Background document on data sharing, institutional arrangements for the AFOLU sector in Bangladesh

Bangladesh Forest Department

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List of Abbreviation

AFOLU- Agriculture, Forestry and Other Lands Use
BARC- Bangladesh Agricultural Research Council
BCCSA- Bangladesh Climate Change Strategy and Action Plan
BFD-Bangladesh Forest Department
BFRI Bangladesh Fisheries Research Institute
BRRI- Bangladesh Rice Research Institute
BUR- Biannual Update Report
CBD- Convention on Biological Diversity
DAE- Department of Agriculture Extension
DLS Department of Livestock Services
DoE-Department of Environment
DoF- Department of Fisheries
FD- Forest Department
FREL -Forest Reference Emission Level
FRL- Forest Reference Level
GDP-Gross Domestic Product
GEF-Global Environment Facility
GHG- Greenhouse Gas
INDCs- Intended Nationally Determined Contributions
IPR-Intellectual Property Rights
MoU- Memorandum of Understanding
NAMAs -Nationally Appropriate Mitigation Actions
NC- National Communication
QA/QC-Quality Assurance/Quality Control
SPARRSO- Bangladesh Space Research and Remote Sensing Organization.
SRDI-Soil Resource Development Institute,
TCCCA -Transparent, Consistent, Comparable, Complete and Accurate
UNDP- United Nations Development Programme.
UNEP-United Nations Environment Program
UNFCCC-United Nations Framework Convention on Climate Change

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Executive summary

Despite overwhelming efforts by the Bangladesh government to actively take part in the UNFCCC as well as its reporting requirement, data sharing and institutional arrangement related with GHG emission estimation is not well enough to comply the transparency, accuracy, completeness, comparability and consistency (TACCC) principle of UNFCCC reporting. For example, the data used for the initial national communication is not consistent with the second national communication, and the data used in both of these national communications are not archived properly. Data non availability, data non accessibility and lack of proper documentation related to data archiving affecting the data sharing processes, which again is related with absence of permanent institutional framework for the national GHG inventory preparation. Moreover, lack of technical knowledge on GHG emission estimation tools also hindering the identification of needed data at the national level. Consistency, accuracy and transparency cannot be achieved without ensuring a permanent institutional framework for data collection, analysis, archiving and documentation.

The report describes the main constraints for data sharing in the AFOLU sector of Bangladesh and provide examples of data sharing mechanisms to facilitate data and information sharing among national entities.

1. Introduction

A clear and strong association exist in the developing countries between natural resources consumption and development (Ndzabandzaba 2015). Again for a coherent, and comprehensive visualization of economic growth and accompanying societal, natural resources and environmental status depends on data availability and accessibility (Schandl et al. 2015). Lives and livelihoods of developing countries around the world relying on the natural resources for their development (Ndzabandzaba 2015). So, government organizations around the world are progressively concerned in sharing data, between and across all levels of government entities. Access to good and updated data is crucial for good management and decision making. Bangladesh is one of the most densely populated countries in the world with around 150 million inhabitants on a landmass of 147,570 square kilometers (WB 2016). This country with limited natural resources is confronting with degradation of the natural environment. Environmental pollution linked to soil, water and air; climate change; salinity intrusion; river bank erosion and river pollution; impact of brick kilns are some of the major challenges for sustainable development (Alam et al. 2017; Hossain et al. 2015).

> ***"Trees are Earth's endless effort to speak to the listening heaven"***
>
> ***Rabindranath Tagore***

So, to ensure a sustainable development as well as to overcome the above mentioned challenges, all the national institutes should work coherently to develop a smooth mechanism for accessibility and sharing of data among the government entities. Unfortunately, government entities of different ministries of Bangladesh face several issues related to data accessibility (e.g.-lack of data sharing policy and lack of updated data) to ensure successful implementation of their mandate. Sometimes data collected for different measurement campaigns related with natural resources management may be lost because of a lack of capacity to archive, and maintain such information. Ensuring consistency and accuracy of greenhouse gas (GHG) measurements from agriculture, forestry and other lands use (AFOLU) and other sector at national level over time depends on proper archiving, sharing, and harmonizing data among government concerned agencies (IPCC 2006).

The objective of this document is to provide an understating regarding the importance of data sharing platform and institutional arrangement, as well as to share the results of the survey conducted among the concerned government entities of AFOLU sector. After this introductory

section, section 2 highlighted the Bangladesh contexts in view of international reporting requirements. Section 3 focused on data sharing constraints in Bangladesh, and the possible data sharing mechanism and legal regime of Bangladesh having data sharing essence discussed in section 4 and 5, respectively. In section 6 and 7, existing data sharing platform in Bangladesh, and examples of institutional arrangement for the national level GHG inventory are highlighted. Before the recommendations and conclusion in section 9 and 10, section 8 presents the results of the survey conducted on organization related with AFOLU sector of Bangladesh.

4 ^{0} C temperature increase could affect Bangladesh in the long run by declining:
30% rice production,
50 % wheat production, and
70 % potato production.
Source: (MoEF 2009b)

2. Bangladesh and international reporting contexts

Bangladesh contributes only 0.35% of GHG emissions, but it is the most climate vulnerable country in the world, which could result into loss of 10% of gross domestic product (GDP) by 2100 (MoEF 2015), equivalent to USD 19 billion based on 2015 GDP. The vulnerability from climate change impacts has many wrinkles, but the key vulnerable sectors are agriculture, fisheries, livestock, forestry, and biodiversity. On the other hand, climate change impacts like drought will affect growth, breeding, production, fishing season and broods of indigenous fish species. Drought as well as sea level rise and associated land inundation in the coastal areas will significantly affect the fodder supply of livestock. The degradation of forest quality because of climate variability and human activities can result into gradual depletion of rich diversity of the forest flora and fauna in Bangladesh (MoEF 2009b). In order to conduct a comprehensive vulnerability assessment of AFOLU sector, as well as to actively take part in mitigation of GHG emission from this sector, the most obvious need is the data related to this sector. Hence, it requires collection and sharing of data at national scales involving different government organization like Department of Agriculture Extension (DAE), Bangladesh Agricultural Research Council (BARC), Bangladesh Rice Research Institute (BRRI), Soil Resource Development Institute (SRDI), Department of Fisheries (DoF), Bangladesh Fisheries Research Institute (BFRI), Department of Livestock Services (DLS), Bangladesh Forest Department (BFD), and Department of Environment (DoE), etc.

As a most vulnerable country due to geographical location, and willing to actively contribute in the robust and ambitious United Nations Framework Convention on Climate Change (UNFCCC); Bangladesh is adopting a two-fold strategy against climate change. The key strategy is (1) to increase resilience to the impacts of climate change (adaptation), and (2) to ensure lower carbon emitting development through unconditional and conditional emissions reduction target (mitigation) (MoEF 2015). Hence, mitigation and low carbon development is one of important pillar among the six pillars mention in the Bangladesh Climate Change Strategy and Action Plan (BCCSAP, 2009) along with adaptation (MoEF 2009a). Bangladesh as a member of non-Annex I Parties has already submitted, or is currently implementing a number of programs to submit the reporting documents to the UNFCCC such as:

> *"AFOLU accounted for 50-60% GHG emission of Bangladesh. INDCs of Bangladesh do not comprehensively include AFOLU mitigation targets, and do not provide cost estimates of AFOLU mitigation measures."*
>
> Source: (Zeleke et al. 2016)

- National Communication (NC) (decision 9/CP.16),
- Biannual Update Report (BUR) (decision 2/CP.17),
- Intended Nationally Determined Contributions (INDCs) (decisions 1/CP.19 and 1/CP.20),
- Nationally Appropriate Mitigation Actions (NAMAs) (decision 1/CP.13),
- Forest Reference Emission Level (FREL)/Forest Reference Level (FRL) (decision 1/CP.16; decision 12/CP.17; decision 13/CP.19).

GHGs emission from AFOLU sector, along with other sector should be reported in the NC and BUR, and similarly in FREL/FRL report. In parallel, mitigation strategies along with adaptation components should be reported in INDC and NAMAs, forest resource assessment to the FRA (FAO 2015), biodiversity to the Convention on Biological Diversity (CBD) (Article 26 of the Convention) (DoE 2015). All of the mentioned reports require updated and consistent data of the AFOLU sector. For this reason this is the high time to establish a consistent and updated AFOLU database through a well-organized and institutionalized data sharing platform to ensure transparent, robust and consistent information to all those frameworks.

Different Bangladesh government organizations are collecting and preserving the data related with agriculture, fisheries, livestock, forestry, and biodiversity sectors. Due to the absence of a common data sharing platform as well as an institutional arrangement, sharing the needed data for comprehensive vulnerability and mitigation assessment of different sector is absent. This is affecting the consistent and transparent preparation of UNFFCC reporting like national communication (NC). It becomes urgent to develop a well referenced and documented database involving all the concerned national stakeholders for the natural resource management, in particular for UNFCCC reporting. A better archiving and documentation of the data used for the GHGs inventory would significantly facilitate the TCCCA (transparent, consistent, comparable, complete and accurate) reporting principles of UNFCCC reporting (decision 4 of COP 15 and decision 12 of COP 17). The following issues significantly affecting Bangladesh to comply with the TCCCA reporting principles, such as:

- Limited availability of data: Limited data availability in Bangladesh often resulted from lack of up-to-date national statistics relevant to AFOLU, and insufficient resources for the collection and update of important dataset such as National Forest Inventory.
- Limited accessibility of data: This data accessibility problem basically arises from uncertainty in intellectual property rules, unclear data use protocols, cultural issues, lack of data sharing structures, human, technological, and financial capacity constraints. Moreover, low data quality and lack of clarification of intellectual property rights related to different types of data is the key challenges for transparent and convenient data sharing. The officials involved with the preparation of the GHG inventory for the AFOLU sector, often have neither sufficient authority to request data from another government institution, nor adequate coordination for data sharing among concerned institutions.
- Lack of proper documentation and data archiving: international and national consultants involved with sectoral GHG inventory preparation tend to hold the ownership of datasets used in the GHG inventory preparation, and often do not record the proper reference for data archiving.

