



Ministry of Agriculture

Strategic Plan for Agricultural Research

Innovation and Creativity

2017-2021



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# Strategic Plan for Agricultural Research

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## Chapter 1

### Introduction

The Palestinian Authority aims to create a vibrant agricultural innovation system (AIS) which will ensure resilience of the agricultural sector and will contribute to development of the Palestinian economy. The new system aims to strengthen the coordination between the various partners and stakeholders in the applied agriculture research system by creating an effective mechanism for coordination among all partners. It is anticipated that the new system will also increase their contributions to resilience, food security, economic development, poverty reduction, and effective utilization of natural resources. All these efforts will ultimately lead to the creation of a sustainable institutional base in this vital sector in Palestine. Over the period of this plan, we will rely on partner organizations' strengths in generating knowledge while simultaneously working towards fostering a culture in which innovation plays an important role.

This strategic partnership is deemed vital because it will allow for the utilization of the infrastructure capacities and human resources available in each organization. Such collaboration will facilitate access to knowledge and resources among partners and farmers alike, which will allow for establishing a viable research system. Though we invite all relevant organizations to contribute to agriculture applied research, we encourage specialization in research areas in order to increase each organization contribution to the national research effort. This encompasses governmental, non-governmental and private organizations which are active in agricultural research.

The roles and responsibilities for these organizations can be summarized as follows:

***The Ministry of Agriculture:*** The National Agricultural Research Center (NARC) will lead the effort to enhance agricultural research by setting up applied research areas of priorities for agricultural development in accordance with the national strategy and the sub-sector strategies. NARC will act as the official research arm for the ministry of agriculture and the agriculture sector.

***Farmers:*** Industrial scale farmers will meet highest international standards for export products and have some scope for direct marketing. Smaller farmers will expand farm size and adopt new technology adapted to their increased scale. Their connection to developing domestic value chains will be enhanced. Their link to knowledge generating institutions will be enhanced through representatives in governing boards.

***Research centers and universities:*** Palestine's knowledge institutions have international quality scientists and academics but there is limited collaboration among them. Transportation disruptions are an impediment but not an insurmountable obstacle in the electronic age. This strategy will promote inter-institutional exchanges, mobility and practices friendly to dual-career couples. A more coordinated approach will give it enhanced importance in influencing policy agendas.

***Agricultural advisory services:*** In an innovation system, what used to be called "extension" will function as part of a "discovery, proof of concept, and scaling up continuum". International experience has shown that it is equally important, where it is located administratively and the ways it connects on both ends to farmers, researchers, and now the

private and NGO sectors as boundary partners of farmers<sup>1</sup>, depending on how empowered the persons in charge, and their commitment, engagement, relations and determination to deliver. In a review of coordination, this strategy will seek stakeholder and expert advice.

**Private Sector and NGOs:** As primary agents in the use and scaling up of innovations, both the private agribusiness sector and NGOs are important boundary partners linking knowledge to action. They can be extenders of knowledge, important contributors to knowledge and sometimes funders of knowledge creation. On occasion, they may be the effective link between evidence-based policy and implementation by policy makers. Under this strategy, this role is welcome.

**Initial Structural Conditions:** A detailed analysis of Strengths, Weaknesses, Opportunities and Threats is found in the Annotated Workbook<sup>2</sup>. The key constraints on land, water, control of markets depend on relaxing the constraints of the occupation. This strategy includes a section on “Preparing for transformation” and describes research that needs to be started now so Palestine can take advantage of opportunities that arise. They will be fruitful areas for collaboration with advanced institutes in development partners.

**Policy environment:** Policy works in three ways: 1) changing incentives through prices and regulations, 2) changing patterns of investment among different ways to help agriculture, and 3) changing the total flow of funds to the sector. Good policies and consistent implementation are magnets for development partners. This strategy will draw on knowledge institutions for analysis, policy experts for advice, and boundary partners for their input. The knowledge generating sector may have increased effectiveness in policy-making if its coordinating body or mechanism is given a new status (whether as an autonomous, body elevated in the government hierarchy or an independent advisory body). This strategy will review the need and format of such a body.

**External Science and Technology:** There is a vast amount of applicable knowledge in the global public domain (both private and public sector). This strategy will work with partners in the CGIAR, UN organizations and technical agencies of donor partners in discovery, proof of concept and scaling up of proven techniques. It will also strive to improve information systems to make search, retrieval and information sharing more efficient as a basis for enhanced collaboration.

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<sup>1</sup> A “boundary partner” bridges principal actors, sometimes without necessarily having a direct stake in the arrangement.

<sup>2</sup> The Annotated Workbook includes three pieces: 1) A Thematic Workbook prepared for the National Consultation; 2) Summaries of key discussions and summary tables prepared after the Consultation, and 3) New data and information contributed by Working Groups after the National Consultation and in preparation of this Strategy.

## Theory of Change

### Complexity, Sphere of Control, and Timer

An innovation perspective recognizes that there are often several ways to achieve an objective; that many parts of the system may have to change together; and that many changes are beyond the immediate sphere of control of principal actors, including government. For technical solution to be adopted, it may be necessary to improve incentives, make investments, and fill gaps in value chains. The further these steps lie from technology, the more complex the interactions and the more they lie beyond the sphere of control, or even influence of researchers and university scientists.

A theory of change is a logical statement about the potential value of a discovery, or proof of concept, and what other arrangements have to fall in place for it to be adopted at scale by producers. A crop-livestock system modeled at the station level needs proof of concept at village or district level before it can be scaled out and national economic impact can be predicted.

Research success, and innovation, which is the application of knowledge for a purpose, is a sequence of actions that bring contextual constraints under control of research, of policies, and of institutions, see figure (1) below.

Six thematic groups worked to define their contributions to the four Researchable Goals leading to Resilience and Development<sup>3</sup>.

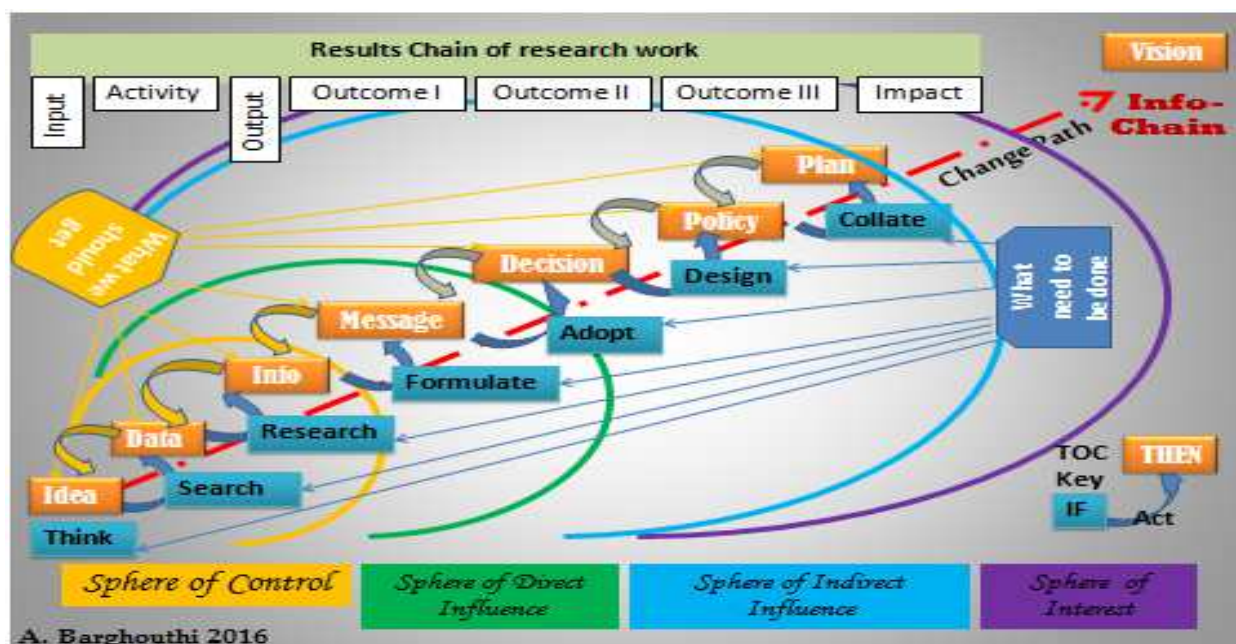
A representative Theory of Change diagram visually shows the impact pathway from research results through use by an intermediary or an end user to adoption at scale shows the potential for net gain. The distribution of net gain among producers, consumers and value chain intermediaries and more generally to the society is an impact evaluation exercise that comes towards the end of a program. However, for ex ante prioritization of research, it is necessary to attach some probable gain at scale.

