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REVIEW ARTICLE

A Viewpoint Toward Water in Arid and Semi-Arid Rural Areas of Iran (South Khorasan Province and Breeding Animals and Plants that are Resistive to Drought and Dried Conditions)

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ABSTRACT

Water is a primary resource, essential for life on planet Earth. It is not only a beverage or an indispensable tool for human hygiene and personal care but also above all, an essential means for agriculture and livestock farming. Accounting for water resources assets is an important part of the inventory of nationally owned natural resources assets and is a basic prerequisite for the preparation of natural resources balance sheets. Iran, as a developing country, is located in arid and semi-arid areas in which water scarcity is a major issue, and regarding the highest level of water shortage is in the agricultural sector, the need for efficient use, or in other words, management of agricultural water, is inevitable. Socioecological sustainability arises from interactions between natural and social systems. Sustainability in water security means effectively managing water resources to continuously achieve social goals without surpassing ecological limits to maintain or enhance ecological integrity and social well-being. Agriculture is a highly water-consuming activity, and water resources worldwide are heavily exploited for food production. Pollution due to agricultural activities in Iran has increased during the last two decades. Pollutions are released into the atmosphere and thereafter pollute water and soil resources. Agriculture is heavily impacted by present climate change, and a potential reduction in harvest may lead to larger water requirements for sustainable yield and a decline in food security worldwide. In this article, author discusses and states the most important aspects of water in arid and semi-arid rural areas of Iran with emphasizing on south Khorasan province and breeding animals and plants that are resistive to drought and dried conditions. Furthermore, this article is an abbreviation and short communication of author's book that published in 2025.

Key words: Arid and semi-arid rural areas, breeding animals and plants, drought and dried conditions, Iran, resistive, south Khorasan province, water

INTRODUCTION

Water is a primary resource, essential for life on planet Earth. It is not only a beverage or an indispensable tool for human hygiene and personal care, but also above all, an essential means for agriculture and livestock farming (Lucchetti and Renzi, 2025).[29]

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The development and utilization of water resources have undergone continuous evolution since the inception of human civilization. Water serves as a critical factor of production, influencing economic activities across diverse sectors and regions worldwide. However, as urbanization and industrialization accelerate, the tension among socioeconomic development, water resource availability, and environmental sustainability has become increasingly pronounced (Han *et al*., 2025).[16]

Socioecological sustainability arises from interactions between natural and social systems.

Sustainability in water security means effectively managing water resources to continuously achieve social goals without surpassing ecological limits to maintain or enhance ecological integrity and social well-being. Despite efforts to measure sustainability focused on water security, challenges remain, such as selecting indicators that capture socioecological dynamics and defining appropriate aggregation methods (Gomez-Jaramillo *et al*., 2025).[14]

Accounting for water resources assets is an important part of the inventory of nationally owned natural resources assets and is a basic prerequisite for the preparation of natural resources balance sheets (Shu-qin *et al*., 2025).[26]

There are recent and growing developments in the analysis of socioecological sustainability. These analyses can be developed from the weak or strong sustainability approach. The weak sustainability approach allows for substitutability between natural capital and man-made capital, meaning natural resources can be used as long as overall well-being is maintained. In contrast, the second approach does not consider substitutability and focuses on understanding the natural system's capacity to maintain the functionality and ecological processes that provide ecosystem goods and services, ensuring the well-being of society over time (Gomez-Jaramillo *et al*., 2025).[14]

In addition, socioecological sustainability analysis can be developed through conceptual frameworks and later operational frameworks (Gomez-Jaramillo *et al*., 2025).[14]

In the 1960s, sociologists and environmentally minded scholars began to study environmental attitudes. This scholarship flourished in the 1970s as environmental degradation worsened and became a greater concern to the general public in Western societies. Over the past several decades, scholars' theoretical and empirical efforts have been devoted to designing proper measures to gauge pro-environmental attitudes in Western industrialized social contexts (Yu, 2014. P: 39).[31]

Past research has also demonstrated that more educated people are more likely to show concern for the environment, since they are often better able to think critically and to recognize negative environmental consequences, especially those harms that are less obviously decipherable, such as climate change or toxins in foods (Yu, 2014. P: 39).[31]

Support for environmental protection was most pronounced in countries where there was either a high per capita income or an abundance of environmental problems.