In view of the above mentioned circumstances, to ensure the sustainability of the future GHG inventory preparation, to comply with the TCCCA principles, and to have a

comprehensive vulnerability and mitigation assessment of different sector in view of climate change, a permanent process of data archiving and sharing should be established within the administrative structure of a key government agency. In the following section issues that impacting data sharing among the concerned entities are discussed.

3. Data sharing constraints

Low awareness on intellectual property rules, unclear data use protocols, cultural issues, lack of institutional, legal and procedural arrangements for data sharing structures, insufficient human, technological and financial capacities, and low data quality are the main constraints preventing transparent and useful sharing of data related to AFOLU sector in the non-annex 1 countries (Tulyasuwan et al. 2012; Jara et al. 2015). Some important issues affecting the transparent and useful sharing of data are discussed here.

BOX 1: DATA SHARING CONSTRAINTS

Absence of Intellectual property rights
Impacts: Hinders collaboration and reduces data availability.

Absence of Data use policy
Impacts: Data owner(s) are often not properly recognized. Creates mistrust among parties involved.

Lack of culture exposure to collaborative environments
Impacts: Absence of formal data sharing culture negatively affects the professional environment.

Lack of Institutional arrangement
Impacts: Incompatible data sets and standards. Outdated and inaccurate data.

Sustainability of efforts
Impacts: Insufficient data collection, quality, and sharing. Lack of transparency in local, national, or regional contributions

3.1 Intellectual property rights

Intellectual property rights (IPR) is the rights over the creations of an entity. IPR is a family name for a range of legal protections related to the results of human innovation, skill, creativity and endeavor. IPR covers copyright, moral rights, database right, patents, trademarks, and trade secrets and other rights (Korn and Oppenheim 2011). The legal regime in Bangladesh to ensure the IPR includes- the Patents and Designs Act (1911) focusing on protecting IPR of manufacturing industry and their innovative product (MoLJPA 2010); the Copyright Act, 2000 (Amended in 2005) focusing on promoting the creativity and to ensure the legal right of the creations like artistic and scientific works, designs and discoveries, and data (MoLJPA 2000); the trademarks act 2009 and Geographical Indicative

Products focused on trademarks, and trade secrets (Registration and Protection) Act, 2013 (MoLJPA 2013). IPR usually belongs to the institution or the project providing funding for the concerned data collection, and not the people who collected the data. In the context of public funded project, data should be public but are often not made available by the responsible entities (Jara et al. 2015).

3.2 Institutional arrangements

The preparation of GHG inventory requires establishment of a permanent and sustainable institutional arrangements and systems, instead of relying on temporary teams. Article 5, paragraph 1 of the Kyoto Protocol, calls for a national system including institutional, legal and procedural arrangements made within a party for estimating GHG emissions that are not controlled by the Montreal Protocol. (Tulyasuwan et al. 2012). Such arrangement is crucial for AFOLU GHG inventory preparation, but unfortunately a formal institutional arrangement for national GHG inventory preparation as well as AFOLU data collection and sharing is absent in Bangladesh.

3.3 Lack of capacity

Lack of capacity basically refers to sufficient and sustainable financial resources as well as technical expertise. Non-Annex I Parties usually have technical capacity in terms of tools and skilled human resources. Due to the absence of permanent GHG inventory team, and permanent staff to perform the technical work regularly, many countries rely on independent consultants. Due to this reason for each GHG inventory report the capacity (data collection, archiving and analysis) has to rebuild every time, rather than having a common and permanent platform resulting into not improved reporting over time (Tulyasuwan et al. 2012). Insufficient technical, human, and financial capacities limiting the data collection, analysis, quality assurance and sharing of data in the respect (Jara et al. 2015). On the other hand, a few non-annex 1 countries addressed the need for continual and

sustainable financing for GHG inventories by securing long-term funding via national budgets. In most of the cases, financial resources for national GHG inventories preparation for the non-annex 1 countries come from international support (Tulyasuwan et al. 2012), which is also the same case for Bangladesh. The initial communication of Bangladesh was funded by the Global Environment Facility (GEF) and the USA government with the technical assistance from United Nations Environment Program (UNEP). The second national communication was also funded by the Global Environment Facility (GEF) through the United Nations Development Programme (UNDP).

3.4 Data use policy

The purpose of data use can vary from commercial activities to simply research purpose. Any project intended to establish a database should clarify at the beginning the purpose of the work undertaken, who is involved with the work, and the data use policy. Sometimes the sharing of data can be based on the mutually agreed definition and terms of what constitutes "fair use". The data use policy should clearly mention the duration of the data use agreement, fair use rules, data sharing options, and solutions for potential disputes (Jara et al. 2015).

There exist some common data sharing agreements, which can be used to overcome the data sharing constraints identified here. Data sharing agreements issues are discussed in the following section.

4. Data sharing

Transfer as well as exchange of data between two or more organizations is known as data sharing (APA 2015; BBSRC 2016). It is practiced across governments, among the government organizations, business entities and or any other organization for informed decision-making. It can be in the form of sharing metadata (information about data), aggregate data, survey or record, inventory, experimental results, spatial data, and administrative data, etc (APA 2015; Beniston et al. 2012; Carroll 2015). Sharing of metadata initiate the process of sharing the aggregated data or

other data like forest inventory, agricultural data, livestock data, or even spatial data among the government entities for informed decision-making (APA 2015; Beniston et al. 2012). So, any type of data sharing initiative basically starts with sharing of metadata, because it exposes the availability as well data properties. Data sharing can be one-way (for example forest area data from Forest Department to Department of Environment), two-ways (for example, sharing of district area by Survey of Bangladesh with Forest Department, and sharing of forest cover within the district area by Forest Department with Survey of Bangladesh), or involve multiple government entities. Data sharing mechanisms or platforms across government entities require a working collaboration and institutional arrangement, and true commitment for data sharing to achieve the desired national objectives (Ndzabandzaba 2015), like consistency of the data being used for reporting to international conventions but also for national purposes. At the same time, to establish clear, consistent, and updated databases through sharing data, government entities should agree on some issues such as, data definition, data format and standard, legal restrictions, etc. So, for data sharing arrangements irrespective of scales, or data sharing frequency data sharing agreement is obvious (Korn and Oppenheim 2011). The key components of data sharing agreement are presented in Box 2. The interaction process of data receiver and sender during the data sharing is illustrated in Figure 1. Common data sharing mechanism are discussed in the subsequent sub-sections.

4.1 Memorandum of understanding

Memorandum of understanding (MoU) is a bilateral or multilateral agreement between two or more parties to achieve the desired objective, for example to share data for the establishment of a database. It usually expresses common consensus on the issues that are critical to achieve the desired objective involving two or more parties. The key elements of MoU are (1) identity of contracting parties, (2) clearly written subject matter and objectives, (3) summary of essential terms, and (4) contracting parties sign (Siple 2014).

4.2 Licensing agreement

Licensing agreement is a written agreement involving two or more entities based on agreed consensus and legal provision, under which the owner of a copyrighted tangible or intangible

property giving permission to another to use that property. It is different than the MoU, because under this agreement, licensors use license agreements to grant their licensees the right to use certain intellectual property, like- software, inventions, database and patents. License agreements should include termination provisions, terms of use and dispute resolution clauses (Carroll 2015).

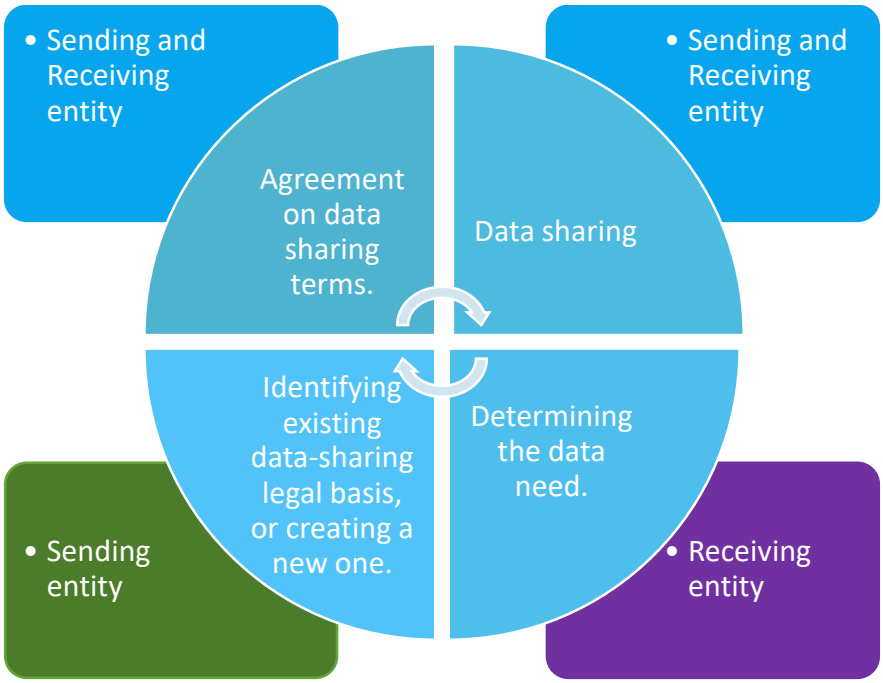


Figure 1: The interaction process of data receiver and sender.

