Diversity, Innovation and Poverty: Governance and Management of Scientific Centres of Excellence in Africa

James R. Smith

I Introduction

The Biosciences Facility for Central and Eastern Africa (Biosciences Facility) heralds a new initiative for African science. The Biosciences Facility is the first of what will become, in the vision of the New Partnership for African Development, a network of African centres of scientific excellence. Central to the successful implementation of centres of excellence is a thorough understanding of what are the needs for the regional science and technology communities, what are the needs of the end users of technologies, allied to a broad and deep understanding of how those needs may be met over a sustained period. These issues revolve around governance; how information and knowledge are analysed, understood and articulated, and in response how resources are best accessed, utilised and managed to promote innovative and applicable research in the biosciences.

The international experience of centres of excellence has shown that centres function most effectively when systems of governance are clear, inclusive, responsive and iterative. Centres of excellence are at their most effective when mechanisms for distributing internal funds are decided with clarity; research coordination is actively managed; there is focused educational development and systemic student support; there is regular and focused internal formal and informal interaction; and there are clear lines of communication and interaction between centres of excellence and a wide range of partners.¹

This briefing paper will focus on contextualising and over viewing governance and management contexts and options for African centres of scientific excellence, more generally and specifically in relation to the Biosciences Facility. The paper begins by briefly examining some conceptual issues that provide background to scientific innovation, research, institutions and their governance in a developing country context. This section is followed by a very brief overview of some of the roles and responsibilities of a range of stakeholders in the initiative. The focus then shifts towards highlighting issues of governance drawn from the international experience of centres of excellence. Case studies are presented that illustrate differing approaches to governing and managing centres of excellence, and their strengths and weaknesses. These case studies lead into a discussion of governance options, the intention of which is to promote debate and discussion at the consultation workshop.
II Governance, Science and Development

As we move into the 21st century, it is becoming increasingly clear that technology, and in particular biotechnology, will play a key role in economic and social development throughout the world. The impacts of technology and biotechnology on agriculture, health and the environment has been widely acknowledged – and debated; the potential exists for generic biotechnology to revolutionise these and other sectors in the coming decades. Within the context of the developing world it is also becoming clear, however, that there are powerful constraints operating at a range of levels that may prevent such expectations being realised within time scales of relevance to poverty reduction, agricultural and economic growth and development in its broadest sense. Many of these constraints erode the potential of development per se, for example: a lack of human capital, a lack of direct investment, or a lack of specialist infrastructure. Related to these generic constraints are more specific constraints covering issues of risk perception and management, obstacles to technology transfer from international sources [including intellectual property rights], the lack of national capabilities to link biotechnology to economic production, and poor policy architecture at all levels of governance. Unless these constraints are resolved, the economic potential of biotechnology and genomics is certain to be compromised. Given that the failures of development, of rising poverty, rising food insecurity and the impacts of disease continue to characterise Africa and punctuate life there it is essential to create innovative policies and institutions that analyse, address and enable science, technological development and biotechnology to make their proper and full contribution to African development.

Strategic Partnerships and Development

The idea of the formation of strategic partnerships as a way of circumventing some of the constraints to African development mentioned above has received much attention over recent years. Partnerships have been put forward as a way to make more efficient and appropriate use of limited resources, of identifying needs (sometimes purely via markets), and of providing for the public good in a more streamlined and reflexive way. Partnerships in a myriad of forms, public-private, north-south, south-south, governmental-non governmental, have been mooted, implemented and debated across a range of sectors within Africa. As point of fact, the World Summit for Sustainable Development, held in Johannesburg in 2002, advocated strategic partnerships as the key way for developing countries to innovate, trade, and develop their way out of poverty. Indeed, the New Partnership for African Development has articulated similar sentiments:

The imperative of development, therefore, not only poses a challenge to moral conscience; it is, in fact, fundamental to the sustainability of the globalisation process. We readily admit that globalisation is a product of scientific and technological advances, many of which have been market driven. Yet, governments - particularly those in the developed world - have, in partnership with the private sector, played an important role in shaping its form, content and course.
Partnerships, relationships, networks and compacts, then, are seen as crucial for Africa’s development. It would be wrong headed, however, to unproblematically assume that partnerships always form a useful method of sharing and utilising resources in a mutually beneficial way, or work for the public good. There are indeed numerous examples in the literature of poorly managed and governed partnerships in Africa, particularly with respect to the provision of public goods.\(^5\)

**Innovation and Institutions**

Refocusing our attention back to science, technology and the process of innovation, it is evident that the nature and strength of partnerships is closely connected to the capacity of an economic system to behave in innovative ways.\(^9\) We know that it is often the sharing of information between nodes of such an "innovation system" that helps to determine its capacity to produce goods and services more productively. And clearly where science-based technologies such as biotechnology are concerned a key actor is the organisations that act as the sources of much new knowledge.\(^10\)

The concept of an innovation system is now used to denote the network of inter-institutional linkages that apparently successful countries have built up as a support system for economic production across the board.\(^11\) In this sense, it has been explicitly recognised that economic creativity is actually about the quality of "technology linkages" and "knowledge flows" amongst and between economic agents. Where the interactions are dynamic and progressive great innovative strides are often made. Conversely, where systemic components are compartmentalised and isolated from each other, the result is often that relevant research bodies are not at all productive. In extreme cases, they have ceased to provide any innovative output at all. Articulated in a different way, the key property of a system of innovation is therefore not so much its component parts, or nodes, but rather how it performs as a dynamic whole.\(^12\) As one recent paper argues: "Even if single elements of such systems are strong, the system as a whole may be weak. The capability to learn and build new competencies will depend on how well the parts fit together and on the strength of these connections."\(^13\) This strikes to the core of governance.

