A Framework for Comparative Analysis of National Knowledge Networks in UK and India

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Abstract

Recognizing that national competitiveness depends on the availability and quality of national Information and Communication Technology networks that support higher education (HE) and research, many countries have developed such infrastructure for their publicly funded HE and research institutes. The National Knowledge Network (NKN), India set up in 2009-10, and the Joint Academic Network (JANET), UK set up in 1984 are examples. These national knowledge networks are embedded within the larger context of HE and research institutions and ICT infrastructure in the country. For an emerging economy like India, effectiveness of NKN is important as resource availability for investment in such a network has to compete with other developmental priorities. A Joint Information Systems Committee (JISC) was set up in 1993 with the objective of overseeing ICT in HE and research and managing JANET. In comparison to JANET, set up in 1984, NKN set up in 2009-10 is still at an early stage. However, it is an opportune time to review its effectiveness as it has a huge potential for all educational and research organizations in India. The evolution of JANET/JISC, not only in terms of the technical capability, but also its organizational form would be of importance to researchers and policy makers in India to formulate the implications for NKN. Towards this end, in this study we develop a framework for analysing elements that have contributed JANET/JISC to support HE and research. These include rationale, objectives, organizational structure and processes, funding, pricing, outcomes and review mechanisms. We also aim to suggest possible learning from this for NKN. This would have implications for other countries planning similar infrastructure.

Key Words: National Knowledge Network; Joint Academic Network; Joint Information Systems Committee; Comparative Analysis

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Background and Objectives of the Study

Research and Development (R&D) at the national level is a measure of competitiveness of the economy. It is increasingly being done in distributed teams across geographically disparate locations, often across national boundaries. Information and Communication Technology (ICT) networks have become an integral and critical part of this. Higher Education (HE) sector is a key contributor to R&D. Recognizing that national competitiveness depends on the availability and quality of national ICT networks, many countries have developed such infrastructure for their publicly funded HE and research institutes. The National Knowledge Network (NKN), India and the Joint Academic Network (JANET), UK are examples. These national knowledge networks are embedded within the larger context of HE and research institutions and ICT infrastructure in the country. For an emerging economy like India, effectiveness of NKN is important as resource availability for investment in such a network has to compete with other developmental priorities.

A Joint Information Systems Committee (JISC) was set up in 1993 with the objective of overseeing ICT in HE and research and managing JANET. In comparison to JANET, set up in 1984, NKN set up in 2009-10 is still at an early stage. However, it is an opportune time to review its effectiveness as it has a huge potential for all educational and research organizations in India. The evolution of JANET/JISC, not only in terms of the technical capability, but also its organizational form would be of importance to researchers and policy makers in India to formulate the implications for NKN.

Towards this end, in this study we develop a framework for analysing elements that have contributed JANET/JISC to support HE and research. These include rationale, objectives, organizational structure and processes, funding, pricing, outcomes and review mechanisms. We examine outcomes in terms of coverage and types of services. We also aim to suggest possible learning from this for NKN. This would have implications for other countries planning similar infrastructure.

Background

We examine the national knowledge networks within the institutional context of higher education and research and national ICT infrastructure, both in UK and India.

Institutional Context of HE and Research

UK[1]

Higher Education

In UK, almost all HE institutions were funded by the government. They were two private universities (the charitable University of Buckingham and The University of Law) where the government did not subsidize the tuition fees. There were 160 universities and colleges in the UK that awarded a wide variety of degrees. There were also over 700 colleges and other institutions that did not have degree-awarding powers but provided complete courses leading to recognized UK degrees. Some of the institutes of Further Education (FE) could award their own 'foundation degrees' (Baskerville, et. al., 2011).

The Higher Education Funding Council for England (HEFCE) funded universities and colleges. HEFCE was a quasi-autonomous non-governmental organization[2] under the Department for Business and Innovation, United Kingdom ("Higher Education Funding Council for England", 2015).

Research

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[1] Major parts of this section have been excerpted from
http://www.ucs.ac.uk/Courses/TeachingandLearning/DiplomaSupplement/DescriptionofHigherEducation.aspx, http://en.wikipedia.org/wiki/Universities_in_the_United_Kingdom,
http://en.wikipedia.org/wiki/Research_Council?, and http://www.educationuk.org/india/articles/higher-education-universities-colleges/, accessed on August 4, 2014

[2] NDPBs are not an integral part of any government department and carry out their work at arm's length from ministers, although ministers are ultimately responsible to Parliament for the activities of bodies sponsored by their department. (Source: http://en.wikipedia.org/wiki/Non-departmental_public_body, accessed on March 20, 2015).

