ARMIS@BARC

Capacity Enhancement of NARS through ICT-based Agricultural Research Management Information System (ARMIS)

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1. Understanding agricultural context

Agriculture sector is at the peak in driving the wheels of economic development of Bangladesh. In spite of the gradual decline, the present share of agriculture towards GDP is at around 16.33%.. Whatever be the case, the total volume of contribution of agriculture to the GDP has increased, and still it remains the predominant sector in terms of employment and livelihood. Food security and poverty alleviation are predominantly influenced by agriculture and related macroeconomic activities. As envisaged in the visionary plan of the government, Bangladesh has to reduce its import dependency of different food items and become self reliant not only in cereals but also on other products.

Major challenges for Bangladesh agriculture are to elevate productivity and profitability, by addressing among others, the issues like; minimize loss of arable land, increase resource-use efficiency, reduce cost of production, tackle adverse effect of natural hazards and climate change, ensure safe production of food and their supply to the consumers. Policy dimensions of agricultural growth encompasses more scientific and technological innovations and their effective dissemination to the users. This obviously demands progressive and considerable increase in the investment of public expenditure in research. Research undertaking suffers, due to low investment in Agricultural R&D by public and insignificant by the private sector. The investment in agriculture needs to be increased to a certain level in order to build a congenial environment and allow the actors to pursue activities without disruption and paucity of fund. It is imperative that, in a resource scare country like Bangladesh, investment by priority is highly desirable and needs to be done at any cost. Pertinent to mention here that, under the leadership of BARC, the research priorities in agriculture by the year 2030 and beyond has been determined and under implementation by the relevant institutions.

2. Role of research in agriculture

The main objective of the national agricultural research system (NARS) organizations under the leadership of Bangladesh Agricultural Research Council (BARC), are to generate demand-led technologies/information and scale-up those for wider adoption. Priorities are given to address the agro-ecologically constrained areas that are more prone to weather vagaries and inhabited by proportionately higher population of poor and vulnerable group. It is recognized that, there has been commendable success in agricultural R&D - particularly in rice and vegetable over the last three decades. There exists mounting concern however, among the scientists and policy planners on the ways to meet the growing demand of the increasing population in the coming days; as the country's natural resource base is shrinking and degrading. The picture is bleak when the climate change matter is transported into the scenario. This is really a dreadful challenge for the nation. A break through in agricultural R&D can only ease the situation. Concerted effort, with required policy support for effective research and development would be the key instrument for increasing production and productivity to cope with the future demand.

3. Justification of undertaking ARMIS project

To undertake new research, the past and on-going research information are needed to i) to decide on the course of action, ii) to avoid wasteful duplication and iii) for economization of scarce resource. Proper documentation with updated information and their availability in time is thus vital. Things become easier and time saving if, the required information largely could be extracted from a single source.

As is known to all, in Bangladesh the NARS institutions, the Universities and quite a number of other agencies are long been engaged in agricultural research and development activities. Through their work, they have by now, generated a significant number of problem solving technologies which have notably contributed towards elevation of agricultural productivity and in attaining self sufficiency in food; specifically cereals. Besides, much useful research information have also been made available; which are acting as an input for further investigation and in making research more responsive to the ground complexity and demand. Unfortunate though, in many cases these technologies/innovated information are scattered and not maintained in an organized manner as a central database system. As a result, either these information are lost or are not readily available to plan and initiate new research programs/projects. Providing the researchers and the development practioners; appropriate information and in time, is decisive for success of the endeavour. In this perspective, a central depository could assist by way of providing the required research information for analytical and need-based planning of future research leading to economization by avoiding wasteful repetition.

Against the backdrop, for effective management of agricultural research, BARC as a part of its mandated responsibility undertook the ICT based research management information system-ARMIS (Agricultural Research Management Information System) project (actual project title is : Capacity Enhancement of NARS through ICT-based Agricultural Research Management Information System) being implemented by the Computer and GIS Unit of BARC. Funded by the Krishi Gobeshona Foundation (KGF) initially for a short period of few months and then considering the reality and enormity of the work, duration extended further. The 1st phase was from July (actual start of activity in September) 2013 to March 2014 and the 2nd phase, under execution since July 2014 is scheduled to end in June 2016 as per approval of revision/continuation with a cost of BDT 4.327 crore.