4.3 Copy right license agreement

A copyright license agreement is a contract under which the owner of the copyright allows other entity to use copyrighted material, reprint it, or distribute it for a specified amount of time. In return, the user will generally pay to the copyright owner a royalty, or payment based on usage. The contract will specify in detail how, where, and when the copyrighted work can be used. This is also known as copyright license, or copyright license contract (BIS 2015; Carroll 2015).

4.4 Data sharing policy

Data sharing policy is currently developing by number of government agencies, scientific society and other entities in different countries. Data sharing policy should specifically define conditions for access covering open access to limited access. Access level, data sharing methods, data format, timing of data sharing, and legal restrictions may vary based on the developed data sharing policy of different entities (APA 2015), for example in the data sharing policy of SPARRSO, it can be mentioned that data can be shared in shape file but not in the form of final map.

Apart from the above mentioned data sharing agreements, other mechanisms like joint publications, collaboration agreement, copy right assignment (transfer ownership of the copyright to another party), and copyright request (asking permission from the owner of copy right to use the copyrighted materials or specific parts).

Legislative framework at the national level can be also use to foster the data sharing among the concerned government agencies of AFOLU sector. The next section discussed the relevant laws in brief having data sharing essence.

5. Legal regime on data sharing

The improvement of existing limited capacities in majority of the countries for a complete and accurate estimation of GHG emissions and in particular natural resources management depends on the national legal and resultant institutional regime (Tulyasuwan et al. 2012). A brief review of the laws of Bangladesh addressing data and data sharing essence are mentioned in the subsequent sub-sections.

5.1 Information and Communication Technology Act, 2006

Information and communication technology act (2006) provide a clear definition of data and database, which are as follows-

Data as a representation of information, knowledge, facts, concepts or instructions which are being prepared or have been prepared in a formalized manner, and is intended to be processed, is being processed, or has been processed in a computer system or computer network, and may be in any form including computer printouts, magnetic or optical storage media, punch cards, punched tapes or stored internally in the memory of the computer.

Electronic record as data, record or data generated, image or sound stored, received or sent in an electronic form or microfilm;

Electronic data interchange as transferring data from one computer to another computer electronically by following a standard for the purpose of organizing information.

Computer database means a representation information, knowledge, facts, concepts or instructions in the form of text, image, audio or video that, (a) are being prepared or have been prepared in a formalized manner by a computer, computer system or computer network; and (b) are intended for use in a computer, computer system or computer network.

BOX 2: THE KEY COMPONENTS OF DATA SHARING AGREEMENT

Aims and purpose
Common understanding of the aims and purpose of a data sharing.

Data definition
Defining the data, metadata and formats, terms of the data sharing.

Legal restrictions
Clearly defined legislative and consent based restrictions as well as copyright issue.

Governance
All aspects of data sharing management and termination.

Access issues
Clear indication of how the data will be accessed and shared.

Data quality
Information about data quality.

Data management
Systems and processes to ensure data integrity and security.

Costs
Details of data price, including payment schedule.

5.2 Right to Information Act, 2009

Right to information Act (2009) provide the information definition, and right to access of what type of information, which are as follows-

Information includes any memo, book, design, map, contract, data, log book, order, notification, document, sample, letter, report, accounts, project proposal, photograph, audio, video, drawing, painting, film, any instrument done through electronic process, machine readable record, and any other documentary material regardless of its physical form or characteristics, and any copy thereof in relation to the constitution, structure and official activities of any authority.

Right to information means the right to obtain information from any authority; subject to the provisions of this act, every citizen shall have the right to information from the authority, and the authority shall, on demand from a citizen, be bound to provide him with the information.

Authority as any organization constituted in accordance with the Constitution of the People's Republic of Bangladesh; any ministry, division or office established the Constitution of the People's Republic of Bangladesh; any statutory body or institution established by or under any Act; any private organization or institution run by government financing or with aid in grant from the government fund; any private organization or institution run by foreign aid in grant; any organization or institution that undertakes public functions. But publication or providing certain types of information not mandatory, like any information that may, if disclosed, cause a threat to the security, integrity and sovereignty of Bangladesh; may affect the foreign policy (Chapter 2, Section 7). Moreover, this act is not applicable to the organizations and institutions which are involved in state security and intelligence like National Security Intelligence (NSI), Directorate General Forces Intelligence (DGFI), Defense Intelligence Units, Criminal Investigation Department (CID)-Bangladesh Police, Special Security Force (SSF), Intelligence Cell of the

National Board of Revenue, Special Branch-Bangladesh Police, Intelligence Cell of Rapid Action Battalion (RAB) (Chapter 8, Section 32).

5.3 National ICT Policy, 2009 and 2015

Bangladesh has developed National ICT Policy, 2009 and 2015. Both of the National ICT Policy, 2009 and 2015 mentioned about the integrity objective along with others like social equity, productivity, and employment generation etc. Bangladesh government wants to achieve transparency, accountability, responsiveness and higher efficiency in the delivery of citizen-services. So, under this objective one strategic theme is to establish interconnectivity across government offices for effective data sharing, and another one is to ensure availability of all public information through electronic means and ensures sustainability of ICT-based citizens' services delivery. Under the first strategic theme, the function identified as use of ICT tools for file and information sharing among all the ministries/ divisions and departments/offices, create a national network for the government to connect the public organizations, establish national data resource center to control and manage the public network and act as a system of national databases to store and supply national data. Under the second strategic theme, the function identified as all public information to be made accessible through appropriate electronic means including SMS and other channels.

5.4 Statistics Act, 2013

Under this act, every citizen, organization, and institute is now legally bound to provide information whenever sought by BBS. Similarly, any authorized staff of BBS can seek access to any official records and documents of other organization in order to collect statistics. BBS became responsible to provide comprehensive, accurate, timely, and reliable data needed by the government to develop and support the economic, social, and environmental policy and planning of the country by amalgamating data from other government agencies as well. It is mandatory for all ministries, divisions and other offices to use the official statistics as source of information. According to this act, any organization or agency that produce statistics in the areas overlapping with BBS must follow the methodology and guidelines followed by BBS. They will require approval from BBS to

publish their own statistics. BBS will publish the updated statistics as well as will be responsible for the conserving those publication in the library.

5.5 The National Cybersecurity Strategy of Bangladesh, 2014

This strategy mentioned about data classification and security of data. For example, under the action 2 (Secure Government Infrastructure) of priority area 2 (Technical and Procedural Measures), the strategy calls for creating, and enforcing a formal information or data classification for sensitive data. While this strategy also calls for implementation of a cybersecurity awareness program for government systems that contain classified data under action 6 (National Culture of Cybersecurity) of priority 3 (Organizational Structures).

6. Data/information sharing platforms

6.1 Open government data sharing platform

Open government data refers to the data produced or commissioned by government or government controlled entities. The open government data sharing platform (http://data.gov.bd/) launched on October, 2016 with the objective to serve as the government's one-stop portal to its publicly available datasets from more than 35 Ministries and related agencies. This data sharing platform is under the planning of Prime Minister's Office with the technical support from access to information program and BBS, It will ensure the efficient use of government resources, and improve the service delivery to the citizens. The data sharing principles include (a) data shall be made easily accessible, (b) data shall be made available for co-creation, (c) data shall be released in a timely manner, (d) data shall be shared in machine-readable format, and (e) data shall be as raw as possible. This initiative intends to have far reaching positive impact on sustainable development aspect like

innovation, transparency, accountability, participatory governance and economic growth. This data sharing platform is still in beta version.

6.2 National Enterprise Architecture

"National Enterprise Architecture and Interoperability Framework' was established to serve as the information systems of government agencies in order to achieve key national objectives, increase interoperability, enhance transparency, speed up management decisions, and reduce risk and lower investment costs. In order to ensure e-Governance this National Enterprise Architecture and Interoperability Framework" (http://nea.bcc.gov.bd/index.php) was established under the Bangladesh Computer Council (BCC) by the Bangladesh government with the funding from World Bank. This initiative shall be the foundation for the successful ICT adoption in the Government.

6.3 GeoDASH

GeoDASH customized from Opensource GeoNode application is a platform for the management and publication of geospatial data. The objective of this platform is to quickly and easily share geospatial data, and create interactive maps. To facilitate data sharing between government stakeholders, academia, and the public, Bangladesh government and World Bank had established this GeoDASH platform (https://geodash.gov.bd/) hosted by Bangladesh Computer Council (BCC). A good amount of data has already been collated and shared in GeoDASH, and in near future it is expected that, GeoDASH will include further information and geospatial data visualization from various global and national sources. This platform can be used as decision support tools by sharing geospatial data to assist the government of Bangladesh for planning and management activities in future.

