
Optimum strategy for agricultural mechanization development in Iran

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Agricultural mechanization is an approach, which makes possible that the agricultural section of Iran leads to industry and commercial production. Lack of a practical plan for agricultural mechanization development in Iran is the major problem. For planning in this field, it is necessary to determine mechanization definition, development process and cycle, challenges, mission (fundamental adjective), long-term goal, and optimum strategy for agricultural mechanization development. Therefore for compilation of optimum strategy, a descriptive and practical research was taken place with survey and documentation research method for agricultural mechanization development planning –with maximum practical capability- in Iran. The sequential changes in science and technology, which has had certain effects over agricultural mechanization, was the cause for using strategic planning methodology for optimum strategy planning. We used brain storming methods for recognizing challenges. Also interview and field observation was used for information gathering and analyzing questionnaires. Sample statistical society, was composed from 809 persons, who were experts in social, economic, planning, management, agricultural engineering and mechanization. With the results, the mission (fundamental objective), long-term goal and optimum strategy were determined. The results showed that the most important challenges for mechanization development in Iran are classified into four groups: social, economic, technical, plan and management. In this research, practical definition of agricultural mechanization, its process and cycle, its challenges and its optimum strategy in Iran were given. Optimum strategy for agricultural mechanization development is, increasing knowledge and technical skills of producers and machinery operators, development of economical insight of producers, development of guild organizations, improving financial affair and reducing injuries of machinery operators and producers.

Key words: Agricultural mechanization

Introduction

It is essential for all persons in agricultural sector to use current findings and technologies to improve the quantity and quality of their products, as well as being able to compete in the local, regional and perhaps world market. Lack

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of consideration to the necessity of development in mechanization of agricultural sector, insufficient cooperation between industrial and agricultural sector, unrealistic selection of goals and objectives and perhaps, more importantly miss use and poor management of resources could all be counted toward the considerable fall back in the agricultural sector.

To this date, we are yet to find considerable findings and research backgrounds in Iran related to agricultural mechanization development. In the years 1991 and 1997 numerous attempts were made by the officials of Ministry of Agriculture to move toward development of mechanization process plan in Iran with very little applicable result. On the other hand, we can clearly see the 90's as the turning point for development of agricultural mechanization with FAO playing the central role in respect to design, programming and support for agricultural mechanization development strategies. Content analysis of related documents in other countries related to mechanization development shows different view points. Some are more with concentration in national level (e.g., agricultural mechanization development in Indonesia, Slovak and Philippine) (Clarke *et al.*, 1993). Some of these views concentrates on geographical field in regional level like a specific region, (e.g., agricultural mechanization projects in the east and south of Africa) (Clarke and Simalenga, 1997) and some pay special attention to specific area of one country (e.g., agricultural mechanization development in southeastern Anatolia in Turkey, Punjab of India). There are also projects with their attention on specific subjects, such as optimum strategy of mechanization development for weed control in Spain (Peruzzi *et al.*, 2002).

In the year 1989, the agricultural mechanization policy and strategy of Thailand were published. In this document the focus was on topics like structural policies in agricultural mechanization, technological management and farm management, and designing strategic models for agricultural mechanization development in Thailand (Rijk, 1989). In the same year, the project of agricultural mechanization policy and strategy of Indonesia was one of the projects which were supported by FAO. In this project, the attention was paid to local resources of Indonesia and policies for agricultural mechanization development. (FAO, 1989)

In the year 1993 a report was published on mechanization development in Slovak Republic. Financial aids, credit for supplying agricultural machines and equipments, technical aids and education to use machines were the subjects of this report (Clarke *et al.*, 1993). In the year 1993, the report of agricultural mechanization strategy for Malawi was published. This report focused on choosing technology suitable for the climate of that country and necessary support for agricultural mechanization development (FAO, 1993).

In year 1997 a comprehensive survey was published by FAO for agricultural mechanization strategy formulation concepts and methodology (FAO, 1997). In the year 1997, after publishing the report of the farm mechanization and strategy formulation in East and Southern Africa, (Clarke and Simalenga, 1997) a survey was published about the agricultural mechanization development in Kenya, Lesotho, the United Republic of Tanzania, Uganda, Zambia, Zimbabwe (Muchiri, 1997). In this survey, because of common problems of these countries about mechanization and small farm, the specific strategy for small farm for agricultural mechanization recommended. (FAO, 1997)

