



International Center for Biosaline Agriculture

ICBA TECHNICAL REVIEW 2016

Authors:

**Prof. Emer. Fayez E. Khasawneh,
Dr. JDH (Dyno) Keatinge,
Dr. Nadiya Al-Saady,**

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1. Executive Summary

The Technical Review Committee can assure the Program Committee of the Board of Directors of ICBA that their Center is well managed and they can be proud of the exemplary scientific record from the Center's outputs over the last five years. The Center's research vision is now well-placed to make a very positive contribution to several of the relevant UN Sustainable Development Goals, with particular reference to disadvantaged groups in the developing world. As such the Center should be in a strong position in the near future to attract a substantial amount of new special project and core funds and we predict fairly rapid expansion of the staff and budget in the period till 2023 when the current strategic plan matures. Yet, within this context we believe it is also vital that the Center continues to maintain its full international research persona.

In order to best cope with this likely expansion and broadening of the existing funding base we make 19 recommendations several of which are designed to achieve more focus and a better balance in the research program of the Center: Specifically, a reorganization of the Center's timing of the planning and review process, a refreshing of the strategic plan in the light of the new SDGs and the creation of a suitable Theory of Change to describe how and where ICBA will go in the medium term. In addition, it is felt necessary that more social scientists be recruited to help ensure that the future scientific output is better attuned to, and creates better outcomes, in the real world. This is particularly the case if an effective and overt gender dimension is to be realized by ICBA's researchers. Moreover, there should be additional resources allocated to the communication division as it is felt that both external and internal communication, and the acquisition of greater donor intelligence at the center will need to be much improved if the proposed expansion of funding is to be successfully achieved. We also suggest that bolder targets for fully open source publication be sought.

At present, it was felt by the panel that the senior management, though currently performing well, will very soon be severely stretched unless a DDG Research and Development position is recruited internationally. More consistent policy on ICBA's consultancy services and consideration of the center's future interaction with regional organizations is also recommended in the context of better senior management efficiency. The panel also applauds the Center's recent recruitment of a senior financial and administrative Director as this was clearly very necessary. However, the new ERP system must be made fully operational as soon as possible and once this is the case then it is vital that the center adopt a policy of full cost recovery in the funding of all special projects. Also where possible to delegate more authority to lower levels to allow all staff to become more efficient in their daily tasks and in the Center-wide on-going drive to raise further funds.

Finally, the TRC recommends strongly to the Board that the existing long term field plots at the Center should be maintained without compromise from further building expansion at the center's site as these experiments are approaching scientific heritage status. Failure in this regard would threaten ICBA's presently excellent scientific reputation.

We hope that our positive vision of the Center's future will generate decisive supportive action by the Board of Directors. In the next 10-20 years the people of the marginal areas of the world will surely need ICBA as their dedicated champion to be strong and effective in bringing about improved future development and resilience in the face of impending deleterious climatic and economic stress.

2. Introduction

This report has been prepared at the request of the Program Committee of the Board of Directors (BOD, the Board) of the International Center for Biosaline Agriculture (ICBA, the Center) as a continuation of a standing practice, whereby the Board shall engage “a consulting scientific ad-hoc committee to audit the technical programs of ICBA every five years”. After due process, the Program Committee of the Board commissioned a Technical Review Committee (TRC) comprised of the following:

- **Prof. Emer. Fayez E. Khasawneh**, Jordan University of Science and Technology, a former soil scientist at Tennessee Valley Authority, a former minister of agriculture in Jordan, a former member of the board of directors of the International Fertilizer Development Center (IFDC), a former President of Yarmouk University in Irbid, Jordan, and currently the Chairman of the Board of Trustees for the same Yarmouk University, as TRC Chairman.
- **Dr. JDH (Dyno) Keatinge**, the former Director General of AVRDC - the World Vegetable Center. Dr. Keatinge holds a Doctorate in Agriculture from Queen’s University, Belfast, Northern Ireland and is a Visiting Professor of Tropical Agriculture at The University of Reading, UK. He has global expertise in crop agronomy and has worked at a range of international agricultural research centers --- ICARDA (Syria), IITA (Nigeria) and ICRISAT (India) and recently was the Director General of AVRDC – The World Vegetable Center based in Taiwan, He was until recently Chair of the Association of International Research and Development Centers for Agriculture (AIRCA), Chair of the Global Horticultural Initiative and presently runs Tropical Agricultural Development Advisory Services (TADAS).

His driving concern is to help the world attain the indicators of Sustainable Development Goal 2 and, in particular, encouraging people to consume a sufficient and appropriately balanced diet. Abolishing hunger and malnutrition is his principal goal. This implies not only overcoming vitamin and mineral deficiency problems but also countering imbalanced nutrition from excess carbohydrate and fat consumption which is causing obesity and leads to serious human diseases such as type II diabetes and other metabolic ailments.

- **Dr. Nadiya Al-Saady**, currently Executive Director of the Oman Animal and Plant Genetic Resources Center (OAPGRC).

Dr. Al Saady obtained her PhD in 2002 from the University of Minnesota, USA, in Plant Genetics. She previously worked as a faculty member in the Department of Crop Sciences, College of Agricultural & Marine Sciences (CAMS) at Sultan Qaboos University in Oman. Prior to this, Dr. Al Saady was the Assistant Dean for Postgraduate Studies and Research at CAMS. She is currently a member of the IUCN group on Crop Wild Relatives. Dr. Al Saady has published in numerous scientific journals on topics related to genetic transformation, disease diagnosis and genetic diversity. Her current focus is in the area of conservation, documentation, characterization, sustainable utilization and valuation of genetic resources in the Sultanate.

1.1 The tasks of the TRC

The TRC task is to focus on the Center’s activities post the last review of 2010 and to evaluate the Center’s technical program “including the research and enabling innovations by looking at the operating context, the institutional management framework, the implementation of the strategy, the relevance and quality of the projects and the regional involvement”.

1.2 Documents and resources reviewed by the TRC

The TRC took note of ICBA Articles of Association and of ICBA's vision and mission statements. In addition, the TRC reviewed the following documents provided by ICBA:

- ICBA Strategy 2013 – 2023.
- ICBA Programs Highlights and Achievements 2009 – 2013.
- ICBA Business plan 2013 -2016.
- ICBA Mid-range business plan review, 2013 - 2016
- ICBA Annual Reports: 2011, 2012, 2013, 2014, 2015.
- ICBA External Stakeholder Assessment, 2016.
- ICBA Organizational Chart

In addition, the TRC utilized presentations by ICBA's professional staff during this visit, as well as one-on-one meetings with some of them.

