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Agricultural Research: Applications and Future Orientations



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Synonyms

[Agricultural research methodology](#)

Definition

Agricultural research can be broadly defined as any research activity aimed at improving productivity and quality of crops by their genetic improvement, better plant protection, irrigation, storage methods, farm mechanization, efficient marketing, and a better management of resources (Loebenstein and Thottappilly 2007).

Introduction

The objective of this document is to provide a tool to understand aspects and future orientations of

agricultural research. It begins with an overview of the concept and/or definition of agricultural research. It then focuses on the role of agricultural research in achieving the goals of 2030 Agenda, different types of agricultural researched, systemic research methodology in agriculture, and finally different kinds of use for agricultural research.

The Concept and Definition of Agricultural Research

Finding answers for questions about unknown phenomena in the agricultural area is the key to agricultural ecosystems' management, which is possible through research in the environment's scope and phenomena (Iman 2009). Everyone needs to do research to answer his/her questions in this field. It means that he/she is learning the process of answering his/her questions (Rosenthal and Rosnow 1991). The most important reason for this is that the environment is disturbing and challenging agricultural researcher (Shahvali and Amiri Ardakani 2011). Research as a set of activities used to answer human questions is a requirement of social life (Borg et al. 1963). By means of knowledge which is the product of individuals' worldview, experiences, biases, and prejudices and also using the power of rationality and creativity, people take a stand against the problems, issues, events, and phenomena they are facing. Several definitions have been proposed for

research, the best of which is “to understand the gap between the truth and reality of subjects to provide a deep and philosophical definition for research” (Iman 2009). “Reality” is a state that exists by itself, whether or not it is perceived by humans. The “truth,” however, refers to the extent of individuals’ perception of existence. Humans’ endeavor to fit the truth into reality is called “research,” and how this is undertaken is known as “research methodology.” Agriculture is no exception to this category.

The Role of Agricultural Research in Achieving the Goals of 2030 Agenda

The 2030 Agenda aims to tackle the complex challenges facing the planet today – ending poverty, hunger, and malnutrition and responding to climate change while achieving inclusive growth, building resilient communities, and sustainably managing our natural resources. As the fundamental connection between people and the planet, sustainable food and agriculture are at the heart of the 2030 Agenda. Without proper nourishment, children cannot learn, people cannot lead healthy and productive lives, and societies cannot prosper. Without nurturing our land and adopting climate-resilient agriculture, future generations will struggle to feed a growing population. Furthermore, agriculture, today, is the world’s biggest employer and largest economic sector for many countries. Yet rural and agricultural communities that produce 80% of our food make up four-fifths of the global poor (FAO 2017). Governments and policy-makers of agriculture in all of the countries need to understand that relevant and problem-solving-oriented agricultural research is essential for the agricultural sector to be able to compete in an open market environment (Morales 2007) and fulfill 2030 Agenda goals.

In last years, the goal of agricultural research has been characterized in greater detail, considering not only products but also other factors as sustainability of resources and impacts on the environment. Research aimed at better varieties, plant nutrition, and water use as well as

agricultural economics and farm management is an important component of agricultural research and the sustainable utilization of resources for the benefit of humanity and the environment. The global goal of agricultural research should be able to feed the ever-increasing population of the world up to 2030. This can only be achieved if agricultural and biological research come up with novel technologies, both conventional and biotechnological, which will increase food yields substantially in present and marginal environments. The goals of agricultural research vary between highly developed and developing countries and between countries in each category. Generally it can be said that the overall mission of agricultural research is to increase efficiency of agricultural production and its quality, enabling a decent income and living to the farmer and taking into account the ecological and social constraints (Loebenstein and Thottappilly 2007).

An overview and pathologic study of research conducted in the field of agriculture shows that many of these researches do not really help to solve problems (food shortage, poverty, employment, etc.) in agricultural sectors. Therefore, the results of these studies are not mainly used. In addition, most of current agricultural researches are not applied and their results are not used by different stakeholders, they do not help to achieve the goals of 2030 Agenda (Majidi et al. 2017). To fill this gap, future agricultural research activities should try to have more focus on the issues like increasing agricultural production and productivity (to ensure food security for the rising population), meeting challenges of degradation of land and water resources, and addressing problems of underemployment, poverty, and malnutrition through diversification of agriculture and promotion of horticulture.

Types of Agricultural Research

Researchers and authors have introduced various types of research methods which may be different in their classifications. In summary, based on the purpose, subject, nature of the data, and the

time of research, agricultural researches can be classified into the following forms.