In the year of 1998, a project was done in India to determine long-term mechanization strategy at national level issues (Pandy, 1998). In the year 2003, the results of a survey were published in Philippine to clarify way of agricultural mechanization development (Philippine, 2003). In the year 2005, a comprehensive research was done in order to use agricultural technology in small farm in Philippine. In this research, mechanization policies were given. Its main approach was technology transfer and harmonizing mechanization with the climate and measuring the usage (Paras *et al.*, 2005). Also, in the year of 2005, a research was done to specify technology transfer strategies for small farm mechanization in the Philippines. The most important strategies for this reason were: information dissemination and management, creation of farmer's organizations, training for farmers, extension agents and manufacturers, focused R&D, revitalized government policies, creation of credit facility and increase income. (Fernando *et al.*, 2005)

Mechanization is an approach which makes possible the development of agricultural sector. Therefore planning for mechanization development was the most important factor in planning the agricultural development and its objective related to the documents containing the main objectives of the country at large. for example " In the Third National Program Of Economic, Social And Cultural Development of Islamic Republic of Iran", "general policies of the Forth Program of Economical, Social and Cultural Development", "Long-Term Mechanization Strategy at National Level Issues and Recommendations" and specially "The Vision of The Islamic Republic of Iran, year 1404" (Moazzen, 2004).

The key elements with direct effect in the research were as follows: Lack of unified definition for the agricultural mechanization. Lack of understanding of mechanization process and the means for its development. Presence of obstacles in agricultural mechanization development and its roots. Lack of clear fundamental vision for development of agricultural mechanization. Lack of having national and local optimum strategy for agricultural mechanization

development. Lack of having an integrated and practical plan based on increase of productivity resulting from mechanization.

The goal of this research was to analyze key elements of practical program for agricultural mechanization development, to define a comprehensive definition for agricultural mechanization, to analyze agricultural mechanization process and cycle, to identify a challenges in the process of agricultural mechanization, to clarify and explain the fundamental objectives and long-term goals in agricultural mechanization development and to offer the optimum strategy for mechanization in agricultural sector.

Materials and methods

This project was a comprehensive work in national level scale done at the request of Ministry Agriculture and Infrastructure for finding the optimum strategy of mechanization development in Iran.

The Sample statistical society was composed of 809 experts in sociology, economic, planning, management, agricultural engineering and mechanization coming from various parts of country, including but not limited to university professors, and executives active in public and private sector.

Mechanization is a multi-dimensional concept and includes social, economical bases, technical and agricultural engineering, agricultural machinery engineering, programming and more importantly management. Consequently study of mechanization should be done using methods in which using the expert's views would be possible.

Considering the fact that a wide portion of the agricultural sector, benefits from mechanization which it self was a consequence of many more external and internal factors. Then we would be paid a special attention to some other elements effective in the issue such as the level of owner ship of the land, standards applicable and perhaps the cost of energy at the time of analyzing mechanization and agriculture issue. Therefore in this research, the interaction of the mentioned cases with agricultural mechanization, have been studied and the view points of experts in related fields of mechanization had been used. For collecting information, we studied the existing documents, questionnaires, interviews and field observations using Delphi method of action. In recognition of agricultural mechanization challenges and attaining the expert's views, the method of brain storming was used.

The multi-dimensional and multi-disciplinary concept of mechanization and the variety of fields and experts resulted in the selection of statistical samples. Therefore, we used stratified random sampling method for determination of statistical society. The number of persons forming the statistical society was determined to be 809.

The questionnaires were filled up by these experts (i.e., 809 experts), the statistical society was interviewed and field observation was done. The Fig. 1 shows the quantity of participants in interviews from various special fields of Iran and Fig. 2 shows quantity of participants in interviews from various provinces of Iran.

Results and discussion

The specific characteristics of an agricultural mechanization development plan

Mechanization development by its nature has a wide range of influences on almost all aspects of agricultural sector, using mechanization development plan resulted to identify appropriate objectives and using methods, which improved productivity and permanent development. Mechanization development strategies should be done in a manner which would result to the least mistaken and executable. In other words, it should have the most consistency with the agricultural conditions of Iran.

The present research was done based on survey and documentary research methods in order to answer the research questions regarding the optimum strategy of agricultural mechanization in Iran, while using the strategic planning model. In this model after determination of the “fundamental objective” and conducting the environmental studies and cross checking the results with the long-term goals, we have defined all the strategies and optimum strategy. Fig. 3 shows the process of compilation strategy in the form of strategic planning.