1.3 Onsite visit and activities at ICBA

The TRC arrived into Dubai on the 16th Of July, 2016, and into ICBA on the 17th. The TRC's activities began with an initial meeting with the Director General and the Director for Research and Innovation to set the stage and provide the overview of ICBA's mandate, the organizational framework, the working program for the review and what is expected from the technical review.

The first day involved a series of presentations from the Division Director for Research and Innovation (DRI) who touched upon the history, organization and technical programs of ICBA. This was followed by detailed presentations by the section heads of Natural Resource Management and Crop Diversity and Genetic Improvement. The presentations covered the objectives of their work and their alignment with the ICBA Strategy 2013 - 2023 as well as the Business Plan 2013 - 2016. The respective section heads from DRI Division focused on presenting their projects and the major achievements accomplished in the last 5 years as well the challenges faced, which were then followed by a question and answer session and general discussion of the presentations.

The TRC then had a one-on-one meeting with the section head of Crop Diversity and Genetic Improvement to further discuss his insight and vision for the future of the section.

The second day continued with presentations from the section head of Climate Change Modeling and Adaptation followed by presentations from the Director of Partnerships & Knowledge Management and the Director of Corporate Services Division. Later on, one-on-one meetings continued with the Section Heads of Natural Resource Management and Climate Change Modeling and Adaptation.

The TRC also visited on the third day with H.E. Dr. Majid Al Qassimi, Director of Animal Health and Development Department in the Ministry of Climate Change and Environment of the UAE, and in this capacity a Board Member. The meeting covered discussions on the importance of ICBA and its achievements for the Marginal Environments and to UAE as well as some initial views the TRC had on ICBA's success and operation and the need to foster its stature as an international center of excellence in its field. This meeting was followed by a brief visit with ICARDA staff, specifically Dr Arash Nejatian.

The TRC then held a tele-meeting with another Board member, H.E. Mr. Mohammad Jamal Al-Saati, Director of the Country Programs Department and the Officer-in-Charge for the Operations Complex at the Islamic Development Bank (IDB) in Jeddah via Skype. The tele-meeting provided an exchange

of thoughts on the need to ensure the long term sustainability of ICBA and the role of IDB as a co-donor. The Technical Review Members then had a tour of ICBA facilities.

The TRC met on the fourth day with H.E. Prof. Abdulrahman Al Sharhan, Chairman of the Board of ICBA, and held a conference call with a third Board member, H.E. Dr. Jaber Eidha Al Jaber, Deputy Secretary General at the Environment Agency – Abu Dhabi, where ideas were exchanged about the initial findings of the TRC panel. The principal theme of all of these discussions focused on measures to enable ICBA's management and staff to continue to excel in their mission and to help the Center to maintain its international status. We recognize that the Center has carved for itself a very reputable and highly well-deserved place among the community of specialized international centers like the CGIAR Consortium of International Agricultural Research Centers (formerly the Consultative Group for International Agricultural Research), AVRDC – the World Vegetable Center (formerly known as the Asian Vegetable Research and Development Center), the International Fertilizer Development Center (IFDC) and related AIRCA group institutions.

The TRC continued its one-on-one meetings with the Agricultural Economist at ICBA and with the Proposal Development Specialist.

Day five involved deliberations amongst the TRC and a presentation of a summary of the review and key observations to the ICBA Management.

Informal discussions took place with ICBA staff throughout the five days, with each day ending with a short briefing with the DRI, the ICBA Focal point.

3. Findings of the TRC

The findings of the review process will be presented in the same sequence as listed in the task statement of the TOR's.

2.1 ICBA's operating context in the global domain

The global context of ICBA's remit is embedded in its articles of association (article 4). ICBA operates in a context where it aims to contribute significantly to human welfare through improved agricultural production from marginal environments. Both its efforts and its achievements are conditioned by important external issues which the Center cannot directly control yet these issues shape the operational objectives of ICBA, its outputs, and their impacts on human welfare. This section examines three of these important issues that are especially relevant to the Center.

2.1.1 Resilient Marginal Land Production Systems with increased incomes, enhanced food supply and improved nutritional security for small-holder farmers

The world population is predicted to increase for the next 40-50 years before peaking at around 9 billion people most of whom will be urban dwellers. Producing sufficient food for this population will be a major challenge for agriculture and horticulture, and both of these agricultural sectors have important roles to play in contributing to high quality, nutrient dense products which are required for healthy, well balanced food and nutritionally-secure diets.

It is recognized that patterns of consumption evolve and will continue to change with urbanization and rising household incomes. Increased demand for greater product diversity and quality is usually associated with rising incomes yet some associated food choices (more red meat, more fats and more sugars) can be made poorly by consumers with obesity being the result, with its severely negative health consequences.

Nevertheless, this brings increased market opportunities for farmers while presenting a few challenges throughout the relevant market web. Growing salinity-resistant crops often requires new approaches to managing the crop growing environment and dealing with severe pest and abiotic stress problems. To these are added the medium-term challenges of coping with climate change, and the pressing need to develop systems that are water, energy and labor efficient. Many recent developments in irrigation science and dryland agriculture have been enabled and widely adopted by rapid advances in information technology. These advances will employ new sensors and scanners to allow the collection and collation of weather and soil data in real time and thus improve producer controls regarding climate, water and energy use.

ICBA's global remit and its commitment to alleviating poverty, food insecurity and malnutrition in marginal environments through land production systems specifically tailor-made for marginal environments gives it an opportunity to play an important role in transferring its own and other existing production technologies from more to less advanced countries where demand and opportunities for 'leapfrogging' innovations can be identified.