Nowadays, agricultural method developments that are productively, economically, environmentally, and socially sustainable are required immediately. The concept of precision agriculture is becoming an attractive idea for managing natural resources and realizing modern sustainable agricultural development (Tohidyan Far and Rezaei-Moghaddam, 2018).[28]

The development policy and conflict literatures highlight the important influence of "high-value" natural resources on sustainable development, conflict, and security at multiple scales. While the physical attributes of these commodities can vary greatly, high-value natural resources generally refer to those commodities that, in their natural state, have the potential to yield substantial revenues. Classic examples are diamonds, oil, natural gas, gold, uranium, coltan, and several precious gems and minerals. When well managed, these valuable resources can be the cornerstone of economic prosperity, substantially raising living standards, facilitating socioeconomic equality, and the reduction of state dependence on foreign aid (Douglas and Alie, 2014. P:270).[9]

Today, useful technologies along with a strategy of environmental conservation as well as viewpoints change from remedial strategies to preventive strategies in using such technologies are at the center of attention. Efforts are made to emphasize applying modern sciences in agriculture that concern production and productivity boost and environmental conservation (Tohidyan Far and Rezaei-Moghaddam, 2018).[28]

Sustainable land management is essential to meeting the global challenge of securing soil and water resources that can support an ever-increasing population.

There is a real need to analyze the economic benefits and long-term sustainability of future development against the protection of high-class land for current and future production requirements. There is a real need to analyze the economic benefits and long-term sustainability of future development against the protection of high-class land for current and future production needs to provide prolonged benefits to the wider and future communities (Curran-Cournane *et al*., 2014).[7]

In the world's semi-arid regions, high crop demands have produced short-term economic incentives to convert food production on native grasslands to dry land row crop food production, while genetic enhancements and equipment have reduced the risk of crop failure (Clay *et al*., 2014).[6]

Understanding interactions among the services provided by agricultural systems requires understanding patterns and the individual trade-offs that occur when the delivery of one service is affected by the delivery of another. While it may be straightforward to assess trade-offs between two ecosystem services, it is more difficult to evaluate trade-offs among multiple services. Trade-off curves describe relationships between pairs of sustainability indicators (Syswerda and Robertson, 2014).[27]

Several important ecosystem services are available in row crop agriculture to provide better knowledge for policy and farm-level decision-making. These eight indicators indicate the strength of ecosystem service delivery in our comparative ecosystems. Among them are (1) grain yield, to indicate the delivery of food and economic benefits; (2) drainage to indicate the delivery of regulating services related to flood control, groundwater discharge, and erosion avoidance; (3) global warming impact to indicate the delivery of climate mitigation services; (4) plant diversity to indicate the delivery of biological control, arthropod habitat, and other conservation benefits; (5) soil carbon to indicate services related to soil fertility, soil microbe and invertebrate habitat, filtration, and soil structure; (6) soil water content to indicate services related to soil water availability; (7) nitrate leaching to indicate services related to nitrogen conservation, nutrient mobility, and water quality in general; and (8) aboveground net primary productivity, as a supporting service, to indicate the overall function of the ecosystem (Syswerda and Robertson, 2014).[27]

Conservation success is often predicated on local support for conservation which is strongly influenced by perceptions of the impacts that are experienced by local communities and opinions of management and governance. Beliefs about livelihood and conservation outcomes were intricately linked with perceptions of management and governance. Overall, perceptions of participants on the quality and effectiveness of management and governance were quite critical (Bennett and Dearden, 2014).[4]

Furthermore, this article is an abbreviation and short communication of author's book that published at 2025.

WATER IN IRAN: SITUATIONS AND USERS

Agriculture is the biggest water user in Iran. 90% of all water withdrawal is currently used for agricultural purposes. The balance is mainly domestic water, while industry does not play an important role yet. However, the industrial sector will become a more important player in the water sector.

Water is an important resource for human society and protection of this natural resource efficiently has become one of the main challenges of this century. According to Iran's geographic information, the country is located in a semi-arid region on the earth. Therefore, it can easily be claimed that the limitation of water resources is one of the major factors in the agricultural development of Iran. The atmospheric precipitation (70% rain and 30% snow) brings the total up to 450 billion m^3 of water. In the present situation, about 269 m^3 of this figure is lost in different forms; however, 30 and 35% of this is devoted to urban areas and agriculture, respectively. On the other hand, 93% of the total water resources are used in agricultural sector, and $<$7% is allocated to municipal and industrial uses. Therefore, the proper water management in this sector is essential and plays a critical role in the sustainable development of agriculture.