6.4 Bangladesh spatial information system

This initiative is taken by Bangladesh Bureau of Statistics (BBS). The objective of such initiative is to integrate the data and information collected by BBS with geographical information system (GIS) for better decision making. This project intended to develop small area atlas of 64 districts

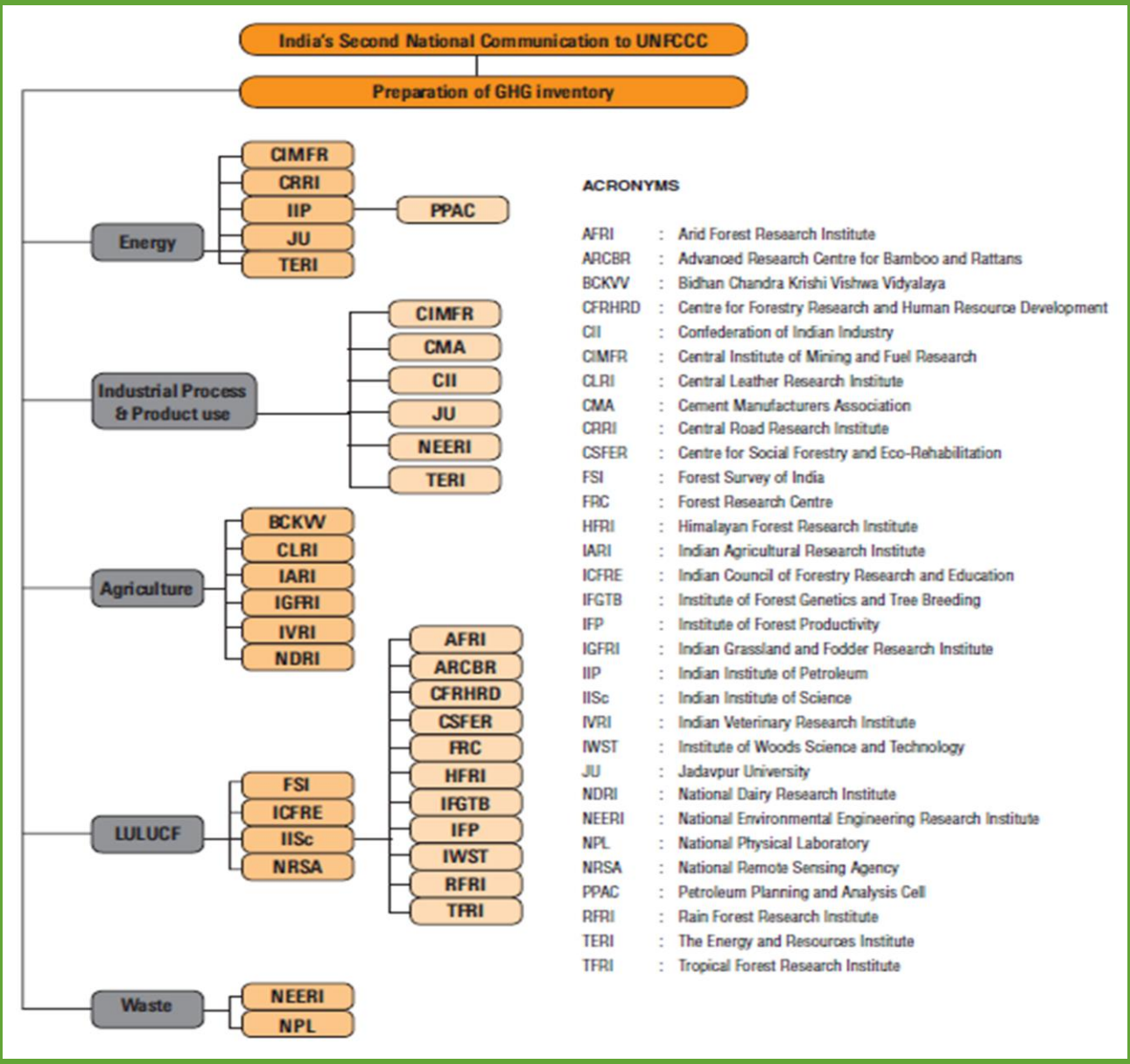
and 11 city corporation using the 2011 census data and geodatabase. The project time period is 2012 to 2017. Digital maps of 51 districts, and 11 city corporations as well as 29 small area Atlas are so far developed under this project.

7. Institutional arrangements

Measurement, reporting and verification (MRV) has crucial role to ensure the success of international efforts for reduce the concentration of GHGs in the atmosphere (Tulyasuwan et al. 2012). At the same time, there is a clear need to develop a functional institutional framework for data sharing stating clear rules and standardized procedures, formats, and finally a data sharing platforms. Article 5, Paragraph 1 of the Kyoto Protocol calls for a single national entity (SNE) with overall responsibility for the planning, preparation and management of the national inventory(UNFCCC 2005).

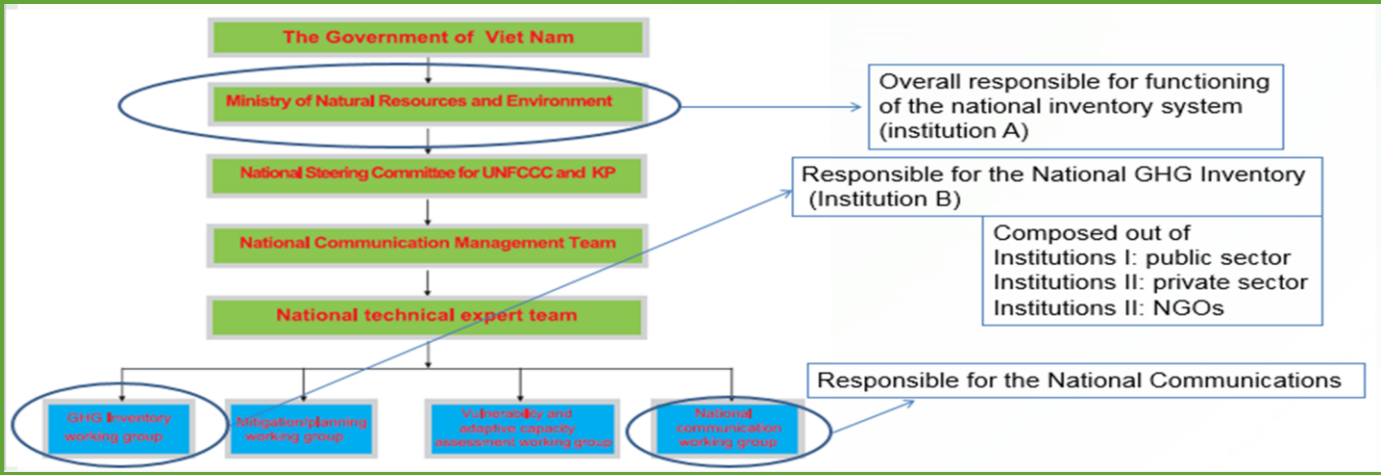
Institutional arrangements can be defined as formal or informal institutional, legal and procedural agreements among the lead inventory preparing agencies, national inventory management body, and other concerned institutions. Institutional arrangements will provide an operating structure of national entities to ensure TACCC principle and confidence in the inventory process due to readily available data as well as regular update of data. NCs cover a number of climate change issues like GHG inventories, mitigation policies, vulnerability and adaptation assessments, support needs, etc. The information and data used in the FREL/FRL report, BUR, INDC and NAMAs should be consistent with the NCs, therefore it is important for Parties to establish an institutional arrangements with good and working cooperation as well as collaboration among various government stakeholders. Institutional arrangement can be as rigorous as for India (Box 3) as well as simple and agency specific as for Finland and Vietnam (Box 4). Two approach can be taken to establish a functional institutional arrangement for the GHG inventory preparation at the national level. One could be legally binding instrument to ensure continuous coordination and cooperation among the concerned government entities (Chapman et al. 2015; Herold et al. 2011). Around 40% of the Annex I Parties have legally binding arrangement for data collection, calculation of emissions and removals, QA/QC, uncertainty analysis and archiving by the concerned government agencies. Comparatively less formal approach can be also use like comprised of working groups, coordinating teams, and advisory boards, as followed by Vietnam (Tulyasuwan et al. 2012).