Based on the purpose, agricultural researches can be divided into three categories of basic research, applied research, and developmental research (Habibpour Gatabi and Safari Shali 2013). Basic research is a kind of research that develops the boundaries of knowledge in the field of agriculture, and it is not expected that these studies will have a particular practical use (Delavar 2017). The main purpose of these agricultural researches is theory development or formulation (Habibpour Gatabi and Safari Shali 2013). For example, Theory of Agricultural Ethics and Human Liability (Zamani 2016) is one of the theories that have resulted from basic research in the field of agriculture. Applied agricultural research is a kind of research which its results are used to meet the needs and solve agricultural problems (Shiri et al. 2011; Valizadeh et al. 2018a). Therefore, the purpose of these researches is to apply the results in solving problems and specific issues of agricultural and non-agricultural communities (Borg et al. 1963). Solutions offered to solve problems in this type of research are universal in application. There is no theorizing in such researches, and the theories derived from basic agricultural researches are used in them (Habibpour Gatabi and Safari Shali 2013). A clear crystal example of such an application can be found in the research of Menatizadeh and Zamani (2016) who have used the Theory of Agricultural Ethics and Human Liability for analyzing the water use in agricultural sector. So many other applied agricultural studies do exist that have used theories derived from basic researches (see Yazdanpanah et al. 2014; Valizadeh et al. 2016, 2018b; Bijani et al. 2017; Raeisi et al. 2018; Mohammadi-Mehr et al. 2018). Developmental research focuses primarily on innovation in processes, tools, and products. The purpose of this type of research is to use the scientific method to solve problems in a specific location and time. Accordingly, the solutions provided by these studies are purely local in application (Habibpour Gatabi and Safari Shali 2013).

Agriculture research based on time (past, present, and future) can be divided into three

categories: historical, survey, and experimental research (Delavar 2017). Historical research is the application of the scientific research method in historical issues of agriculture. This research is necessarily concerned with events that occurred before the investigator's decision to study them (Habibpour Gatabi and Safari Shali 2013). For example, an examination of the process of modernity's impact on the agricultural water management system requires a historical research endeavor (Habashiani 2011). If the answer to the question is relevant to present time (now), survey method is used. In this way, the researcher examines the current conditions for solving problems (Delavar 2017). Survey is mainly based on techniques such as questionnaires and interviews to collect information. In addition, the generalizability of the results is one of the characteristics of this type of research (Borg et al. 1963). There are so many studies (see Lockheed et al. 1980; Feder et al. 1985; Damalas et al. 2006; Anastasios et al. 2010) that have used survey method in the agricultural areas. The third type of time-based research is experimental research. Such research is the most common type of agricultural research. Experiment is the most accurate and most sophisticated type of scientific research. One of the main characteristics of experiments is "controlling," and based on this feature, the agricultural researcher is able to determine causal relationships between variables. In other words, the purpose of experiment is to interpret the causal relationships between controlled phenomena. In agricultural experimental research, three periods of time including past (pre-test), present (during the test), and future (posttest) are mainly taken into consideration (Habibpour Gatabi and Safari Shali 2013). Controllability, choice of treatments, replicability, etc. are the main features of these types of research methods. Experimental research methods consist of several types: experimental, quasi-experimental, and pre-experimental designs (see Borg et al. 1963).

Agriculture researches are also divided into quantitative and qualitative categories based on the nature of the data. Researchers interested in quantitative methods are trying to transform research information into mathematical symbols

to use statistical and mathematical analysis capabilities to describe and analyze issues in the field of agriculture (Iman 2009; Delavar 2017). Agricultural qualitative research is mainly descriptive in which the researcher is interested in the process of meaning and understanding of the terms, behaviors, culture, etc. The main reason for development of this kind of research is the weakness of the quantitative methods in the study of agricultural environments' social phenomena (Malekian et al. 2017). In qualitative method, observation, participatory observation, interviewing, content analysis, and discourse analysis are used.

Increasing the speed of changes in the environments, fields, and disciplines of agriculture and also complexity of problems in current era has caused many agricultural researchers to encounter difficulties in applying research methods, because, in many cases, answering research questions is not possible using existing research methods. The agricultural sector not only is one of the sectors that affects a lot of changes but also is affected by various global changes. In this regard, agricultural researchers are faced with a lot of problems in responding to these changes and issues and also applying research methods. But the development and extension of systemic thinking in agricultural research has made it possible to facilitate the exploration and resolutions of agricultural issues by employing the insights generated by this approach.