One of the central issues from the standpoint of developing countries (especially the poorest such as those in many parts of Africa) is that many scientific institutions have indeed becomes unincorporated from each other and have ceased to function as part of a network. In the lexicon of innovation theory, they are described as still very much "mode 1" in character.\(^14\) That is, the organisations such as universities and research institutes, that should act in an innovative fashion, generating engaged, context-bound knowledge, have become progressively alienated from the economic mainstream, preferring to see their roles as confined to the pure production of disinterested knowledge. Hence, their capacity to relate systemically to the wider environment (to behave as "mode 2" bodies) is heavily circumscribed. Such behaviour is in marked contrast to many of their counterparts in the industrialised world. While there have certainly been major problems with transformation in this regard, and these are still ongoing, it is clear that many scientific institutions
have begun to transform themselves in appropriate ways (or new institutions have been created to mediate between the search for and the utilisation of knowledge) (see Table 1).

**Table 1** Comparison of “Mode 1” and “Mode 2” Institutions

<table>
<thead>
<tr>
<th>Mode 1</th>
<th>Mode 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main objective is the production of new knowledge</td>
<td>Problem-solving is the main objective</td>
</tr>
<tr>
<td>Homogenous, hierarchical structure. Traditional mode of organisation in universities</td>
<td>Heterogeneous team and unstable social structure of production (task oriented network)</td>
</tr>
<tr>
<td>“Pure” disciplines are the locus of new knowledge, production and scientific recognition</td>
<td>Multidisiplinary</td>
</tr>
<tr>
<td>Staging process of scientific development: from fundamental to applied research</td>
<td>Contextualisation of research and the localisation of research in new social spaces</td>
</tr>
<tr>
<td>Peer review system as the predominant form of assessment (research, career)</td>
<td>End of academic monopoly on assessment of research</td>
</tr>
<tr>
<td>Main target for diffusion of knowledge: Peer-reviewed journals</td>
<td>Diversification and de-institutionalisation of knowledge diffusion activities</td>
</tr>
</tbody>
</table>

There are a range of identifiable drivers, pressures and conditions that shape the evolution of research processes from “mode 1” to “mode 2”. To an extent, these factors are context-bound, but some are appropriate to the example of the Biosciences Facility:

- Redistribution of technical and scientific competencies within a network;
- New ways of funding research (e.g. DfID);
- Social pressures for the application of knowledge in the resolution of political, economic and social issues;
- Political and economic pressures to increase level of cooperation of researchers in a contextualised form of research;
- Shifting from knowledge-driven research to outcomes-oriented research

It is important to bear in mind some of the forces that drive shifts in the way research is conceptualised, conducted and institutionalised. These forces not only provide a component of the rationale behind the idea of a Biosciences Facility, they also highlight particular issues that need careful governing as the Biosciences Facility evolves. They are conditions that resist the shift to a mode 2 focus, and they must be identified, acknowledged and managed.
Again in relation to the dynamics of changes in the research process discussed above a heavy emphasis is placed on building networks and partnerships to bridge different actors and their relationship to knowledge, and that promote flows of information in ways that mobilise expertise most relevant to the immediate needs of people as efficiently as possible (vis. outcomes-based research). Furthermore, it is clear that sound, sustainable and appropriate systems of governance play a central role in shaping what kind of research is conducted at what kind of institution.\textsuperscript{15}

\textit{Information, Knowledge and Governance}

A key variable in systemic behaviour is therefore \textit{information} and how it permeates and connects the system’s component parts. However, it is then necessary to make a distinction between ‘information’ and ‘knowledge’ since in practice it is only useful knowledge that has relevance for meaningful research and design and economic production. In fact, conventional economic analysis does not make this distinction but tends to use both concepts interchangeably to describe a category of boundary conditions that prevent economic actors from behaving as they ought to (to achieve some putative optimum in terms of the allocation of resources).\textsuperscript{16} What the formal theory of information does, then, is to define the concept in a way that is logically independent of ‘meaning’ and in so doing provides the basis for a more general theory of systemic communication. In particular, it allows us to relate the flow of information to that of energy/entropy and thence to develop a model of the technical change process that has the property of systemic generality.\textsuperscript{17}

The notion of "knowledge market failure" is therefore to be seen in the light of this key difference between an economic and an informational transaction. With the former, there is generally a shared understanding around what is being bought and sold on the part of the buyer and seller. However with the latter, the transaction is much more complex and it is within this complexity that many of the fundamental issues arise. For example, a special case of this concerns the decision of when and how to co-operate in informational exchange. Too great a readiness to exchange might compromise private advantage. On the other hand, there are often longer-term gains to be made from sharing information. It is for this reason that organisations continuously seek institutional mechanisms to mediate the uncertainties involved, such as various types of partnership, or various hierarchies of governance. The concept of centres of excellence is an example of an institution that mediates these transactions for some sort of common good.\textsuperscript{18}
The organisational concept of a centre of excellence has in many ways grown out of some of the issues overviewed above:

- Firstly, there are many examples of initiatives in Africa that have focused primarily on the supply-side, infrastructural aspects of institutional building.\(^{19}\) Technical and financial resources have been steered towards bricks and mortar and equipment, as opposed to perhaps providing the conditions needed for an institution to participate systemically within a given context;

- Secondly, an understanding and acknowledgement of the array of constraints that face institutions in their pursuit of scientific knowledge and innovation has led to an increasing acknowledgement of the importance of building strategic partnerships and alliances to overcome these problems;

- Thirdly and closely related to the issue of partnerships, is the realisation that sound management of “knowledge flows” and “technological connections” define the strength and utility of relationships more so than the constituent institutions themselves;

- Fourthly and finally, an understanding of the differences between “information” and “knowledge”, the implications for communication of knowledge, and the ways in which knowledge lubricates networks is fundamental for managing research and innovation within a network.

The idea of a centre of excellence, then, is a way of avoiding some of the problems that have characterised science and innovation, particularly in a developing country context. Centres of excellence take advantage of economies of scale, of strategic partnerships, of knowledge-sharing and informational networks, and of institutions becoming an integral part of an innovation system. It is clear that sound governance is at the heart of creating the conditions where a centre of excellence can flourish, as conceptualising and managing relationships are fundamental for two reasons: firstly, avoiding some of the problems discussed above, and secondly utilising institutional structures and networks in such a way as to integrate them successfully with each other and within systems of innovation more broadly.

