Towards establishing a functional GBIF Participant Node (Part I)

Definitions and general considerations

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Introduction

According to the GBIF Memorandum of Understanding (2007-2011), GBIF Participants should establish a "Participant Node", which is generally defined as the technical contact point between the Participant (including all its institutions or stakeholders), other GBIF Participants, and the Secretariat. The establishment of functional Nodes is critical to ensure that GBIF Participants get full benefits from and actively contribute to the GBIF's mission, goals, and work programme. This paper aims at providing some guidance to GBIF Participants concerning where and how to establish a functional Participant Node. A full list of current GBIF Participant Nodes is available at http://www.gbif.org/GBIF_org/whoiswho/nodes-mem

What is a GBIF Participant Node?

The definition of Participant Node has evolved over the years (Box 1). In the GBIF Work Programme for 2009-2010, a GBIF Participant Node has been defined as *"a unit, agency or institution designated by a GBIF Participant to coordinate the development and activities of a biodiversity information facility (BIF) at the Participant level (e.g. national, regional, or thematic; NBIF, ReBIF, ThemeBIF, respectively)"*.

The main role of a Participant Node is therefore to promote, coordinate, and facilitate the mobilisation and use of biodiversity data among all the relevant stakeholders within the Participant's domain, primarily to help address the Participant's information needs and priorities. Thus they are not 'GBIF Nodes' to 'serve GBIF', but 'Participant Nodes' to serve the Participants.

Participant Nodes also operate as communication gateways among GBIF Participants and the Secretariat, contributing to and benefiting from the central services, infrastructure, and capacity provided by GBIF as a globally decentralised network of Participant networks.

Box 1. Initial definitions of a GBIF Participant Node

In the first GBIF Memorandum of Understanding (GBIF MoU 2001-2006) GBIF Nodes were defined as "*A stable computing gateway that allows real-time inter-operational search of multiple institutional, national, regional and/or subregional databases containing primary or meta-level biodiversity data (...) or a single, web-accessible computer containing one or more significant maintained biodiversity databases".* It is clear that the emphasis in this definition was on the technical process of providing access to biodiversity data.

The main lesson learnt from this approach was that the process of mobilising data cannot be fully automated. First, it requires people to interact with both the technologies (hardware, software, middleware) and the data (interoperability issues); second, and perhaps more importantly, it requires people to interact with other people (from learning activities to reaching institutional agreements on data access and use policies).

As a result, in the second GBIF MoU (2007-2011) GBIF Nodes were re-defined as "*A mechanism by which a Participant coordinates and supports its GBIF data-sharing activities. A Participant Node includes both physical infrastructure and human resources. Typically a Participant Node encourages and supports the activities of the Participant's data providers to both contribute and use GBIF-served data, provides information technology (IT) infrastructure and expertise for GBIF activities, and functions as an information gateway among Participants, other partners, and the Secretariat.*"
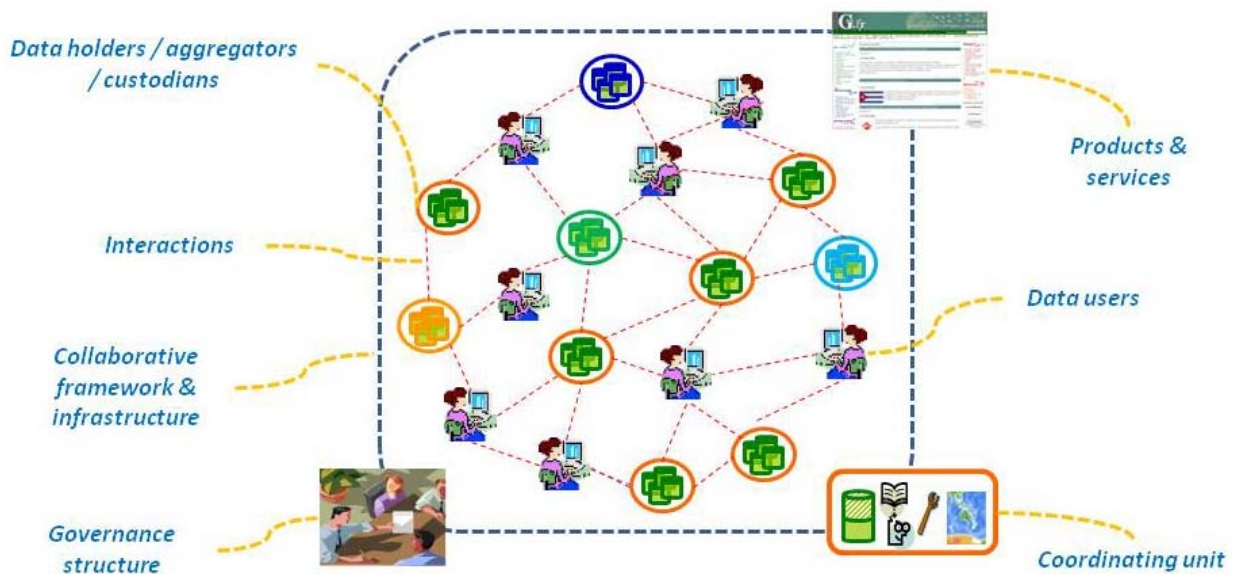
Figure 1. General components of a biodiversity information network or facility (BIF).