The TRC panel found that ICBA's in-house and collaborative research are well aligned with this objective. The focus of earlier years of ICBA might have been more on local and regional issues related to salinity and saline waters, but the quality of its work in this particular area and the kind of its accumulated knowledge and expertise have propelled ICBA into the global domain to warrant the recent paradigm shift in its goals and objectives to widen its remit to include marginal and stressed environments. This global status is not only well deserved, but has become an added asset and a

handsome return on all past investments in the Center that needs to be utilized further. The TRC panel, therefore, recommends that the Board provide the Center with all the means to strengthen the international standing of the Center, and in particular to contemplate amending the core funding protocols as stated in Article 5 of the Articles of Association. That would assure the Center of a sustainable long-term core funding process that takes into account the inflationary pressures on operating costs. This viewpoint of the panel is predicated on its recognition that further priority continuity of ICBA's primary mandated work makes a very positive and continuing contribution to Sustainable Development Goal 2 (End hunger, achieve food security and improved nutrition and promote sustainable agriculture) specifically addressing targets 2.1 - 2.5 (Appendix 1).

2.1.2 Climate Change

The anthropogenic emission of greenhouse gases continues to drive increased global temperatures resulting in increased and less predictable climatic variability, especially as regards to temperature, precipitation and storm activity. Higher temperatures and increased precipitation may increase crop yield in some areas but overall, unavailability of rainfall, sea level rise, salinization of ground and irrigation waters and drought mean that in many regions, especially in the tropics and sub-tropics, climate change will result in decreased agricultural productivity, decreased food security, poorer diets and increased malnutrition.

Geographically, the worst effects of climate change will be experienced in many of the areas where ICBA is most active including the Middle East and North Africa and the drier areas of Africa thus exacerbating the heavy burden of existing food importation. The adverse effects of climate change are likely to be felt most by the poorest and most vulnerable members of society many of whom reside in marginal production environments --- the focus of ICBA's mission.

ICBA has the leading role to play in monitoring climate change to evaluate the risks for production, and to advocate actions which reduce risk and maintain or increase production in the MENA region. The core function of ICBA to identify, preserve and use a wide range of crop biodiversity with resistance to saline conditions will be vital in meeting the challenges of climate change. It will allow sufficient flexibility of production systems, and will impact marketing and consumption systems in response to increased biotic and abiotic stresses and thus promote resilience amongst vulnerable producers and consumers.

For this reason, the TRC suggests that "Adapting to climate change" should continue to be a key driver of ICBA's research for development program and thus over the next decade make a further positive contribution to Sustainable Development Goal 13 ("Take urgent action to combat climate change and its impact") and specifically targets 13.1, 13.2, 13.3 and 13b and the related SDG complimentary targets 1.5 and 2.4 (Appendix 1).

2.1.3 Enhancing the Welfare of vulnerable communities and especially women, young girls, youth, the elderly, the handicapped and the infirm

Women are often closely involved in agricultural activities related to production in marginal environments such as with home gardens, and thus promoting this sector can have a more powerful positive impact on women's welfare than other more general changes in agriculture. Of course, women's welfare depends much more on social norms and structures than on the means of agricultural production. ICBA's production technologies alone cannot overcome the many forms of socio-economic disadvantages that presently hamper women and other vulnerable groups. Nonetheless, because women are so involved in home production, marketing and consumption in very many ways, the type of technologies innovated at or adapted by ICBA does provide some useful leverage to improve their welfare, particularly in sub-Saharan Africa.

Women are also often a key part of the labor force in marginal land production so that expansion of this sector could create additional employment opportunities for women. Generally, women are key decision makers in household food consumption, making women's choices critical in achieving better family health outcomes and nutrition from increased consumption of ICBA's currently preferred nutrient-dense crop portfolio such as quinoa, millet, tomatoes and eggplants.

ICBA has been actively seeking to include women, youth and the disadvantaged in its development activities, including training and participation in project activities. The impact of this involvement is not only material but also social. ICBA needs to value this impact and to monitor the long-term effects of its programs. This is critical as a recent study by the World Vegetable Center (a key ICBA partner within AIRCA) has found evidence that even in a highly gendered social system disadvantageous to female equality, promotion of technologies such as home gardens can lead to at least modest gains in female empowerment.

From its current position ICBA now has the opportunity to conduct research directly aimed at understanding how change in the agricultural marginal lands production sector can help the Center make a more positive contribution to all vulnerable groups in terms of SDG 2--- targets 2.2 and 2.3 and more generically to SDG 5 (Achieve gender equality and empower all women and girls, Appendix 1). Such research could include topics such as studies of the roles of women as well as young people and the elderly in marginal land crop value webs as producers and market participants; women's roles in contributing to family welfare and nutrition, or in enhancing family knowledge in decision making for healthy consumption, or in the generation of overall employment for women, the handicapped, the young people and the other presently disadvantaged groups. The attendant social and economic returns of such activities are inescapable.

2.2 ICBA's Operating Context in the local and regional domains

The pursuit of technological innovations to enhance the utilization of marginal environments for food production has been inclusive of local and regional environments. Knowledge and expertise developed or adopted by ICBA scientists and professionals have been made available to counterparts in the UAE as well as in other GCC countries. The TRC panel feels that such activities are not only well justified but also extremely necessary on two grounds: the Center is hosted in the region, and the region's environment has a marginal nature in terms of agricultural production and thus falls fully within the remit of the Center. The TRC panel urges the Center to continue to be forthcoming with its expertise and knowhow towards the local and regional governments. It appears, however, that such activities were not adequately valued to account for the costs of time and materials expended, even though they were conducted with due documentation of tasks in terms of objectives, of who did what and when and of the outcomes. A realistic valuation of these activities in terms of real and in-kind expenditures is needed, and some measure of economic and social returns are needed as well. While such quantitative data on project costs and expenditures have been collected for all the other projects with partners in other countries and partially utilized to rationalize project funding from donors, they were not similarly valued for some activities and services rendered to GCC countries. Such data will be particularly useful towards stronger rationalization of sustainable funds from the current major core funding sources, namely IDB and UAE.

4. Institutional Management Framework

The organizational structure chart of the Center, inclusive of the vacant positions, portrays a lean and robust management framework. It was pointed out that services that would be assigned to two of the vacant posts are currently outsourced as these services at the moment do not justify hiring full time employees. These are the posts for legal affairs and internal audit. This approach is commendable, and the TRC panel recommends that the Center continues in this manner subject to further review upon substantial expansion of activities and staff in the future.