With this in mind, the international experience of centres of excellence has shown that they function most effectively when systems of governance are clear, inclusive, responsive and iterative.\(^{20}\) Centre of excellence are at their most effective when:

- Mechanisms for distributing internal funds are clear;
- Research coordination is actively managed;
- There is focused educational development and systemic student support;
- There is regular and focused internal formal and informal interaction;
- There are clear lines of communication and interaction between centres of excellence and a wide range of partners.\(^{21}\)
Attention now turns to the Biosciences Facility of Eastern and Central Africa, what it will encompass, and the roles and responsibilities circumscribed to some of its key partners.

III The Biosciences Facility for Eastern and Central Africa

The idea of a Biosciences Facility for Eastern and Central Africa has arisen from a number of regional discussions and initiatives, which have themselves arisen from some of the issues discussed above. A report of the Association for Strengthening Agricultural Research in East and Central Africa (ASARECA) examining priorities for agricultural biotechnology research in the region highlighted several constraints to biotechnological development in the region and within Africa as a whole:\textsuperscript{22}

- The lack of sufficient numbers of trained people;
- A lack of suitable laboratory facilities and specialised equipment;
- A lack of technical expertise

![Diagram showing linkages between Biosciences Facility and partners]

**Figure 1** Some linkages between Biosciences Facility and partners

The Biosciences Facility was envisaged as a way of making optimum use of available resources, including human and infrastructural resources, and of leveraging the drawing of new resources into the region. The Biosciences Facility can be conceptualised as a **Hub**, which not only provides a range of facilities to users, but also has a governance role, priority-setting research
where needed, disbursing resources as appropriate, and of offering expert advice in grant applications amongst other roles. Essentially the Biosciences Facility will act as a way of enabling scientists and institutions in the region to conduct innovative research.

The idea of the Biosciences Facility as a facilitatory Hub operating in the midst of a Network of institutions including regional National Agricultural Research Systems (NARS), universities, other research institutions, NGOs, and society more broadly, means it is important to identify some of the roles and responsibilities of the institutions the Biosciences Facility will operate in concert with. Figure 1 maps out some of these relationships.

III Roles and Responsibilities

New Partnership for African Development

The Science and Technology Secretariat of NEPAD has played an important role in the conception of the Biosciences Facility. Furthermore, NEPAD has acknowledged the crucial role that consolidating research through partnerships can play in Africa’s development:

[Through NEPAD African countries wish to establish networks of] “centres of excellence, especially through the internet, for cross-border staff exchange and training programmes, ... and researchers”

The Science and Technology Secretariat of NEPAD acknowledge that scientific resources are thinly spread across the continent, and initiatives such as biotechnological research tend to be replicated in country after country, even when very similar problems and issues are being addressed. NEPAD encourages countries to build their research and design programmes firstly, in partnership, and secondly, through the lens of well-defined problems that science can address.

To this end, through research and consultation (which this workshop forms a part of), NEPAD will seek to:

- Develop features or characteristics of centres of excellence and then assess the extent to which existing selected networks and centres in Africa fit the description;
- Draw lessons from the international experience in developing knowledge networks and centres of excellence;
- Design and implement measures to effectively engage existing centres of excellence in the implementation of NEPAD’s programmes.

NEPAD is proposing to work in partnership with regional and international institutions to support these aims by:

- Undertaking a study to provide a conceptual understanding of what constitutes a centre of excellence by drawing on international experience. This study will suggest specific ways of creating sub-regional and regional networks in Africa;
• Developing draft guidelines for identifying, reviewing and evaluating large regional science and technology facilities and networks of centres of excellence in Africa;
• Constructing a databank and profiles of large science facilities in Africa – an exercise designed to identify existing science laboratories that offer opportunities for the creation of networks and centres of excellence.

Alongside these ongoing aims, NEPAD has engaged at the Ministerial level to seek the adoption of guidelines and key decisions on how best to engage in the creation of effective, appropriate centres of excellence.

At this stage, NEPAD’s relationship to the Biosciences Facility is threefold. Firstly, NEPAD is contributing resources to the implementation process of the Biosciences Facility. Secondly, NEPAD, as demonstrated by the Ministerial Conference on Science and Technology held in Johannesburg last November, is acting as a conduit between the Biosciences Facility – and other potential facilities - and layers of state governance within Africa, and will provide a framework for the implementation of new centres of excellence in the future. Thirdly, NEPAD aims to create a set of best practises of how to set up a centre of excellence through the analysis of the Biosciences Facility implementation process.

The role of NEPAD in relation to the Biosciences facility is one of assisting with implementation, creating a regional and African-wide political space in which implementation can take place, and iteratively learning from this process for future initiatives.

*International Livestock Research Institute*

The roles and responsibilities of the International Livestock Research Institute (ILRI) are related to its position as a leading agricultural research institute in the region. ILRI has a well-established laboratory infrastructure and research capacity in molecular biology, genomics, bioinformatics, immunology, diagnostics and vaccine technology. ILRI is an internationally recognised research institute, containing a range of expertise in the biosciences.

There are other concrete advantages for basing the Biosciences Facility at ILRI. Host country agreements are well established, enabling storage and movement of a wide range of biological materials. There is the freedom and the facilities to host scientists from countries across the region. International-standard audit procedures will reassure donors that research investments are appropriately utilised. ILRI has management experience of handling grants, funding and research. ILRI has expertise working from a mandate to develop public goods.

ILRI, then, has a range of expertise, infrastructure and intellectual capital that can provide a foundation for the creation of a Biosciences Facility in the region. Conceptually ILRI will form the infrastructural ‘Hub’ of the facility (although not the management and governance hub). ILRI is also contributing to the management and administration in less direct ways, through a presence
on the interim steering committee, through assisting with the coordination of the design phase, and through its experience in managing partnerships.