The UK government had set up and funded seven Research Councils for coordinating and funding particular areas of research, including the Arts, Humanities, Biotechnology, Engineering and Physical Sciences[3]. The secretariat of the Research Councils UK (RCUK) coordinated across the councils. The main functions of research councils were to fund research, support post-graduate training, support science in society activities. They also collaborated with European and other research facilities for UK researchers to have access to them.

India

The Ministry of Human Resources Development (MHRD) was the nodal ministry that overlooked the policies, institutions and organizations related to education. These include the central universities, 'Institutes of National Importance' such as the Indian Institutes of Technology (IITs), Indian Institutes of Management (IIMs), National Institutes of Technology (NITs), International Institutes of Information Technology (IIITs), National Institute of Technical Teachers Training & Research (NITTTR) and Statutory Councils of India and Research Councils of India.

There were several national-level organizations involved in scientific research. India was in the top 10 countries in the world in terms of R & D investments. About 70 per cent of these investments were made by the government (Bhan, et. al., 2013). Of late, industry's share had steadily increased (Venkatesan, 2009). While several HE institutes had research as an integral part of their agenda, organizations that did just research had also been set-up. For example, research councils in India were publicly funded government organizations that contributed to advanced studies in atomic energy, defence, agriculture, medical, social sciences and history.

The HE system had more than 700 universities and 35,000 colleges (Deloitte, 2013). Despite these large numbers, there were few high quality research and educational institutes. As in many other emerging economies, there was high disparity in access across states, gender and community. These inequities tended to get accentuated with the increasing role of ICT in HE

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[3] Excerpted from http://www.rcuk.ac.uk/about/aboutrcs/, accessed on January 20, 2014

both on the dimensions of access to technology and in having the requisite skills to exploit the technology.

Objectives

We develop a framework for analysing elements that have contributed JANET/JISC to support HE and research. These include rationale, objectives, organizational structure and processes, funding, pricing, outcomes and review mechanisms. We also aim to suggest possible learning from this for NKN. This would have implications for other countries planning similar infrastructure.

Methodology

Our study is based on primary and secondary sources of data. We collected qualitative data based on focus group discussions (FGDs) and detailed individual interviews. In the UK, we visited one research and four educational institutes and the JANET office. We visited three research and six educational institutes and two NKN offices in India. These are given below. We also examined relevant background documents and reports on JANET/JISC and NKN.

UK

- JANET Office: ESRC Shared Services Facility, Swindon

- Research institutes: Advanced Forming Research Centre, University of Strathclyde, Glasgow

- Educational institutes:
  1. Goldsmiths University of London, London
  2. The Glasgow School of Art, Glasgow
  3. University of Highlands and Islands, Inverness, Scotland
  4. University of Strathclyde, Glasgow

India

- NIC-NKN Offices:
  1. NKN Point of Presence (PoP), Belapur, Navi Mumbai
  2. NKN-NIC Office, New Delhi

- Research institutes
  1. Council of Scientific and Industrial Research (CSIR), New Delhi
  2. Saha Institute of Nuclear Physics (SINP), Kolkata
  3. Tata Institute of Research (TIFR), Mumbai

- Educational institutes
  1. All India Institute of Medical Sciences (AIIMS), New Delhi
  2. Indian Institute of Management Ahmedabad (IIMA), Ahmedabad
  3. Indian Institute of Management Calcutta (IIMC), Kolkata
  4. Indian Institute of Technology Bombay (IITB), Mumbai
  5. Indian Institute of Technology Gandhinagar (IITGN), Gandhinagar
  6. Punjab Engineering College (PEC), Chandigarh

Framework for Comparison

Based on the data from primary and secondary sources, we developed a framework for analysing elements that had contributed JANET/JISC to support HE and research. These include rationale, objectives, organizational structure, processes, funding, resources and outcomes. We examine outcomes in terms of coverage and types of services. Along each of these dimensions, we also compare the corresponding developments in NKN (Table 1).