BOX 3: INSTITUTIONAL ARRANGEMENT OF INDIA



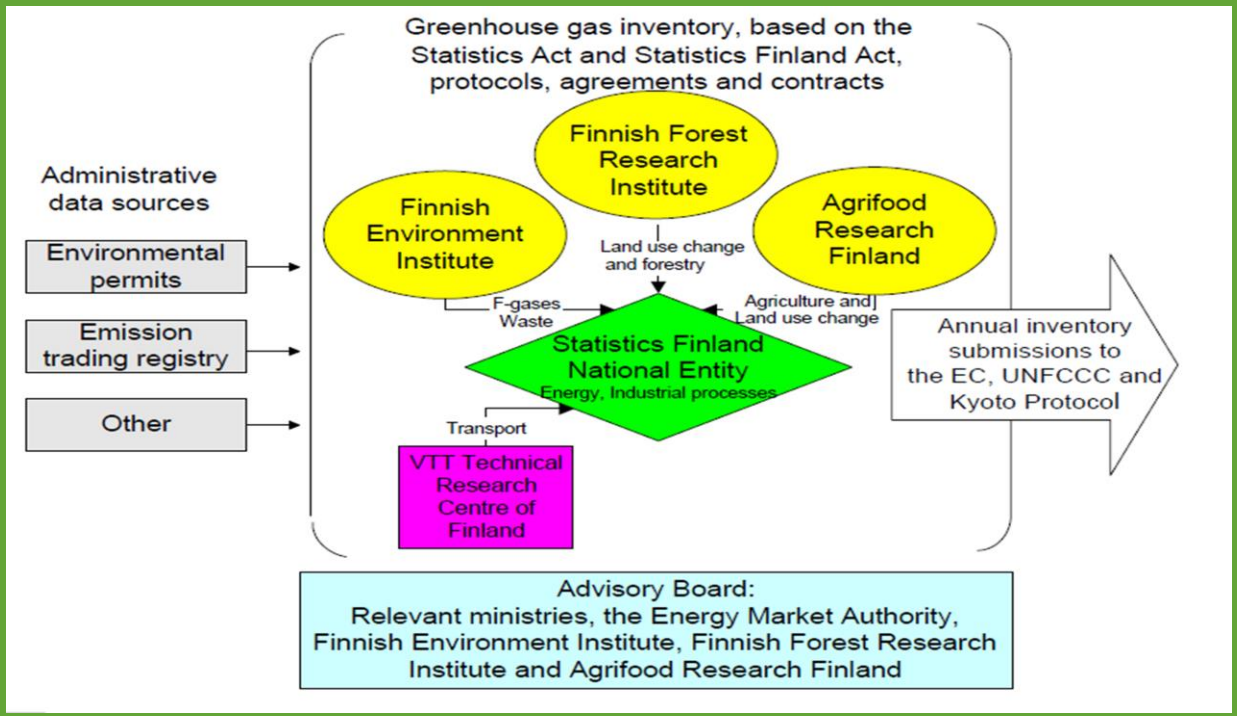
Source: Second National Communication of India.

BOX 4: INSTITUTIONAL ARRANGEMENT OF VIETNAM



Source: Second National Communication of VIETNAM

BOX 5: INSTITUTIONAL ARRANGEMENT OF FINLAND



Source: First Biennial Report of FINLAND

8. Results of the survey

This section presents the results obtained through a questionnaire to assess the data availability and accessibility for the Agriculture, Forestry and Other Land Use sector (AFOLU) sector of Bangladesh. 23 participants from the organizations mentioned in box 5 responded to the questionnaire. The details outcome of the survey is presented in the appendix section.

Figure 2 presents the working disciplines of the respondent of the survey. Highest number of respondent answer that, their working discipline belongs to the broad category environment (48%), followed by agriculture (38%). Around 40% respondent answer that, their working discipline belongs to other category such as ecology, biodiversity, climate change, market development, value chain, project planning, donor liaison, water resources, surveying and mapping, information and communication technology. Around 35% organization activities belongs to forestry working disciplines and 22% organization activities belongs to livestock working disciplines.

The data accessibility websites of the respondent organization reported in table 1. In most of the case, government organization has the website. On the other hand, the academia more relies on online scientific community for data accessibility.

AFOLU Data availability

-13% of organizations do not share data on Forestry, Agriculture, Wetland, Land management or Livestock

-13% of organizations share data and information on the five disciplines (Forestry, Agriculture, Wetland, Land management or Livestock)

-40% of organizations have data on tree volume or biomass but none of those data are shared publicly or on internet.

-26% of organizations provide information about areas of settlements but none of them are consistent between each other and at national scale.

-65% of organizations work with soil data but the latest available and accessible soil map and classification is of 1988 (29 years old).

Sharing data on Internet

-34% of organizations do not share their data on their website or do not have a website

-13% of organizations share their data through publications and scientific networks

BOX 6: RESPONDED ORGANIZATIONS

1. Forest Department (FD)
2. Bangladesh Agricultural Research Council (BARC)
3. Bangladesh Bureau of Statistics (BBS)
4. Center for Environmental and Geographic Information Services (CEGIS)
5. Bangladesh Rice Research Institute (BRRI)
6. University of Chittagong
7. Khulna University
8. Department of Fisheries (DoF)
9. GIZ
10. Advanced Chemical Industries (ACI) Limited
11. Bangladesh Rural Advancement Committee (BRAC)
12. Arannyak Foundation
13. Department of Livestock Services (DLS)
14. International Union for Conservation of Nature Bangladesh (IUCN)
15. Shahjalal University of Science & Technology
16. Information and Communication Technology Division (ICTD)
17. Water Resources Planning Organization (WARPO)
18. Bangladesh Haor and Wetland Development Board (BHWDB)
19. Survey of Bangladesh (SoB)
20. Bangladesh Institute of Development Studies (BIDS)
21. Bangladesh Forest Research Institute (BFRI)
22. Soil Resource Development Institute (SRDI)
23. Copy right office Bangladesh

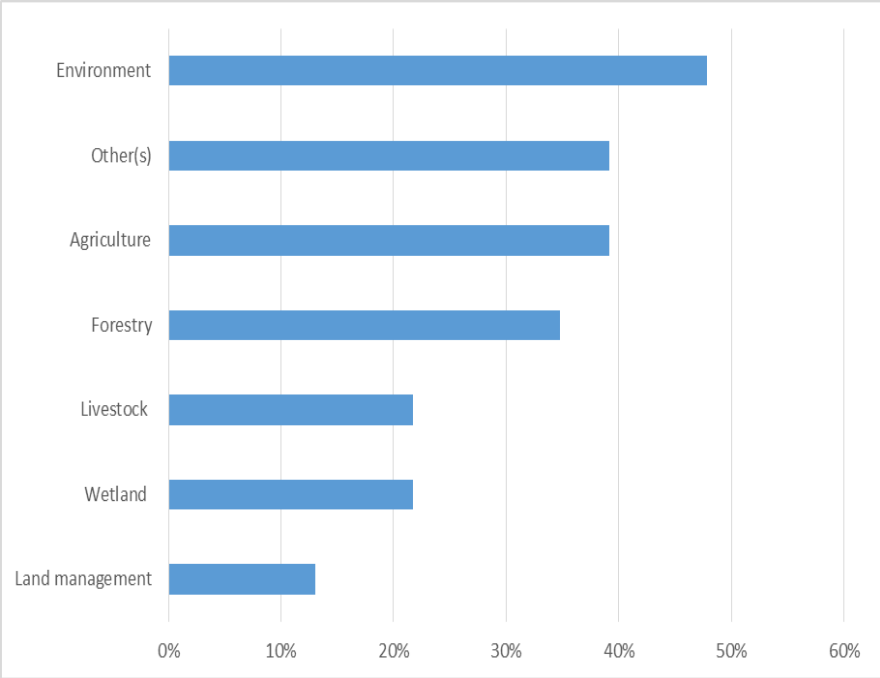


Figure 2. Respondent's working disciplines.

Figure 3 presents the reasons for data request to the organization. 70% organization respondent that, national reporting purposes is the key reason of data requesting followed by annual progress reports (52%), and other purposes (52%) such as personal use, library use, academic purposes, internal report, research, military purposes, developments projects. Update and development of the national statistical database (26%) is another reason of requesting data to each organization.

Table 1: Data accessibility websites of various organizations.

Organization	**URL/webpage**
BARC	www.barc.gov.bd
BBS	
CEGIS	www.cegisbd.com
Chittagong University	
Khulna Uni.	Research Gate
DoF	www.fisheries.gov.bd
GIZ	
ACI	http://aciagribusinesses.com/
BRAC	http://docs.brac.net http://research.brac.net
Arannayk	www.arannayk.org
DLS	www.dls.gov.bd
IUCN	https://portals.iucn.org/library/dir/publications-list
SUST	Google Scholar
WARPO	www.warpo.gov.bd
BHWDB	www.bdhwd.gov.bd
SoB	
BRRI	Research Gate
Copyright Office	
SRDI	www.srdi.gov.bd
ICTD	
BFRI	
BIDS	
FD	www.bforest.gov.bd

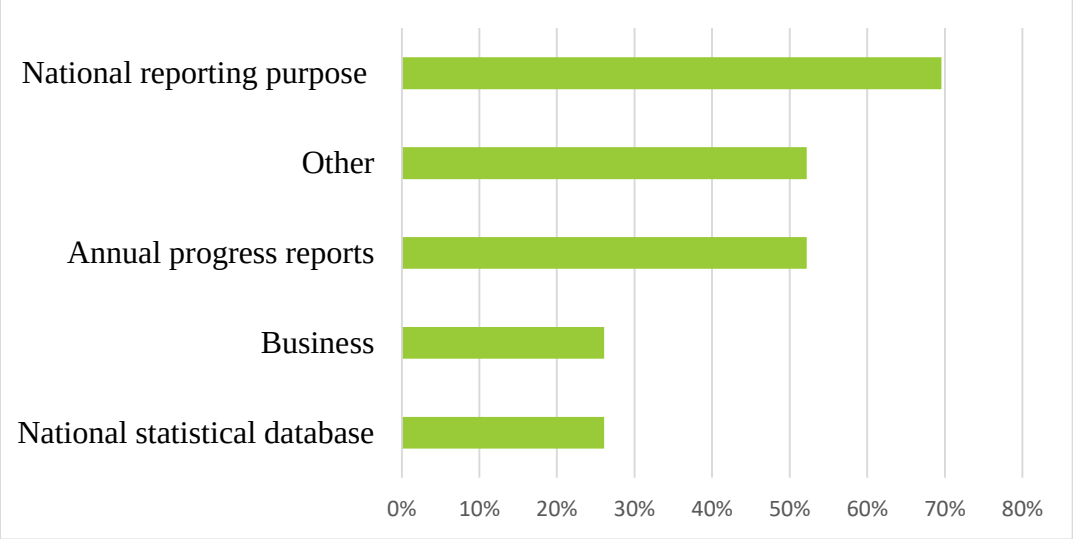


Figure 3: Reported reasons for data request.