Since many countries for years have been faced with a serious crisis due to a shortage of water resources on the one hand and on the other hand due to population growth and economic and social development, it can be said that water problems in the future would be more and more and water would be undoubtedly an important issue. Based on the UN Commission on Sustainable Development, the growth of water demand in 2025 would be equivalent to 212% of demand in 1990, which means that the need to consume water will be more than the country's water resources (Samian *et al*., 2015).[23]

Iran, as a developing country, is located in arid and semi-arid areas in which water scarcity is a major issue and regarding the highest level of water shortage is in the agricultural sector, the need for efficient use, or in other words, management of agricultural water is inevitable. Agricultural water management is a systematic approach to control water in the farm and it leads to the provision of crop irrigation and drainage while there are physical, social, and governmental problems in production systems (Samian *et al*., 2015).[23]

The aim of the effective management of agricultural water is to increase economic performance with reduced consumption of water and energy. Hence, agricultural water management in areas that are facing the problem of water shortage seems to be more important to expect maximum efficiency from the minimum water resources.

Undoubtedly, understanding the factors affecting agricultural water management can provide management strategies for agricultural water (Samian *et al*., 2015).[23]

Role of Dams

Throughout the world, an important strategy for harnessing water has traditionally been the construction of multipurpose dams. They have served the needs of agriculture, energy, and growing cities and helped protect populations from flood hazards, particularly in Asia, where such hazards have increased measurably. Indeed, the largest such investments have been in China, and the most assistance for the construction of dams by the World Bank has been in South Asia. Increasingly, international assistance agencies have questioned the development of new dams on the basis of their economic, social, and environmental benefits. Yet, countries have continued to invest in dams, although with different levels of efficiency and effectiveness (Lele *et al*., 2013) [Figure 1].[20]

Figure 1: establishing small and medium dams by central government for harnessing seasonal rainfalls and floods, etc., in remote, deprived and isolated areas in various cities, rural and nomadic areas of south Khorasan province, south east of Iran (Pictures by: General Department of Natural Resources and Watershed Management of south Khorasan province, south east of Iran. January 2025)[10]

Beyond building dams, which tends to have a strong appeal among national policymakers, increasing the supply of water also means the need to increase the efficiency and productivity of the water used in agriculture. Increasing water use efficiency calls for reducing water losses in transmission and the non-beneficial use of water (i.e., reducing leakage or evaporative losses in water conveyance and application). Historically, this aspect of water management has received more attention (Lele *et al*., 2013).[20]

The third option is to reallocate water toward higher-value uses through intra-sector transfers. Limiting the irrigated area under a particular crop would reduce evapotranspiration. Alternatively, water could be diverted toward higher-value crops through inter-sector transfers (transfers to municipal supplies, for instance).

All the efficiency increasing strategies in agriculture, which use water better, have important income distribution and economy-wide policy and political implications across states, over time, and among the different classes of farmers. Exporters win and the hungry lose. In short, the various policy choices and their impacts on producers and consumers are intimately related to the issues of governance and accountability to the public for results on development outcomes at large (Lele *et al*., 2013) [Figure 1].

Governance has been conceived at different levels by different analysts. There is insufficient clarity on what constitutes good governance. Unlike in the case of water, the food security governance framework has typically ranged from the global to the local levels, involving global supply and demand, international trade rules overseen by the World Trade Organization, food safety rules, and food aid. There is also an increased space for the involvement of the private sector and NGOs – all the way from the global to the national level, down to the community, household, and individual levels (Lele *et al.*, 2013) [Figure 1].[20]