**Other Stakeholders**

There are a whole array of international, regional and national stakeholders who will interact with the Biosciences Facility in a range of ways and with different levels of engagement. These partners may interact with the Facility in one or more of a number of distinct ways:

- Within the Facility ‘Hub’ as:
  - Users of the research facilities;
  - Contributors to Facility governance;
  - Donors
- Within the broader Facility ‘Network’ as:
  - Research partners;
  - Policy-makers;
  - Innovators and users of science and technology;

Some stakeholders clearly fall into one or other of these categories such as the role organisations as ASARECA play in priority-setting and evolving research agendas in the region. Other stakeholders could include local academics who would interact purely in terms of making use of facilities. It would be relatively simple to interact with and incorporate these more clearly defined stakeholders within The Biosciences Facility. Concordantly, there are other stakeholders who will have more complicated relationships with the Biosciences Facility, within both the Hub and with the Network. For example NARS may contribute to the Biosciences Facility in a number of ways and may also be users of research facilities through a range of project partnerships.

In terms of conceptualising the different ways in which stakeholders may interact with the Biosciences Facility it may be useful to think of the partnerships, relationships and stakeholders sketched in Figure 1 in a more concrete way. Table 2 is a matrix of stakeholder relationships (Table 3 illustrates how this matrix might work in reality). It is possible to map all stakeholders within this matrix, whether their relationship is that of a ‘client’ utilising Bioscience Facility resources, or is that of a ‘service provider’ providing resources or knowledge for the use of the Facility.

**Table 2** Matrix of stakeholder relationships

<table>
<thead>
<tr>
<th>Stakeholder</th>
<th>Hub</th>
<th>Network</th>
</tr>
</thead>
<tbody>
<tr>
<td>Client</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Service provider</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
When one begins to disaggregate stakeholders and their relationships with the Biosciences Facility in this concrete way, it provides a framework for understanding the nature of the transactions that shape and define the interrelationships within the Facility, a crucial component to understanding how governance and management can best work.

### Table 3  Matrix of stakeholder - examples

<table>
<thead>
<tr>
<th>Local scientist</th>
<th>Hub</th>
<th>Network</th>
<th>Donor</th>
<th>Hub</th>
<th>Network</th>
</tr>
</thead>
<tbody>
<tr>
<td>Client</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Service provider</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Private research</td>
<td>Hub</td>
<td>Network</td>
<td>Regional science network</td>
<td>Hub</td>
<td>Network</td>
</tr>
<tr>
<td>Client</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Service provider</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Biosciences Steering Committee**

At this nascent stage in the development of the Biosciences Facility perhaps the other important component of the Facility that should be focused on is the Interim Steering Committee. At this stage of the process the primary responsibility of the Steering Committee has been to guide the initial consultation process. It is clear, however, that at some stage in the process the Steering Committee will assume a greater range of responsibilities (and probably inherit a new title). What these responsibilities are, and who will serve on the committee to assume those responsibilities are probably issues to be discussed in more depth later in this process. However, experience from other centres of excellence gives an insight into the range of issues that the Steering Committee / Governing Council may assume responsibility for:

- Developing and approving a business plan;
- Overseeing long-term vision and strategy of the centre of excellence;
- Monitoring management and administration;
- Making executive and policy decisions;
- Strategic planning around research projects;
- Ensuring compliancy with statutory requirements

It is relevant to think about these responsibilities in the context of different options for governance structures as responsibilities may be shifted from the Steering Committee to various forms of advisory groups, for example.
Attention now turns to examining governance structures of centres of excellence through selected case studies.

IV Lessons from Case Studies

Case studies are presented to demonstrate some of the governance options that may be open to the Biosciences Facility, and to perhaps highlight strengths and weaknesses of particular approaches. These particular case studies have been chosen for a variety of reasons: The John Innes Centre is an example of a centre of excellence in the biosciences, the Canadian case study in an example of networks of centres of excellence, and finally the Biocentrum Helsinki case study is an example of a clearly defined system of scientific management, which may guide us.27

Each case study will draw out a few issues that can be used to frame debate and discussion around governance the Biosciences Facility. It is important to reiterate, and to recognise, that these examples of functioning centres of excellence are informed by some of the theories discussed above:

“Mode 1 problems are set and solved in a context governed by the, largely academic, interests of a specific community. By contrast, Mode 2 is carried out in the context of application. Mode 1 is disciplinary while Mode 2 is transdisciplinary. Mode 1 is characterised by homogeneity, Mode 2 by heterogeneity. Organisationally, Mode 1 is hierarchical and tends to preserve its form, while Mode 2 is more heterarchical and transient. In comparison with Mode 1, Mode 2 is socially accountable and reflexive.”28

One should examine the following case studies from the premise that all the centres of excellence are conceived of as operating as Mode 2 institutions, focusing on needs, on networks and networking, on applications, on fully engaging with society through understanding, innovation, policy and scientific application.

John Innes Centre
The John Innes Centre (JIC), located within a science park on the campus of the University of East Anglia, England, is an international centre of excellence in plant and microbial science. Its mission states the desire to carry out fundamental and strategic research, to train scientists and to make its findings available to society, which it breaks down into the following four points:

- Conducting world-leading fundamental and strategic research relating to the understanding and exploitation of plants and microbes, with special emphasis on yield and productivity, quality and valuable products and environmental interactions;
- Disseminating knowledge, technology and know-how to meet the needs of end-users and beneficiaries;
- Providing high quality doctoral and post-doctoral research training that is fully integrated into the work and life of the Centre;
- Providing advice and developing innovative outreach programmes in the non-medical life sciences.

The research at the Centre makes use of a wide range of disciplines in the biological and chemical sciences, including cell biology, biochemistry, chemistry, genetics and molecular biology. JIC science contributes to UK research priority areas and the needs of its sponsors and user communities. It is a major site of biological research in the UK and asserts this position to allow it great leverage in gaining access to funding. The JIC has been designed and is managed as an integrated bioscience centre. Its scientists study biological systems at the genetic, molecular, cellular and whole organism levels via multidisciplinary research programmes. The Centre maintains a strategic mix of fundamental and strategic research. For example, work on organisms that are ideal for scientific research is carefully integrated with studies on economically important species.

To give a sense of the scale of the JIC, the accounts for 2002 showed that incoming research resources totalled slightly over £25 000 000, just over half of which was unrestricted, and just over half of which comes from government and other public bodies. There are approximately 1000 staff on site. A Governing Council is responsible for the management and administration of the JIC’s affairs. The Governing Council has specific responsibilities under the original Conditions of Grant. It is responsible for the management and administration of the JIC’s income and expenditure, assets and liabilities and for the conduct of the JIC’s affairs in accordance with previous negotiated standards.