Modalities for data accessibility reported in table 2. Majority of the organization (52%) provided the data collected, or from their survey or experiment free of charge, while 48 % of organizations provided data access through data request letter from the concerned ministry and or department. 43% of organizations provided data to other organization through MoU.

Data exchange between organizations

- *4 organizations do not share with others*
- *One organization share with up to 9 other type of organizations*
- *BRAC is the organization share with the largest number of organization*
- *Universities and Forest Department are the organizations receiving data from the largest number of organizations*
- *3 organizations share data with international stakeholders*

Table 2: Modalities for data accessibility.

Organization	MoU	Data Sharing Agreements	Data request Letter	Payment	Data request Letter and Payment	Free Access	Others
BARC						X	X
BBS	X	X	X	X	X	X	X
CEGIS	X			X	X		
Chittag. Uni.	X	X	X				
Khulna Uni.			X			X	
DoF			X			X	X
GIZ	X	X				X	X
ACI	X	X				X	
BRAC	X					X	
Arannayk						X	
DLS			X			X	X
IUCN			X			X	
SUST		X	X				
WARPO	X		X		X		
BHWDB	X		X			X	
SoB					X		
BRRI		X					
Copyright Office		X					
SRDI	X	X	X	X	X		
ICTD	X						
BFRI						X	
BIDS						X	
FD			X				

Figure 4 presents the format of the shared data by the surveyed organization. Among the survey organization, more than half (74%) of the organization respondent that they share their data in hard copies when any data request receive, followed by providing the data in pdf file (70%). Some organization also share shapefile (30%) for the geospatial data.

Data accessibility

-52% of organizations reported free data access is in their organizations.
-48 % of organizations provided data access through data request letter.
-43% of organizations provided data access through MoU.
-35% of organizations provided data access through data sharing agreements.
-13% of organizations provided data via payment for their data.

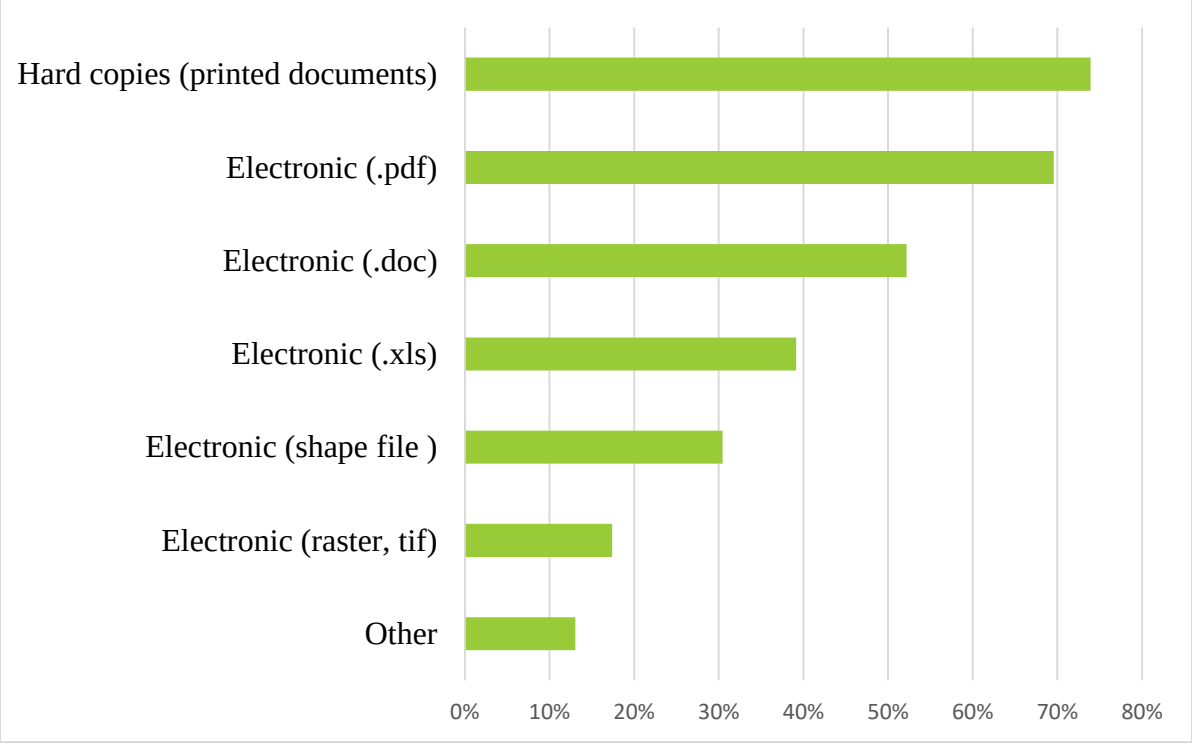


Figure 4: Format of the shared data.

As illustrated in Figure 4, the majority of the organizations (35%) have data archiving and documentations. One of the key findings is that, 13% of organizations have no archiving and documentation, while 40% of the organizations do not have archiving system, but follow the documentation processes. Among the surveyed organization, only one organization has archiving, documentation, reference management system, as well as the organization website used to share their data.

Data format

-74% of organization share their data in hard copies.
-70% share data in pdf file.
-30% share shapefile.
-17% share raster database.

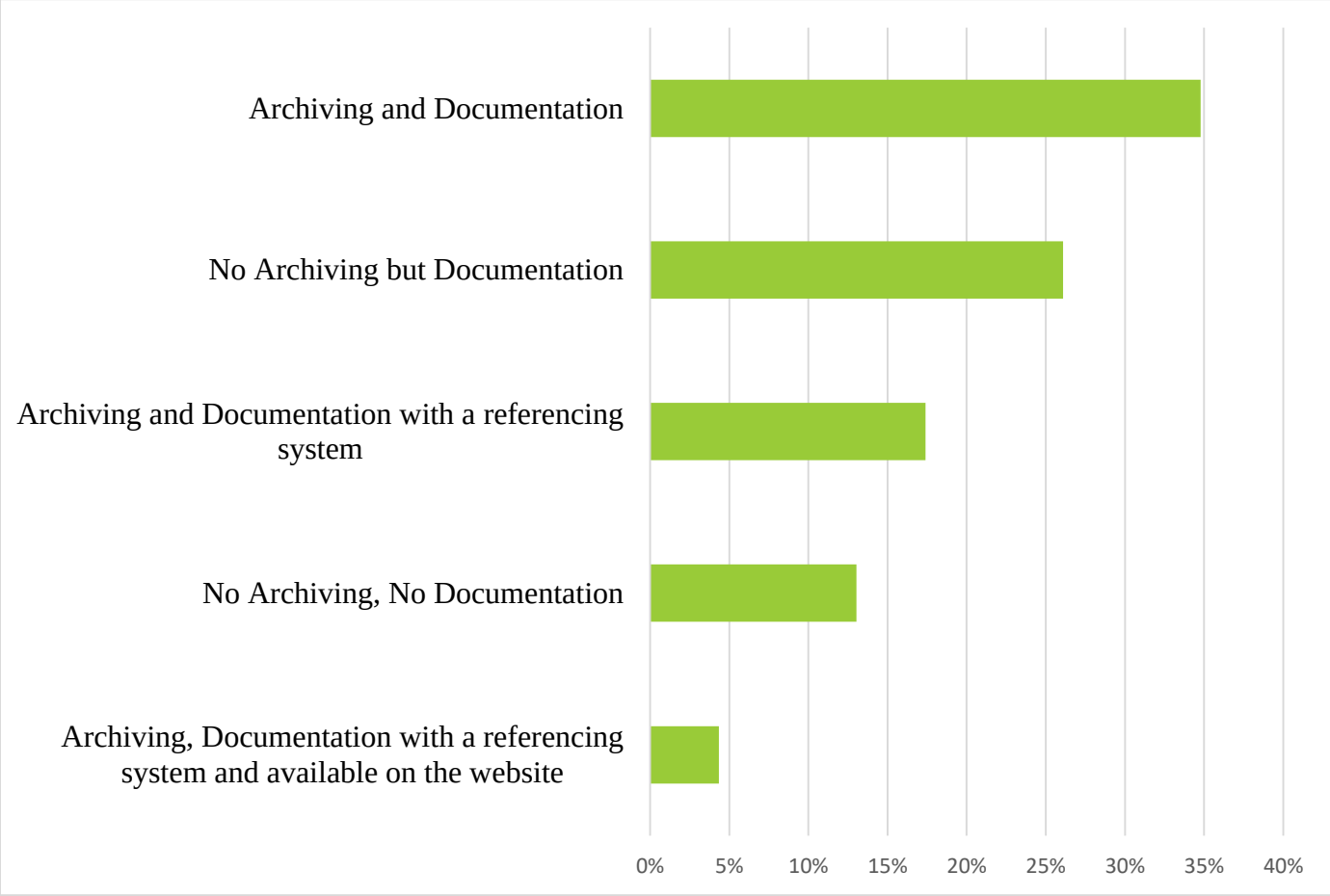


Figure 5: Data archiving and documentation status.