Unified and comprehensive definition for agricultural mechanization plan

Lack of a unified and comprehensive definition which would cover various aspects of mechanization was one of the findings of opinion of 809 experts interviewed. Comparison of the definitions which the research society offered with the definitions offered in text books and references show that there are common points between them. Based on those points we can define agricultural mechanization is over all scope. Those points are: practical view to mechanization, clarification of mechanization process, application of suitable machines, recognition of technologies and applying suitable methods for production, production and processing of agricultural products, continuous increase of productivity as the result of the reducing the cost of production, reduction of the losses and increase of efficiency and increase of income (Akram, 2004; Almasi, 2001; Behrooz Lar; 2001).

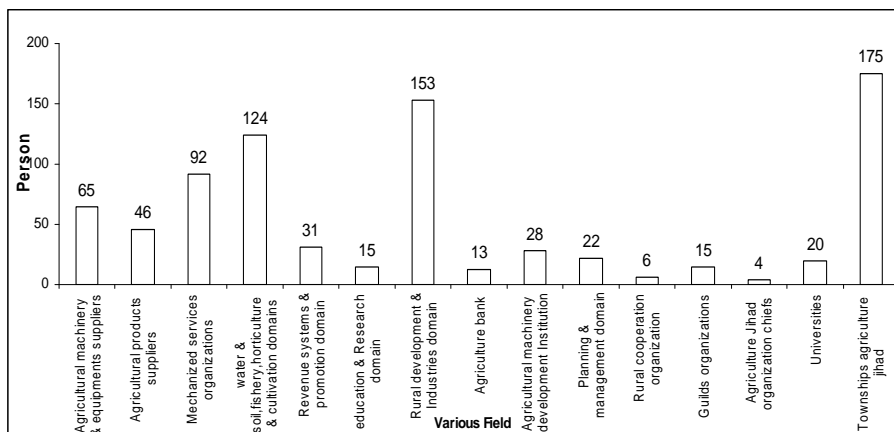


Fig. 1. Quantity of participants in interviews from various special fields of Iran.

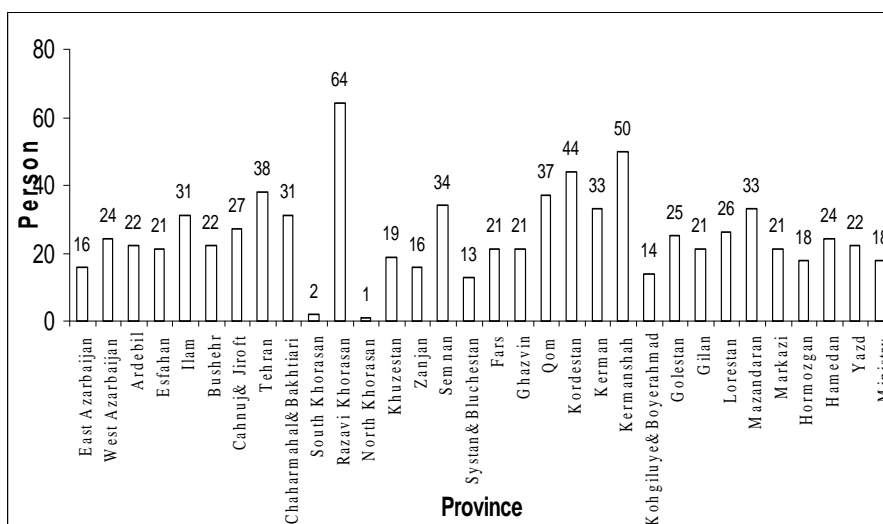


Fig. 2. Quantity of participants in interviews from various provinces of Iran.

The analysis of questionnaires, the results gathered from interviews lead us to logical deduction that the mechanization should improve the application and guarantees the effectiveness of the actions (improving productivity) in the total process of pre production, production stage and sell of agricultural products.

Considering above, we could define the comprehensive agricultural mechanization as the selection and use of suitable technologies and required possibilities with scientific methods in economical process of production and supply of agricultural products in scope of permanent development and production system.

Processing cycle in mechanization development

Agricultural mechanization takes place in a specific process. This process comprises specific steps (Table 1). Considering the fact that most findings related to the agricultural sector are continually faced with changes and improvements, therefore, we add feedback step to above process. By adding feedback to agricultural mechanization process, it will be upgraded as shown in the Fig. 4.

The mission (fundamental objective) in agricultural mechanization development

The importance of issues was considered as the benefits to the end users and the users, it would effect agricultural mechanization development based on definition of agricultural mechanization is: formation of mechanization for reducing the production cost and continuous increasing of the productivity in agricultural sector.