The governing council has a wide discretion over the JIC’s use of public funds, and is responsible for the “proper stewardship” of those funds. The Governing Council also has responsibility for developing the long-term vision for the JIC; overseeing the Director in the management and furthering of the JIC’s mission, aims and objectives; reviewing and monitoring the quality and relevance of its work; monitoring JIC’s management and administration; ensuring an appropriate “balance and synergy between the core, strategic and other research programmes”; administering and being accountable for JIC funds in accordance with BBSRC financial requirements and ensuring compliance with statutory requirements.

Working on behalf of the Governing Council are two boards and three committees. Their roles and responsibilities are as follows (Figure 2, below, illustrates the management structure):

- The Centre Management Board (CMB) The CMB is the main executive body of the John Innes Centre. The CMB holds a whole day meeting each month for major executive and policy decisions, with bi-monthly half-day discussion meetings dealing with long-term strategic planning. Decision-making is speeded up by less important decisions being devolved to a Centre Management Executive – a component of the CMB.
• **Centre Management Committee (CMC)** The CMC is a high level committee for advice and communication on issues affecting site operations and acts as the management fulcrum between CMB and science departments. Its membership includes heads of departments, support and administration, a representative of the scientists, and the chairman of the health and safety committee.

• **Scientific Board.** The scientific board formulates the JIC’s scientific strategies. It has a rolling programme of research reviews that involve scientists from within JIC (usually heads of scientific departments) and other organisations.

• **Resources Committee.** The Resources Committee oversees financial and policy matters at JIC on behalf of the Governing Council.

• **Audit Committee** The Audit Committee oversees audit matters at the JIC on behalf of the Governing Council.

The John Innes Centre is a useful case study for our purposes in several ways. The goals, aims and rationale of the JIC are similar to those of the Biosciences Facility, although the scale is different. This means that the majority of roles and responsibilities that need to be encompassed with the Biosciences Facility systems of governance are also encompassed with the JIC management systems. Furthermore, the JIC is regarded as a leader in the field of biosciences centres of excellence and is hence worth examining.

![Management structure of the John Innes Centre](image-url)
There are, or course, some caveats. Firstly, the JIC is larger and more resource-rich than the Biosciences Facility. Secondly, the JIC has a national remit, not a regional remit as the Biosciences Facility. Thirdly, while the JIC is working within a science park, it is not working in a context where it is the only, or even the main, centre of excellence in the biosciences. Despite these caveats, the JIC does provide a blueprint from which to work:

- It seems that the responsibilities assigned to the Governing Council of the JIC might be broadly similar to those undertaken by the equivalent body at the Biosciences Facility;
- The responsibilities of the CMB and the CMC in the JIC model would also have to incorporated within management body at the Biosciences Facility;
- The roles of the Audit and Resources Committee and the Scientific Board as representatives of the Governing Council, and advisors of the management structures are worth exploring further;
- The ways in which the CMC acts as an information and management Hub for the various scientific departments may provide a useful framework for the Biosciences Facility

On the other hand, it appears that the JIC governance model is perhaps just too complicated. The Biosciences Facility will be a smaller, more diffuse entity and with this in mind, the roles of the CMB and CMC could be collapsed into one another and altered. Also, there are not the explicit, clearly defined linkages with partner organisations, needed to articulate knowledge and resources within the Network. This is something of fundamental important in the Biosciences Facility model.

Program for the Networks of Centres of Excellence – Canada

Canada has run a federal program of the Networks of Centres of Excellence (NCE) since 1988. There are currently 18 ongoing Networks within the Canadian system, covering a wide range of issues and disciplines. The goals of the NCE program are to: “mobilise Canada’s research talent in the academic, private and public sectors and apply to the task of developing the economy and improving quality of life of Canadians.”

In particular, collaboration between Canadian Universities and the private sector is emphasised. The research networks should meet the following objectives:

- To develop and maintain world-class basic and applied research in areas which are important to Canada’s economic growth;
- To create nation-wide multidisciplinary and multisectoral research partnerships that integrate the research and development priorities of all participants;
- To enhance the exchange of research results and, together with organisations, to enhance the use of knowledge to improve Canada’s economic and social development.
These objectives are in many ways not dissimilar from those of NEPAD’s. In terms of management, each research network consists of the following components:

- **A Board of Directors**, which has responsibility for the management and is financially accountable. The Board of Directors must reflect interests of participating institutions: universities, the private and the public sectors. At least 50 per cent of the members of the Board of Directors should be from outside the research centre, some of those must come from industry. The Chair of the Board must be from outside the partner institutions. One member should be a researcher with no committee responsibilities to the network. The Board of Directors is responsible to the NCE Steering Committee, who also reserves the right to name one member of the Board;

- **A Program Leader**, who is responsible for a whole network and provides scientific leadership and who reports to the Board of Directors. Each network must also have a Senior Manager to direct business and management of the network;

![Diagram](image-url)

**Figure 3** Management structure of the Canadian NCEs
Within the network, individual projects are assessed by a committee which is chaired by the Program Leader and has as members researchers from the network and representatives from the end-user sector, industry and the government. A stated expectation for networks is the carrying out of efficient communication and knowledge transfer between projects as well as communications directed to the public, in close collaboration with NCE’s Communications Officer. (Figure 3 overviews this management structure).

The Canadian model is somewhat simpler than the John Innes model, perhaps because the Canadian networks are conceptualised more as ‘networks’ and less as institutions within a network. In that case, examining the components and structures (in particular in relation to communication strategy) from this case study may guide us in understanding the best way to management the relationships between the Biosciences Facility Hub and its network of partners.

*Biocentrum Helsinki, Finland*

Finland was impulsed to implement centres of excellence as the Finnish government saw innovation as a way of circumventing the developmental problems of Finland’s poor natural resource base, and of scaling up to compete against the larger western European economies and research institutes. Hence, within the Finnish context, centres of excellence are meant to lay the foundation for the emergence of creative, innovative and efficient research and training environments that can generate top international research. In addition, the aim is to raise the quality in Finnish research, and to improve its international competitiveness and visibility. The Finnish Centres of Excellence Programme aims to create the information base required for cultural, social and industrial development, and to create a foundation for a national innovation system.