INTEGRATED MANAGEMENT OF AGRICULTURAL WATER RESOURCES IN IRAN

While growing populations and increasing water requirements are a certainty, there is a big uncertainty about how these requirements will be affected by human activities. The importance of integrated management of water resources by farmers under water deficit conditions must be considered as a tool for optimum farm management. Water is a shared resource with multiple functions, uses, and merits. Today, this resource confronts serious environmental, economic, social, and political challenges in the Middle East. In Iran, water has a very heterogeneous spatial distribution due to natural climatic conditions and the resultant temporal distribution of rainfall. The amount of precipitation varies across years and even seasons, posing problems to different sectors, including the agricultural sector and the supply of drinking water in urban areas in recent years, causing substantial economic losses to these sectors. Therefore, it is imperative to pay attention to the sound management of water resource exploitation, the groundwater recharge, the retention of the surface waters, and the improved management of water use and its productivity enhancement. Integrated management of water resources can be the least, but a serious step. In some parts, the overexploitation of water resources has increased the risk of degradation. Overall, the use of water by the agricultural sector is not optimum in Iran. However, a given policy is likely to elicit a range of responses among individual farmers. Farmers are key stakeholders in the use of water for irrigation, but their position at the end of the water chain means that they are often marginalized in water resource decision-making processes. From this point of view, an understanding of the heterogeneity of farmers may shed light on particular policy options, whereas a failure to appreciate the range and complexity of behavioral drivers among farmers may lead to a failure of water management policies. Accordingly, to gain support from farmers and farm communities, rebuilding farmers' water use associations and promoting the development of community-based water management systems should remain a priority of the integrated water resource management reform (Hadizadeh *et al*., 2018).[15]

GROUNDWATER DEMAND MANAGEMENT AT LOCAL SCALE IN RURAL AREAS

Watershed development programs provide an opportunity for sustainable management strategies, although currently, they remain largely "supply-side" mechanisms of water resources development. Hydrogeological conditions, community participation, and status of groundwater usage are important in evolving strategies on "demand-side" groundwater management. Groundwater forms an important source of water supply in rural areas. It is often the only source of water supply, particularly in remote villages, where surface water supplies cannot be relied upon for more than a couple of months. It is quite obvious that traditional approaches of watershed development that stress enhancing recharge to groundwater do not pay adequate attention to the challenge of sustainably utilizing the recharged water.

Sustainable and equitable groundwater use would put the concept of watershed development one step ahead of its current status of simply enhancing groundwater recharge to increase soil moisture bases and/or promote more wells, without studying the impact of such changes in future scenarios. Using groundwater to supply human needs has great advantages, but there are also negative effects, as with the development of any other natural resource, effects that depend upon specific characteristics of the resource (Kulkarni *et al*., 2004) [Figures 2 and 3].[19]

ADAPTATION TO CLIMATE VARIABILITY AND CHANGE IN IRAN

The issue of climate change and the sustainable use of resources is at the heart of international topics and discussions (Caturegli *et al*., 2015).[5]

Limits and barriers to adaptation restrict people's ability to address the negative impacts of climate change or manage risks in a way that maximizes their well-being (Islam *et al*., 2014).[18]

Climate change in Asia is affecting farmers' socioeconomic practices. Climate change is forecasted to worsen across the Asian region.

Figure 2: Land Subsidence because of over-extraction of groundwater resources and lake of watershed projects in the plains of south Khorasan province, southeast of Iran (Pictures by: General Department of Natural Resources and Watershed Management of south Khorasan province, southeast of Iran. January 2025)[10]

Rising temperature is strongest over the continental interiors of Asia. In a period of 105 years (1990 to 2005), precipitation increased significantly in northern and central Asia but declined in parts of southern Asia.

Climate change is proven to affect water resource scarcity as the unstable climate variability and more rapid melting of glaciers increase risk of extinction for many plant and animal species, while the increasing sea level rise is proven to affect the coastal ecosystems. While the impact of severe climate change on the environment continues to be recorded, climate change's impact on human beings is more severe, particularly among those who rely on environmental and climatic stability such as Asian farmers (Shaffril *et al*., 2018).[25]

Climate change is a global challenge, and adaptation measures must be practiced to minimize its impacts and capture possible opportunities.