1. Rationale

A. JANET/JISC

Since the 1970s, many universities had acquired their computing resources and were locally networked. These networks had evolved separately, used different technologies and had a variety of funding mechanisms. JANET began as an initiative in 1983/84 to link up the existing computer systems available at various universities (Wells, 1988).

JANET was created to respond to the needs of universities to share computing resources among themselves. The Computer Board, that oversaw the provision of university computing resources, recommended creation of a single network by transitioning from multiple owners and agencies to a single network. The cost of this network was not to be more than the disparate networks (Wells, 1988).

JANET connected the various entities using eight switching centres. The leased lines were provided by BT and the switching hardware and software was provided by GEC. A small group of people had oversight of running JANET and liaising both with GEC and BT for operational issues and maintenance (Wells, 1988).

Over a period of time JANET was upgraded to a fibre-optic network running over IP. In Janet6, the latest version of JANET, as at the time of writing, had a core speed of 2Tbits/s (https://www.ja.net/). Its support included video conferencing and video streaming facility for distant education, and linking large data storage, and high performance computing for researchers. It is linked to GEANT – the European network and other international networks ("JANET", 2015).

B. NKN

The key ICT infrastructure at the national level in HE was provided by the MHRD and Department of Electronics & Information Technology (DeitY), Ministry of Communications and Information Technology. The National Informatics Centre (NIC-About us, n.d.), under DeitY, had set-up the largest public network – NICNET. The network provided connectivity and applications to the ministries/departments of the central, state and district administrations. Education and Research Network (ERNET-About us, n.d.), under the DeitY, supported public research and educational institutes.

The MHRD had launched a mission "to provide connectivity, content and low-cost devices to all institutes of higher learning" through various initiatives (MHRD-National Mission in Education through ICT, n.d.). These included an education portal, video servers for hosting educational content at IIT Madras, and virtual labs that allowed sharing of costly equipment

across the country and access in rural areas. Several institutes such as Indira Gandhi National Open University, IIT Bombay (IITB), IIT Kanpur (IITK) had used a variety of network technologies to offer distance learning programs.

Considering the magnitude of the challenge to build quality institutions with requisite research facilities, the National Knowledge Commission (NKC) recommended setting up an extremely high capacity connectivity across the existing institutes so that academic outputs such as coursework, expertise, ideas, innovations, equipment and facilities amongst them could be shared. This was to be called the National Knowledge Network (NKN). This would require connectivity of around 5,000 points (NKC, 2006-09). The idea of setting up the NKN was driven by various developments such as:

i.   National e-governance plan that envisaged provision of e-government services through community service centres in all nearly 6,00,000 villages. It also envisaged setting up of state data centres that would hold all citizen data related to public delivery of services and the aim to connecting the state data centres.

ii. Making distance education for schools and colleges a reality through high-speed and adequate bandwidth at the national level.

iii. Research institutes could get directly connected without having to be concerned about who would pay the cost of connectivity.

Besides having the aim of connecting the 1,500 educational and research institutes, the NKN had come up with the concept of 'model projects' with a view to encourage the usage of the network. These were projects that specifically made a case for high-bandwidth or computational resources and were of national importance.

The NIC considered the option of just being a backbone provider and allowing organizations to join voluntarily. But this could take a long time, so the NIC decided to put its routers in various institutes so that they could immediately get connected. The NIC chose three public sectors/entities, namely Bharat Sanchar Nigam Limited (BSNL), RailTel Corporation of India Limited (RCIL) and Power Grid Corporation of India Ltd (PGCIL) for providing the bandwidth. Using more than one bandwidth supplier allowed the NIC to have redundancy

and consequently a high-reliability network. It was felt that in comparison to the private sector, the public-sector units would bring down the cost of the network.

NKN provides multiple 2.5/10 G and progressively 40/100 Gbps in the core. The institutions connect to it at gigabit speed. Its support included virtual classrooms for distant education, and linking research institutions for computationally intensive projects.

2. Objectives

A. JANET/JISC

Objectives of JISC included promotion, adoption and effective usage of ICT to support learning, research and management of institutions. JISC had to ensure that it continued to improve its own working practices and support the engagement of institutions with the wider community ("JISC", 2015).