The Biocentrum Helsinki (BH) is regarded as the most successful centre of excellence in Finland. The Biocentrum Helsinki is an umbrella organisation housed at the University of Helsinki, encompassing some 300 people engaged in research within 20 member groups located at the University. The research activities at the Biocentrum Helsinki range from human molecular genetics to plant biotechnology. The Biocentrum Helsinki is an example of a very formal network in that the member groups have been selected by international experts strictly on the basis of their scientific accomplishments, providing that the work of the group is related to the fields of biotechnology and molecular biology.

The Biocentrum Helsinki was established in 1994, and its mission is to:

- Practice research in biotechnology, molecular biology and the disciplines underlying these, and to engage in research and paid services related to structural biology, biophysics and electron microscopy;
- Develop and maintain international relations in the fields it represents;
- Practise and promote co-operation with other research units, universities and industry in the fields it represents;
• Promote and provide education in the fields it represents

The BH has a coordinating role, aiming to improve cooperation amongst already well-established research groups at the University of Helsinki, not only in conducting scientific research in the fields of biotechnology and molecular biology, but also in providing joint graduate training programs, and linking research to industry.

**Box 1 Scientific governance within the Institute of Biotechnology / Biocentrum Helsinki**

| Board | The activities and finances of the Institute of Biotechnology are controlled and supervised by a Board whose term is three years. The Board appoints and engages Research Directors and Group Leaders and makes recommendations for the selection of a Director and the appointment and engagement of Research Directors. The Board also submits proposals for operational and financial plans and for budgets, and it issues an annual report on the Institute's activities. |
| Director | The Director manages and supervises the Institute's activities and finances and engages in research undertaken at the Institute. The term of the Director is five years. |
| Research Administration | The Director is responsible for the Institute's research administration and execution of its research policy. |
| International Scientific Advisory Board | To promote its scientific activities the Institute has established a Scientific Advisory Board whose task is to evaluate the Institute's scientific programmes and also to formulate initiatives and provide statements on new research programmes. |

**Organisation of research**

Research at the Institute of Biotechnology is organised mainly in the form of research programmes which include one or more Research Groups. The Institute also has service units which support the research work undertaken. The Institute may also operate joint research programmes and units with departments of the University of Helsinki as well as with other universities, other institutions, organisations and industry.

Decisions on setting up or discontinuing research programmes are taken by the Board, once it has heard the views of the international Scientific Advisory Board. The latter also evaluates the Institute's projects at intervals of 2–4 years.

The Research Directors are responsible for the quality of research undertaken within the research programmes and for the general organisation of the programmes. All extensions to research programmes must be negotiated with the Director in advance. Permission for a project to be carried out at the Institute is granted by the Director.

**Tasks of Research Directors/Project Directors**

Include:
- Scientific management of the programme/project.
- Organisation and management of the programme/project; role of immediate superior to the employees in the project.
- Drawing up an annual personnel plan for the Research Group.
- Responsibility for adequate training of new employees in the use of apparatus and equipment.
- Responsibility for the flow of information to all the different personnel groups involved in the project.
- Personal responsibility for the correct use and adequacy of the allocations granted for the project.
- Ensuring that a copy of all decisions on granting allocations is submitted to the Administration Director.
The governing Board of BH is appointed over a five-year period. The functions of the board include:

(i) To make decisions regarding the allocation of earmarked biotechnology funds;
(ii) To organise external evaluations;
(iii) To improve research coordination and to establish core facilities;
(iv) To coordinate research training; and
(v) To help formulate future plans in the field of biotechnology within the network.

Purely out of interest, the board’s visioning process for the next five years includes raising the standard of research and only maintaining links with partners who meet those standards, placing greater emphasis on acquiring state of the art core facilities and infrastructure, supporting the repatriation of outstanding young Finnish scientists, forging further international collaborative relationships, and finally seeking closer ties with industry.

The Institute of Biotechnology is one of the 20 something groups that exists within (underneath?) the BH umbrella. It is quite interesting for our purposes as it is a similar size to the Biosciences Facility, has a similar remit and it has very clear, detailed systems of governance – particularly in relation to organising and managing research. (Box 1) above.

V Governance Options for the Biosciences Facility

So far, this paper has examined some of the theoretical bedrock of organising a centre of excellence, some of the roles and responsibilities that Bioscience Facility stakeholders may play, and highlighted some cognate issues from other examples of centres of excellence. Attention now turns to offering broad governance frameworks that may help inform stakeholders during the design phase of the Biosciences Facility. It should be noted that these options are merely that, options, and are designed to stimulate debate and the search for better ways of doing things. Governance, and the creation of methods of governance, are inherently works in progress, and these options are no different.

Hub

The options for the Hub of the Biosciences Facility are perhaps more straightforward as they deal primarily with the day-to-day running of a centre of excellence within the context of the Hub’s constituent parts (In Figures 4 and 5 the constituents of the Hub are highlighted in bold for clarity). There are still, however, options around governance within the Hub. These options revolve around two core issues which need to be debated:

- **Organisation of Hub** What governance structures should be put in place? What will these structures be responsible for? How will these structures be made representative? What responsibilities will ILRI assume and what responsibilities will be assumed by the management of the Biosciences Facility? (refer back to Figure 1);
- **Structuring of knowledge within Hub** How scientific knowledge is managed within the Facility. Is decision-making around research centrally controlled through a Steering Committee and an attached Technical Advisory Committee of some sort, or is that level of decision-making devolved down to departments, project managers, or thematic groupings; in sum, how is science organised?

**Figure 4** Governance option 1 – Centralised Management Structure
These issues are primarily around the “vertical” organisation of decision-making and knowledge flows within the Biosciences Facility. **Figure 4** is an example of one such structure.

**Figure 4** is an option whereby decision-making around research is fairly centralised. Firstly, the relationship between the Biosciences Facility and broader spheres of governance is mediated by the NEPAD Science and Technology Secretariat. Secondly, a Scientific or Technical Advisory Body advises the Steering Committee around cognate issues, including decision-
making around proposals and regulations. Therefore, most decision-making occurs at that level and only a layer of laboratory and administrative management mediates the relationship between the Steering Committee and Projects.