Six thematic Groups were created to underpin the Strategy process:

1. Plant Improvement, Production and Protection
2. Animal Genetics, Husbandry, and health
3. Natural resource access and sustainability
4. Socio-economics, Farm Management and Livelihoods
5. Policy: Public finance, Institutions, and Oversight of the agricultural economy
6. Marketing, Value Chains, Private sector, and Innovation

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<sup>3</sup>Resilience= 1) resilience to physical and economic shocks + 2) Food and nutrition security; and Development= NRM and Ecosystem Services + Capacity Development: Human, Institutional and Policy Processes



**Figure 1:** Theory of Change & Information-Chain

The groups have worked to identify agricultural research contributions (areas of research) to achieve the strategic objectives that lead to higher goals in the resilience and development.

### **Methodology for preparation of national agriculture research strategy**

The challenge dialogue methodology was used to reach consensus among all stakeholders on main focal points. This methodology is based on two main principles:

1. Dialogue brings better results than debate
2. Consensus building simply means that all parties can all work together towards a common end.

The working methods included these preparations:

1. Deciding the frame for system frames and components
2. Surveying all stakeholders to determine their attitude and input on the propositions and hypothesis for the innovation and invention policy frames.
3. ATSI was used to analyze the results and verify the system various components.
4. Verifying the strengths, weakness, opportunities, and threats (SWOT) for the system.
5. Function analysis for Palestinian Innovation System using interviews with all relevant parties.
6. Six focus group outcomes.

To perform the study, a national team was formed, led by the Ministry of Agriculture and included members from the ministry, other related government offices, research centers, and national universities. The team provided consultations and support during strategy preparation, reviewed and commented on various drafts, and offered technical support for the working teams. We also enlisted the expertise of six technical teams to develop the main

themes for technical programs and the strategic interventions for promoting innovation in agriculture. Finally, a series of workshops and consultation meetings were organized with all agriculture research stakeholders.

### **Outcomes of the meetings for the specialized thematic groups**

Six specialized technical teams were formed to support strategy development process. These teams are:

1. Plant production, improvement and protection
2. Livestock genetics, husbandry, and health
3. Natural resource access and sustainability
4. Socio-economics, farm management and livelihoods
5. Policy: public finance, institutions, and oversight of the agricultural economy
6. Marketing, value chains, private sector, and innovation

The main results for the specialized teams meeting came as follows:

1. ***Plant improvement, production and protection*** includes fruit, vegetables, cereals and forage and medicinal plants as commodities while rain-fed agriculture and organic farming take a cropping systems perspective. Plant protection cuts across systems and commodities.

Research in this area is aimed at:

- raising factor productivity,
- disease protection and improving the competitiveness of national agriculture products.
- diversification and integration.

It is widely known that there is an unsatisfied domestic demand for cereals, vegetables and forages that is a potential sink for research on production increase and sound distribution. Competitiveness in external markets will depend on meeting quality and sanitary and phytosanitary standards as well as impairments which may happen due to foreign control of marketing channels. In the short term, research in this area may very likely contribute to improving productivity and production which may in turn create rising incomes in the short term.

2. ***Livestock genetics, husbandry and health***: Sub-themes include feed and forage, animal genetic resources, animal diseases, animal husbandry and non-livestock themes of bee keeping and fish farming.

The research objectives in this area include:

- Improved breeds (high production and disease resistant),
- Improved nutrition,
- Animal health and disease protection,
- Livestock-based production systems,



- Feed and forage cost reduction and animal waste treatment, e.g. feed and forage production from waste water treatment stations and recycling and reuse of fish waste.
  - Improving dairy production industry
3. ***Natural resource access and sustainable use:*** Access and use of land, water, energy, genetic resources and forests and range-land heavily depends on access to Area C. Around 62% of arable lands are controlled by the Israeli occupation forces.

Critical and eminently researchable issues in the area of natural resource use are:

- rights to land and water resources,
- access and control,
- sustainable management of natural resources,
- and improving capacity of Palestinian institutions.

4. ***Socio-economics, farm management and livelihoods:*** This all-inclusive heading will bring to focus several socio-economic disciplines and farm management issues. The researchable issues cut across:

- Rural development
- farm household economics,
- farm incomes and livelihoods,
- food security and safety,
- farm enterprise management

Partnership among national agricultural research centers, rural advisory services, universities and think tanks is needed if all these issues are to receive due attention. Multidisciplinary teams will need to be formed and gender issues will need to be considered throughout.

5. ***Policy, Institutions, and organizations:*** Policy issues are pervasive because they affect public finance, organization bylaws, agricultural insurance, and supervision of agricultural economy. Special skills are needed to explore and perhaps create fiscal opportunities for raising resources to support agriculture and agricultural research and innovation. The banking and insurance industries are still underdeveloped as far as the services (loans and insurance) they deliver to the agricultural sector are concerned. Under this strategy, the options for alternative provision of such services will be reviewed and presented to the Palestinian Government. Public administration regulations that impede collaboration among research centers, universities and the non-governmental sector will be reviewed and revised. The Government will seek a facilitating and incentivizing role in the emerging agricultural innovation system.
6. ***Marketing, Value Chains, Private Sector and Innovation:*** The starting point for exploring this theme lies in the availability of a marketable surplus at the farm level. However, the key to development in this area lies in efficiently implementing development projects with the assistance of consultants from the public sector, the non-governmental organizations or actors along the line of value chains. The public

sector can provide help by sharing open market information, facilitating national commodity exchange, supervising the health and safety regulations, and providing support if needed.

The proposed strategy is rooted in the present for the short term (2017-2021). The prospective gains will result from establishing a vibrant information base in plant and animal production. Though the logic behind the strategy is clear, any measurable net benefits will remain only estimation and will largely depend on good performance upon executing the strategy.

The studies for preparing a scientific base for the long-term agricultural transformation in Palestine will enter into effect immediately.

This strategy consists of seven chapters: 1) Introduction and methodology; 2) An overview of the agriculture sector; 3) The vision for research strategy; 4) Analysis of the current situation; 5) Strategic goals; 6) Strategic programs; 7) Monitoring and evaluation.