4. How ARMIS can help

Essentially, ARMIS is a gizmo for informed decision making. The underlying principle of the ARMIS project is to provide a single source location of research information on projects/programs/activities in order to enable the research planners/managers and other users to make use of it. The configuration of the service-oriented on-line initiative of ARMIS tool is intended to facilitate users to view, update, search/query and generate report according to the user's privilege and specific need. The ARMIS system once developed in totality, (by now it has bloomed, spreading fragrance and in operation) will act as an essential decision support tool for the research managers to identify research needs and in initiating new research programs/projects as per priority.

5. ARMIS : *for better management of research*

For sustainable development of agricultural research; functionality of a modern agricultural research management system and access by all, at all times to the near-real time information is crucial. For the agricultural development practionners in general and the research community in particular, there is a crying need of a technological tool for knowledge management to bring efficiency in research. In this context, establishment and maintenance of an effective Agricultural Research Management Information System (ARMIS) might be the solution. ARMIS, as a central depository could assist by way of providing the required research information for planning future research, understanding the strength and weakness of the past, economization of research by avoiding extravagant recurrence, identify gaps and thus in undertaking research through need analysis.

In order to make the ARMIS more practicable; data entry and retrieval procedure restructured and based on the feedback from the training/workshop participants and knowledgeable sources, the software has been turned more client responsive. It is expected that, with the new arrangement, the ARMIS will take the shape of an user-friendly genuine hub of centralized and integrated online application system for collection and retrieval of agricultural research information. Relevant to mention here, during the late 1980's and early 1990's, a number of attempts were made for documenting research outputs; which due to various reasons could not been sustained. The sustainability of ARMIS has been ensured by establishing an in-built mechanism of information flow from various agencies through a two way system and is shown in the conceptual diagram below.

Fig. 1 : Conceptual diagram of two way data flow

6. Project objectives

The goal of the project is to develop an Agriculture Research Management Information System (ARMIS) and make available a single location platform of required information for effective and efficient management of agricultural research in Bangladesh. The main objectives of the project are;

- To gather and input research projects/programs related information of NARS and other organizations and accordingly develop a comprehensive and effective ARMIS database and application.
- To ensure availability of information for the researchers, policy planners and others in an organized and timely manner through ICT based communication channel and
- To develop sustainable repository/hub of agricultural research information/findings for the users with up to date information.

7. Implementation approach and methodology

In ARMIS application and database development, a systematic approach and a common framework planned and followed all through. These includes; exercise of collaborative effort in the spirit of collective ownership with different agencies having institutional responsibility and one-to-one contact/liaison with all including individuals interested in activities in the broader area of agricultural research covering land, soil, water, crop, livestock, fisheries, forestry, socio-economics, policy and environment etc. Journals, patronizing activities in the said areas are also in our list of contact.

In case of an agency, the person in charge of research or one designated by the head of the respective institution (referred as Focal point/Admin/Contact person) is responsible to coordinate with the project management and play supervisory role at the local level. Activities of the functional units to cover; collection, synthesis, structuring of data input as per the template and entry of the data/information through scrutiny, editing, ensuring quality and reliability etc. Interval review of the research data and its recommendation for approval will also be part of the agency responsibility. The appropriate functional units, being determined in consultation with the ARMIS personnel by the Focal

point/Admin/Contact person of an institution, does have the freedom to input research data. From the sponsors side, identification of potential individuals and collection of their work for entry is an important part of the process.

ARMIS has planned to collate, during its tenure, nearly 25,000 research information/entries from the expanded list of agricultural R&D organizations of the country (total 266 numbers including 78 recognized journals at the moment). Effort being undertaken to collect information since 1971 to date. Published work in journals, reports, books etc. and also accomplished tasks with certain result/output are given priority. The ongoing work are not excluded for the benefit of checking duplication and economy in resource investment.

BARC as a part of it's mandate, is coordinating the activities and shall be maintaining the research database in an organized, updated and sustainable manner even on expiry of the project.

7.1 Switch over to Version 2

ARMIS begin its journey with the development of the Version 1 (V1) of the software/interface; which however, was not that user friendly to the level expected. There were less scope for checking quality of the entries made, and no provision for tracking of viewers; their origin, area of interest etc. In V1, there was no scope for entry of multiple commodity and non-commodity-very vital in agricultural research. For an online system to function smoothly, notification to many different level of users, though important, was absent in V1. Further in V1, there was no on-line option to be an user and no easy mechanism for providing feedback. Again, business intelligence part, although very much required by the decision makers and relevant others to have a quick idea on the

output and performance was not present. The duplication checking part in V1 was not that effective and there was no 'save' option. Providence of an Id instantly just after an entry was confusing, since the entry and Id receipt could be made-just by entering organizations name. Free text options in the drop-down turned the system messy as anyone could enter anything. Problem in Web app. access was acute and there was no mechanism for retrieval of forgotten Id and password in V1.