The vacant post for a deputy Director General, DDG, on the other hand needs to be filled. The requirement for a DDG arises specifically to free up the DG to dedicate more time and effort towards fund raising from international organizations and governments that have shared overall goals and objectives in meeting the newly adopted alignment of ICBA with the UN's Strategic Development Goals (SDG's). This sets an *a priori* idea of the qualifications and specialization of such a person. The DDG needs to be well-groomed in the pertinent science and technology in use at the Center. The TRC panel recommends that the qualifications and core competencies be defined and that a comprehensive job description for this position be drafted in a manner that is commensurate with these needs.

On another perspective of institutional management, and as gathered from general discussions and observations as well as from the one-on-one sessions that the panel held with several staff members, it was very clear that the *esprit de corps* was high, that the DG and the division directors were quite close to their staff. Given the diversity in age, tenure, ethnic origin, gender, and technical expertise, the congeniality and amicability amongst all appeared to be genuine and well established, and that is a credit to ICBA's top management.

It was particularly interesting to note that when criticism was expressed, it was framed in positive tones. For example, there was a mention of certain cumbersome bureaucratic procedures involving lengthy sequences of signatures on administrative actions, even trivial ones. When this matter was taken up with division directors, the panel learned that this matter was already getting streamlined with the newly hired Corporate Services Division Director. To ensure that such matters will be mitigated with due attention to propriety, the panel recommends that management keeps a close eye on internal communication and that policies and procedures are fully comprehended by all, particularly the younger newer staff who had joined the Center lately.

The visits we had with Board members representing UAE and IDB and with H.E. the Board Chairman availed us of an opportunity to observe and assess the way top management was handling issues at the interface between the Center and the major donors/local authorities. It was clear that ICBA's management was very courteous, proper, and very forthcoming in availing ICBA's expertise and knowhow to the UAE and the GCC countries. Again, the panel finds that to be very praiseworthy.

5. Implementation of the Strategy

4.1 Based on the review of 2010, ICBA began implementing the recommendations of that review on a year by year basis. ICBA further documented program highlights for the period 2009 – 2013 in a special report. ICBA then developed a 10-year strategy covering the period 2013 – 2023. A business plan covering the period 2013 – 2016 was then developed and duly approved by the BOD.

“The aim of the business plan is to:

- Ensure that ICBA has the right science to achieve its Mission and Vision
- Ensure alignment of business activities with the 10-year strategy
- Track the delivery of outputs and outcomes
- Enable ICBA to engage with donors, stakeholders and partners
- Improve the Center’s effectiveness and efficiency”

The business plan identified increased food nutrition and security, more resilient environment and income, and improved water security as major strategic goals. Whereas ICBA started out with a focus on salinity and biosaline agriculture, the Center adopted a broader integrated approach to improve agricultural production in marginal and stressed environments, with salinity constituting one of the many aspects of marginal environments. The activities of the Center since then have spanned marginal environments in the MENA region, Central Asia, GCC countries, and sub-Saharan Africa.

4.2 The business plan further designated 10 key performance indicators that were grouped in three categories:

- **Securing funding**
 - KPI 1: Consolidate core funding
 - KPI 2: Grow grant funding
 - KPI 3: Increase outputs, outcomes, and impacts of research
- **Effective collaboration**
 - KPI 4: Effective partnerships in ICBA projects
 - KPI 5: Ensuring that collaboration with key strategic partners is functioning effectively
- **High performance of the organization**
 - KPI 6: Improved project management
 - KPI 7: Increased number of quality scientific publications
 - KPI 8: Increased quality and timeliness of corporate service delivery to the Center
 - KPI 9: Improved gender profile of the Center
 - KPI 10: Increased capacity and effectiveness of staff in their jobs.

The TRC’s review of the Center’s performance for the period 2013 – 2016 was gleaned principally from the mid-range business plan review completed in 2016. In as much as the Center adopted a new vision and mission in 2013, as stated in the 2013 – 2016 Strategy and the subsequent business plan, the annual reports of 2013 through 2015 were relevant only in conjunction with the business

plan, while the earlier annual reports were relevant only in conjunction with the recommendations of the technical review of 2010, especially as summarized in the 2009 – 2013 Program Highlights and achievements.

On the matter of consolidating core funding, the panel learned that ICBA's management is collaborating with the Board to utilize the concept of *waqf* or trust whereby the Center can supplement its core funding with income from this trust. This will be a welcome development, especially if it is in addition to the current arrangements and not in lieu of same. The open ended standing commitment of \$M 5 annually by UAE and of \$M 2 annually during the current 5-year cycle by IDB have been significantly eroded by inflationary pressures outside the control of ICBA. The Center has been very diligent and successfully so in increasing the noncore funds, but the need for assured and sustainable core funds at a constant purchasing power parity level represents a minimum requirement to maintain the sterling international status that the Center has achieved.

The degree of meeting the stated KPI's of the business plan are adequately summarized in the Mid-Range Business Plan Review of 2013 – 2016. The presentations by Division Directors further assured the panel that the Center is complying quite satisfactorily with the business plan. The panel was particularly concerned with ascertaining that what the Center is doing is aligned with the plan, that it is based on sound science, and that it is done in the right place and within the planned budget and timeline. The Center is to be complemented on all these counts.

5.3 Descriptive statements on the implementation of planned work; Relevance and quality of the projects; and Regional involvement

4.3.1 Assessment of Natural Resources in Saline and Marginal Environments

Work in this research innovation domain has been underway over the entire lifetime of the Center. The objectives of the ongoing research have been changing towards the applied and most suitable knowhow and practices for marginal environments. In the first 2 – 3 years of the 2010 – 2015 cycle, the research focused on optimizing on-farm irrigation water use efficiency in saline soils, on matching the irrigation scheduling with crop needs through moisture and salinity sensors using a SCADA (supervisory control and data acquisition) system, and on incorporating weather data into SCADA. Work was also started on treated waste water in crop production, on evaluating it when it is mixed with sea or brine water, and on using it for recharging water aquifers. Some of this work matured later on into proven practices that were amenable to further scaling up and for demonstrations in cooperation with partners in other countries. During this time period, the value of land use mapping gained some attention and soil maps for UAE were completed, and a soil museum was established with targeted external funding. Soil mapping has come in handy later on as input data for the climate change initiative.

The technology and expertise developed or demonstrated at ICBA continued to be shared through partners with farmers and other recipients in several countries in the MENA region, SSA countries, and Central Asia. The technology and expertise in this area were also provided to UAE and other GCC countries.

