maghsoudi (2002) and Mohseni (2008).

Infrastructural factors are also crucial in determining the role of public sector in developing biotechnology. Ozor (2008) citing Mugabe (2003) indicated that the developing countries have not established and applied strategies for research institution working in biotechnology. Such institution lack scientific and technological infrastructure for sustained agricultural biotechnology R&D.

The results show that research factors could influence the public sector, because most of the research centers

Table 4. Variables loaded in the factors using varimax rotated factor analysis.

Factor	Variable	Factor loading
Policy making	Trade Strategies	0.846
	Developing necessary regulation such as intellectual property rights	0.808
	Acquiring legal license and agreement	0.736
	Linkages with international organizations	0.690
	Agricultural Biotechnology management	0.602
Research	Establishing genetic bank	0.778
	Basic research	0.726
	Training researchers	0.678
	Transferring biotechnology findings	0.644
Infrastructural	Providing financial resources	0.702
	Access to technical equipments	0.733
	Knowledge about plant varieties and animals	0.806
Marketing	Producing large amount of biotechnology products	0.883
	Applied research	0.807
	Access to markets	0.716
Educational	Access to information and communication networks	0.737
	Technical knowledge and scientific information	0.641
	Applied research	0.567

in developing nations are in control of governments. Research and development in developing countries significantly is in control of public sector (Kameri et al., 2001).

Educational factors are likely to be the key factors influencing the development of biotechnology in agriculture sector. It is well known that existence of information sources and technical knowledge would accelerate the process of developing biotechnology by public sector.

It recommend the initiation of a wide range of participatory processes to enable direct input from the general public into new technology assessment and determination of priorities and principles for public policy, R&D and legislation (Johnson et al., 2007).

Based on the results of this study, it is apparent that there is still need to further research about other factors that could influence the development of agricultural biotechnology by public sector in Iran.

REFERENCES

Escaler M (2002). Public- Private Partnerships in modern biotechnology. Available: http://www.scidev.net/en/policy-briefs.

Ghareyazie B (1999). Iran: Hopes, Achievements, and Constraints in Agricultural Biotechnology. In Persley GJ, Lantin MM (Ed.), Agricultural Biotechnology and the Poor. An International Conference on Biotechnology. Washington: CGIAR.

Johnson PD, Santillo J, Parr D (2007). Policy on nanotechnology. Greenpeace Environmental Trust.

Kameri Mbote P, Wafula D, Clark N (2001). Public and private partnership for biotechnology in Africa. African Center for Technology Studies.

Kefayatee E (2001). The situation of biotechnology industry and research. Available online at: http://www.bio.itan.ir

Lewis J (1999). Leveraging partnerships between the public and private sector - experience of USAID's agricultural biotechnology program. Agricultural biotechnology for the poor. Proceedings from an international conference. CGIAR.

Maghsoudi N (2002). Commercialization of biotechnology with emphasize on the role of public sector. Hamshari. Daily 11:31-46.

Mohseni Azar M (2008). Assessment of role of public sector in developing private biotechnology companies in Iran. Available online at: http://www.azarbiotech.blogfa.com.

Mugabe J (2002). Biotechnology in Sub-Saharan Africa: Toward a policy research agenda, ATPS special series paper p.3.

Ozor N (2008). Challenges and impacts of agricultural biotechnology on developing societies. Afr. J. Biotechnol. 4:322-330.

Pinerio M (2007). Agricultural technology transfer to developing countries and public sector. CGIAR, Washington D.C.

Shoemaker R, Harwood J, Day-Rubenstein K, Dunahay T, Heisey P, Hoffman L, Klotz Ingram C, Lin W, Mitchell L, McBride W, Fernandez Cornejo J (2001). Economic issues in agricultural biotechnology. ERS Agriculture Information Bulletin p.762.