In general terms a GBIF Participant Node (better referred as a Participant Biodiversity Information Facility or Participant BIF) comprises the following components (Figure 1):

- Data holders. Organisations and people that produce, manage, or hold biodiversity data. The target is that all data holders will eventually become data publishers (i.e., by publishing their data holdings on the Internet via GBIF). Data holders can form groups or networks depending on their affinities or interests (e.g., natural history collections, birdwatchers, invasive species networks, etc.).

- Data users. Those people and organisations that use biodiversity data for specific purposes and at various levels of synthesis / aggregation. General categories of data use include research, policy and decision making, education, and recreation. It is recommended that each GBIF Participant makes an assessment of data users and user needs within its domain, as well as periodical evaluations about how well the data mobilisation process carried out by the GBIF Participant is addressing those needs.

- A collaborative framework and infrastructure. A set of policies, rules, agreements, standards, protocols (among others) adopted by all the relevant actors at the Participant level (i.e. data holders, data users, other stakeholders and authorities, etc) regarding the sharing and publication on the Internet of biodiversity data and information. The collaborative framework also includes the informatics infrastructure necessary to facilitate the publication of biodiversity data.

- A Governance structure. A mechanism by which the various data holders, users and other relevant actors at the GBIF Participant level contribute, participate, and are represented in the collective decisions concerning the sharing and publishing of biodiversity data.

- A Coordinating Unit (or Secretariat). A team established or designated to promote, coordinate, and facilitate the data sharing activities at the Participant level. The Coordinating Unit is responsible (and resourced accordingly) to engage and assist all the relevant actors (from data holders to information users) with the data mobilisation and publication process (for example, through provision of data

standards). It is instrumental in helping the GBIF Participant to fulfil its own biodiversity data and information management needs.

- A set of biodiversity data and information products and services. The most tangible set of outputs from the data sharing and publishing activities carried out by the GBIF Participant. It includes primary data, aggregated data and information, online tools, to name but a few.

Why Participant Nodes are needed?

Participant Nodes/BIFs help GBIF Participants to significantly increase the benefits from their past, current, and future investments in biodiversity research and data collection. In its facilitating role, a Participant BIF can help data holders to share and publish their data using common standards and protocols (to ensure its interoperability and open access). Likewise, Participant BIFs also help overcoming the many sociological constraints to data sharing, by proving a common, safe platform for collaboration and open access to biodiversity data.