Availability of natural resources enables the farmers to practice the old ways of irrigating their crops. The availability of water from rivers, wells, rainwater, and efforts on constructing canals and digging drainage systems allows the construction of natural irrigation system (Shaffril *et al*., 2018).[25]

THE ECONOMIC IMPACT OF AGRICULTURAL POLLUTIONS IN IRAN

Studies on environmental effects caused by agricultural activities in water, soil, and weather

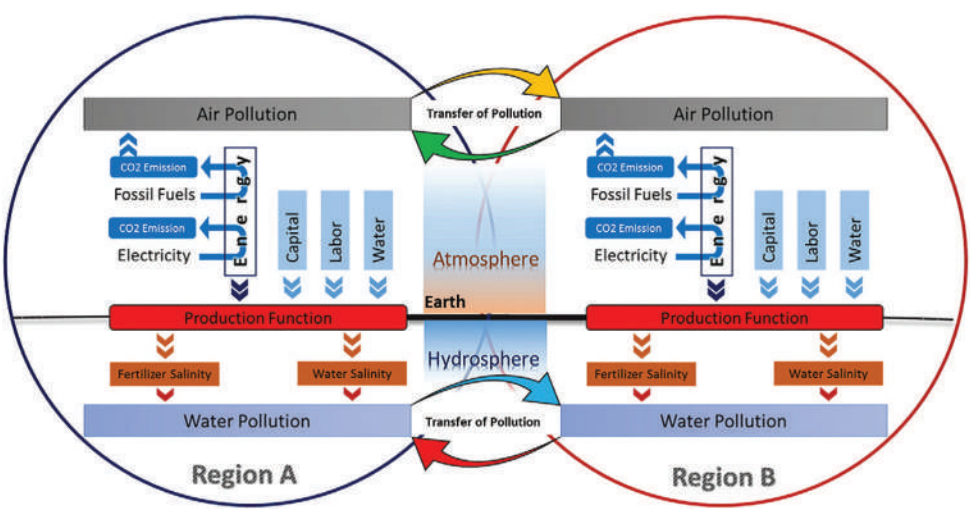

Figure 3: Agricultural pollutions in three dimensions in Iran (Atmosphere, Hydrosphere, and Adjacency regions) (Najafi Alamdarlo, 2018)[21]

sectors have increased in recent years. The growth of agriculture with excessive water consumption in Iran and more use of fertilizers has polluted water resources. The subject of pollution due to agricultural activities in Iran is one of the important challenges of the agricultural sector and has increased in the last two decades. This condition can affect the environment of Iran and cause challenges for sustainable agriculture.

Undesirable (bad) outputs were produced with desirable (good) products simultaneously, which is often due to the inputs used in the production process. Therefore, energy consumption in the agricultural sector led to the emission of CO_2 in the atmosphere. Thus, the pollution caused by agriculture is emitted into the atmosphere and transferred to water and soil resources. A certain strategy should be defined for beneficiaries based on the emission of environmental pollutants. Furthermore, these pollutions move both on the ground and under the ground leading to the transfer of pollution in adjacent regions. As shown in Figure 1, agricultural activities in region A were produced by using water and other inputs. Using such inputs leads to the emission of pollution on the ground and under the ground. For example, the groundwater salinity occurs as a result of water extraction and use of fertilizers. The pollution created in region A spreads to the adjacent regions. Thus, region B can be polluted as a result of the agricultural activities in another region. Due to the importance of this subject (pollution), models that can analyze such pollutions are needed (Najafi Alamdarlo, 2018) [Figure 4].[21]

Many studies have shown that shadow prices are the best instruments for applying environmental control. One way of estimating the undesirable output of the shadow price is to use the distance function.[21]

However, in both spheres (atmosphere and hydrosphere), the spatial effects of pollution transfer were disregarded and no study was conducted to estimate the environmental effects caused by the proximity of regions to each other (Najafi Alamdarlo, 2018) [Figure 4].

The estimated results showed that there are spatial effects for two variables of water salinity and CO_2 emission. Thus, using the spatial approach was confirmed. The efficiency for the whole county in this period was equal to 85.8. Thus, the

Figure 4: Field research visiting of author from a modern and new established greenhouse complex in Darmian County in south Khorasan province, southeast of Iran. In this greenhouse complex, utilizing modern technologies for desalination and suiting water for growing plants and fish farming, etc. in this greenhouse complex planting trees of orange inside the greenhouse – as a byproduct and fancy and amusing tree – and jujube (Ziziphus jujube) and Grape (vinifera) trees and shrubs – planted as windbreaker and sunshade trees – outside the greenhouse, plus utilizing, consuming, and selling their products. This greenhouse complex established by loans and helps of central government, agricultural bank, and local people in this deprived and remote area with high degree of salinity and salt amount in its water and soil (Pictures by author. October 18, 2024)

efficiency of agricultural production in Iran can be increased by applying the appropriate policies. However, the efficiency rate varies from 94% to 77% among the regions of Iran. Hence, agricultural development programs in these provinces should be prioritized.