B. NKN

NKN articulated its objectives as bringing together various institutions from the fields of science, technology, HE, healthcare, agriculture and governance to a common platform on a high speed and low latency gigabit platform. This would facilitate knowledge sharing, collaborative research, development, advanced distance education in specialized fields such as engineering, medicine etc., and e-governance.

3. Organizational Structure and Processes

A. JANET/JISC

At the time of creation of the higher education funding councils of England, Scotland and Wales, the Secretaries of State suggested creation of a common committee to oversee the deployment and usage of ICT in HE and research. This led to the formation of Joint Information Systems Committee (JISC) on April 1, 1993. The scope of JISC included overseeing ICT in HE and RCUK and managing JANET (Wells, 1988).

In order to address the common needs of a newly formed network, JISC had committees for

- Authentication and Security
- Electronic Information
- Integrated Environments for Learners
- Awareness, Liaison and Training
- Networking (Wells, 1988)

In 1994, JISC began the e-library program as a response to the increasing requirement of digitalization of libraries. Support for further education institutes through regional support centres was implemented.

Consequent to the expansion of number of institutions covered, a review of JISC led to the restructuring of the governance mechanisms. JISC works under a Memorandum of Understanding with the four UK HE funding bodies. The new structure envisaged a JISC Board, with a Steering Committee advising it. The JISC Board identifies the scope of JISC activities, keeping in mind the priorities of HE and research communities. The Steering Committee had representation from senior members from the Funding Councils. The various sub-committees covered the strategy and policy areas across the communities they served – research, teaching and learning and also covered management. The functional aspects covered networking, information environment and content acquisition ("JISC", 2015; "JISC Collections", 2015; Review of the Joint Information Systems Committee, 2011).

On January 1, 2003 JISC Collections was set up as a mutual trading company in order to be able to negotiate licence agreements centrally with publishers and owners of digital content. This would enable it to offer online resources for education and research at lower costs than individual organizations doing it separately. Important aspects managed by JISC was the developing a system for evaluation of quality, centralized negotiation and national licensing. This enabled the institutions it served to have not only low cost access but also to widen access to resources, and improve management of licensing.

The Board of JISC was made up of professionals in the HE and FE sector and was supported by various sub-committees. Over time the governance structure had evolved to include the following ("JISC", 2015):

- JISC Organisational Support committee (JOS): helped managers and administrators in user institutes to identify JISC resources they could leverage.
- JISC Infrastructure and Resources committee (JIR); was responsible for cost-effective provisioning of shared network resources and infrastructure.
- JISC Learning and Teaching committee (JLT): provided support to user institutes for supporting innovations in learning and teaching.
- JISC Support of Research Committee (JSR): supported researchers, especially for data storage and retrieval.
- The Chairs Committee: provided coordination across the above committees and had representation from the chairs of these sub-committees, the chair and deputy chair of the Board, and JISC Executive senior managers. ("JISC", 2015; Review of the Joint Information Systems Committee, 2011).

JISC had a subsidiary company: JISC Collections and JANET Limited. JISC Collections and JANET are two subdivisions of the subsidiary.

While there were periodic reviews of JISC, the latest one in 2011 (Review of the Joint Information Systems Committee, 2011) brought about significant changes. While recognizing that JISC was a national asset and provided a competitive edge to UK HE and research, it recommended that going forward, JISC would have to refocus its strategy. It needed to create greater impact on the sectors under it and be responsive to the underlying priorities in areas of research, teaching, and management and administration. Further, it should showcase best practices and engage with institutions in ICT strategy, provide thought leadership in emerging areas through a JISC Futures Lab and rationalize the current portfolio of services. It would have to consider alternate funding options such as a combination of grants and subscription based charging. JISC would have to be cognizant that HE or research institutions could opt of such a model, reducing revenues for JISC. On the other hand, it could become more community oriented by focusing only those services that were demanded. JISC also needed to streamline its internal structures.

JISC became a company on August 1, 2012 and was registered as a charity in UK (http://www.jisc.ac.uk/). This was done to bring together the variety of services it offered and remove it from direct control of HE and FE. Despite JISC being set up as a company, it operated within the government framework of costs, recruitment, marketing and so on.

Subsequent to the review, the primary areas of focus for JISC were identified as Infrastructure and Services, Data Content and Services and JISC Futures/Solutions Services ("JISC", 2015).