Such support is necessary –among other reasons– to make the publication of primary data mainstream (there is a well established tradition to publish the results from biodiversity research, but not to publish the primary data on which those results are built, nor to make these data available for additional analyses).
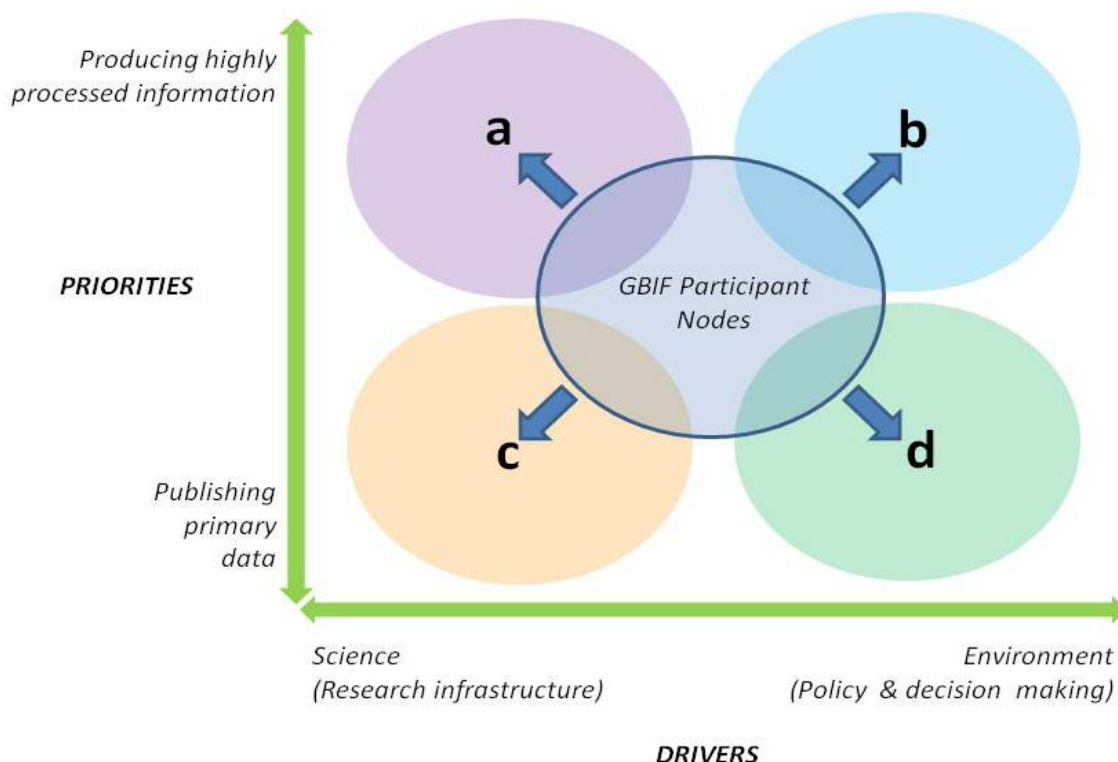
Figure 2. Drivers and priorities for the implementation of a biodiversity information facility that define the GBIF Participant Node. Depending on the combination of these two factors, the Participant BIF can evolve as a primarily scientific endeavour (*a* and *c*), or as a policy support system (*b* and *d*), or preferably as the interface between these two

domains. The GBIF recommendation is to see this facilitating / coordinating role so as to serve as wide a range of users and applications as possible for the Participant.

The majority of data holders still need guidance on the various steps involved in such a data publishing process, from standardised organisation and digitisation of the data, to the deployment of technologies to improve the quality and track the use of data made available on the Internet. In many cases Participant BIFs also help key end-users to find the information they need, and guide them on how to use it. This is particularly important to make the use of data relevant to support policy and decision making, especially in relation to the conservation and sustainable use of biodiversity and ultimately towards sustainable development.

Last but not least Participant BIFs, in their coordinating and facilitating role, are best positioned to help the Participant to assess their own biodiversity data gaps (taxonomic, spatial, temporal, and thematic), to understand data and information needs, to engage new communities (and mobilise new data types), and to devise strategies to effectively respond to those needs. Independently of the drivers or priorities motivating the mobilisation of biodiversity data (Figure 2), well established and fully functional Participant Nodes or BIFs are instrumental in helping Participants achieve their own biodiversity data-related goals and targets.

What makes a fully functional Participant Node or Participant BIF?

A GBIF Participant Node or BIF is considered as fully functional when it effectively helps the Participant to establish, coordinate, and maintain an active biodiversity information network or facility (BIF), using the general framework, principles and infrastructure of GBIF for that purpose. In essence, a fully functional Participant Node/BIF plays a role similar to the GBIF Secretariat but at the level of the Participant (i.e., national, regional or organisational). Thus, a fully functional Participant Node / BIF:

a) helps the GBIF Participant to assess and address its own biodiversity information needs,

b) actively engages data holders and users within the Participant's domain,

c) assists the varied Participant data holders to share and publish biodiversity data (to the GBIF network, but primarily for access and use within the Participant's domain),

d) assists building biodiversity informatics capacity at the Participant level,

e) promotes and facilitates the development of applications to serve the Participant's end-user needs,

f) shares its capacity and experience with other Participant Nodes, particularly those in earlier stages of development,

g) helps to develop, test, implement and deploy the GBIF community informatics infrastructure, best practices and applications; and

h) actively contributes to achieve the GBIF community's mission, targets, and goals through implementation of the GBIF Work Programme.