## Chapter 2

### An overview of the agriculture sector

As a background, it is useful to offer some important facts and statistics which directly impact agriculture in Palestine. The area of arable land is estimated at 1.2 million donums which amounts to 21% of the total area in the West Bank and Gaza area. 90% of the arable land is located in the West Bank while only 10% is in Gaza. The rain farmed area accounts for 81% and the irrigated area is only 19% of the total agriculture land. The grazing and pasture area is estimated at 2.02 million donums, of those the area available for Palestinian farmers is limited to 620 thousand donums due to limitations imposed by the Israeli occupation. The area designated as closed forest amounts to 94 thousand donums while the open forest area totals 320 thousand donums. 62.9% of these areas are located in area C, 18.8% in area B, and 18.3% in area A. Concerning water utilization for agriculture purposes, it was estimated at 146 million cubic meters for 2011 which amounts to 44% of the total water consumption amounts for Palestine; 60 million cubic meters in the West Bank and 86 million cubic meter in Gaza. Most of the water in Gaza and the West Bank is pumped from underground aquifers and springs provide another irrigation source in the West Bank. 82% of the underground water in the West Bank remains under control from Israel.

The livestock statistics in the West Bank are 732, 399 sheep, 240,136 goats, 39,625 cows, 1,506 camels, and 3,603 horses. On the other hand, the poultry farm birds are approximately 3,650,000 and the egg production farms have approximately 1,600,000 farm birds. The number of beehives in the country whether traditional or modern is 44,278 while the fish farms contain approximately 1,318 tons of fish.

Palestine is considered a lower middle income country whose potential for growth and development is constrained by several unique factors. The Palestinian authority has no control its borders or on the network of roads connecting its cities and villages together. The state lacks control over administration of the majority of its land and water resources; and its access to trade tax revenue is controlled by an occupying country - Israel controls external trade and the trade revenues. Over the years, Palestine has benefitted from grants and loans given by the Arab countries and the development and security aids provided by European and North American governments. However, it is important to understand that the uncertain flows of support funds make it particularly difficult for the Government to commit to long term development from own budgets.

Additionally, the lack of control over the land and water in Area C places limitations over any potential development in the agriculture sector. Nevertheless, even though the role of agriculture in the economy is relatively small (3.3% of the Gross Domestic Product for 2015), yet the agriculture sector continues to provide 11% of employment opportunities in the country. A small percentage of the population in Palestine remains food insecure (a bit less than 10% of the West Bank population lives below the new poverty line of \$1.50/day). Therefore, food security continues to be an issue of high concern because of the risk which may come from any interruption in the aid supplies and the partial reliance on imports to maintain consumption.

Agriculture research in Palestine continues to suffer from lack of coordination and collaboration among various stakeholders and still falls short from meeting the requirements of sustainable agriculture development. For example, Palestinian universities produce

substantive amounts of theoretical research the results of which cannot or are not used for improving the agriculture production systems. On the hand, the National Center for Agricultural Research is not receiving needed support to improve the infrastructure or the research human capacity or the laws and regulations which will enable it to play its leading role in coordinating and guiding agriculture research towards addressing the sector's priorities.

## Chapter 3

### The vision for research strategy

This Strategy supports the evolution of a coherent, collaborative and effective Palestinian Agricultural Innovation System (PAIS). It will be one in which the knowledge organizations collaborate to supply farmers, value chain actors, and future generations of scientists, educators and service providers with the skills they require for Palestine's expansion into regional and global markets.

An innovation system is inherently evolutionary. This is why the public system can guide and reinforce positive trends but cannot create and sustain an innovation system on its own. Palestine will count on its financial donors to align themselves with the priorities of this strategy.

The following actions should be taken:

1. The development of the legal environment to control research work, and to enable the National Center for Agricultural Research (NARC) responsible for implementing the policy and strategy of agricultural research. Increase interest and taking the results of agricultural research by the policy makers.
2. Designation the researchers and provide an enabling and sustainable work environment and facilitate and increase the possibilities and opportunities for mobility of researchers between the institutions through agreements to be negotiated and agreed upon between these institutions, in order to promote the work of researchers opportunities in their areas of specialization.
3. Improving the scientific and technical cooperation between institutions working in the field of agricultural research through better means of communication and joint planning and coordination, and incentive systems.
4. Provide financial support for research programs suggested by this strategy.

## Chapter 4

### Status of the agricultural sector

**Natural resources:** There exist fertile lands on which sustainable production is possible (both rained and irrigated). However, many farmers exist on small and fragmented holdings, with degraded soil and water. The Israeli control of land administration makes it difficult for Palestinians to access agricultural land in Area C, 62% of the territory.

**Production systems:** Farmers and cooperatives have adapted systems that are resilient but at a low level of productivity that is not competitive in their own market with Israeli products on price and quality. Farmers have ineffective lobbying capacity to change laws and regulations. Donors are interested in helping them modernize technology and institutions

**Research institutions:** There is a network of agricultural research centers (NARCs) with land, stations basic equipment, and some state-of-the-art instruments funded by project. The network is well distributed throughout the country. There is, however, weak coordination among agricultural research centers; some duplication of research; and failure to renovate equipment and facilities. Universities pursue discovery research and didactic research with little connection to farmer needs or links to NARCs. Information is a cross-cutting concern does not benefit from coordination. All parts of this part of the knowledge system are affected by budget volatility and unsustainable funding for priorities.

**Legal and Regulatory System:** Agricultural laws need to be renewed, policies are out of line with national goals and objectives, and laws governing land and water right are not clear and arbitrarily enforced. The major threat is the absence or weak enforcement of policies and laws.

**Markets:** There is a small and a “thin” national market for most commodities. While there is some scope for import substitution the local product does not compete on the basis of quality, reliability of supply for processors and quantity. Thus the growth linkages from increased processing and marketing for export are limited. There is some scope for specialized “Holy Land” products but large scale production for export will require vertical integration best done by the private sector. Quality and standards will need to be enforced. The Israeli control of imports of necessary inputs and marketing of exports constitutes a risk factor.

**Agricultural Knowledge Systems:** The universities and higher agricultural training institutions produce many graduates who do not match market demands. Academic publications meet quality standards but their impact factor is said to be low. The country lacks a national reference library for agriculture, which weakens the capacity for policy advice. Unfortunately, the demand for independent policy advice is not strong.

**Agricultural data and Information:** The improvement of broadband connectivity in the West Bank creates the opportunity for market information to improve the effectiveness of matching supply and demand. It will facilitate banking and farm insurance for small farmers and lower its cost and it will make water management more efficient. Skilled people will need to be trained to take advantage of these opportunities.

## SWOT analysis

The SWOT analysis is essential to determine the development tracks and to identify the problematic areas in the agriculture sector which it is hoped that this strategy will help resolve. It will also help define the strategic goals for agricultural research in Palestine which will in turn significantly contribute to the “resilience and “development” in this sector as noted earlier in the NASS.

This Strategy looks at the Strengths, Weakness, Opportunities and Threats (SWOT) facing a potential Palestinian agricultural innovation system (PAIS) as the context for development of a strategy for the PAIS.