The developer of the ARMIS software made constant effort and tried to visualize the whole object from users perspective. In the journey of transformation from V1 to V2, all out endeavour were undertaken to gather users feedback from the 22 trainings and workshop arranged in different parts of the country, besides taking opinion of the knowledgeable sources and from expert consultation. This involved, zooming out and simplification to address the issues surfaced and continued stride to turn it more and more user friendly. Refinement and pre-testing of the V2 before release was a part of the game.

In the revised version (V2), for entry and easy retrieval; classification of the collected information by program area, commodity, non-commodity as per set structure introduced. The V2 application has in-built mechanism to verify, recommend and approve the data/entry at two levels: internally by respective organization and externally by the senior professional of the organization/BARC/designated line expert. To take care of the multiple users of a division/department of an organization, induction of internal reviewer (Head/Chairman of the division/department) to verify and recommend the data entered from his/her division- established in V2 System. The concept of

External review and approval, as practiced in case of Journals has also been introduced in V2. This will be done by competent professional of the agency/BARC/designated line expert; upon recommendation by the internal reviewer. Once approved, the research entry will be published in the ARMIS website

7.2 Entry and Approval Process in V2

In order to make entry of research information, one has to enrol /sign up first as an user. This may be done by making an on-line request. Once authenticated by the institutional process, there will be issuance of an user Id. Using this Id and chosen password by the user, s/he can make entry as per format. For successful submission, one has to complete 10 mandatory fields plus others. After partial work or until satisfaction, one may save work and submit only when feel comfortable. After submission, the entry will pass through internal and external review mechanism. The user has to meet up the reviewer's queries, if any, and resubmit for further action. The entry once approved by the external reviewer, it will be in the Website. Once in the web, there will be no scope for any alteration or what so ever. The induction and approval process, i.e the graduation of an entry in ARMIS may be seen in the figure below.
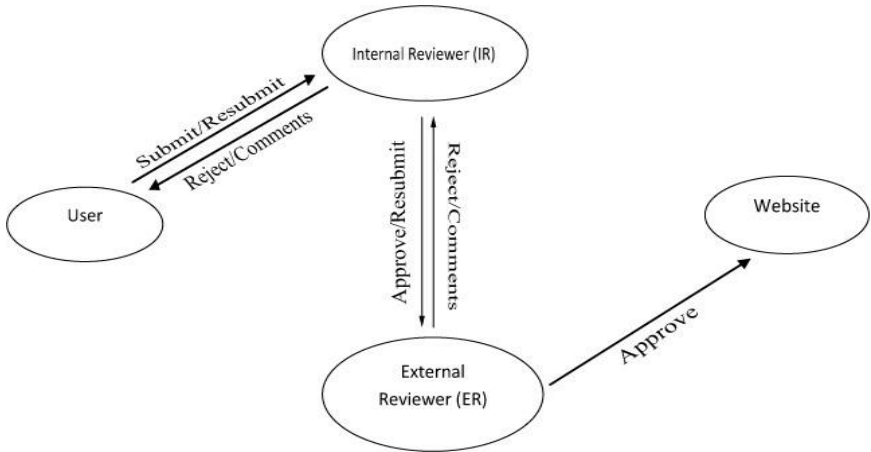
Fig. 2: Graduation process of an entry in ARMIS

7.3 Implementation strategy to attain objectives

In course of progress with the project activities, it was deemed necessary to make the entry volume reasonably well covered and representative. As many organizations, scattered all over the country were noted to have been working and producing research information on a subject area, the strategy had been modified and these may be listed as under;

- Expansion of scope: from earlier 16 to 188 agencies and inclusion of 78 reputed journals (may be more in the coming days)
- Spreading out the coverage, from 1971 to date (earlier it was for 10 years from 2000-2010)
- Priority on published and completed work (e.g Books /Journal /Reports/Proceedings etc.), but ongoing works are not excluded
- Systematization of the documentation process, for entry and retrieval
- Dynamism in design and development of the database

- Ensuring quality and reliability of an entry to the extent possible
- Making software user friendly and interactive (modification and transformation from V1 to V2) and nearly meeting users expectation on content
- Reach 25,000 research entries during the revised project tenure of June 2016
- Wider orientation of the users on ARMIS, in particular on V2 software.
- Branding ARMIS as a prestigious hub of agricultural research information
- Reach out to all possible, rigorous pursuance and sensitization to act and feel the pride of a contributor
- Believe and practice : *Quit talking, begin doing and get moving*