The shadow price of agricultural pollution was equal to 16.23 dollars without considering the spatial effect, but this value reached 42.54 by entering the spatial effects, including the importance of the estimation method in estimating the shadow price appropriately. Thus, the presence of spatial effects is one of the effective factors.

These spatial effects occur as a result of pollution transfer and can be affected by climate (Najafi Alamdarlo, 2018).[21]

Furthermore, infiltration plays an important role in the hydrologic cycle, runoff generation, soil erosion, as well as irrigation. It has been widely accepted that the hydrologic cycle, runoff generation, soil erosion, and irrigation are affected by infiltration. Precipitation, irrigation, or contaminated spill water, which enters the soil or creates runoff, is determined by infiltration. It also plays a key role in controlling crop yield for designing irrigation systems, increasing the efficiency of water and solute transport in the soil profile, and reducing water losses. The amount of infiltrated water into the soil is one of the main parameters for water resources management. The groundwater system sustainability is also dependent on the amount of recharge by infiltrating rainfall. So far, a large number of modeling approaches for infiltration have been developed by numerous soil and water scientists (Babaei *et al*., 2018).[3]

FARMER COOPERATIVES (FC) FOR ORGANIZING COLLECTIVE ACTION

In recent years, the concept of agricultural innovation system (AIS) has gained currency as a way to understand how agricultural innovation takes place and how innovation can best be supported. An AIS is defined as a system that consists of a wide range of actors from the public, private, and civil sector to bring new products, new processes, and new forms of organization into economic use, together with the institutions and policies that affect the way different agents interact, share, access, and exchange and use knowledge. Although there is much emphasis on knowledge creation, exchange, and use in the above definition of AIS, innovation systems need to fulfil several other functions that are essential for innovation. These functions include fostering entrepreneurial-driven activity, vision development, resource mobilization (e.g., capital),

Figure 5: Field research visiting of author from a Barberry (Berberis vulgaris) garden and its shrubs in Gask village in Darmian County in south Khorasan province, south east of Iran. This medical plant is very resistive to drought and dried conditions and high degree of salinity and salt amount in its water and soil. Barberry (Berberis vulgaris) plays an important role in livelihood and welfare of rural people in this deprived, isolated, and arid area, namely south Khorasan province, south east of Iran (Pictures by author. October 18, 2024)

Figure 6: Field research visiting of author from a Grape (vinifera) garden and its shrubs in beside a modern and new established greenhouse complex in Darmian County in south Khorasan province, south east of Iran. This plant is very resistive to drought and dried conditions and high degree of salinity and salt amount in its water and soil. In this greenhouse complex jujube (Ziziphus jujube) and Grape (vinifera) trees and shrubs – planted as windbreaker and sunshade trees – outside the greenhouse, plus utilizing, consuming and selling their products. With utilizing drip irrigation system for Grape (vinifera) shrubs. This greenhouse complex established by loans and helps of central government, agricultural bank, and local people in this isolated, deprived, and remote area with high degree of salinity and salt amount in its water and soil (Pictures by author. October 18, 2024)

market formation, building legitimacy for change, and overcoming resistance to change by means of advocacy and lobbying. The AIS approach thus recognizes that innovation is a process in which technological developments are combined with new organizational and institutional arrangements, which imply that new forms of coordination within a network of actors are a key. The provision of brokerage and mediation functions may often not be the primary role of an innovation intermediary as Howells argues, because these, for example, "also cover more traditional contract research and technical services which involve no third-party type collaboration" (Yang *et al*., 2014)[30] and (Golmohammadi, 2018- A).[12]

FC is a more formalized way of organizing collective action of farmers and exists at the village, regional, national, and even international levels. They have been found to link different actors and bring synergy to agricultural innovation efforts, combining innovation intermediation with other kinds of services, like input supply and collective marketing. Few studies have taken an innovation intermediary perspective to examine FCs' roles and position in the AIS [Figures 6-9].