B. NKN

The NKN was conceived by the Principal Scientific Advisor to the Government of India, and the National Knowledge Commission. To establish the NKN, the Government of India (GoI) constituted a high-level committee (HLC), to provide the organizational structure and blueprint for NKN. The NKN had a wide representation from the academic and research community. The NIC, a government agency under the DeitY responsible for designing and implementing systems and applications for the government was designated as the implementing agency for the NKN. The HLC set up the Technical Advisory Committee (TAC) to design the NKN (http://www.nkn.in/).

- **High Level Committee (HLC):** The HLC acts as the enabling agency for the implementation of the NKN. HLC also coordinates and monitors the activities pertaining to the NKN.
- **Executive Committee:** The Executive Committee was responsible for taking decisions on implementation issues.
- **Technical Advisory Committee (TAC):** Its role has been to design NKN architecture
- **The Security Advisory Committee**: to advise on the security aspects
- **Model Projects Evaluation Committee**: to evaluate the model projects (http://www.nkn.in/).

4. Funding

A. JANET/JISC

At the time of creation of JANET, its capital and operational expenses were to be paid by the Computer Board, that was responsible for funding University Computing Services. The Research Councils would supplement the funding. There was no accounting for usage or charging (Wells, 1988).

The funding mechanism for HE, research council and polytechnics varied as they came under different jurisdictions. The University Grants Commission funded universities, the Advisory Board of Research Councils funded the RCUK and the Local Education Authorities funded the Polytechnics. Although all three types of institutions were funded by the Department of Education and Sciences, the differences in routing options for funding created initial issues about creation and operations of JANET (Wells, 1988).

In a situation of reduced overall public funding, JISC funding has reduced over the years. There has been an increasing focus on sustainability. This has led the funding model to be more subscription driven. This was expected to drive operational efficiencies within JISC and create and strengthen orientation towards needs of the communities it serves. By providing shared services and other centrally negotiated products and services, JISC provides cost savings to its users which more than compensate them for the subscriptions. Over time, with changes in the HE and FE sectors, besides funding from HE and FE Councils (80%), JISC was funded through subscriptions and charges to institutions (20%).

B. NKN

NKN was totally funded by the GoI. The user institutes did not have to pay any charges for using the NKN network and resources.

5. Outcomes

A. *JANET/JISC*

Coverage: JANET covered all HE and FE institutions. It had also started providing connectivity to schools. Its services included (https://www.ja.net/ and http://www.jisc.ac.uk/):

- Single sign-on shared services such as eduroam and library resources access.
- Advisory Services on IT resources procurement, deployment and use in HE
- Upgradation of JANET to have state-of-the-art bandwidth and speed.
- Connectivity to high speed international networks such as GEANT
- Support for GRID technologies and hence greater computational power
- International agreements with a number of countries such as Germany, Denmark and Netherlands for creating knowledge exchanges
- Digitization of resources of national importance
- Make research data electronically available and searchable
- Centrally negotiated free cloud services to HE institutions through Google Apps
- Shared data centre for research
- Connectivity to London Internet Exchange, increasing the response time for access across universities
- Support to HE for adopting on-line virtual resources and distance learning
- Focus on security and privacy of data and the associated legal issues.

The UK government set up "UK Shared Business Services Ltd (UK SBS), formerly RCUK Shared Services Centre, in helping the research councils reduce spend on administration. It is a separate legal entity owned by its public-sector customers – including the seven UK research councils, providing shared services in HR, finance, procurement and IT and grants support through management of the Joint Electronic Submission (Je-S) service for grants, studentships and fellowships."[4]

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[4] Excerpted from http://www.rcuk.ac.uk/funding/grantsprocess/, accessed on January 20, 2014

B. NKN

As of March 31, 2014, of the 1,500 target institutions, 1,182 government research and educational institutions had been connected including the Council of Scientific and Industrial Research (CSIR), Tata Institute of Fundamental Research (TIFR), institutes of national importance, state universities, central universities and several government bodies. The NKN had funded almost 20 model projects, out of which seven projects had been completed (http://www.nkn.in/). Although the NKN had connected a large number of institutes, we found out that not many individuals in these institutes were aware of its availability or had leveraged it to the maximum extent possible for academic purposes. Those who had made the most effective use of NKN were the ones who either already had some applications that required greater or lower cost bandwidth than what they had (IITB distance learning and e-Foundry) or were planning some applications but could not implement that due to lack of availability of high-end compute grid infrastructure which was available over NKN (CSIR-OSDD) (http://www.nkn.in/).