8. Expected output/out come

It is envisaged that, the service-oriented approach of ARMIS will make it possible for the users from any corner of the globe to view, provide online input, update and search/query of information-as well as generate desired report. The system is to provide opportunity for sharing of research information/data, review and formulate new research proposals and thus assist to avoid wasteful duplication. It is expected that, the targeted volume of information will be able to provide a well representative picture of the agricultural research scenario of the country. Further, the process is to facilitate the researchers to unearth and make use of the information efficiently and effectively to draw new research plan and implement thereof. The system thus, to benefit all the stakeholders engaged in the broader field of agricultural research and development.

9. Milestone event /activities of the ARMIS

As planned, much has been achieved by now. Prominent among those are;

- Program area: Detailed out and divided into 16 categories and 107 nos. Further sub-divided into 39, to facilitate entry and review.
- Commodity group: Detailed out and sub-divided into 28 categories and 384 nos.
- Non- commodity group: Detailed out and sub-divided into 6 categories and 33 nos.
- Research Format : Modified fourth time based on the feedback
- Software development : Transformation from V1 to V2
- Involvement of 188 agencies as of now
- Inclusion of 78 Journal information relating to agriculture
- 22,268 research entries attained till date
- Trainings/workshop/special seminars : Conducted 23 nos. in different locations of the country and through those 1,532 scientists /academia oriented
- Users guideline : Developed and uploaded in the ARMIS web along with a video tutorial in Bangla
- Project Brochure : 'ARMIS@BARC' modified upon project extension, reprinted and distributed among all concerned
- Media Coverage : In daily newspapers, in MoA's 'Krishi Bhavna' group and in BARC's Facebook page

10. Risk factors in implementation

Key challenges, remain with the gathering of huge volume of research programs/projects/activity related data and entering those into the database after proper scrutiny and review. Besides, augmentation of the data archive and retrieval system, major modifications of the ARMIS Version 1 application software and transformation to Version 2, its functionality is the key issue that has to be taken into account with utmost seriousness and priority. Accumulation and storage of the data will nonetheless, depend on the nature, quality and of course availability and willingness of the institution/individual to share the information. Risk and impediment involved may be underlined as below :

- Earlier information, say from 1971 to mid. 1980s are not that available and in many cases, does not contain needed details.
- Documentation of research work at the institutes /universities, sometimes are not as per ARMIS need.
- Delay in start-up and gap between closure of Phase-I and start of Phase-II due to recruitment of the personnel afresh, impacted implementation progress.
- Project encountered setback, as the movement of the personnel were obstructed twice due to certain unavoidable circumstances during project tenure.
- Continuity of activities suffered in a few cases, due to changes in Head of agencies/Focal points and their fresh orientation.
- Certain reluctance exists on the part of the individuals to provide/make research entry.
- Contribution to science and the joy of being a part of such an activity, are/were not equally appreciated by all.

11. Project Management and staffing

The Computer and GIS unit of BARC, headed by its Director provides overall guidance and oversee the program activities. The day to day management, relating to the development and maintenance of ARMIS is being performed by the Principal Investigator (PI) who is the CEO of the project. The PI is also the Senior System Analyst of the unit and, in his running the show, is assisted by a Team headed by the Technical Coordinator; comprising a number of Agriculture Experts, Research Associates, Data Encoders and a couple of support staff.

The project activities are being monitored by the Computer and GIS unit and the relevant person(s) of the funding agency- the KGF. The activities of the project personnel are being governed by their respective ToRs and time to time directives, as crops up over time. To attain project success, it is imperative that, the Technical Coordinator, Agriculture Experts and others, maintain close linkage with the targeted agencies and persons involved in the process,

keep on pro-active and self motivated and act as per need. Likewise, it is expected that the participating agencies; as a part of their institutional responsibility, shall continuously enrich the central depository and be a part of the pride of contributor. At ARMIS, we would like to find and practice the culture of being self responsive and continue to ensure 'free-flow' of the generated data/information all time; as a matter of sustaining the system, even after expiry of the project.

Project financing for the entire duration, is committed by the KGF subject to submission of acceptable technical and expenditure reports as per set guideline and timeframe. Details of the staffing may be seen in the facing pages.