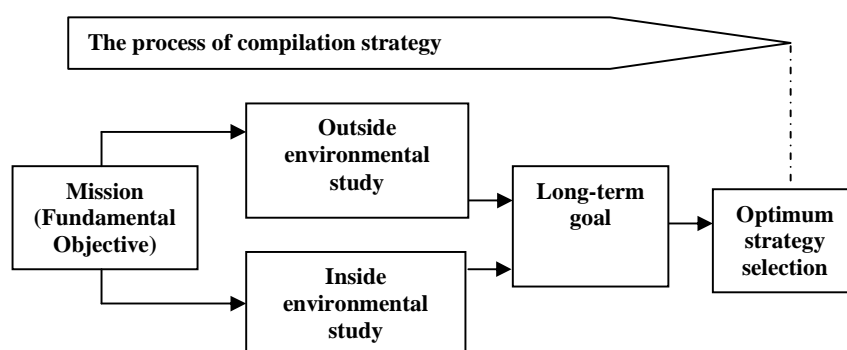


Fig. 3. The process of compilation strategy in the form of strategic planning.

The challenges of agricultural mechanization development process in Iran

Challenges of agricultural mechanization development process in Iran is classified into four groups: “Social”, “economical”, “technical” and “programming and management”. Although several challenges of agricultural mechanization development process in Iran were observed. The most important challenges of agricultural mechanization development process in Iran were shown in Table 2.

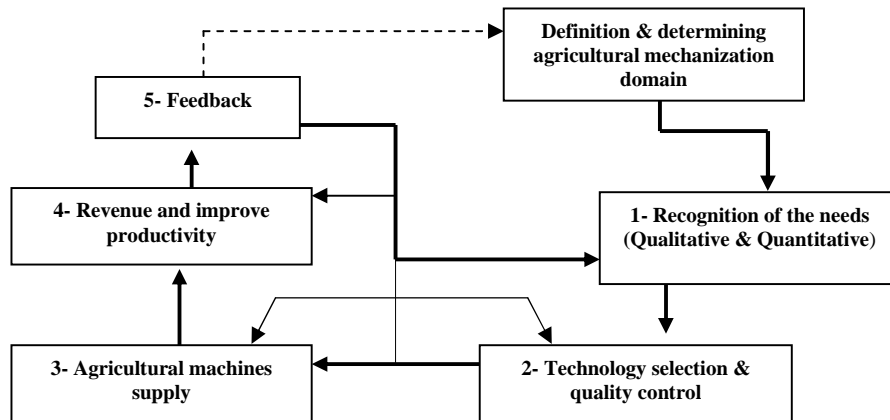


Fig. 4. Diagram of agricultural mechanization development cycling.

Long-term goals in agricultural mechanization development

The long-term goals were defined in relation with the missions. So, the most important factors of long-term goals were “role of the non governmental sector in mechanization development”, “optimum usage from the resources”, “qualitative and quantitative improvement in production of agricultural machinery and agricultural production”, “improving the degree of independency in production of basic crops”, “reducing losses” and “increasing value and the value of exports”. These factors were the bases of continues improvement of productivity, which should be in accordance to the necessity of improving productivity as well as the guide of environmental conservation and permanent agricultural development.

The optimum strategies for agricultural mechanization development in Iran

Agricultural mechanization of Iran has fundamental problems and challenges and without serious attendance not only could not help for agricultural development but also created very big challenges for agriculture sector. So, compilation a comprehensive and optimum strategy for development of agricultural mechanization was very important. Among all the strategies and approaches – with goal of growth of components- we used Directional strategy. Also Diversification strategy of the growth strategies used for determination the optimum strategy for mechanization development (Table 3).

Table 1. Agricultural mechanization process.

Steps	Title	Important operations	Authorities
First	determination Goals (Qualitative and Quantitative)	1- Statistic and information Supply 2- Recognition of the continues problems 3- Recognition of the continues needs 4- agricultural information system establishment	1- Ministry of Jihad-e-Agriculture 2- Ministry of industries and mines 3- Ministry of science, research and technology 4- Ministry of commerce 5- Management and programming organization 6- Guilds organizations
Second	Technology selection and qualitative control	5- Research and sampling 6- Selection and improve technology and the methods 7- Education and extension of technologies and methods 8- Standards compilation 9- Issuing license standard 10- production Quality control	1- Ministry of Jihad-e-Agriculture 2- Ministry of industries and mines 3- Ministry of science, research and technology 7- Non governmental laboratories
Third	Agricultural machines supply	11- Industrial & half-industrial production 12- Credit support, supply and payment 13- Subside supply & payment 14- Currency Supply and payment 15- Imports 16- After sale services	1- Ministry of Jihad-e-Agriculture 2- Ministry of industries and mines 4- Ministry of commerce 5- Management and programming organization 6- Guilds organizations 8- The producers and importers of agricultural machines 9- Central bank
Forth	Making profit and improve productivity	17- Training expert human resource 18- Establishment and strategies of machine usage system 19- Training, technical and professional operators 20- Establishment and strategies of control and supervision system 21- Cost credit and owning properties supply and payment 22- Development of non governmental organizations and guild organizations and supporting them	1 Ministry of Jihad-e-Agriculture 3- Ministry of science, research and technology 5- Management and programming organization 8- The producers and importers of agricultural machines 10- Ministry of labor and social affair 11- Mechanized services supplier

Table 2. The most important challenges of agricultural mechanization development process in Iran.