What does a Participant Node require to become fully functional?

In order to fulfil its coordinating/facilitating role, a GBIF Participant Node/PBIF needs, as a minimum:

a) **A clear mandate** (i.e. official; institutional) by which the Participant Node is formally given the responsibilities of coordinating, promoting, and facilitating biodiversity data sharing activities among the relevant institutions, partners, or stakeholders within the Participant's domain (for an example see Box 2). Such a mandate should ideally be part of **a collaborative framework** defined and agreed by the relevant actors within the Participant's domain. Normally, such a mandate is provided through a designated institution. As it will be explained further in the following sections, the position and mandate of the Node within the Participant domain is crucial for the successful performance of the Node.

b) **A designated team and facility** to implement the Participant Node's mandate, including the formulation and implementation of its **work plan**. The team includes sufficient staff (the totality or at least a significant part of which should be trained in biodiversity informatics) and the facility physical infrastructure (from office facilities to ICT).

c) It also requires an **adequate level of institutional and financial support** to carry out the coordinating, promoting, and facilitating activities at the level defined in the corresponding work plan. The institutional support may be in the form of administrative assistance, hosting facilities, or political endorsement to engage key partners, raise interest and visibility, and mobilise funds. Of particular relevance in this context is the need for **fluent communication between the Node team and the members of the governance structure** set up to lead the data-sharing activities at the Participant level (including the Participant's delegation to GBIF).

> **Box 2. GBIF Spain: An example of a Participant Node with a legal mandate**
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> GBIF Spain (http://www.gbif.es) was created by a Ministerial Resolution (Resolution 13959 of 12 June 2002 from the Ministry of Science and Technology). According to this, the Ministry commissions the organization and coordination of GBIF-related activities in Spain to the Spanish Research Council (CSIC). Such resolution also meant that there is a budget from the Ministry allocated for the operations of GBIF Spain; such budget includes funding for biodiversity data holders to digitise and publish their data, as well as for building capacity on biodiversity informatics in the country. With this mandate GBIF Spain was also created as a network of partner institutions at the national level (which includes the coordinating unit, the data holder institutions, the Ministry, etc.).
>
> Such mandate has made possible for GBIF Spain to consolidate itself as one of the leading Participant Nodes in the GBIF network. In addition to bring stability to the activities of the Participant Node (in terms of budgets, plans, day-to-day operations) it has helped to position GBIF Spain nationally as part of the country's infrastructure for scientific research.

d) Finally, a Participant Node/BIF requires **access to the right set of tools, best practices, learning opportunities, and training documentation** to perform its duties at the best possible level. Most of these are part of either the central services provided by GBIF (mostly through its Secretariat) or the services contributed by other GBIF Participants through the GBIF network.

The lack of one of the listed "requirements" will affect the overall functionality of the Node/PBIF. For instance, a Participant Node/BIF with all these requirements except a clear mandate can easily fail in its inter-institutional interactions and coordinating role. Lack of sufficient staff, even when resources are

available, can also limit the capacity of the Node to effectively respond to the Participant's needs. A Participant Node/BIF having a very clear and strong mandate, experienced (and sufficient) staff and infrastructure, an appropriate level of funding, yet that lacks institutional support (particularly from the host institution) can easily get drained by trying to overcome intra-institutional barriers (usually political, managerial, or administrative) and never actually be able to achieve any of its Participant BIF activities.

Which features make a Participant Node successful?

Basically all the activities carried out by a GBIF Participant Node/BIF revolve around interacting with others at multiple levels. The coordinating unit of a Participant Node/BIF needs to be skilful not only in technical matters, but also in communicating, engaging, and interacting with people and organisations from different backgrounds. These skills are a prerequisite for helping the Node/BIF to overcome sociological barriers and solve conflicts related to data sharing, participation, attribution, etc. The foremost features of a Participant BIF to be successful are:

a) **Neutrality**: Participant Nodes/BIFs established to coordinate, promote, and facilitate data sharing activities among multiple institutions should ideally not be involved in generating or using data purely for themselves. If the Node is involved in biodiversity research activities of any type, then it is quite possible that other institutions and partners also doing biodiversity research will see it as a competitor or will perceive the Node's endeavours as led by vested interests, leading ultimately to reluctance to participate in data sharing activities. Even if the Node is not actually competing for the same resources or trying to use its position to get results using data from others, the simple fact of being directly involved in any type of data collection, digitisation, or analysis will raise suspicions from the institutions it is supposed to assist and provide coordination for. Neutrality, from the coordinating institution is essential to overcome any sociological obstacles linked to the publication of primary biodiversity data on the Internet. The Node should be able to work with all the relevant communities without having preferences or priorities not defined or agreed by the whole community. The institutional location of the Participant Node is decisive for its neutrality (see next section). Likewise, neutrality is essential to build trust in the data sharing activities at all levels.