Figure 7: Field research visiting of author from forests of trees of medical plants of Pistacia Atlantica, in Ark village in south Khorasan province, south east of Iran. This medical plant is very resistive to drought and dried conditions and high degree of salinity and salt amount in their water and soil, plus weak soil conditions in depth, slope, and organic matters (Pictures by author. 2021)

Figure 8: Field research visiting of author from projects of Camel and Ostrich breeding in arid and semi-arid Areas of Iran, in Khosf city in south Khorasan province, south east of Iran. These animals are very resistive to drought and dried conditions and high degree of salinity and salt amount in water and soil. Camel and Ostrich breeding can provide enough money for the conditions of a medium livelihood in these rural areas of Iran (Pictures by author. 2023 and 2024)

This is because the organizational form of innovation intermediaries is dependent on the specific problems to be addressed, different social and cultural contexts, and the institutional history of the AIS in which they are embedded. An FC can be conceptualized as a non-neutral intermediary which aims to gain a better position for farmers in the agricultural value chain and the AIS. Basically, it is a membership organization representing farmers to improve their position in production and commercialization. Hence, it can be seen to be in a representation or gatekeeper position for farmers in its relations with other actors. An FC is not a specialized innovation broker, as it combines innovation intermediation with other functions, like input and credit supply, and collective marketing (Golmohammadi, 2018- A) [Figure 5].[12]

Figure 9: Author book covers, etc., that published at 2025 and most of the text of this article obtained from it.[11]

DISCUSSION AND CONCLUSION

Independence must begin at the grassroots level; whether each village can perform its affairs, it can be done. MAHATMA GANDHI. As quoted in (Golmohammadi, F. 2018- B).[13]

"It's fun to be the sucker – If you can afford it" (John Steinbeck, Sweet Thursday, p. 20). As quoted in: (Golmohammadi, F. 2018- B).[13]

Water is a primary resource, essential for life on planet earth. It is not only a beverage or an indispensable tool for human hygiene and personal care but also above all, an essential means for agriculture and livestock farming (Lucchetti and Renzi, 2025).[29]

The development and utilization of water resources have undergone continuous evolution since the inception of human civilization. Water serves as a critical factor of production, influencing economic activities across diverse sectors and regions worldwide [Figures 6-9].

However, as urbanization and industrialization accelerate, the tension among socioeconomic development, water resource availability, and environmental sustainability has become increasingly pronounced (Han *et al*., 2025).[16]

The agricultural sector faces increasing pressure to adopt sustainable practices amid rising regulatory complexity and environmental concerns (Brinken *et al*., 2025).[29]

The issues outlined in the literature regarding the evaluation of sustainability through indicators underscore the significance and urgency of developing methodologies that ascertain appropriate indicators aligned with a conceptual framework. Sustainability assessments often focus on single indicators, obtaining one value without analyzing the relationships between variables and components, which are crucial for understanding the state of sustainability. Many studies stress the importance of integrating the socioecological approach into an operational framework that aligns with a conceptual one. This integration is a key to detecting changes early and taking action to prevent significant losses in ecosystem services, ecological environment, etc., aspects (Gomez-Jaramillo *et al*., 2025).[14]

Different scientists have presented various models to examine attitudes and behaviors (Tohidyan Far and Rezaei-Moghaddam, 2018).[28]

Rural areas in Iran are necessarily linked to agriculture with very little diversification. These communities are solely dependent upon the fortunes of one or two primary enterprises. This is an extremely tenuous situation and these communities must diversify to ensure economic and social viability. Proper distribution of subsidies, utilization of resources, and adaptation of new laws would have a significant effect on the future growth in Iran (Ardehali, 2006).[2]

Pollution due to agricultural activities in Iran has increased during the past two decades. Pollutions are released into the atmosphere and thereafter pollute water and soil resources (Najafi Alamdarlo, 2018).[21]

Livelihood in Iran's rural areas, as elsewhere in the developing world, is highly intertwined with the harvesting of environmental resources, leading to severe environmental degradation.