A permanent and sustainable system for the national GHG inventory is crucial. The respondent of the survey recommend that, to optimize the institutional arrangements and data sharing of AFOLU sector in Bangladesh, MoU among the concerned government agencies could be a possible solution (40%), while two organizations specifically propose that, on one dedicated website AFOLU sector could be publicly available. Other respondent (26%) also identifies there is a need to improve data accessibility via their own organizational website.

9. Recommendations

The establishment of an operating and working data sharing platform for AFOLU sector involves a comprehensive institutional arrangement, which may involve several processes as mentioned below:

- The key government agency or a high level specified committee for the data sharing of AFOLU sector should create close coordination among the relevant government agencies and with the national statistics collection authority-Bangladesh Bureau of Statistics (BBS);
- The data-gathering task should become a part of the routine responsibilities of the concerned agencies. The key government agency or committee should set the roles and responsibilities for data collection of the concerned government agencies during the GHG inventory preparation as well as regular update of the required data.
- The key government agency or a high level specified committee should initiate necessary institutional arrangement for data sharing for AFOLU sector among the GHG inventory preparing agencies;
- To provide access to data that are already available, the committee should provide authority to the relevant government agencies to collect already available data;

Suggestions

To optimize the institutional arrangements and data sharing
-40% of organizations suggest the use of MoU.
-2 organizations propose the data to be available publicly on one website.
-26% of organizations recognize the need to improve data accessibility via their website.

- Addressing the need of data non availability, the key government agency or committee should set list of data need;
- Gaps in data collection should be identified and prioritized according to relevance of the sources and sinks as well as national needs,
- Strategies for gap filling and sustainability of data collection and management should be designed and implemented by key government agency or committee;
- Based on the data gap analysis the key government agency or committee should start monitoring activities with the aim to collect the needed data with proper quality and within a proper timeframe deploying the concerned government agencies;
- Proper documentation of data should be done. Documentation of data should explains how data were created, collected or digitized. It should covers the aspect like the data meaning and definition, data content and structure, variables, codes, and terminology or acronyms. Proper referencing of the data documentation is also important to ensure the data authenticity during data sharing.
- It is recommended to set a uniform data format, because it is crucial for the analysis of data. Setting the data format depends on discipline specific standards, objectives as well as established customs. Data format can vary depending on the data type, such as- (a) for quantitative tabular data with minimal metadata SPSS portable format (.por) or delimited text and command file can be used, (b) for quantitative tabular data with minimal metadata comma-separated values file format (.csv) can be used, (c) for geospatial data ESRI Shapefile format (.shp, .shx, .dbf ; optional: .prj, .sbx, .sbn), geo-referenced TIFF format (.tif, .tfw) can be used. Setting a uniform data standard is highly important for long-term digital preservation and conversion of one common format to another.

BOX 7: KEY ELEMENTS OF GOOD DATA DOCUMENTATION

The context of data collection

Data collection methods

Dataset structure

Data validation

User instruction

Data confidentiality

- The data accessibility rely on the storage medium quality and proper archiving of the data in a good storage medium. Data storage and its management is highly important because digital storage media are inherently unreliable, and due to the collapse of the storage media all the stored data can become obsolete. So, to overcome such difficulties and for effective data sharing, keeping the back-ups data files is vital part of data management. Regular back-up is essential due to hardware failure, software faults, malware or virus infection, hacking, and human errors. Backing-up is simply the copying of files to restore originals in the event of any collapse of the key storage medium. Such backing-up procedure is basically depend on the value and security of the data. Networked hard drive, online storage media or stored offline media like recordable CD/DVD, removable hard drive or magnetic tape can be used as back-up media.

10. Conclusion

The AFOLU sector is a key contributor to GHG emissions in the countries of Asia like India, Thailand, Vietnam, Indonesia and Bangladesh, where a continual monitoring, reporting and verification (MRV) is needed. Bangladesh as non-Annex I country has a number of capacity constraints, and among them lack of data sharing involving the concerned government entities through a well-established and permanent institutional arrangement is the major capacity constraint to comply with the TACCC principle. So, it is high time to take necessary actions to establish a permanent institutional arrangement for updated and continuous data sharing for the national GHG emission reporting.

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Appendix

	Discipline							Data availability				
Inst.	**ENV**	**FOR**	**AGR**	**WET**	**LAND**	**LIV**	**Others**	**Forest**	**Agriculture**	**Wetland**	**Land Management**	**Livestock**
BARC			X									
BBS	X		X			X		Forest volume	Soil classification Crop residue mgmt Area under fice cultivation	Amount of fish production		Number of animals
CEGIS	X						Ecology, Biodiversity	Maps Wood density Soil classification Timber extraction Fuelwood extraction Forest disturbances such as fires etc status of flora and fauna, economic importance	Soil Carbon	Biodiversity of wetlands	Area of Settlements Tree cover area in settlement	
CU	X	X						Forest volume Forest biomass Soil carbon Timber extraction Fuelwood extraction		Soil carbon stock Management of wetland soils Biomass stocks Carbon fraction of dry matter		
KU		X						Forest volume Forest biomass Soil carbon Models				
Do Fisheries				X			Fishery			Management of wetland soils Biomass stocks Amount of fish production maps, fisheries resources, biomass, fisheries mgmt, organic and inorganic inputs, fertilizer, manure mgmt, area of fisheries resources, fish cultivation and harvesting		
GIZ	X	X					Climate Change	Maps Models				
ACI			X			X			Soil classification Fertilizer Crop residue mgmt., Organic inputs in rice fields			Number of animals
BRAC	X	X	X			X	Market Development, Value Chain, Project Planning, Donor Liaison	Maps Forest volume, Soil classification	Soil Carbon Soil classification Fertilizer Crop residue mgmt Area under fice cultivation Organic inputs in rice fields Cultivation Period of rice	Amount of fish production	Tree cover area in settlement	Number of animals Animal mass per livestock category (kg) Manure management
Arannayk Foundation	X	X	X	X	X	X		Maps, Timber extraction Fuelwood extraction Forest disturbances such as fires etc	Fertilizer	Management of wetland soils Area burnt	Area of Settlements Tree cover area in settlement	Number of animals Animal mass per livestock category (kg)
DLS						X						

IUCN	X	X	X	X	X			Maps Forest volume Forest biomass Forest disturbances such as fires etc	Fertilizer Soil type under rice cultivation Eco-agriculture	Amount of fish production	Area of Settlements Tree cover area in settlement	
SUST	X	X						Forest biomass Soil carbon Fuelwood extraction				
WARPO							Water Resources Database	Maps Forest disturbances such as fires etc	Soil classification Fertilizer Crop residue mgmt Area under fice cultivation	Amount of fish production	Area of Settlements	Number of animals
Haor & Wetlands Development				X				Afforestation	Organic inputs in rice fields Soil type under rice cultivation Study on Surface and ground water avaiability in haor (deep wetlands) area.	Conservation of wetlands.		
SoB							Surveying and Mapping	Maps Forest volume all topographic features		marsh, swamp, mud etc	Area of Settlements Tree cover area in settlement	
BRRI	X		X	X					Crop biomass Soil classification Crop residue mgmt Area under fice cultivation			
Copyright office					X			Maps			Area of Settlements	Manure management
SRDI			X						Crop biomass Soil Carbon Soil classification Fertilizer Water mgmt in rice fields		Area of Settlements	
ICTD							Information and Communication Technology					
BFRI		X						Pest and disease management				
BIDS	X		X				The Bangladesh Unnayan Gobeshona Protishthan or BIDS is an autonomous public multi-disciplinary organization which conducts policy oriented research on development issues facing Bangladesh and other developing countries.					
FD	X											