b) **Service-oriented:** A GBIF Participant Node (more specifically the Participant BIF's coordinating unit or Secretariat) is established to assist a community of people and institutions within the Participant's domain to share, publish, and use biodiversity data and information. A Participant Node should therefore be equipped and prepared to technically support such a community as much as possible, striving to make the mobilisation and use of biodiversity data easy and cost-effective. The Participant Node is there to serve, not to dictate; it is a support facility to the Participant network/community, just as the GBIF Secretariat is a support facility to the whole network/community. As such, the service-oriented approach should permeate all the activities carried out by the Participant Node/BIF.

c) **Capacity:** The team supporting a Participant Node/BIF (i.e., the coordinating unit) must be proficient and skilled in the various areas of biodiversity informatics in order to provide the required services to the Participant's community. This technical capacity includes knowledge (e.g. know-how, best practices), technologies (e.g. software, hardware), staff (enough experienced personnel to cover all the relevant areas as defined in the Node's work plan), and mandate (the Participant Node should be empowered to perform its duties at the appropriate level). A capable and efficient coordinating unit or secretariat will be definitely best positioned to engage the Participant's community, and to help the Participant achieve its information goals and targets.

d) **Leadership and initiative:** In many ways a Participant Node/BIF is responsible for stimulating interest and mobilising people and organisations around the publication and use of biodiversity data. The Participant Node should be an inspiring figure, able to bring multiple communities together and effectively promote participation as well as collaborations in all kind of synergies.

Where best to locate a GBIF Participant Node/BIF?

The positioning of the Participant Node/BIF is a very critical decision for any GBIF Participant that has not previously (to the signature of the GBIF MoU) established a biodiversity information network or facility. The position will largely determine how the Participant Node (especially its coordinating unit or secretariat) will relate to all the other institutions within the Participant's domain, and how easily the Participant Node will achieve the above- mentioned features of neutrality, service, capacity, and leadership. This is also one of the earliest decisions to be discussed and made by a GBIF Participant (ideally even before formalising the Participant BIF's mandate). Normally this is a long-term decision that -once made- it is held for several years. Hence the importance of get it right from the beginning

The institutional location of the Participant Node (especially its coordinating unit) usually depends on:

a) the institutional landscape at the Participant level (number and types of institutions, roles, socio-economic context, research tradition, etc.),

b) the interests, needs, and priorities of the Participant with regards to biodiversity data and information, and

c) the current and potential capacity of the Participant (in terms of funding, infrastructure, staff, etc.).

These factors change from one GBIF Participant to the other, making it very difficult to provide a definitive recommendation. However, there are lessons learnt from the community that can help new GBIF members (or those going through strategic changes) with their own decision making process.

The first recommendation is to start an internal process (at the Participant level), ideally led either the institution responsible to sign the GBIF MoU or by the Head of Delegation (if associated to a different institution) to evaluate the different options and come up with a recommendation about where and how to locate the Participant Node. To ensure participation and ownership of the process right from the beginning, it is advisable for the Head of Delegation or leading institution to convene a group of representatives from the key biodiversity stakeholder institutions within the Participant.

The first task for this group of stakeholders is to define the long term vision and goals for the Participant Node; focus should be on how the Node/BIF will address the Participant's needs and priorities, and how it will complement with other biodiversity-related or information-related initiatives. This process should help identify priorities and answer the general question of "what type of GBIF Participant Node do we need –or want-, and what for?". The matrix of drivers and priorities presented in Figure 2 can be used to guide these initial discussions and decisions, particularly as part of a scoping exercise. To support this process it is normally recommended to undertake (or use, if existing) a "biodiversity information need analysis" and a preliminary "survey of data holders" (both at the Participant level).

Once this is done, this group might start discussing how to implement the agreed long-term vision and goals, including aspects such as collaborative framework, infrastructure requirements, governance structure, membership, and coordinating unit/secretariat's roles and responsibilities.