**Figure 5**, overleaf, illustrates a somewhat different governance option. In this option, management is devolved down to the thematic level. Scientific and laboratory management has been devolved into four research themes: ‘Plants’, ‘Animals’ and ‘Micro-organisms’. The fourth theme, ‘Policy and Infrastructure’ would also encompass issues such as day-to-day management of the Facility and would provide research back up on issues such as governance and priority setting for the other themes.40

It is perhaps pertinent at this point to turn our attention back to the experience of the John Innes Centre. The central governance structures of the JIC are notable primarily for their inclusiveness. Governance structures include not only heads of departments, but also representatives of scientists, representatives of partner institutions, and representatives of advisory bodies. In order to make the linkage between the core and the periphery, the Hub and the Network, it is important that central governance structures contain the correct mix of partners. In fact, the current Biosciences Facility Interim Steering Committee would appear to offer an appropriate mix of people that would be suitable for the more permanent equivalent in the future. Other important issues revolve around the processes used to choose the committee members.

One final issue that needs to be examined in relation to the governance of the Biosciences Facility Hub is the disaggregation between the roles and responsibilities of the Facility and of ILRI. It is clear that there are comparative advantages in making use of ILRI’s administrative systems, including taking advantage of ILRI’s experience and history of managing funding and day-to-day running costs. With this in mind one has to examine a whole set of issues around to what extend administration and laboratory management are shared. There are several options that need to be analysed:

- Project management and Facility administration handled by ILRI;
- Project management handled by the Facility and administration handled by ILRI;
- Some form of shared governance over project management and/or administration
It may be that this is too early in the design process to talk to issues of who assumes what responsibility, as these issues would revolve around staffing and resource allocation within the Facility and discussion around these issues within the Facility are some way off. It is pertinent, however, to flag these issues as they will have important implications for planning, funding, resource allocation, and day-to-day running of the Facility.

Associated Network
To a certain degree, the way in which the associated Network is governed depends on the way in which the Hub is governed. If management is more
centralised it is likely that “horizontal” governance, the linkages to partnerships via networks will take place at a higher level, between management committee and management committee. International experience shows that if management of the Hub is devolved down to the level of scientific themes or agendas it is likely that horizontal linkages within the network will dominate at that level, and this is particularly important in terms of building strong research partnerships and knowledge flows within a centre of excellence (Figure 6 overleaf).\(^1\)

Transactions within networks tend to be more efficient and benefits and burdens more equitably negotiated if relationships are made from similar contexts. To reiterate, innovation theory tells us that the strength of a system lies within its capacity to learn, build competencies and share information, which in turn depends on how well the constituent nodes interact with each other. Therefore, what is most important, regardless of the governance structure adopted for the Hub, is that information and resources are encouraged to flow as freely as possible outwith the Hub, within the Network. With this in mind, it is important to implement powerful, pro-active strategies to facilitate that transactional flow, particularly at lower levels within the Network where flows of information may not be as explicit and strategic as they are at the managerial level. Debates about how the Biosciences Facility should be governed should be informed above all else by the fundamental necessity to facilitate transfers of information, assets, resources, and ideas within all the constituent nodes of the Facility and its partners.

**Mechanisms for Governing and Strengthening Associated Networks**

The type of mechanisms that can be used to strengthen networks and build strong, sustainable and resource-rich relationships between the Hub and the Network are varied. It is perhaps here that we will have to be at our most innovative in discussing suitable solutions and mechanisms as the region, and the Facility, are unique in terms of biosciences for a number of reasons:

- The large number of countries involved;
- The wide range of research institutions in the region;
- The important role NGOs play in biotechnological development;
- The complex set of issues and problems that must be grappled with;
- The relative lack of resources that many partners suffer from.

If one turns to the international experience there are not many – if any – examples of a single Hub and Network potentially supporting such a wide range of biotechnological research in such an environmentally discontiguous region across such a number of countries. We can perhaps proffer some examples of mechanisms that may mediate information, resources and relationships in the ways we seek.
Figure 6  Governance options for ‘Associated Networks.’ (The broken lined boxes represent ways in which the Hub-Network relationships can be mediated)
Figure 7 illustrates three foci for managing Hub – Network relationships, information, resources and institutional. These ideas are drawn from a wide range of sources and may or may not work in this situation. Nevertheless, their inclusion gives us a point of departure when we begin to think about these conceptual and concrete issues. Again, what particular focus dominates will probably depend on how the central management of the Hub is determined. Again, this is no blueprint, but is a means for stimulating debate.

Option 1 – Focus on information
- Country representatives regularly meet at the Hub
- I.T. and internet resources utilised to share information
- Broad stakeholder committee could meet periodically
- Research themes could drive ‘virtual’ research communities

Option 2 – Focus on resources
- Grants, internships, sabbaticals and training could all be used to ensure stakeholders from all countries participate
- Priority could be given to projects with a cross-border focus and research input
- Subsidies could operate to encourage use of the labs (reduced bench fees, for example)

Option 3 – Focus on institution
- Geographical and partner inclusiveness of systems of governance
- A revolving place could exist within systems of governance for a country rep (every 6 months?)
- Priority setting around equipping of labs could prioritise equipment that would encourage stakeholder partnerships
- Hub-Network relationships could become another cross-cutting theme
- ‘Membership’ of the Facility through an access card, membership privileges

Figure 7 Some options for managing Hub – Network relationships
VI Conclusions
It is the intention that this background paper will stimulate debate and
discussion around governance issues during the consultative workshop and
the consultation phase of the Biosciences Facility for Eastern and Central
Africa. The intent of the paper was firstly, to provide some theoretical
grounding to debates of governance, innovation and development in order to
inform our thinking as we grapple with issues of governance. Secondly, to
provide some ideas from the international experience of scientific centres of
excellence. And thirdly, to provide one or two governance options that can be
rejected or refined during the process of defining appropriate structures for the
Biosciences Facility.