Focus on the principal mission of ICBA was maintained sufficiently well during the first 2-3 years of this period, but the scientists were drawn into other related activities with varying degrees of relevance to the main mission. Perhaps this was one of the reasons that ICBA embarked on a strategic planning exercise for the following years, and a long-term strategy was developed followed by the 3-year plan of 2013 – 2016.

The strategic plan of 2013 – 2023 called for continuation of assessment of water, land, crops, and cropping systems in marginal environments, to develop science based recommendations on land management and on restoring degraded land. ICBA was to follow up on whatever technology was developed or tested and adopted for marginal environments and to make it available to stakeholders and partners through effective means to ensure maximum impact.

The business plan of 2013 – 2016 reflected the directives of the strategic plan with the addition of a goal to propel ICBA to become a global center of excellence for innovative agriculture in marginal environments. The underlying theme in the plan is to target food, water and nutritional security in marginal environments, and to enhance resilience in such environments. It was pointed out that for such achievements to be realized, the biophysical constraints on the productivity and resilience potential of marginal environments must be assessed with robust measurements of their soils, water resources, landscape and climate. The plan listed several key objectives to be pursued both at ICBA and at other locations in collaboration with donors and partners in other countries. The key outcomes in this research innovation domain comprised the continuation of work towards the adaptation and transfer of water conservation technologies suited to marginal environments, on the adoption of land use mapping for better utilization of land resources in the MENA region, the GCC countries, central Asia, and sub-Saharan Africa. Additional outcomes related to environmental impact assessments and best farm management practices were listed.

Judging from the annual reports, the mid-range business plan review, and the presentations made by division directors and section heads, the TRC finds that most of the goals were achieved in terms of the number and distribution of projects, and that the science employed in these projects was sound and at cutting edge level. Perhaps some thought needs to be given to diversifying the partnership profile to add farm cooperatives wherever they are available, other active NGO's, some farmer organizations, and small businesses in the agricultural value chain systems who have direct contacts with a large and broad cross section of potential beneficiaries of ICBA's innovative technologies. The TRC panel also strongly encourages all the involved project leaders of all such activities to work closely with the newly hired agricultural economist to embed the necessary data collection features in their work to enable ICBA to measure the economic impact of all such work as it goes along. Such data are invaluable in the formulation of future research proposals to be submitted to potential donors. If and when a sociologist is hired, additional such data to measure the social impact of all these interventions will become possible and will enhance the salability of proposals to donors. It is strongly recommended that if a sociologist will not be hired any time soon, that such a task be outsourced because otherwise the opportunity to embed these issues in the design of the projects will have been partly lost.

4.3.2 Crop Productivity, Diversification and Genetic Improvement Research at ICBA

The review of the crop diversity section takes a look at the work done from the point of view of the business plan. In addition, it takes a look at the relevance, implementation and impact of the work done to meet the needs and demands of marginal environments in the region as well as their alignment with the Sustainable Development Goals (SDG). It will also look at the sections' work contributing to the expected outcomes of food, nutrition, income and improved water security as outlined in the strategic plan of 2013 – 2023 and the business plan of 2013 – 2016.

The conservation and use of genetic diversity is an ancient practice. Since time immemorial farmers have chosen, domesticated and bred many wild plants to meet their needs. Over time hundreds of different species have been domesticated within different species. Human and natural selection have combined to produce innumerable novel varieties.

Crop diversification and genetic improvement is critical to the world's food and nutritional security if we are to meet the challenges of new and ever-changing diseases, pests and changing

environmental conditions. This is more imperative in the areas that ICBA specializes in, namely marginalized and stressed environments due to salinity, drought, or poor quality irrigation water, or where saline environments are brought into food production. ICBA is well equipped and in a position with its accumulated expertise to contribute to mitigating the impact of both biotic and abiotic stresses through the identification and selection of new resilient varieties and new technologies.

4.3.2.1 Key Objectives for the Business Plan 2013 -2016

1. To evaluate 30 newly developed and wild genotypes of quinoa, sorghum and pearl millet for food, feed and fuel under climate change impact in marginal environments of CA countries, SSA and the GCC
2. To assess, conserve and utilize the biodiversity of new genetic resources in GCC and SSA
3. To genetically improve a few lines of sorghum and barley crops that are economically important and are tolerant to marginal environments
4. To improve sea water based agriculture production systems
5. To develop salt tolerant seeds production programs for marginal environments

4.3.2.2 Summary of Activities:

Some of the main activities of the crop diversity section focused on enhancing the diversification of crop production to adapt to climate change and marginal environments through extensive testing and selection of more productive and resilient species and varieties. The projects also focused on the development of integrated production systems for marginal and saline conditions with several governmental partners in different countries falling within the category of National Agricultural Research Systems (NARS), as well as through farmer participatory projects with farming communities both locally and in the region.

Work is ongoing on identifying and selecting new halophyte species and on optimizing their production parameters. The section activities have included a look into protected agriculture that could be adapted to marginal and stressed environments. The section maintains a unique collection of salt tolerant crops which has reached over 12,567 accessions, representing 62 genera and 226 species. This is a valuable scientific resource and a commendable achievement with worldwide implications and significance.

4.3.2.3 Some key achievements:

- New genotypes of nutritious salt tolerant crops have been introduced in countries with marginal environments. Sorghum, pearl millet and other varieties have been introduced to central Asia.
- Quinoa as an alternative crop for marginal environment was successfully introduced and scaled up in 5 WANA countries
- Development of systems for alternative water use for the production of cash crops under marginal environments
- ICBA has developed manuals on seed germination and nutritional values of different salt tolerant and halophytic crops along with their agronomic practices
- ICBA has developed national strategies for Kuwait, Oman and UAE related to water conservation and management, agriculture and food security issues. As a result of different bilateral and regional collaborative projects, the national governments in Tunisia, Jordan and Syria prepared their own national strategy

4.3.2.4 Relevant observations

The research and development work conducted by the Cop diversity and genetic improvement section is aligned with the strategic plan and business plan of ICBA. It is meeting its key objectives and contributing to the overall expected outcomes of ICBA Management. Many capacity building activities and knowledge transfer have been carried out, especially in participatory programs involving several countries in the region.