With the results from these discussions and agreements, the group of stakeholders may begin addressing the question about where and how to locate the Participant Node and its coordinating unit / secretariat. The following set of questions can be used to guide this process:

a) *Which institutional location will offer the greatest political neutrality to the Participant Node/BIF (particularly to its coordinating unit or secretariat), ensuring that the Participant Node will be as inclusive as possible?*

b) *Which institutional location would provide the Participant Node / BIF with the greatest freedom, mandate and budget to be service-oriented?*

c) *Which institutional location would offer the greatest chances for the Participant Node / BIF to develop capacity and perform its coordinating/facilitating role at the best possible level?*

d) *Which institutional location would offer maximum stability and long term perspective to the Participant Node / BIF?*

e) *Which institutional location would get the maximum buy-in and visibility for the Participant Node / BIF among the relevant actors and stakeholders at the Participant level?*

f) *Which institutional location would be more suitable for the Node/BIF to serve the Participant's needs and priorities?*

Table 1 and 2 provide some examples of pros and cons from various institutional arrangements for the Participant Node / BIF (specifically regarding its coordinating unit or secretariat). Table 1 focuses on the level of delegation (from a new organisation created with the formal mandate to run the Participant Node, to an individual designated by the Head of Delegation as the Node Manager as an addition to his/her job responsibilities). Table 2 provides more concrete examples around types of institutions selected to operate the Node/BIF (e.g., a natural history museum, a ministry, a university, etc.). These tables can be used as a reference when answering the questions listed above. GBIF Participants are encouraged to interact with other GBIF Participants and the GBIF Secretariat during this process as much as possible; learning from other experiences always help to identify potential problems and find innovative and sound solutions.

Results from this process should ideally form the basis of the recommendations for the establishment of the Participant BIF (including the most formal aspects such as the legal mandate). Similarly, the group of stakeholders convened to support this process may become the seed for the Participant BIF's governing bodies and membership (e.g. steering committee, network's board, general assembly, etc.).

Finding an ideal recipe for establishing a Participant Node is not possible –it is about changing the way individuals, institutions, countries and organisations operate- so any choice will imply compromising on certain aspects and gaining on others. The final resolution will always depend on the Participant's vision regarding sharing and using biodiversity data, as well as on the role that the Participant believes the Node can play in accomplishing such vision. But it also depends on how inclusive such vision is, particularly concerning the capacity of the Participant (as a country or an international organisation) to bring together and actively engage the most relevant stakeholders involved in the production, management, sharing, publishing, and use of biodiversity data and information. The more inclusive, transparent and participatory such process is, the higher the chances the Participant Node will be successfully established and maintained in the long term.

Table 1. Examples of different combinations for the establishment of a Participant Node, indicating some pros and cons in each case.

	Situation	Pros	Cons
a)	The mission and mandate of the designated institution are precisely those of coordinating, promoting, and facilitating the biodiversity data sharing activities at the Participant level.	• In many aspects this is the ideal situation • Greater autonomy and flexibility • Highest possibilities to achieve neutrality • Highest possibilities to be service oriented • Maximum level of expertise and specialisation, hence of capacity to serve the Participant's community	• It requires maximum high level of investment (resource demanding), thus more sensitive to changes in the Participant's priorities (with budget implications) and the greatest level of political negotiation and agreement
b)	The Node is hosted by a designated institution, but is not part of it	• More autonomy and flexibility for implementing the Node's Work Plan • More time to concentrate on the Node's specific activities • Greater chance to create its own corporate image (in terms of neutrality, capacity, etc.) • Greater chance to respond to a partnership or a group of institutions, rather than a single institution	• It may lack institutional support and funding • It may require some external investments in staff, infrastructure (if not provided by the host)
c)	The designated institution acts as the Node, although its scope and activities are much broader within its national mandate	• It may have a very strong and solid mandate, also with very strong institutional support • Higher chances of having a good level of technical capacity and budget • The "national biodiversity institutes" established in response to the Convention of Biological Diversity are a good example of this	• Depending on the scope of the institution, it may compromise neutrality • It may also compromise in terms of "service-oriented approach"
d)	The Node is a unit or a team within a designated institution	• Low investment in terms of infrastructure, staff, etc. • It can easily be aligned with an already established institutional framework	• Results will depend largely on the host institution • The Node's staff may get heavily involved in the institution's internal activities • It makes it more difficult to serve the needs of a group of institutions (the Node staff normally depends on and responds first to the Institution's management team)
e)	The designated institution acts only as a technical contact point for communications with the GBIF Secretariat	• A very temporary situation to initiate further interactions where all other options are not available	• Without a clear, agreed and mandated plan to follow this temporary solution, activities end here • The Node remains largely unknown to other institutions • It may become reactive rather than proactive and essentially fails to develop further

Table 2. Examples of type of institutions designated to host or to play the role of a GBIF Participant Node. These examples are generalised, and examples may vary greatly depending on the specific situation of the Participant. They are mostly focused on countries, rather than international organisations.