No.	Important Challenges
1	The weakness of the producers of agricultural machines and the operators of these machines from in protecting their guild benefits
2	Small and scattered farm and a great amount of the gardens are farmed traditionally
3	Financial weakness of the agricultural machines producers
4	Financial weakness of the mechanized services organizations (agricultural machines operators)
5	Worn out agricultural machinery
6	Lacking of high quality of the domestic agricultural machines
7	Lack of suitable services after sale of agricultural machinery
8	Lack of skilled drivers and operators in using correctly the agricultural machines and equipments
9	Lack of quality of the bachelors of related fields in technical skills
10	Slowness of the test group of agricultural machines in their duty
11	Lack of cooperation of research section with agricultural mechanization needs
12	Lack of suitable information services in agricultural section, especially in agricultural mechanization
13	Lack of law in agricultural mechanization fields

The Planning duration

The results of the studies showed that if we consider the effective variables in agricultural machinery remain constant, at least for the next few years we should still expect to see at least one important change each year in agricultural mechanization field. But in fact the current conditions make us to believe that those effective variables would remain constant, because of the new findings in science and technology (Bagheri, 2006). Therefore the programming and implementation plans should be done in short-term or middle-term at the most with the possibility of re-evaluation at all the stages (rolling plan type), as oppose to long-term planning. This kind of planning is flexible and can be adapted to the changes.

Definition

It is proposed that agricultural mechanization is selecting suitable machinery and their suitable application taking into account economical aspects and bases of development principals.

Process and cycle

The recognition of mechanization process and cycle showed that in this process there are four steps, which comprises 22 important operations and 11

governmental and non governmental organizations. Therefore, the achievement of mechanization goals depends on doing correctly the above steps. Of course, the feedback step is an instrumental stage that would result in to success of the mechanization process.

Agricultural mechanization challenges

The study of challenges showed that an important part of challenges were related to human resources. Therefore the human resources development is the cause of solving a lot of challenges.

Agricultural mechanization mission

The mechanization mission was a constant movement in reducing the production cost and continues improvement of productivity from the production factors in agricultural section considering the permanent development principals.

Clarification of the Long-Term Goal

Long-term goal is the management of agricultural mechanization with continues improvement of productivity (increase of constant efficiency and effectiveness) considering permanent development principals.

Conclusion

Optimum strategy for agricultural mechanization development is, enabling the producers and machinery operators (equipment and machines) to be adopted to increasing knowledge and technical skills, development of economical insight, establishment & development of guild organizations improving financial resources and reducing human injuries.

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Table 3. Determination the optimum strategy based on the most important challenges.

No	The most important challenges	Suggested Strategies				Optimum strategy
		Improving the ability of the agricultural product producers	Enlarging and modernizing of revenue	Import development of equipment and agricultural machines	Improvement of the domestic producers abilities (equipment and agricultural machinery)	Improving agricultural mechanized services organizations
*	Total	2	1	6	12	13
1	The weakness of the producers of agricultural machines and the users of these machines from in protecting their guild benefits	-	-	-	*	*
2	Small and scattered farm and a great amount of the gardens are farmed traditionally		*	-	*	*
3	Financial weakness of the agricultural machines producers	*	-	-	*	*
4	Financial weakness of the mechanized services organizations (agricultural machines operators)	*	-	-	-	*
5	Worn out agricultural machinery	-	-	*	*	*
6	Lacking of high quality of the domestic agricultural machines	-	-	*	*	*
7	Lack of suitable services after sale of agricultural machinery	-	-	*	*	*
8	Lack of skilled drivers and operators in using correctly the agricultural machines and equipments	-	-	*	*	*
9	Lack of quality of the bachelors of related fields in technical skills	-	-		*	*
10	Slowness of the test group of agricultural machines in their duty	-	-		*	*
11	Lack of cooperation of research section with agricultural mechanization needs	-	-	*	*	*
12	Lack of suitable information services in agricultural section, especially in agricultural mechanization	-	-		*	*
13	Lack of law in agricultural mechanization field	-	-	*	*	*