The section needs to continue its work on collecting and identifying new crops for use in saline and marginal environments. The unique collection of salt tolerant plants and species is expected to grow as it should, and this calls for the urgent expansion and upgrade of the gene bank facility and respective skilled personnel. Preferably there is a need for a breeder/molecular biologist to assist the section in further testing and developing of new varieties for use in marginal environment. Such capacity is needed to prime the course of future work towards more basic work with assured practical application. For at some point ICBA needs to contemplate a strategic move on whether or not to engage in fundamental genetic research related to identifying, for example, the genetic factors that make certain halophytes resilient to salinity, and the possibility of transferring such genetic factors to other economic crops in an effort to widen the choices for food production in stressed environments. Such a decision, it should be recognized, will require more generous funding, and it is a matter for the Board to weigh the priorities of the returns on donor funds.

The panel concludes that the section is working in cross sectional projects which are critical to the success of the development of integrated production systems for marginal environments. The quality of their work is of high standard.

4.3.2.5 Aquaculture and Bioenergy

4.3.2.5.1 Key objectives:

- a) To evaluate and develop alternative halophyte production systems for biomass and energy production using brackish water, sea water, treated waste water, and mixtures thereof.
- b) To develop a system that integrates aquaculture with crop production systems

4.3.2.5.2 Achievements:

A model farm for integrated aquaculture and agricultural system (IAAS) was established and is currently in its third year of implementation. Several vegetable and halophytic crops have been successfully incorporated into the system. Soil monitoring and water analysis of the growing season have been completed.

4.3.2.5.3 Observations:

Work is ongoing on the development of IAAS and on transferring the knowhow to partners and farmer communities. This will help diversify the income of farmers in marginal environments if proven to be successful and cost effective.

4.3.3 Climate Change Research at ICBA

This has been an area which has emerged from a fringe activity status at the time of the last external technical review to now becoming a state-of-the-art vibrant discipline with a well-established record of special project funding success. The panel commends the Center and its staff for this considerable achievement.

Substantive, high-level technical and innovative expertise now exists at the Center for the purposes of modelling, adaptation and functional use of meteorological and crop parameters and real-time remote sensing. The potential for advice on early warning of negative climatic events and for suitable

ameliorative agronomic recommendations can be presently downscaled close to farm level. This is a major achievement and especially in the context of the MENA focus region as this has been achieved on an essentially blank canvas given the recent development globally of climate change science.

4.3.3.1 Key Objectives for the Business Plan 2013 -2016

1. To develop mitigation and adaptation technologies and management related to agricultural production under changing climate change scenarios.
2. To generate new climate change data for the MENA and SSA region based on the downscaling of global models to empower decision makers, particularly focusing on drought events.
3. To develop drought monitoring in the MENA to help mitigate and adapt to extreme climatic conditions.
4. To identify the most vulnerable economic sectors and communities that are most impacted by drought, and develop mitigation and adaptation strategies to offset the impacts of future events.
5. To develop strategies to meet challenges of food, nutrition and water securities as a result of climate change and regional issues.
6. To provide sound scientific evidence and policy recommendations to guide groundwater abstraction and utilization practices.
7. To create a web based knowledge portal for information.

4.3.3.2 Some key activities

- Work is ongoing to accumulate climate change data on rainfall, temperature, drought and vulnerability in the MENA region using a global climate change model assessment and downscaling it to the MENA region and the UAE through the MAWRED, CODRA and RDMS projects.
- Characterizing agro-climatic zones in Jordan, Lebanon, Tunisia and Morocco with additional monitoring and future projection of changes in these areas to help in the adaptation of crops and animal production systems.
- Identification and characterization of vulnerable agro-ecological zones, production basins and farming systems.
- Monitoring irrigation for increased water conservation and productivity using Near Real time (NRT) Sensors in Jordan, Oman, Tunisia and UAE.
- MENA regional Drought Management Systems, a water scarcity initiative with FAO.

4.3.3.3 Some key achievements

- A water/crop/climate change modeling hub has been established at ICBA under the MAWRED and CODRA projects
- Data accumulation is realized through NRT sensors in countries in several climates in the region.
- Regional and country level adaptation strategies have been developed for UAE, Tunisia and Jordan.
- Knowledge transfer through capacity building projects has been achieved on issues such as climate change modeling and mapping, and on empowering women to diversify their house

hold incomes.

- Participatory community based approach on the promotion of biosaline practices has been done in CA countries

4.3.3.4 Relevant observations

The significantly successful achievements in this section have been engendered by effective recruitment of high-quality, young NARS staff from the region which has providentially permitted access to meteorological data that would not otherwise have been freely available in the public domain. It has also been achieved by the development of close relations with globally-leading modelling and remote sensing research groups in the USA aided by USAID funding.

The success of this research section at ICBA has been further magnified by their policy of collegial capacity building and generating immediate ownership of the intellectual property within capable national program groups. ICBA's willingness to lead in the customization of models and output to suit local needs has been a major factor instrumental in achieving this progress.

Yet, it should be recognized that the present strong status of climate change research outputs at the Center has come at the cost of making some fairly bold educated assumptions in the selection of models and in the processing of data, given that the raw meteorological and cropping data in the region are not of the highest quality or consistency. It is vital that the group continues to fully verify and rationalize these assumptions repeatedly and overtly, otherwise it would possibly compromise the confidence in which their output would be viewed by other scientists. Furthermore, as the methods and output from the group can be seen to be potentially hard to comprehend by colleagues at ICBA and in the collaborating institutions not familiar with the language of this discipline, the staff must work diligently to bridge this communication gap if their efforts are to be appropriately valued. Continuing good linkages with the germplasm and applied agronomy personnel resources at the Center are necessary if the groups' output is to become effective outcomes in support of the attainment of SDGs 2 and 13 (specifically targets 2.4 and 13.1-13.3, Appendix 1).

We conclude that further investment by ICBA in upgrading the physical and personnel resources of this group would be worthwhile.

6. Recommendations

After extensive deliberation, the TRC commends ICBA on its overall performance and its willingness to address some of the more difficult challenges of the modern world on behalf of the mostly disadvantaged communities living in marginal environments. Yet, within this context the TRC wishes to make a series of recommendations which we feel will help the Center become more effective in achieving its mission in the coming years and will help it gain its desired status as the world's apex research for development organization in marginal areas and a true champion of those population groups that live and work in agricultural and related communities in the developing world.