Systemic Research Methodology in Agriculture

Agricultural development in recent decades along with societal interests in agricultural activities and their consequences has introduced a new challenge to agricultural science. Accordingly, research in the field of agriculture needs to be reconsidered. In this part, it is argued that developing a systemic approach in the field of agricultural research would help to resolve this problem (Alrøe and Kristensen 2002). Such a view to agricultural research not only provides a holistic and wholeness-oriented basis for research but also

presents appropriate criteria to improve the scientific quality of research (Zanoli and Krell 1999). From the perspective of the research philosophy, science is considered as an interactive learning process with both cognitive and social communication dimensions, implying that the science plays a role in the world it studies (Malekian et al. 2017). A type of science affecting its subject area is called systemic science. Accordingly, agricultural science is also a systemic science; however, research studies conducted in this field generally do not possess the systemic research specifications (Alrøe and Kristensen 2002). Here are some of the most important changes to be made in agricultural research. Applying these suggestions can enhance the systemic nature of agricultural research.

In order to move toward a systematic research methodology, the connections among different branches of science are of paramount importance. Nowadays, given the complexity of issues and problems in different fields, especially agriculture, it is not possible to solve them using the knowledge and expertise of a researcher in a particular branch of agriculture (Gibbons et al. 1994). In this regard, it is necessary to use the expertise of a group of people in different scientific disciplines. Such a research perspective has led to the expansion of interdisciplinary collaborations and the formation of a realistic and holistic viewpoint toward solving the problems (Khoursandi-Taskouh 2009); thus it can be mentioned that the actual effectiveness and efficiency of scientific research to provide broad and dynamic viewpoints depends upon the avoidance of the disciplinary biases and ideologies, which would contribute to the research process in solving problems (Aboelela et al. 2007). For example, research seeking to address water conservation practices in the agricultural sector should not adopt the expertise of a particular discipline such as hydraulic systems, irrigation, or drainage in their own investigations; however, they should resort to all relevant fields of agriculture and even nonagricultural fields to contribute to research and problem-solving, since all these factors play a vital role in the concerned system.

Science can never be value-free. From this perspective, it is necessary to re-evaluate the role of values in science (Lekka-Kowalik 2010). Values play a significant role in science not only in the form of constitutive values, such as good-science norms, but also in the form of contextual values that are relevant to the science process. The consideration of such values is contrary to the objectivity existed in positivist research. Therefore, reflexive objectivity along with the relevance can be regarded as a new criterion for good science (Alrøe and Kristensen 2002). Reflexive objectivity shows that communication of science must consist of cognitive context, including social, intentional, and observational ones (Popa et al. 2015). In other words, both the involved actor's standpoint and the external observer's standpoint are considered in the systematic research process. The same standpoints need to be considered in systemic agricultural research.

Another point to be concerned in approaching systemic research is to adopt a proactive view toward the issues under study (Madani 2014). In other words, most agricultural research studies are carried out to solve problems that have already arisen prior to the research. Such a view toward research stems from a reactionary standpoint to the studied issues. Meanwhile, in addition to solving current problems in a systematic approach to research, the studies should provide predictions to avoid similar problems in the near or far future (Shahvali 2013). Holding such a prospective view and moving beyond the boundaries of the system in question refer to the possible implications of the subject under study, which could set a perspective for researchers or future research.

Nowadays, one of the main issues and problems of agricultural research is the researchers' tendency to reduce the studied issues and problems to the simple ones (Majidi et al. 2017). This partly is associated with the researcher's academic expertise (Shahvali 2013). In contrast, the systemic approach is underpinned by a principle indicating that research is to examine issues within a wide range of complexity (Alrøe and Kristensen 2002). In systematic methodology, the subject itself is a system that may consist

of a large number of subsystems, each of which may require a different research methodology (e. g., surveys, laboratory methods, time series analysis, and so on). Regarding low irrigation efficiency in agricultural sector (as the main system under study), for example, the secondary problems such as worn-out irrigation systems, farmers' lack of knowledge and awareness about water conservation methods, inappropriate soil texture for agricultural purposes, and inappropriate distribution of rainfalls in the growing seasons can be detected, each of which is assumed as a subsystem in this field and requires different research methodology.

Regardless of the reducibility from the perspective of the researcher's expertise and the emphasis on analyzing complex problems by using a method (Guba and Lincoln 1994), quantity orientation and statistical manipulation in research and the focus on using the intellectual paradigm of positivism are another problem in today's research, especially agricultural research (Majidi et al. 2017; Ebrahimi Sarcheshmeh et al. 2018; Fallah Haghighi et al. 2019). This critique is mostly introduced in social studies in the field of agriculture since such a viewpoint does not pay enough attention to the creative and human aspects of the phenomenon and seeks to control the phenomena and issues at certain levels and employ natural sciences methods to examine human behaviors. As noted earlier, the systemic approach to research rejects such a perspective since the researcher in the first stage reduces the complexity of the concerned system in order to increase his own potentials to measure the phenomenon, and he encounters a kind of methodological bias in the second stage as such he makes attempts to analyze all systems as hard systems.