Type of host / designated institution	Pros	Cons
a) natural history collections	• Full knowledge of the challenges and requirements to digitise and manage natural history data	• It may need big efforts to demonstrate neutrality (e.g. if it is a zoological collection, that it can work with other types of collections, or that it is not competing for digitisation funds, etc.) • It may find difficulty to engage with other communities holding other types of biodiversity data (e.g. observations, ecological data, etc.) • In some cases it makes it difficult for the Node to serve the needs of users outside the scientific community (even those outside the natural history collections community)
b) ministries (of science, environment, etc.)	• Very strong mandate, capacity to influence and support policy and decision making • Easily aligned with national biodiversity policies, strategies, and programme	• Challenges to operate at the technical level, and to provide technical support (e.g. to the scientific community) • Easily affected by political changes
c) biodiversity or biological research institutes	• High potential for developing capacity on biodiversity informatics easily and quickly • Full knowledge of the biodiversity-research realm • It may have a very strong and clear institutional mandate	• It may face "neutrality" issues, depending on how the institute fits within the overall institutional landscape of the participant (considering aspects such as complementarity, overlap, singularity, etc.)
d) research councils or science & technology commissions	• Excellent position to use the Participant node to coordinate, promote, and facilitate • Easy to align with national research policies, strategies, and programmes	• May require investments to get the capacity to provide technical support • May become very science-driven, putting less emphasis on supporting policy and decision making for the conservation and sustainable use of biodiversity
e) non-governmental organisation	• Flexibility and autonomy	• Potential lack of mandate, difficulty to formally engage with government institutions • May become very dependent on funded projects
f) university department or faculty	• High potential for developing capacity on biodiversity informatics easily and quickly • Potential for permeating the Node's activities with various agendas of the biodiversity research community	• May face "neutrality" issues • May also become very dependent on projects

Conclusions

Perhaps one of the most important lessons learnt after the seven years of GBIF's existence is that sociological barriers and complexities are by far the most crucial to overcome for the proper functioning of and benefits from the GBIF network. Therefore it is essential to emphasise on the coordinating, promoting, and facilitating role of GBIF Participant Nodes. It is also critical to underscore that GBIF was established - and thus Participant Nodes should be established- primarily to serve the Participant's own needs and priorities. In that regard, it is necessary to recognise that a Participant Node typically needs to engage and work with a variety of people and institutions, each with different levels of capacity, and different interests and expectations. Consequently, when establishing a Participant Node it is important to ensure that it will be neutral, that it will have the capacity necessary to effectively support the Participant's community, and that it will be able to deliver on a service oriented approach. To achieve this, the Participant Node needs a strong and clear mandate, and the appropriate level of institutional and financial support.

The successful implementation of the Participant Node / BIF is to a great extent determined by where the Node / BIF (specifically its coordinating unit) is institutionally located. Considering that the activities of the Participant Node mostly revolve around human and institutional interactions (even those machine-mediated or automated processes need to be agreed and planned beforehand), the institutional location may facilitate or prevent wider participation of key actors at the Participant level (as data holders, users, funding agencies, etc.). It is important then to follow a multi-stakeholder approach in the process of selecting the institutional location for the Participant Node and its coordinating unit.

The recommendation is to start the process by defining the Participant's vision concerning sharing, publishing and using of biodiversity data (e.g. as a collective, collaborative initiative to address issues of societal relevance), and then discussing on how best to achieve that vision; results from these deliberations should provide the ground for making decisions concerning the implementation of the Node / BIF. Although it sounds very simple, the reality is that in the early years of GBIF (and possibly due to the lack of previous experiences) many Participant Nodes where established in a less formalised way, not responding to a strategic plan or long term vision.

References

GBIF (2008) GBIF Work Programme for 2009-2010. GBIF Secretariat, Copenhagen. 59pp.