	Data availability			Reason that data are requested					
Inst.	**Availability of webpage/URL**	**The 5 most commonly requested data**	**Organizations requesting your data**	**Nat. reporting purpose**	**Annual reports**	**Nat. stat. database**	**Business**	**Other**	**Other**
BARC	www.barc.gov.bd	Fertilizer recommendation for crops and cropping patterns	DAE, agricultural research institutes, universities, individuals					X	personal use, library use
BBS		1.Population census, 2 economic census, 3 agriculture census, 4 HH income and expenditure survey,5 sample vital registration system	DAE, Dep of agriculture marketing, Do Fisheries, Bangladesh Meteorology Dep., FD	X	X		X	X	
CEGIS	www.cegisbd.com	1. Land covers, 2 settlement vegetation, 3 status of flora, 4 status of fauna, 5 economic importance	BWDB, FAO, BFD, Bangladesh Petroleum Corporation, Power Grid Company of Bangladesh	X	X	X			
CU		1. Deforestation rate, 2 Rate of biomass removed per year, 3 Biomass stock, 4 Carbon stock, 5 Rate of GHG emission from forestland	FD, FAO, UNDP	X		X		X	
KU	ResearchGate	biomass models	BFD; Institute of Forestry and Environmental Sciences, University of Chittagong; Kerala Forest Research Institute, India; Institute of Biological Science, University Malaya	X				X	Academics
Do Fisheries	www.fisheries.gov.bd	1. annual fish production, 2 sector wise fish production, 3 inland and marine fisheries resources 4 fish export, 5 other fisheries information (fisherman, habitat restoration etc)	BBS, Planning commission, Water resource dep., other Gov Depart., DAE, Bangladesh Film Development Corporation, BARI, BARC	X	X	X	X	X	policy planning, decision makers, development partners, advancements of fisheries sector, plan for mgmt of fisheries resources
GIZ	Not open for public domain, Internal use only.			X				X	Internal Report Purpose
ACI	http://aciagribusinesses.com/	1 market size, 2. users of certain input, 3. productivity and 4. yield data	Donors/Partners such as USAID, IRRI, Winrock, Swisscontact, DFID, SNV		X		X		
BRAC	http://docs.brac.net ; http://research.brac.net	1. Amount of seed produced and distributed, 2. Land coverage with quality seed, 3. Crop yield, 4.Vaccination provided to number of animal, 5. Number of saplings distributed	Ministry of Agriculture, Ministry of Environment and Forest, Ministry of Fisheries and Livestock, DFID, DFAT, IRRI, WorldFish, IFPRI, AESA	X	X				
Arannayk Foundation	www.arannayk.org	1. Amount of forest resources collected by resource poor, 2. forest dependency, 3. no. of forest dependent people, 4. annual income increase through agriculture, 5. livestock, poultry	Forest Department	X	X				
DLS	www.dls.gov.bd	1. Population of animal (ruminant & poultry) 2.Production (milk, meat & egg) 3.Number of dairy & poultry farms 4.Cattle crossbred data 5.Animal products & by-products data	1. Universities, 2.BLRI, 3.BBS, 4.Ministry Of Finance & other ministries. 5.Personnels	X	X	X	X	X	Research
IUCN	https://portals.iucn.org/library/dir/publications-list	1. forest volume, 2. blue carbon, 3. fish, 4. plantation map	Bangladesh Forest Department, Department of Fisheries	X	X				
SUST	https://scholar.google.com/citations?user=L69hTlwAAAAJ&hl=en	1. Forest resource utilization, 2. Fuelwood collection, 3. Carbon estimation	No specific organization. All data were produced for research purpose					X	Research
WARPO	www.warpo.gov.bd. Data sample, metadata, attribute information, bundle information have been included in the data Catalogue.	1. Digital Elevation Model (DEM) 2. Details River of Bangladesh 3. Water Level Data (Daily) 4. Rainfall Data (Daily) 5. Union Boundaries of Bangladesh	1. Government Organizations 2. Educational Institutions (Local, Foreign) 3. International Organizations 4. Non- Government Organizations 5. Consultancy Firms	X			X		a) Planning, Project Implementation, Monitoring in National, Regional and Local Level; b) Flood Warning and Forecasting; c) Disaster Management; d) River Training Works; e) Research; f) Hydrological and Hydromorphological Analysis and Study; g) Model Study; h) Studies on Climate Change, Feasibility, national and Social Interactions, Agriculture, Irrigation, Landuse Change, Socio-Economic evelopment, Environmental Protection etc.; i) Construction and Development works of Road, Bridge and Other Infrastructures; j) Development of other databases (Haor, Delta Plan, ESPA etc) and k) Others

Haor & Wetlands Develop.	www.bdhwd.gov.bd	1. list of wetlands in Bangladesh, 2. Dev. oroject and impact etc.	Govt. office, NGOs	X			X		
SoB		1. topographic maps	army, other govt. organizations	X				X	military
BRRI	ResearchGate	1. Long term nutrient omission on Rice productivity 2. Greenhouse gas emission from rice soil 3. Net Ecosystem Carbon Balance during rice cultivation or Cropping Pattern 4. Carbon balance/sequestration in rice soil 5. Water management on Global warming potential in paddy field	Bangladesh Rice research Institute, International Rice Research Institute (Philippine), Gyeongsang National University (South Korea)			X			
Copyright office				X					
SRDI	www.srdi.gov.bd	1. Soil nutrients , 2. Land use , 3. Physiography , 4. AEZ , 5 Soil Salinity	Different organization of NARS , Different universities , BBS , CGIS	X	X	X		X	Research
ICTD									
BFRI		1. Pest & disease management in plantation of forest tree species 2. Pest & disease management in major cultivated medicinal plants in Bangladesh 3. Major pest & diseases in Heavea rubber & their management in Bangladesh 4. Major pest & diseases in forest seeds and their management in Bangladesh 5. Mortality of sissoo (Dalbergia sissoo) and its management	Ministry of Environment and Forest, Bangladesh Agricultural Developmental Council (BARC)	X	X				
BIDS								X	To conducts policy oriented research on development issues facing Bangladesh
FD	www.bforest.gov.bd	1.Total Plantation area by The Forest Department in different year. 2. Total no. of seedlings avalable in differnt nursery of Forest Department.	Ministry of Environment and Forest, Reporter of news papers. N.G.O. etc.		X			X	to prepare the plan for the development projects, and for the Annual development programmes

Inst.	MoU	Data sharing agreements	Data Request Letter	Payment	Data Request Letter and payment	Free access	Other	Hard copies	Electronic (.doc)	Electronic (.pdf)	Electronic (.xls)	Electronic (shape file)	Electronic (raster, tif)	Other
BARC						X	personal contact							
BBS	X	X	X	X	X	X		X	X	X		X		
CEGIS	X			X	X			X	X	X	X	X	X	
CU	X	X	X					X			X			
KU			X			X			X					
Do Fisheries			X			X	personal communication	X	X	X				
GIZ	X	X				X	Communication over responsible officers	X	X	X	X	X	X	JPG files
ACI	X	X				X		X	X	X	X			
BRAC	X					X			X	X	X			
Arannayk Foundation						X			X	X	X	X		
DLS			X			X	Personnels	X	X	X	X			
IUCN			X			X		X		X		X		
SUST		X	X						X	X	X			
WARPO	X		X		X			X	X	X	X	X	X	Tabular Data can be exported in any desired format as Excel, Access, Dbase and Text Format using the tool.

Haor & Wetlands Development	X		X			X		X	X	X				
SoB					X			X		X		X	X	
BRRI		X								X				
Copyright office		X						X						
SRDI	X	X	X	X	X			X		X				
ICTD	X													
BFRI						X		X						
BIDS							Access restricted	X						Data Access restricted
FD			X					X		X				

	Data archiving and documentation							Suggestions for optimal institutional arrangements
Inst.	**No archiving and no documentation**	**No archiving but documentation**	**Archiving and documentation**	**Archiving and documentation with a referencing system**	**Archiving and documentation with a referencing system and accessible on the website**	**Other**	**If other, specify**	
BARC								Data should be public properties. Data should be published as hard copies and in websites for wider use
BBS				X				MoU with other Dep. Common Internet Hub
CEGIS			X					MoU with other organizations Depositing data with a specialist data centre, data bank, Submitting fata to a journal to support a publication
CU		X						MoU
KU		X						MoU
Do Fisheries								Strengthening mode of operation for data sharing among variou organizations Strong coordination and liaizon among organizations MoU Follow up meeting could be initiated
GIZ			X	X				A data sharing agreement (with in legal framework) must be present among the Institutes, projects who are working in Forestry sector. RIMS should be open for Projects, Donor on formal request basis. A Focal person should be assigned in RIMS for Data sharing. The process should be transparent, quick and need basis. date aggregation in a common platform is necessary.
ACI		X						A comprehensive MoU agreement between all the organizations would be helpful for exchange and sharing of data. A central body may act as coordinator for this endeavor.
BRAC			X					A central forum of all the relevant organization need to formed to make sharing of all the data and its management. Effective data sharing forum can be established among different stakeholders that will create access of having necessary data for the organization who work in Agriculture, Forestry and other land use sector in Bangladesh. Existing cluster networks and other national and international forum can play more significant role to develop the institutional capacity of data management and effective sharing.
Arannayk Foundation			X					Online access and sharing platform via dropbox, google. Quarterly or half yearly meeting of parties, etc.
DLS		X						Memorandum of understanding to be signed between various organization so that data can be easily exchanged.
IUCN					X			More coordination and interaction for data access and sharing among relevant organizations

SUST	X							Data sharing agreement
WARPO				X				Communication infrastructure should be introduced to establish networking among the agencies for on-line data sharing. Development of Data sharing Protocols, Data Management Policies etc.
Haor & Wetlands Development		X						Both hardcopy and electronic system
SoB			X	X				NSDI
BRRI			X					Website basis
Copyright office	X							
SRDI			X					Memorandum of understanding , Agreements
ICTD								Data Center can play vital role in that context. Software solution develop for this can follow National Enterprise Architecture thus inter-operability can be ensured.
BFRI	X							exchange of data sharing through arrange training, seminar, website, journal etc.
BIDS			X					Data Access restricted, we have BDS journal, Research Report etc as document and any one can buy it.
FD		X						MoU