Concept Paper: Promoting Sustainable Development through Innovative Cutting-edge Agricultural Technologies for Increased Production

I. Rationale

Unregulated population growth, inappropriate agricultural practices, and slow technology adoption lead to degradation of natural resources and undermine attempts to sustainably increase global food production and consumption. Science and technology have played a very important role by introducing agricultural cutting-edge technologies to address global food security challenges. Modern agricultural practices and technologies have enhanced the potential for partnering with farmers to promote sustainable agriculture. However, affordability, efficiency, and ease of access to innovations are still considered to be an issue in several countries. Investment in agricultural technologies to increase crop and animal production is one of the most promising pathways for achieving sustainable agri-food systems and food security. Therefore, it is important to look for novel solutions and cutting-edge technologies to address the unmet needs of farmers. The need for the utilization of advanced plant breeding tools for crop improvement by developing biotic and abiotic stress-resistant varieties are of utmost importance. The incorporation of farm management decision support systems including monitoring sensors and software to capture data such as big, timely, and right data analytics, and computing platforms will have far-reaching positive impacts on animal and crop productivity. There are opportunities for expanding innovative agricultural technological developments to meet the Sustainable Development Goals (SDGs) pacing food production to population growth.

II. Background

Green revolution technologies and tremendous expansion of agricultural land tripled agricultural production between 1960 and 2015[1]. However, the Global agricultural productivity that is measured as Total Factor Productivity is alarmingly far below the United Nations SDGs target in low-income countries[2]. The population growth in these countries is expected to be fast in the future. The majority of these countries are showing inadequate food consumption with high levels of undernourishment[3]. Currently, 821 million people mostly residing in developing countries are undernourished[4]. The United Nations lays out Sustainable Development Goals (SDGs), among them end poverty and hunger are directly related to agricultural productivity. In this regard, innovative agricultural technologies tailored for all scales of agricultural production will continue to play a critical role in enhancing the agricultural productivity. However, biotic and abiotic stresses especially in the face of climate change and intensive cultivation significantly affecting crops in terms of huge economic losses at various stages. Therefore, agriculture sector urgently needs transformative changes to achieve social and economic equity, economic profitability, and improve environmental health. Agricultural technologies may only be sustainable if the innovation in the technology is aligned with the real-world challenges and provides affordable solutions. Two main technological advancements and the adoption of the innovation with possible ways to fill the gaps in delivery are highlighted below.

[1] FAO, annual report (2017). The future of food and agriculture–Trends and challenges.
[2] Steensland A, Zeigler M. 2018. Global Agricultural Productivity Report® (GAP Report®) Global Harvest Initiative, Washington, D.C., October 2018.
[3] Alexandratos N, Bruinsma J. 2012. World agriculture towards 2030/2050: the 2012 revision. ESA Working paper No. 12-03. Rome, FAO.
[4] UN report. 2019. World hunger is still not going down after three years and obesity is still growing.

1. Advanced Plant Breeding Tools for Crop Improvement

Biotic and abiotic stresses are adversely affecting plants and the frequency and intensity of these impacts are increasing every year. Theses stresses cause huge economic damage and losses to crop production worth billions of dollars annually. Sustainable food supply in the form of cereals, fruits, and vegetables holds greater significance to meet the emerging food demands for the growing population in order to eliminate hunger and malnutrition. The development of innovative breeding tools for advancing crop improvement strategy and by developing resistant varieties against biotic and abiotic stresses are equally effective to safeguard plant health and achieve a better quality of produce with more yield in different crops worldwide.

2. Farm Management Decision Support Systems (DSS)

Decision Support Systems (DSS), defined as: Farm management primarily based on the decision-making process, which affects farms and farmers. Profitability and sustainability demand market-orientated farm management skills and tools. The key aspects of decision-making tools include diagnosis, planning, implementation, monitoring, and evaluation. Decision support tools (DST) rely on evidence-based decision-making approach mainly aimed at improving crop productivity and efficient use of resources. The digital tools can help farmers to make more informed and appropriate decisions to implement timely management strategies through an integrated system to overcome losses and improve food production. The farm management DSS is cost-effectiveness and can be customized for specific applications to ensure compatibility with the real-world demands. Big data analytics and digital platforms for farm management have tremendous potential to uplift and improve the incomes of the farmers by increasing productivity and sustainable use of natural resources. The implementation of farm management decision support tools would help achieve sustainability in food production and efficient use of natural resources and inputs.

3. Adoption of the technologies

Resource scarcity, population growth and climate change is presenting a daunting challenge for global agriculture sector. However, the recent unprecedented advances in digitalization, genomics, Information and Communication Technologies (ICT), and software have increased the pace of agricultural innovations. In this regard, private sector R&D spending is growing robustly and has filled the gap of public sector R&D due to their recent fiscal constraints[5]. Newly introduced agricultural innovations from the private sector R&D along with the input of academia, producers and incubators have shown tremendous potential to enhance yield, improve productivity and promote sustainability. However, adoption of the innovations, which is the precursor to improve outputs is a critical challenge. Public sector should intervene to shorten the gap between successful private sector R&D efforts and widespread adoption. Dissemination of the knowledge about the new agricultural technologies through publicly funded agricultural extension programs could be a key historical link to facilitate the adoption by the farmers. Furthermore, government policies are the key factors to expand regional and international cooperation, which would enable farmers to raise yields by rapid adoption of agricultural innovations for maximum returns.

[5] Pardey PG, Chan-Kang C, Beddow JM, Dehmer SM. 2016. InSTePP International Innovation Accounts: Research and Development Spending, Version 3.5 (Food and Agricultural R&D Series)-Documentation. St. Paul, MN: International Science and Technology Practice and Policy (InSTePP).

III. Proposed Future Collaborative Mechanism for G20 MACS 2020

1. Kingdom of Saudi Arabia in collaboration with FAO and relevant International Organizations will organize International Forum Innovation in Agri-Food Systems in order to feature important research developments, and draw conclusions to feed into the deliberations of Agriculture Ministers Meeting. All interested G20 members and Invitees are encouraged to participate in this event on 15-17th March, 2020.
2. Interested G20 members along with relevant International Organizations should develop research collaboration regarding emerging technologies and innovations for sustainable agricultural production to achieve SDGs.