There are perhaps three key points that can be drawn out of this paper:

- Firstly, we need to understand science, innovation and development in
  their broadest senses in order to build institutions that are responses to
  the failings of previous institutions in the region;
- Secondly, we need to understand key issues in order to inform the kind
  of governance we want: what are the regional needs in terms of
  agricultural research and innovation, what resources do we have
  access to and what do we need, and how can we utilise these
  resources to best advantage;
- Finally, we need to understand that systems of governance and
  management are not set in stone, they are iterative. The *raison d’être*
  of governance systems is to facilitate. To facilitate research, innovation
  and information flows, and to facilitate science engaging fully with
  society.

Given the role of the Bioscience Facility as the first NEPAD-sponsored centre
of excellence it is clear that the facility will act as both a beacon and a blue
print for the implementation of further African centres of excellence across a
range of disciplines. It is the hope that this paper will be part of an ongoing
process of conceptualising, conceiving, implementing and documenting
scientific governance structures in an African context. It is clear that effective
governance is central to the ways in which science is utilised in the continent,
and recent experience has served to highlight how crucial strategic, apolitical,
informed decision-making is in the governance of science. It is hoped that
these debates will not only be confined to the management of centres of
excellence but are absorbed into decision-making within society more broadly.
Appendix 1: List of Acronyms

ASARECA  Association for Strengthening Agricultural Research in East and Central Africa
BBSRC  The Biotechnology and Biological Sciences Research Council
BH  Biocentrum Helsinki
CMB  Centre Management Board
CME  Centre Management Executive
CGIAR  The Consultative Group for International Agricultural Research
DFID  Department for International Development (UK)
ILRI  International Livestock Research Institute
JIC  John Innes Centre
KARI  Kenyan Agricultural Research Institute
NARS  National Agricultural Research Systems
NCE  Networks of Centres of Excellence
NEPAD  New Partnership for African Development
NGO  Non-governmental Organisation
UK  United Kingdom
USAID  United States Agency for International Development
WSSD  World Summit on Sustainable Development

and Deeds, D. L., 2000: An analysis of the critical role of public science in innovation: the
6 See for example, the Initiative on Public-Private Partnerships for Health.
http://www.ippph.org/index.cfm
7 NEPAD, 2002, 8.
8 For example, Bond, P., 2002: Unsustainable South Africa: Environment, Development, 
Social Process, University of Natal Press, Durban, highlights examples of partnerships not
performing for the public good in a South African context.
9 Intarakamnerd, P. et al., 2001: National innovation systems in less successful developing
countries: the case of Thailand, paper presented at the DRUID Conference, Aalborg, 
Denmark, June 12-15.
10 Hall, A. J., Yoganand, B., Crouch, J. H. and Clark, N. G., 2003: The evolving culture of 
science in the Consultative Group on International Agricultural Research [CGIAR]: concepts 
for building a new architecture of innovation in agri-biotechnology.
11 Etzkowitz, H. and Leydesdorff, L., 2000: The dynamics of innovation: from National 
Systems and “Mode 2” to a Triple Helix of university – industry – government relations, 
Research Policy, 29, 109-123.
12 Hall, A., Sulaiman, V.R., Clark, N. and Yoganand, B., 2003: From measuring impact to 
learning institutional lessons: an innovation systems perspective on improving the 
management of international agricultural research, Agricultural Systems, 78, 213-241. Adeoti, 
J. and Adeoti, A., 2003: Biotechnology R&D partnerships for industrial innovation in Nigeria, 
Technovation.
13 UNCTAD, 1996: UNCTAD’s Science, Technology and Innovation Policy Reviews (STIP), 
Science and Public Policy, 23, (6), 385-90, 5-6.
14 Gibbons, M., Nowotny, H., Limoges, C., Trow, M., Schwartzman, S. and Scott, P., 1994: 
The New Production of Knowledge: The Dynamics of Science and Research in Contemporary 
Societies, Sage, London.
15 Horton, D. and Mackay, R., 2003: Using evaluation to enhance institutional learning and 
change: recent experiences with agricultural research and development, Agricultural 
Systems, 78, 127-142.
16 For example, see Machlup, F., 1962: The Production and Distribution of Knowledge in the 
United States, Princeton UP, Princeton.
17 For a detailed discussion of this point see Clark and Juma (1992)
18 Chiesa, V., 1995: Globalizing R&D around centres of excellence, Long Range Planning, 
28(6), 19-28.
19 For example, see Mugabe, J., 2003: Centers of Excellence in Science and Technology for 
Africa’s Sustainable Development, Nepad Science and Technology Secretariat, Pretoria.
Research: Aims and Practises in 17 countries and Regions, The Academy of Finland, 
Helsinki.
Biotechnology: Priorities for Agricultural Research.
23 Please note that this is not an exhaustive or definitive list, it is merely a broadly brushed 
sketch to provoke discussion.
24 Mugabe, 2003, 1.
27 The case studies were drawn after going through the Finnish study, Centre of Excellence 
Policies in Research: Aims and Practices in 17 Countries and Regions, a study which 
focused on Europe, Canada and East Asia. Latin American case studies such as the 
National Research Center for Agrobiology in Brazil and the Centro Internacional de Fisica 
Edificio de Programas Especiales “Manuel Ancizar” Ciudad Universitaria of Colombia and 
African case studies such as the National Research Center of Egypt and the National 
Mathematical Center of Nigeria were also looked at but a lack of explicit, available data about 
governance structures and the particular relevance of the case studies that were used 
precluded their detailed analysis at this stage.
The Biotechnology and Biological Sciences Research Council (BBSRC), a UK Government body, awarded the initial start up grant and limited running costs.

Governing Council members are nominated by the University of East Anglia, The John Innes Foundation (a charitable foundation that provided fund for the research costs of a predecessor institution in the 1940s), and the BBSRC.


Academy of Finland, 1999: Finnish Programme for Centres of Excellence in Research, Erweko Painotoute Oy, Helsinki.


University of Helsinki, 2001: Practices and Procedures, Biocenter 1, University of Helsinki.

These themes are fairly arbitrary at the moment and have been based on the discussion held at the workshop thus far.