The Conception of Use in Agricultural Research

Annually, there are a large number of research studies in the field of agriculture; however, some studies are called Applied Research and others are referred to as Basic Research. As it was previously mentioned, in the applied research, the main

purpose is to test the feasibility of knowledge. On the other hand, the basic research, though capable of having practical implications, mainly aims to expand the development of knowledge and understanding boundaries (Schensul et al. 2012). The positivist conception of use has made many social studies in the field of agriculture and environment be regarded as non-applied research (Delavar 2017). This is partly due to the fact that such studies are more of a behavioral and social nature and that the results of social and behavioral research are not objective and deterministic. Many individuals do not classify them as applied research. Another factor leading to the formation of such a viewpoint toward the social agricultural research is associated with the definition and interpretations of the concept “use” by different individuals and scholars. It should be noted that this concept and its significance in research were first appreciated by evaluation researchers. Then it was concerned in other fields of research.

Since the 1970s, the term “use” has been a hotbed for debate by theorists and researchers. In the early definitions of “use,” the scope was extremely limited and included only immediate, concrete, and observable outcomes derived from research results on a particular decision or policy. During the following decades, the theorists focused on the fact that the research findings may not necessarily lead to immediate consequences and changes and may cause changes in individuals’ minds. In the early 1980s, researchers began to broaden the concept “use” by including measures such as learning from the research conducting process, increasing the research audience and stakeholders’ awareness about the research effects and consequences, and thinking about the evaluation (Shadish et al. 1991). Patton (2008) defines the term “use” as how real people in real world apply research findings and experience. Recently, Henry and Mark (2003) have put forward a broader conception of “use” in evaluation research, which highlights the importance of considering the research “influence.” These led to paradigmatic changes in attitudes toward the “use” of research findings, and consequently the immediate and short-term use was replaced

by the long-term use. To this end, it was also suggested that each researcher explains the implications of his/her research findings in order to facilitate their use since the research results are not impelling by themselves and the researcher himself should try to improve their use.

With the evolution of topics on the concept “use” over time, different types of “use” have been introduced, three main types of which in research are as follows: instrumental use, conceptual use, and persuasive use. An instrumental use occurs when decision-makers use research findings to modify or change their programs (Fleischer and Christie 2009). This kind of use is also pointed out by Patton (2008). In this type, the results and information gathered during the research process are used directly and concretely or for a specific decision.

Conceptual use occurs when the research results help the research team or key stakeholders to understand the research and the research situations. Conceptual use might be of significance for research situations carried out by novice researchers or research situations about which there is no sufficient understanding because they lead to a better or novel understanding of the research or research situation, rather than its direct and instrumental use (Shadish et al. 1991). An example of conceptual use in agricultural research is the study of “agricultural sustainability or unsustainability” in a particular region. If the research results indicate that agriculture is not sustainable in the concerned region area and some modification of farmers’ attitudes is required to make agriculture sustainable, then a conceptual use of the research results is made. However, if some strategies such as changes in conventional farming methods and techniques by the authorities are adopted following the research results, then the instrumental use is concerned for the research findings. In this regard, Weiss et al. (2005) state that conceptual use is also known as “enlightenment,” “organizational learning,” and “cognitive processing.”

Persuasive use, sometimes referred to as political use, is not always taken as a positive use. Examples of negative persuasive use include the use of research results to justify or legitimize

the adopted decisions or to endorse executive decision-makers and stakeholders (Fleischer and Christie 2009). In some cases, even though, the political use is not deliberately intended to justify a particular decision or action, and it is in line with the actual use of the research results (Patton 2008), i.e., positive persuasive use. It should, however, be noted that the potential of persuasive use to be positive and negative is one of the fundamental features in this type of use.

In short, it can be claimed that each type of research in the field of agriculture may have at least an instrumental, conceptual, or persuasive use. This implies that scholars and theorists should not merely consider research having no instrumental use as non-applied research because such research studies may have conceptual or persuasive uses.

Summary

The purpose of this entry was to discuss contemporary topics in agricultural research with focus on its definition, the role of agricultural research in achieving 2030 Agenda goals, different types of agricultural research, systemic research methodology in agricultural sectors, and different kinds of use in agricultural researches.

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