Strengths	Weaknesses
<ul style="list-style-type: none"> <li>• A network of agriculture research centers which are quite conveniently spread out across the country.</li> <li>• The availability of specialized research teams.</li> <li>• The availability of academic specialization in agriculture at national HEIs.</li> <li>• The availability of fertile lands which can be used for research purposes.</li> <li>• The availability of basic infrastructure for agriculture research.</li> <li>• The availability of a network of cooperatives.</li> </ul>	<ul style="list-style-type: none"> <li>• Low funding and financial resources allocated for agriculture research.</li> <li>• Lack of coordination among agricultural research centers.</li> <li>• The obvious mismatch between agriculture university graduates and the demands of the labor market.</li> <li>• Land ownership dispersion.</li> <li>• Traditional rain farming and irrigation technology available.</li> <li>• Scarcity of water resources due to denial of access rights.</li> <li>• Lack of control over arable lands or control over potential expansions.</li> <li>• The need for updating and modernizing agriculture laws and regulations.</li> <li>• The weak marketing environment and the small markets available for agri-products.</li> <li>• The weak capacities available for research centers and the mismatch of tasks with the main goals for these centers.</li> <li>• Overlap in research topics and themes between the research centers and the universities.</li> <li>• Low capacity for data collection, analysis and utilization.</li> <li>• Lack of interest in quality data at policy making levels.</li> </ul>

Strengths	Weaknesses
	<ul style="list-style-type: none"> <li>• The rights to land and water resources remain vague.</li> <li>• A weak agri-industry sector and post-harvest practices.</li> <li>• Low response from farmers to opportunities.</li> </ul>
Opportunities	Threats
<ul style="list-style-type: none"> <li>• Donor support for production projects in the sector.</li> <li>• Access to modern and advanced technology.</li> <li>• The availability of knowledge generation institutions.</li> <li>• Fast speedy communication tools and networks.</li> <li>• A relatively strong national publishing industry.</li> <li>• Decision makers' conviction that agri-laws need to be modified.</li> <li>• The availability of agriculture law enforcement regulations.</li> <li>• Tourist demand for holy land products (quality standards).</li> <li>• Trade and free trade agreements and the exemption agreements with the EU.</li> </ul>	<ul style="list-style-type: none"> <li>• The political condition of occupation which hinders growth in the national economy.</li> <li>• Climate change and the rainfall rate fluctuations together with the lack of control over water resources.</li> <li>• The absence of a national strategy for agricultural research.</li> <li>• The absence of a national policy to support research and the instability of donor funds for this purpose.</li> <li>• The uncertain fund allocations for agriculture in the national budget.</li> <li>• Total reliance on Israeli mediators for imports.</li> <li>• Lack of control over Israeli product infiltrations of the national market.</li> </ul>

## **Prioritization of Research for Intermediate Development Outcomes**

### **Discovery, Proof of Concept, and Scaling Up**

The ability to achieve impact at scale depends on a continuum of research running from discovery, to proof of concept, and adaptation of results to meet the need of many producers with different constraints. Universities are normally associated with discovery and proof of concept. Academics often run multi-location and multi-stakeholder experiments are research in development. NARC was established to develop knowledge, technologies and systems that can benefit producers at large. In many countries, national agricultural research institutes (NARIs) were created out of separate ministerial departments of agricultural, livestock, and natural resource research for an integrated approach to applied research. Whether production and extension departments were included in the new NARIs depended on size, geographic diversity and commodity concentration. Scaling up and scaling out proven techniques is often done with formal extension, NGOs, farmer organizations and private sector aggregators, processors and input suppliers.



### **Formal prioritization: Applied research**

NARC, the leading applied research organization, undertook a formal priority-setting exercise that addressed the contribution of research to the two formal goals for agriculture of “Resilience” and “Development” (NASS).

1. Resistance to climate change and economic shocks,
2. Food and Nutrition Security. Four clusters of program activities under each area were further identified.
3. Natural resources and Ecosystem Services.
4. Capacity development, Institutions and Policy.

Prioritization issues: Time horizon & Cross-Cutting-themes

The time horizon must be present in all considerations. In the long run more things are possible, more costs are variable, and more things can be brought under one’s sphere of influence and control. Physical constraints may be overcome through new technology; policies and regulatory constraints may be overcome through negotiation and collective action; and skill shortages can be overcome through training. However, the groundwork for the future must begin with planning and research feasibility.

Time horizon: The priorities for the short run are determined by the available research structure, infrastructure, and human resources. They are what can be done reasonably in the time frame discussed. With planning, and effort to raise funding, changes will be made that can be transformative.

This Strategy calls for three special “audits” to advise the Minister on potentially transformative changes to the agricultural innovation system and what Palestine’s research and higher education budgets can provide in terms of research infrastructure, modern information and communications infrastructure, and ensuring gender equity.

**Infrastructure:** Ensuring adequate investment in basic infrastructure and equipment to carry out the right mix of discovery (basic) and development oriented proof of concept research. Investment is needed for new directions and cannot be ensured by project funding. Governments must build this into institutional planning.

**ASTI<sup>4</sup> data** for West Asia and North Africa and relevant parts of Asia show that there are wide differences among countries in the proportion of expenditures that go into 1) salaries, 2) operating costs, and 3) capital investment. This varies by country but when salaries account for more than 75% of total expenditures there appear stresses in operating budgets or degradation due to lack of reinvestment in equipment. This Strategy calls for an urgent benchmarking of the national system and a monitoring system put in place for the health of the system, quite apart from the monitoring of research programs themselves. With data on the distribution of resources around the country, Palestine will be in a better position to organize collaboration among institutions.

**ICT:** Information supports all stages of the research process: knowledge is retrieved, discovery comes from data that is published as information as an output that is used for impact by other people. Information management, communication and technology (ICT) are

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<sup>4</sup> Agricultural Science and Technology Indicators (IFPRI, 2015)

the platform upon which bench science is done. Palestine is able to benefit from information-intensive work of ARIJ and modeling capabilities in some universities; ICT can share the usefulness of their techniques more widely. The expansion of information-intensive research often favors gender equity since its office-base and regular hours attract female scientists.

*Gender:* Gender is about both men and women and Palestine has many female scientists. A gender audit would look at their efficient and equitable deployment and preparation for leadership. Since scientists are often married to other scientists in related fields, enlightened regulations should ensure optimal career opportunities for dual-career families. For example, reporting and evaluation relationships should not put related individuals in conflict of interest but need not forbid employment in the same institution. Given that gender equity is a high priority for international donors, Palestine will need to show conviction in adoption of this cross-cutting objective.

Issues for the medium and longer term require preparations begin now. Their implementation will require acceptance and buy-in requiring changes in attitudes, institutions and culture.

1. Strengthening the evidence base for fair access to Palestine's water and land
2. Breaking systemic bottlenecks in trade and local market development, and
3. Strengthening the cohesiveness of the Palestinian agricultural knowledge institutions through joint challenges, inter-institutional mobility, and gender-friendly policies for dual career families.