12. Human resource development

During the tenure of the ARMIS project, there remains adequate scope for orientation and awareness building of the persons involved in the activities, through organization of training/ workshop etc. since these are integral building block for successful implementation of the project. Skill development activities include, local level as well as national level training and workshop programs both on the data entry process, use of the software, and in making quality data entry etc. The lecture program and the demonstration, further covers, many different aspects including defining the program area, classifying commodity and non-commodity, induction of multi-commodity etc. Again, there is provision of arranging expert consultation with the focal point/Admin/contact persons and even with the scientists and professionals of different disciplines of agriculture as well. As mentioned earlier, through 23 number of trainings/workshop and special seminars, by now 1,523 scientists/academia have been oriented on ARMIS software and database.
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13. Clientele services

As the apex body of the NARS, the BARC has the term of office to undertake activities and provide solutions to the common and emerging issues of many different stakeholders. Among them, the NARS institutes, policy planners, three major public extension agencies, several public and private academic institutions, NGOs, private organizations, development partners and above all the agricultural research information users are of primary consideration. In allegiance to its citizen's charter, the BARC has full respect to the RTI (right to information) and the project's output/outcome are an endeavour towards that direction. The ARMIS project in its implementation arrangement, has conspicuously integrated all these factors. In truest sense, the building philosophy of ARMIS is based on collective ownership; with BARC as the custodian. In line with the mission of BARC; which is to plan, design and implement demand-driven research for generation of need-oriented technology/information and arrange dissemination, ARMIS is absolutely committed and shall be bearing all these tasks. The project believe in collaboration and team effort, and would relentlessly practice this rewarding notion in all their programs and activities. In the process of generation of research information and to scale up the output/outcome, the door to remain always unlock for everyone who are interested to glorify ARMIS and make use of the system to orchestrate contributing material towards the agricultural development of Bangladesh.

14. Branding ARMIS

Branding is not a one day gimmick- no matter which. It needs to be nurtured and built up. To brand ARMIS, it is important to depict by

evidence; its difference with others and establish worthiness: b*y quality, reliability and usefulness.* Continuous stride to showcase research achievement by ARMIS may go a long way towards this direction. Aligning with the users expectation, being responsive and serving many different cliental need are the prime elements to be constantly taken care in the road to branding. Thus, there is the necessity of investing resource; in respect of enhancing data quality and users scientific skill. Once ARMIS is branded, it is understandable that, there will be natural flow of data from institutions and individuals leading to it's enrichment and flourish as an unique hub of agricultural research information in the country.

15. Sustainability of ARMIS

Sustainability of a system among others depend on (a) Quality and utility (b) Legal binding (c) Recognition and incentives e.g creditability and monetary benefit (d) Institutional and individual commitment etc. Project is always time bound and thus will end sometime, but the process, if proved to be beneficial/rewarding should continue. Conviction, appreciation on the advantages, participation and willingness of concerned all; are the key constituent to keep a system alive. ARMIS is not an exception. Clearly, its a collective effort. For the success of such a system, all have to act accordingly. Indisputable desire and commitment of all needed to keep the system vibrant. The proposed system of data auto-flow in V2 from all participating institution and individual will work and review and approval mechanism will function then. The mechanism once institutionalized-will organically flourish and get deep rooted. Database will thus grow, serve all stakeholders;

leading to the branding of ARMIS as a prestigious hub of agricultural research information in Bangladesh.

Its high time to give a serious thought on these issues and decide. All have to be serious while putting information in ARMIS regarding it's quality and reliability. As is being done in case of NARS institutional program presentation and approval by the Executive Council of BARC, documentation of research and their induction in the ARMIS as well, could be made obligatory for the NARS institutes, as a first step. For others, certain device to be worked out in course of time as well. Time has ripen to think of recognizing ARMIS as a Journal and offer publication credit for entry in ARMIS. Why not, ARMIS database is consulted in evaluating the research performance of the scientists ? Modest remuneration for contribution to the ARMIS can also be think and decided. For review, the system is very much in practice in case of journals.

16. Getting involved in ARMIS

For a researcher, academia or a development practioner, contribution in the ARMIS is an investment. Publication in the on-line ARMIS system, will certainly attract others to take note of their work and thus will craft an opportunity for others to use it as a reference while undertaking further work. It's a step towards setting footprint at the national/global level. ARMIS assures full credit to the contributor with 100% respect to IPR. We appeal to all, to take the pride of joining ARMIS, in pulling together all research work since 1971 to date. To be useful, the research information should be output/outcome oriented - not raw. Extra care to be taken by all on reliability and quality of the information. To ARMIS, everyone is important. Big is superb and small is beautiful. Help ARMIS and

help yourself. ARMIS is a collective output and thus its ownership. ARMIS belongs to one and all.

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