Our recommendations are as follows:

1. The TRC is concerned by the lack of synchronicity between the following: the development periods of the strategic plan, the business plan, the five-year reviews and the re-funding presentations to key core donors scheduled for 2019 and beyond. We recommend that the management present to the Board an amended, more efficient timetable for their concurrence.
2. The TRC recommends that the Center refreshes its Strategic Plan with specific reference to the new UN Sustainable Development Goals in the context of the specifically defined goal targets which are relevant to ICBA's quantifiable outputs. It is expected that such an effort will be rewarded by heightened interest among international donors.
3. The Center has carved for itself a sterling international reputation as an information and technological hub for marginal environments with a focus on salinity and saline waters. This international dimension needs to be preserved and strengthened. The TRC panel urges the Board to consider measures that will absolve the Center from the contingency status with respect to allocation of time restricted core funds every five years as stipulated in the Articles of Association. The panel feels that the Center has well earned its colors and should be rewarded with sustained core funding that accounts for the inflationary pressures of the past 15 years. The success of the Center and its earned international standing is not only a credit to its management and staff, but also to the wise foresight of the UAE government and IDB exhibited 16 years ago.
4. Given the good potential of a large increase in special project funds being won by ICBA in the immediate future we recommend that the Center adopt a policy of full cost recovery and seek to eliminate subsidization of as many projects as possible from the present invaluable core funding. This is inevitably a painful process for the staff and needs to be undertaken in a determined but sensitive and well communicated manner.
5. The TRC recommends that the management of ICBA prepares an updated list which clearly prioritizes vacant and new staff positions within the context of the strategic and new business plan which will enable them to better develop the Center's staff with appropriate skill sets to reflect its new future persona as the global apex institute for the improvement of agriculture on marginal lands.
6. We recommend strongly that a better balance be sought amongst the biological and social science disciplines over the next business plan period. It is important that ICBA has economists and related disciplinary staff to undertake monitoring and evaluation functions as well as assessment and valuation of impact for all projects at the Center. In addition, there is a clear need for historical impact assessment which can record and examine the consequences of ICBA's technology outcomes in the longer term and with a more regionally wide perspective.

7. The TRC sees the immediate construction of a center-generated, realistic theory of change for the whole research program in which all staff can feel joint-ownership and commitment thus strengthening and clarifying the ICBA brand for donors and for the general public.
8. The TRC recommends that new gender-specific and environmentally friendly research foci, seen in their broadest context, be applied to all ICBA research areas and are clearly reported as such given the new overt commitment to the SDGs and donor policies in these areas.
9. The TRC is concerned by the lack of a DDG position in place. These places an unreasonable burden directly on the DG and diverts her from her fund raising and ambassadorial role. We recommend that, after discussion with the UAE Government, a candidate be sought internationally with suitable global scientific research management experience and recruited as a matter of urgent priority in order to help shape the center's development up to and beyond 2019.
10. The TRC commends the Center's management on its positive action with regard to the recruitment of postdoctoral scientists but recommends that ICBA should now have a clear policy ready for either their promotion into the ICBA's tenured staff after two years on the job or for efforts to be made to ensure direct seeding of well trained and loyal scientists into good jobs in countries (public or private sector) to support the capacity development of marginal areas research.
11. The TRC believes that donor policies in the very near future will generally coalesce around a requirement for publications to be 100% open source. Publication in high impact scientific journals need to continue, and the more the better. To be sure, requiring that such publication will be open source will require extra publication expenditures. We recommend that the ICBA Board, management and staff should embrace this change as it is vital that all its information be readily available fully in the public domain.
12. ICBA is presently seeking to diversify its funding base. One option is to approach the Crop Diversity Trust for assistance in covering the costs of its gene bank. The collection of genetic resources is presently vulnerable as it is held outside of the main international system and the Center risks reputational damage as a result. We therefore recommend that the ICBA management open negotiations with the Secretariat of the International Treaty for Genetic Resources for Food and Agriculture with a view to signing an agreement under article 15 of the treaty and adopting its provisions including the standard material transfer agreement. This is one of the requirements for Crop Diversity Trust funding.
13. The TRC recommends that the Center further invests to expand and upgrade its gene bank infrastructure and overall management protocols. The present situation while somewhat adequate is not conducive to growth and expansion, and consequently in danger of falling below international standards.
14. The TRC feels that there is currently a degree of over-centralization of authority with respect to special project grant winning. If the winning of more grants is the way forward for the Center then greater delegation of authority down to Section head level is required to fulfil this task.
15. The TRC recognizes the vital role of the communication personnel within the overall image presentation of the Center and recommends that this group be strengthened to improve internal and external communication where necessary and to ensure more effective advocacy with donors and to help in achieving greater success in special project grant winning.
16. The TRC recommends that ICBA's consultancy services to outside agencies be now further formalized and regularized with respect to the use, valuation, charging and future commitment

of senior staff time.

17. We ask the Management and Board to consider the future interactions between ICBA and regional and sub-regional organizations. We suggest that the time-consuming nature of servicing ARINENA, CACAARI, APAARI, CORAF and ASARECA as an individual Center will be overly burdensome for the staff. We thus recommend that alternative mechanisms, perhaps through AIRCA or through close national partner allies, be sought to share and fulfil the Center's responsibility in this regard.
18. Donor intelligence is an area that needs to be further developed and made available to all international staff in a timely manner. In the ongoing transition from responding to competitive calls to now developing more commissioned research the panel feels this will improve the success rate of the Center's project proposal submissions. We recommend that the management take steps to seek the most effective ways of garnering and sharing such knowledge.
19. The TRC recognizes that the field plots at ICBA, some of which are now nearly 16 years in the running, have become a national treasure for the UAE. Additionally, these plots have also become globally significant as a unique experimental resource in the very specialized field of biosaline agriculture. Their value continues to accrue annually and will become a scientific heritage site the likes of which are otherwise absent for biosaline agriculture, and even rare for general agricultural field experiments of such significance. The TRC panel strongly recommends that these experimental plots be continued and their objectives preserved, and the whole area should not be compromised by alternate land uses of any kind.