### **Strengthening Uptake: Adopting an innovation systems perspective**

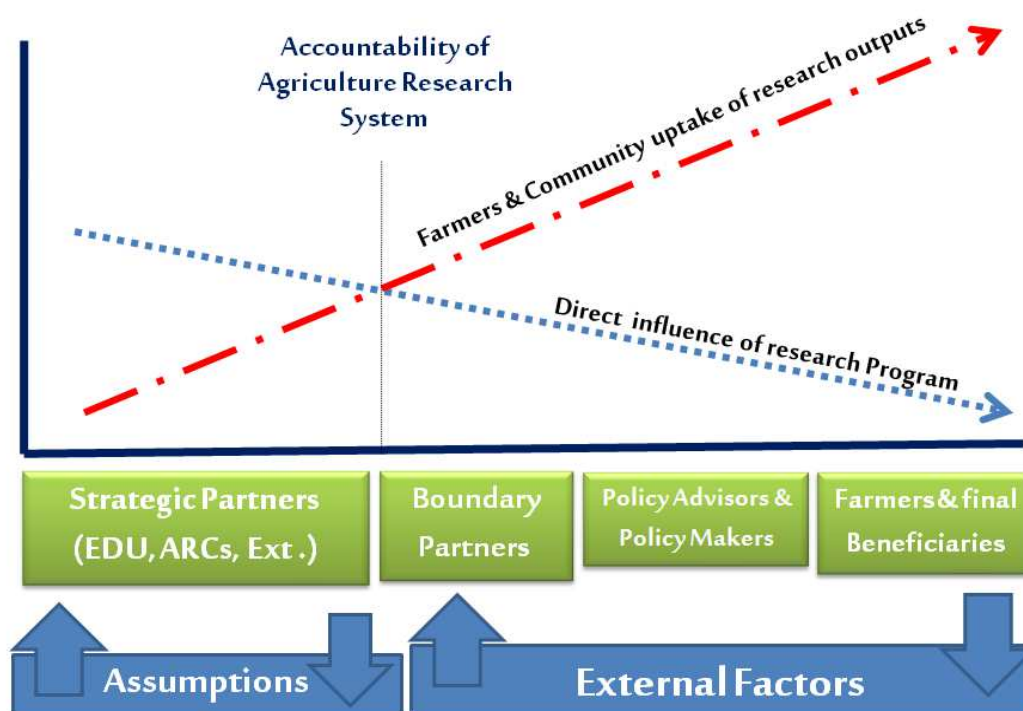
A principal challenge for the Strategy was to address a historical problem of research-extension linkages. The innovation systems perspective recognizes that fixing one linkage is not the main problem when all systems are evolving. There is no one solution that is best, only the best fit (Figure 2).

The Palestinian system is evolving. Measures must be designed for best fit when there is a continuum from research discovery through proof of concept to scaling up. Partners share many functions and the partner closest to the key bottleneck can often be given the lead knowing the rest of the system will accommodate.

Extension systems have been modernizing. Their function is currently less transfer of technology from research to user but to facilitate services to farmers and their organizations, organize innovation platforms, and facilitate value chain integration. NGOs are often skilled in performing similar functions.

The Strategy team analyzed the expected behavior of partners with respect to uptake of research results. Results of consultation process are summarized in the Technical Annex (2).

Highlights of the findings are given below for the short-term Strategy period 2017-2021. They are organized by key actor and include suggested actions for improvement.



A. Barghouthi 2016

Figure 2: Direct influence of research program and uptake of its outputs

**MOA Central Departments and Policy-Makers:** These actors must take an active role in endorsing or improving recommendations from the Strategy so that they have a stake in implementation. An institutional framework or body for annual consultations, interim meetings with stakeholders on new issues and workshops are among the solutions. Sharing results of evaluations with stakeholders will help research be responsive to their clients.

**NGOs:** NGOs frequently fill vacuums in the system. Many are known for their technical competence and, in some countries, carry out rigorous discovery research, for example, in conducting multi-community trials in health and agriculture. They are quick to adopt and scale out research results. Their funding is, however, project-driven and sustainability is not ensured. Palestine can be proactive in identifying and recruiting NGOs that address Palestinian priorities and can be associated with research from the proof-of-concept stage forward. NGOs in country should be involved in identifying farmer and community needs since they bring local knowledge and technical information.

**Universities and Higher Agricultural Schools:** Universities are not charged with scaling up technology; they are, however, useful evaluators of applied science involved in scaling up; need to be connected to the ground to be able to teach research skills to applied agriculturalists; and need constantly to ask whether their proof of concept research has potential for impact at the end of an impact pathway. (Predicting rainfall is not impact: changing planting dates as a consequence is.) This is why an innovation perspective looks for ways to encourage collaboration, shared use of facilities, and joint planning. Competitive grants favoring joint work and national agricultural research forums are other mechanisms.

**Research centers:** Research centers are at the heart of applied and adaptive research. They can link discovery and proof of concept research to agricultural advisory services. They have the advantage of being geographically distributed close to local administration. Given their

weak financial position as dependent on government financing, they need freedom to engage in aggressive fund raising for priority projects. Supportive political and regulatory license to join with Universities and uptake partners in pursuing funding is needed. Their role in developing technology along the value chain opens many avenues to funding.

***Private sector:*** The private sector is not dependent on the NARC for its technology since it often must organize an entire value chain. It has its own technicians that may request help in scaling up their supply chain by identifying and training new producers. The government may join with the private sector in setting up agri-business incubators. The government can play a key role in organizing access to water, land and transportation that serves a wider public. Market potential needs to be carefully evaluated.

***Farmers and farmer organizations:*** Small farmers are said to be risk averse and slow to adopt new technology. It may be a good strategy in an uncertain physical and political environment. Larger farmers defined by commodity rather than “farming”, are closer in behavior to private sector. Farmers' organizations have played an important role in credit filling a gap left vacant by the commercial banks. Farmer organizations have a role to play as an important boundary partner linking farmers to politicians and policy makers. Their potential role has been understated especially given their role in asserting rights to the land.

All of the above elements of the Palestinian agricultural innovation system can be individually improved; working together as a system they can achieve transformative results.

## Chapter 5

### **The national strategic objectives for agricultural research and the impact on development**

The objectives for the national strategy for the emerging Palestinian agricultural innovation system are derived from the high level goals of the NASS 2014-2016 which are mainly related to “Resilience and Development”. Resilience and development are wide concepts that can be broken down into key components which are served by a formal set of core governmental institutions and a wider range of non-governmental actors in addition to other stakeholders. One important function for this Strategy is to facilitate and coordinate their contributions towards achieving the four researchable objectives of the Palestinian agricultural innovation system (PAIS) as explained below.

The national level goals of resilience and development are broken down into researchable and up-scaling goals of the innovation system. Resilience is addressed through immunity and dynamism in the agricultural practices and policies which enable Palestine to recover from shocks and to fast return to at least the former situation. Resilience is also addressed by food and nutrition security measures which include various dimensions like production and productivity, markets, fund transfers and loans from both public and private sources.

The factors which will contribute to resilience and development include improved natural resource (water and land) systems; the protection of ecosystem services; capacity development and improvements in research and higher education; improvements in extension and agricultural advisory services; improvement and development in research institutions, value chains, and policy making processes; and the creation of an enabling policy making environment in which evidence-based policies are drafted and acted upon.

The national strategy objectives were principally derived from a situation analysis study, the problems and challenges encountering the agriculture research effort in Palestine. The strategy is geared towards reinforcing the agriculture research role and contribution in furthering the national objectives and priorities for the agriculture sector.

Additionally, this strategy depends largely on impact studies and the theory of change which was discussed in more detail earlier. A set of Intended Development Objectives (IDOs) and Sub-objectives; for each strategic objective, the strategy team were able to define the contexts and themes which may well serve to achieve the national objectives.