Therefore, interventions aimed at enhancing both conservation and livelihoods should improve the human, social, and financial assets of resource users, to facilitate the adoption of less environmentally reliant and profitable strategies. As mentioned in the previous sections, understanding local livelihood and its determinants can be the first step in designing more effective environmental conservation programs, especially where local livelihoods are highly dependent on harvesting from environmental resources (Dehghani Pour *et al*., 2018).[8]

There is a general consensus among policymakers, researchers, and development practitioners that environmental resources and particularly forests contribute to rural livelihoods in developing countries by supporting current consumption and providing households with a form of "natural insurance" against hardships. The literature abounds in evidence of forests and other environmental resources' contribution to household income in different regions around the world (POULIOT and TREUE, 2013).[22]

Both reductions of greenhouse gas emissions and carbon sequestration have the potential to reduce global climate warming and avoid dangerous climate change (Schimmelpfenniga *et al*., 2014).

Applying precision agriculture systems is regarded as a means of achieving sustainable agriculture, a move toward which is inevitable for all countries, especially developed ones, as a result of environmental problems and food security provision for a growing population.

It is revealed that other agricultural systems such as traditional and organic farming may not provide growing population food security. The most significant social impact of precision agricultural system refers to rural area development. The most important technical impacts of precision agricultural technologies are an increase in productivity, increasing product quality, and improving farm condition (Tohidyan Far and Rezaei-Moghaddam, 2018).[28]

Identifying factors that influence the attitudes of agricultural experts regarding precision agriculture play an important role in developing, promoting, and establishing precision agriculture (Allahyari *et al*., 2016) [Figures 6-9].[1]

In recent years, agriculture has turned into an industry in response to food provision and food security and human relation with environment has been changed due to achievement in different technologies. In this respect, agricultural systems emphasize utilizing inputs that are produced by fossil fuels such as chemical fertilizers, pesticides, herbicides, and agricultural machinery with high fuel consumption. Information technology in agriculture called precision agricultural technologies is considered among modern technologies. This kind of agricultural system is farming precision management based on input data and knowledge and regards using inputs in terms of the farm's needs and site-specific management.

Precision agriculture refers to a systematic approach for remaking the whole system of agriculture for developing sustainable, low-input, and high-yield agriculture. Precision agriculture methods are able to enhance economic and environmental sustainability of production (Tohidyan Far and Rezaei-Moghaddam, 2018).[28]

The application of precision agriculture) PA(technologies is an alternative to sustainable agriculture. This is one of the fastest-growing alternative agricultural systems in the world. The presence of experts about PA initiates a learning process, enabling potential users to become more aware and confident about precision agriculture) PA(tools, and thus promoting the perception of an "easy to use" technology (Allahyari *et al*., 2016).[1]

Researches must apply theoretical knowledge of precision agriculture in the country of Iran. Approving necessary credits for research and encouraging researchers to plan and apply the relevant plans in precision agriculture are essential too. Perceived usefulness is considered the most significant variable affecting behavioral attitude and the second factor influencing attitude of precision agriculture technologies. Therefore, education should focus on justifying perceived usefulness of those technologies to experts so that teaching precision agriculture at universities should be regarded more [Figures 6-9].

Planning in-service training courses for experts, forming a network of experts, teachers, and technicians, developing and performing internship programs for experts are suggested. Finally, officials and relevant policy-makers can establish strategic planning to diffuse these kinds of technologies (Tohidyan Far and Rezaei-Moghaddam, 2018).[28]

The role of precision agriculture on environmental sustainability and economic efficiency and growth must be considered. In other words, the perception and adoption of precision agriculture represent a complex management strategy. Therefore, economic, technical, and accessibility factors should constitute the priority programs of the Agricultural Organization. According to the above considerations, components identified in this study should be recommended by agricultural experts and managers to identify the current situation and improve the required position (Allahyari *et al*., 2016) [Figures 6-9].[1]

APPENDIXES

complementary field research pictures of the author in the domain of this book in Iran from 2023 to 2025 include Precision agriculture for sustainable development through farmers' cooperatives (FC) for organizing collective action, plus a viewpoint Toward Medical plant of Pistacia Atlantica and jujube (Ziziphus jujube), Barberry (Berberis vulgaris), trees and shrubs, etc., Plus Ostrich breeding in arid and semi-arid forests and Areas of Iran.

Furthermore, this article is an abbreviation and short communication of author's book that was published in 2025.[11]

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