7. ICBA in 2023 – Our future vision

The TRC Panel projects a period of rapid and sustained growth in the staff and budget in the period leading up to 2023 by which date the current strategic plan will have matured. We anticipate that the very considerable relevance of ICBA's mission to the UN targets demanded by the Sustainable Development Goals (specifically Goal Targets 1.4, 1.5, 2.1-2.5, 5a and 13.1-13.3, Appendix 1) and in summary reducing poverty, improving food and nutritional security, gender empowerment and combatting climate change) will significantly enhance its immediate attractiveness to a broad range of donors. ICBA, perhaps, will have by then rebranded itself to become the "World Marginal Lands Center" as its current acronym, though well recognized will be seen by the public and scientific community to be increasingly inappropriate as a reflection of the Center's enhanced function.

It is likely by this time the international staff numbers will exceed 100+, it will be sufficiently balanced in terms of biological and social science disciplines and the annual budget will be around \$30+ million. This will consist of continued substantive support from the Islamic Development Bank and the UAE Government and this will be provided in the form of core, or attributed core funding to a minimum of \$10-15 million and the remaining two thirds of the budget will consist of new special project funding won from a broad range of donors likely to include the BMGF, the Asian Development Bank, the African Development Bank, the Crop Diversity Trust, ACIAR, BMZ, Dutch Aid, DFID and potentially many others thus providing a broader funding base and greater financial resilience for the Center in the medium term.

The Center will have the MENA region, Sahelian Africa, Central Asia and South Asia as its principal spheres of attention. The Center will be recognized as the world's apex organization for improved agricultural production in land marginalized by heat, drought and salinity and related abiotic stress factors. In response, the center will have shown considerable scope in using poor quality and grey water for functional protected and field scale agriculture, in the selection and use of suitable halophytic crops for low quality land, in determining the detailed risks of climate change at a field level and advocating suitable policies at national levels to address the potential risks associated with climate uncertainty.

It will have mentored a wide range of new small agribusinesses and helped to provide functional employment for many young people in rural areas. Its contribution in terms of capacity development at a scientific level will be notable. Women and other relatively disadvantaged groups will be preferential beneficiaries of the Center's research outputs delivered at scale through collegial partnership between the Center and effective national programs, large NGOs and private sector water & seed companies.

The main risks envisaged for the attainment of this scenario would be the Center becoming overconfident and expanding into more disciplinary and geographic areas than it can effectively handle. Thus, failing to create or be guided by a meaningful institutional theory of change with sufficiently clear prioritization must be avoided. Likewise, it will require more effective decentralized management and a very positive internal *esprit de corps* with good communication and collaboration between disciplinary and likely outreach scientific groups.

8. Conclusion:

The Review Panel has been more than satisfied by the scientific quality of the work and by the effort and output shown by the talented staff of the Center. It is well managed and morale appears to be favorable. Some key appointments such as the Director of the Corporate Services Division have recently been made and improvements implemented in budget management will quickly be noted.

The Panel therefore urges the Board of Directors to adopt bold policies which will assist the Center to grow consistently and in a sustainable manner over the next five-year period. They should seek diligently, with the senior management, to minimize funding uncertainty well into the medium term as otherwise short-termism may corrode morale in an institution whose mandate embraces supporting the communities of the marginal areas and thus by definition requires long term commitment and support.

This is a seminal moment for the Center as it seeks to grow beyond its current confines. If ICBA is to continue as a **World Center of Excellence** then steps to ensure this need to be taken now. When this is achieved, and we are confident that it is very doable, then all the establishing organizations and core donor agencies will be able to proudly point to their joint achievement in 2030 when the Sustainable Development Goals are reviewed and a big thank you will come from the communities of the marginal areas worldwide that ICBA has effectively championed in bringing about their sustainable development.

9. Appendix (1)

Sustainable Development Goals and their Targets Relevant to ICBA

SDG 1 End poverty in all its forms everywhere

Target 1.4 By 2030, ensure that all men and women, in particular the poor and vulnerable, have equal rights to economic resources, as well as access to basic services, ownership and control over land and other forms of property, inheritance, natural resources, appropriate new technology and financial services including microfinance.

Target 1.5 by 2030 build the resilience of the poor and those in vulnerable situations and reduce their exposure to vulnerability to climate-related extreme events and other economic, social and environmental shocks and disasters.

SDG 2 End hunger, achieve food security and improved nutrition and promote sustainable agriculture

Target 2.1 by 2030, end hunger and ensure access by all people, in particular the poor and people in vulnerable situations, including infants, to safe, nutritious and sufficient food all year round.

Target 2.2 by 2030, end all forms of malnutrition, including achieving, by 2025, the internationally agreed targets on stunting and wasting in children under 5 years of age, and address the nutritional needs of adolescent girls, pregnant and lactating women and older persons

Target 2.3 by 2030, double the agricultural productivity and incomes of small-scale food producers, in particular women, indigenous peoples, family farmers, pastoralists and fishers, including through secure and equal access to land, other productive resources and inputs, knowledge, financial services, markets and opportunities for value addition and non-farm employment

Target 2.4 by 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality.

Target 2.5 by 2020, maintain the genetic diversity of seeds, cultivated plants and farmed and domesticated animals and their related wild species, including through soundly managed and diversified seed and plant banks at the national, regional and international levels, and promote access to and fair and equitable sharing of benefits arising from the utilization of genetic resources and associated traditional knowledge, as internationally agreed.

Target 2.a Increase investment, including through enhanced international cooperation, in rural infrastructure, agricultural research and extension services, technology development and plant and livestock gene banks in order to enhance agricultural productive capacity in developing countries, in particular least developed countries

SDG 5 Achieve gender equality and empower all women and girls

Target 5.1 End all forms of discrimination against all women and girls everywhere

Target 5.5 Ensure women's full and effective participation and equal opportunities for leadership at all levels of decision-making in political, economic and public life

Target 5.a Undertake reforms to give women equal rights to economic resources, as well as access to ownership and control over land and other forms of property, financial services, inheritance and natural resources, in accordance with national laws

Target 5.c Adopt and strengthen sound policies and enforceable legislation for the promotion of gender equality and the empowerment of all women and girls at all levels

SDG 13 Take urgent action to combat climate change and its impacts

Target 13.1 Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries

Target 13.2 Integrate climate change measures into national policies, strategies and planning

Target 13.3 Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning

SDG 15 Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.

Target 15.3 by 2030, combat desertification, restore degraded land and soil, including land affected by desertification, drought and floods, and strive to achieve a land degradation-neutral world