Accordingly, the national strategic objectives were set as follows:

#### **Strategic Objective 1: Applied agricultural Research**

This strategic objective will increase resilience of agriculture sector to financial and economic crisis. Such efforts have been implemented.

The recognition of Palestine as a non-member observer state in the United Nations is an important turning point when it comes to controlling of Palestinian natural resources. In this regard, agriculture is seen as one important sector to maximize the benefits coming from such a step. Evidently, this will require increasing the potentials for resilience of Palestinian farmers by transforming agriculture into a beneficial, sustainable, adaptable and resilient economic activity which could resist any economic or environmental shocks for this sector.

Such support becomes more important if we keep in mind the small farm enterprises which constitute about 85% of the agricultural activity in Palestine and which is more likely to be more vulnerable to crises. Therefore, increasing productivity and resilience to shocks is deemed one important area for agricultural research which will contribute to poverty reduction, income increase and employment opportunities.

This strategic objective will help achieve four medium-term development outcomes: 1) improve resilience of small farmers to climate change and various other shocks; 2) Income increase; 3) Increasing employment opportunities; 4) Improving productivity.

1. improving resilience of small farmers to climate change and various other shocks

This research will include studies on income diversification, agriculture product diversification as a venue for income improvement and income stability for smaller size farmers. This will require improved access to technology, information, and support services which can be made available through applied research and technology transfer.

2. Improving access of small farmers to the markets

This research will include socio-economic research aimed at policy change and minimizing market access legal, social, and material challenges, e.g. road infrastructure and transport systems. Other research themes include enhancing access to innovations and technology innovations which often requires improved access to financial services. The anticipated outcome for this research is improved access of small size farm owners to the market, reduction in transport cost, and increase profit margins for these farmers.

3. Income and job increases

Improved agriculture practices and the use of modern technology will improve the efficiency of production inputs - e.g. water, fertilizers, and insecticides – as well as improve the agri-production practices and the competitiveness of agri-products. This research will help increase income and work opportunities in the rural areas. The women and youth in rural areas will be targeted most by this kind of research.

4. Increasing productivity

This strategic object will be achieved by doing research that is aimed at preserving and utilizing genetic resources to improve productivity of genetically modified types. This thematic focus will contribute to improving the application and practices of agricultural production and consequently the improving farmer opportunities, especially female farmers, to access production assets like water, land, and genetic resources.

These research interventions in the complementary agriculture systems and policies will increase the potentials for resilience and for surviving economic and environmental shocks, price fluctuations in the food industry, and/or destruction of products caused by natural disasters or plant diseases.

**Strategic objective 2: Applied research on food security and nutrition**

1. Despite the role agriculture currently plays in achieving food security for families and at a national level, there is great potential for achieving better results. The concept of food security encompasses improved production and access to healthy food.

This strategic objective will help achieve five medium-term development outcomes, including improved productivity, availability and diversification of local agricultural

products, access to food, quality and safety of agricultural products, human and animal health through agriculture best practice.

2. Increased productivity and food availability

This type of research aimed at increasing animal and plant produce using complementary husbandry and management systems will improve food availability. Food cost can be reduced by using efficient agri-food systems and the dissemination of good practice in the area of food production and production technology or through improved food storage and transport systems. Sustained production can be reached by reducing the crop life cycle to avoid harsh weather conditions.

3. Improved diversification of local produce

Food security does not only mean increased supplies of food products with sufficient calories or the availability of one food element but also includes diverse food products with good nutritional value. Here it is important to stress the important role for woman in improving food security at family level. The availability of rich nutritional food products should be addressed through research on diversifying the agriculture production system.

4. Improved access to food

In addition to food availability, food access and improving access opportunities is of extreme importance to agriculture research. When foods are available outside farm, then access to food will be determined by financial resources available for families. This is especially important when we address food security for low income families. This theme will be covered by research projects which address gender from socio-economic perspectives.

5. Improved food quality and safety

Agriculture products often have expiry dates beyond which the products will become harmful to health; therefore, the research on quality and safety of products is considered a national priority. Such research of food quality is also important because it will increase the competitiveness of national products through improved food production management and production technology. Potential interventions in this area vary, e.g. development of Aflatoxin resistant crops which lead to a significant drop in chemical and biological hazards.

6. Improved animal and human health

Human and animal health could be improved through dissemination of good practice in agriculture and aquaculture which will contribute to improving water quality, secure use of agricultural inputs, and effective management of pesticides, use of disease resistant types, and weather change resistance.

**Strategic objective 3** Research on improving natural resources and ecosystems

This strategic objective will help achieve three medium-term development outcomes, including natural resource protection from climate related damage, improved benefits for environmental system services, sustainable management for agricultural ecological systems.

1. Improving and protection of natural resources

The management of natural resources poses significant challenges to Palestinian farmers due to the restrictions imposed by the Israeli Occupation on access or use of water and land resources. This situation calls for research interventions on improving efficiency for use of available resources, facing climate change impact, abuse or non-sustainable exploitation. Much research attention should be directed towards land and water contamination, threats to bio-diversity, and climate change impact on bio-diversity. This rather serious challenge calls for new approaches to sustainability of ecological systems.

2. Maximizing benefits from products and environmental systems

There is an urgent need for restructuring agricultural systems to protect land and water resources from mal-environmental practices which led to soil erosion or deterioration in the quality of soil. Research themes here include improvements in water harvest practices and expansion in organic farming and the use of natural pollination.

3. Sustainable management for ecological agricultural systems

Interventions here will address the drop in soil quality, the drop or loss in economic or biological productivity, the drop in rain farming, the decrease in irrigated farming, pastures and forest area due to soil erosion or the deterioration of its physical, chemical or biological features, the long-term loss in flora and canopy. Research will focus on improving the ecological system ability to survive or overcome these damages. This research will improve resilience for the ecological and agricultural systems and for the local communities as well by improving ability to recover after increasing climate change shocks.

**Strategic Objective 4** Institutionalizing agriculture research systems, gender, climate change, and policies

1. The national agriculture research system

The success in constructing a national agricultural research system will depend on the existence of well functional and efficient research institutions. Coordination and complementary work between these institutions is also essential. The governmental, non-governmental and private institutions should be enabled to implement the above listed strategic objectives and national priorities. To reach such situation, these institutions will need capacity building, improvement of research efficiency, higher education outcomes, and advisory and consultation services. In particular, capacity building is needed in data management, communication technologies, ecological system analysis, and modern agriculture systems. Capacity building along the value chain will be needed in innovation in Palestinian agricultural system.

2. Development of agriculture policies

Policy making and policy changes are deemed essential for achieving the national strategic objectives in development and resilience. Policies should allow for the creation of an agriculture environment that is oriented towards scientific evidence and agriculture research results. It is also expected that research will lead to agriculture institutions reform propositions to make fit more for the higher goal of developing the agriculture sector and



the farmers' households. There is also need for evaluation studies of the food security and sustainable resource management regulations.

### 3. Combating climate change impact

The research and development activity should attempt to improve agriculture sector abilities to resist and survive climate shocks, to adapt to climate change, and to mitigate negative impacts.

### 4. Gender, youth, and other marginalized groups

Research on gender equality is another important research theme in the national strategy. Youth and other marginalized groups is another target for research that is concerned with empowering these groups. Priorities should be given to rural development research projects, food availability along agriculture supply chains, and youth employment opportunities.

## **Strategic objectives indicators**

1. Increase in farmer incomes in the research target areas.
2. The net value for agricultural products in the research target areas.
3. Food security levels for targeted areas.
4. Return on investment in the targeted areas.
5. Number of researchers implemented at national level in collaboration between the national research system stakeholders.
6. Number of farmers using agriculture technology inputs
8. Ratio of lands suffering from deterioration conditions
9. Rain-fall farming productivity.
10. Ratio of cases of animal transmitted diseases.
11. Sustainability of natural resources.
12. Contribution of animal production in the GDP.

## Chapter 6

### Strategic programs for agricultural research

#### Area 1: Plant production and protection

Program 1: Plant genetic resources

Program 2: Pesticides

Program 3: Plant production

Program 4: Organic agriculture

#### Area 2: Natural Resources

Program 5: Soil, plant nutrition, chemicals and fertilizers

Program 6: Agriculture water resources

Program 7: Forests and pastures

#### Area 3: Animal wealth and production

Program 8: Animal wealth

Program 9: Animal food production

Program 10: Animal genetic resources

### Area 1: Plant production and protection

#### Program 1: Plant genetic resources

This program is considered one very important research focus due to the rich biodiversity and the important geographic location for Palestine. Palestine has 2700 wild plants which vary in their location and their need for rainfall amounts. In addition, the country is rich in agri-biodiversity coming from the diverse agricultural environments and diverse weathers which make it possible to produce various kinds of products at different times in the year. Such diversity is threatened by climate change and the repeated number of severe weather conditions like dry seasons, floods, and frost. This program will collect and preserve genetic resources in the genetic resource bank which will be established at the National Research Center.

1. Program goals: Preservation and sustainable use for agricultural genetic resources
2. Outcomes and KPIs are provided in the table below.
3. Action plan for technical programs

Annex 1 has the detailed action plan for each program.

#### Program 2: Pesticides

Pesticides could cause both direct and indirect damage for crops at any growth stage or during crop storage; they can therefore negatively affect the quality and quantity of agricultural production. The annual loss caused by pesticides is estimated at 35-45%

worldwide. To reduce such large amount of loss, farmers often resort to using pesticides; however, the malpractice in using pesticides, such as high concentrations and repeated frequent uses, has led to soil and water pollutions and high concentrations of chemicals in human and animal food and in the soil.

This program will focus on wise consumption of pesticide products, reduction of damage caused by pesticide consumption, and pesticide control and monitoring practices.

### **Program 3: Plant production**

Plant production is one of the most important agricultural sectors in Palestine. In 2011 for example Palestine produced 124,000 tons of fruits, 280,000 tons of vegetables, and 44,000 tons of field crops. The fluctuation of rain fall in the country has negatively impacted plant production, especially the olive crop. Some crops produce 5 times as much in the good rainfall season. It is worth noting that the country is self-sufficient in local products of most vegetables, olives, olive oil, poultry, honey, grapes, and figs; while there remains noticeable shortage in other plant products due to fluctuating rain amounts and limited access to water resources. Most plant production supplies are imported and therefore subject to limitations and restrictions imposed by Israel on quantities and types of inputs, e.g. fertilizers.

This program will work towards improving quality of plant produce and the sustainability of production.

#### ***Program objectives***

- Improving production sustainability and the productivity of rainfed and irrigated agriculture.
- Improving marketability and competitiveness of Palestinian products.
- Increasing productivity of the olive crop.
- Increasing productivity and net profits for fruits and date produce.
- Profitable and sustainable irrigated farming.
- Reduction of post-harvest loss.

### **Program 4: Organic agriculture**

Organic agriculture systems rely on the utilization of natural and biological resources to replace chemicals, pesticides, hazardous materials or genetically modified types. The produce of this type of farming will reach consumers in its most natural state.

Organic farming amounts to only 10% of the agricultural production in Palestine. This small percentage calls for action to increase organic farming production due to increased local and international demand.

This program will work towards increasing production and improving quality of produce.

#### ***Program objectives***

- Increasing economic, social and environmental awareness for organic farming
- Improving organic agriculture practices and providing necessary supplies for it.

## **Area 2: Natural Resources**

### **Program 5: Soil, fertilizers, chemicals and plant nutrition**

The growing demand for food which resulted from the increasing numbers of population has led some farmers to use chemicals to improve land fertility and increase production. And according the FAO recommendations, food production must increase while maintaining control over fertilizers wise consumption. Additionally, agricultural research has demonstrated that we can increase wheat produce for example by 60% if we use particular types of fertilizers.

The over use of fertilizers by Palestinian farmers may cause soil pollution and various kinds of environmental damage.

This program will work towards wise consumption of fertilizers with the aim of maintaining production levels and simultaneously protecting the environment from over use of these materials.

***Program objectives***

- Wise and efficient consumption of fertilizers and soil nutritionals.
- Safe utilization of soil and nutritionals.

**Program 6: Agriculture water resources**

The water consumption statistics for 2011 show that the amount of water used for agriculture reached 146 million cubic meters which accounts for 44% of the total water consumption ratio for this year. Of these 60 million cubic meters were used in the West Bank and 86 million in the Gaza Strip. Israel confiscates 82% of the underground water in the West Bank.

Water management is one great challenge for Palestinian farmers since the Occupation controls large portions of the Palestinian natural resources, especially underground water resources. Research in natural resources will help increase the efficiency of natural resource utilization.

***Program objectives***

- Preservation and wise utilization of the natural resources in Palestine
- Increasing utilization of non-traditional water resources.

**Program 7: Forests and pastures**

The pastures designated area reaches 2.02 million donums, of which only 621,000 donums are accessible by Palestinian farmers. The area designated as forests is 94000 donums. The one designated as green canopy reaches 340,000 donums under which fall the 48 natural reserves. The Palestinian Authority controls only 17 reserves on the Eastern slopes of the Jordan valley. A total of 62.9% of the land area is classified as area C, 18.8% is classified as area B, while only 18.3% as area A.

The agricultural research on forest and pastures will work towards better utilization of forest lands, increasing the productivity of pastures, and the protection and preservation and sustainable use of green canopy areas.

***Program objectives***

- Increasing the forest and pasture area
- Preservation and sustainability of these green areas.

### **Area 3: Animal wealth and production**

#### **Program 8: Animal wealth**

There is a significant drop in animal wealth produce due to the rising prices for animal food and the fluctuation in the annual rainfall. Our figures show that 95,000 tons of meat, 194,000 tons of milk, 390,000,000 eggs and 216 tons of honey were produced in the year 2015.

The majority of livestock owners are small farmers who mostly use the traditional production methods. The research in this area will work towards improving their access to modern production technology and methods. Such research attention will improve the status of this sector and increase its contribution to food security.

#### ***Program objective:***

- Improving animal wealth productivity.

#### **Program 9: Animal food production**

While the local production of various types of animal food came at 231,000 tons, the local annual needs amount to 734,000 tons out of which 448,000 tons are used for cow and sheep food. These figures indicate that there is annual deficit of 503,000 tons. Therefore, research should work towards bridging the gap by improving the quality and quantity of animal food production.

#### ***Program objectives:***

- Improving animal food productivity
- Sustainability of animal food production

#### **Program 10: Animal genetic resources**

Palestine enjoys quite good diversity in animal species. Around 30,904 different species live in the country. Out of those 30,000 are invertebrates, 373 are bird types, 297 fish types, 92 are mammals, 82 reptiles, and 5 amphibians. This research program will focus on the preservation and utilization of such impressive genetic resource diversity.

#### ***Program objectives***

- Preservation and wise utilization of animal genetic resources.

The matrix attached to annex 1 provides a summary of the proposed technical research programs and the objectives, interventions, and outcomes for each program. These programs will help achieve the medium-term developmental outcomes, the four strategic goals for agricultural research, and the two national goals for development and resilience of the agricultural sector.

### **Identifying applied research priorities**

NARC, the leading applied research organization, undertook a formal priority-setting exercise which addressed the contribution of research to the two national goals for agriculture of “Resilience” and “Development” (NASS).

The prioritization exercise used a qualitative scoring approach that “weighted the objectives” and “scored the indicators”. The method is replicable and easily used to test sensitivity to

different weights, objectives and indicators by simply changing one and observing the impact this change will have on the total scores. Some may consider the approach subjective because its weights on goals reflect the quantities and not the quality, value and impact on achieving the desired goals.

The sub-themes were identified as follows: The six areas related to plant genetic resources: 1) Improving the material conditions for resilience; 2) Increasing productivity; 3) Locally produced food items and products; 4) access to and utilization of natural resources; 5) Improving the net profits for ecological systems services; and 6) sustainable utilization for ecological systems. (See annex 2).

## Chapter 7

### Planning, Monitoring, Evaluation, Accountability and Learning (PMEAL)

#### System, Institute, and Project Level

The functions of Planning, Monitoring, Evaluation, Accountability and Learning are all related and must be addressed appropriately at each level. Increasing sophistication in defining SMART (Specific, Measurable, Attainable, Relevant and Time-bound) indicators consumes effort at all levels<sup>5</sup>.

#### System-level

A Strategy aiming at agricultural innovation for resilience and development is looking at performance of a wide system and whether its component parts are coordinated to the objectives. This calls for the creation of measures of adequacy, joint use and focus of resources on national targets. The targets are researchable: food security and safety and on objectives such as capacity development, improved services, and evidence based policies. Input measures like the ASTI database provide regional comparators as a guide to policy. Investment ratios, qualification of scientists and university educators, and support staff ratios can be indicators of progress or decline. Regional databases are also able to measure food and nutrition security with suitable comparators. It is at the national level that government support to agricultural innovation is most easily compared with neighbors.

#### Institute Level

Institutes manage portfolios of research programs that can be categorized by research function (discovery, proof of concept, scaling up and out); discipline, or final objective. Institute managements report to Boards, Ministerial departments, and/or funding sources. Accountability for expenditure is the concern of administrators; accountability for results is the concern of top managers; and learning is the interest of scientists.

#### Project level

The term “monitoring and evaluation” is most usually applied to performance monitoring of research with the objective of re-evaluating feasibility of goals and the means of attaining them in time to make necessary adaptations. This monitoring for learning purposes is part of research programs and overseen by research managers. Participatory M&E processes require resources and may account for 5-8% of total project resources. There is no “norm” for budgeting but allowance needs to be made across an institute a whole or provided within individual project budgets.

Ex post evaluation goes beyond the impact of a project on a sample of research project beneficiaries and tries to calculate the expected benefit on society if the project were scaled out at a national level. This would involve additional costs, potential price declines if markets

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<sup>5</sup> When evaluators are taunted for their indicators, their reverse challenge to planners is: “If you can plan it, we can evaluate it!”)

are thin, and a distribution of gains among consumers, value chain actors and farmers. It is the time of evaluation that informs future policy.

The various systems of PMEAL will have to be designed for the coordination mechanisms that are deemed effective.



## Action Agenda

This Strategy has identified a number of issues and an action agenda.

The introductory Vision Statement has many statements about what the Government will do or what the Strategy will do.

This Strategy calls for three special “audits” to advise the Minister on potentially transformative changes to the agricultural innovation system

- A. Strategy calls for an urgent benchmarking of the national system and a monitoring system put in place for the health of the system, quite apart from the monitoring of research programs themselves
- B. Infrastructure depicting and building on what national research centers' and institutes' have of laboratories, research fields and farms.
- C. The strategy calls for mapping of research partners' capacities, capabilities, research efforts and putting a national research agenda and program that best fit institutes' capacities and competence, efficiently uses available resources and ensures effective achievement of national objectives and goals. The strategy consultation work has developed a national research program covering the 6 themes.

The consultation work identified 26 research areas under the 6 themes covering a wide range of research logics, among others: mapping of land races, breeds, pests, bio-enemies...; alternative and effective resources, rations, inputs...; best fit and innovative techniques and policies to improve decision taking at farm levels and policy making at central level.

The programs prioritization process by thematic groups showed the importance of access and management of natural resources (particularly land and water), improving productivity and value-added in rain-fed farming, improving productivity of land-races and introducing new varieties, programs of animal husbandry and more details in the technical attachments.

The following table shows an agenda of action derived from the strategy consultation workshop. The agenda emphasizes the issues raised and discussed earlier in the short strategy. It stresses the importance of:

- Benchmarking the national agriculture research system as a first step to innovate and implement innovative research initiatives,
- Put and implement a national coordination strategy that benefit from research partners capacities, resources and competencies and owned by national research centers and institutions,
- A national consultation work to develop research policy, reform research organizational structure, develop research plans,
- Annual or bi-annual national gathering to exchange, disseminate and reflect on researches conducted earlier.

Action agenda, action, responsibility, participants and timing

Action	Convened by	Who Participates	When
Benchmarking National Research System using ASTI approach and questionnaire	NARC	Universities, ARCs, other RCs, Donors, NGOs	2016 Immediate Priority to attract donors
Audit of research infrastructure	NARC	Above plus MOH, PWA, AEQ	2016
Develop & implement coordination strategy	MOA	Univ., PS and Research centers	2016, 2017
Reform regulatory System (law, By-law and regulations)	MOA	MOJ, ARCs, Univ., NARC,	2016
Reform and strengthen NARC to carry on highly collaborative national research work	MOA	Above plus PS, Donors, Experts	2016, 2017
In-depth study of appropriate models for improved coordination (semi-autonomous NARO, Council, Foundation)	Prime Minister, PA	High Level Task Force	2016-2017
Develop and implement a national Research Policy	MOA/NARC	Univ., ARCs, NGOs, UN agencies, PS	2017
Develop Research and Decision Support & Advisory Systems	NARC	Univ., ARCs, NGOs, UN agencies, PS	2018
Establish National Research Fund	MOF	MOA, Univ. (MOHE), PS,	2017, 2018
Research programs identified and implemented and annual research action plans	NARC	ARCs, Univ. NGOs, PS & farmers, UN agencies, donor	2016 - 2020
M&E system reflecting strategy consultations developed, trained and implemented	MOA/ NARC	NARC, MOA, ARCs, Univ., Farmers Associations	2016,2017
Reform policies impacting agriculture sector	MOA	Inter-ministerial work, PS, ARCs, Univ.	2017, 2018
Develop a national research communication strategy	NARC	MOA, Univ., ARCs, NGOs, PS, Donors	2017
Hold National dissemination workshops, conferences (part of communication strategy)	NARC	Univ., ARCs, UN agencies, NGOs, PS, Farmers	2017, 2018, 2019, 2020



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