Resources

1. High speed gigabit network
2. GRID Computing
3. Support for Model projects of national importance: LHC
4. Development of some domain specific networks and platforms Bio/cheminformatics, brain and cancer grid
5. Distance learning and education infrastructure

Analysis

Comparing JANET and NKN is premature as JANET has been in operation since 1984 and NKN since 2009-10. However some aspects of organization structure, funding and strategy may have lessons for NKN as it evolves. Table 1 gives a broad overview of the dimensions of comparison. In the following we elaborate on the identified dimensions.

Rationale

JANET was conceived based on user requirements of wishing to share resources and creating opportunities for distance education. NKN was a top down initiative, without a pull factor from a large number of institutes. It may be argued that in emerging economies, such as India, many user institutes may not be aware of the benefits of such a high speed computational intensive network and were therefore, precluding themselves from participating in activities that leveraged such resources. Therefore, provision of such networks in these institutes would require sensitivity and awareness training and creation of appropriate organizational mechanisms at user institutes to exploit this resource. In turn, it would mean that NKN would require to have a mechanism that could support such initiative. In the early years of JISC, the Committee on Awareness, Liaison and Training provided support for this. NKN has been bringing awareness through road shows, workshops and conferences. While these are good opportunities, it would need to also a systematic on-going mechanism to address this aspect through an established committee for the same.

Objectives

In comparison to the objectives of JISC, NKN had a more limited scope. The latter did not have a mandate to cover the management aspects of HE and research institutions. Further, there was no specific mandate regarding managing costs effectively. While there was an orientation in managing costs, by relying on PSUs to provide bandwidth, as it was claimed that they could provide lower cost bandwidth. However, competitive bidding for this could have ensured better accountability on this dimension.

While JISC had seen service provision as an integral part of its mandate, NKN had seen its role as that of a network infrastructure provider. Support for model projects indicated some service orientation, but here too, the support was limited to providing bandwidth and computation power through GRID computing. On the other hand, JISC provided domain specific services and tools.

Organizational Structure and Processes

JANET's organization structure has evolved to respond to the changing needs of the communities it served and policy changes in the HE and FE domains. The formation of JISC in 1993 and its oversight over JANET indicated the need for a centralized entity to oversee ICT deployments across HE and research. Various changes to the internal structures and setting up of different organizational forms such as JISC Collections and a not-for-profit enterprise for JISC indicates the orientation that changing strategy requires changing organizational structures. The changes have been based on a number of dimensions: recognition of separate role for networks and services, responsiveness to different communities, creating value addition through shared services.

Since JISC was established by the funding councils in HE and FE, an orientation to cost effectiveness in public funding was likely to be embedded in the implementation of JANET.

Separation of Networks and Services

JISC recognized that there were two parts to supporting the HE and research. The first part was the high speed and quality network infrastructure and the second part was services. While the network infrastructure and some services were identified as common requirements across its constituency, others were specific to the communities. JISCs organizational structure reflected this. The separation of JISC and JANET was an example of this. Further, setting up JISC Collection as a means to focus on digital content. In contrast, NKN has viewed itself as an infrastructure provider, with little emphasis on services.

Responsiveness to User Constituencies

Early on, the formation of various subcommittees of JISC indicated a focus on common services (such as Authentication and Security), teaching (JCIEL), awareness creation and establishing the network. In the initial years, JISC did not have a strong explicit focus on supporting research.

As the usage increased and the HE environment changed to greater acceptance of networking resources, JISC's focus shifted to include e-libraries as a common resource. The sub-committees of JISC also changed to reflect the need to support research as well.

The setting up of JISC Collections as a separate company recognized the importance of digital content in furthering HE and research. Since individual colleges and universities may not have been to negotiate with publishers as they have an upper hand due to the demand for content, pooling the requirements enabled cost effective solutions. While this could have been done by any other centralized committee that oversaw administration of HE and research, JISC had the technical expertise to leverage the distribution of a centralized resource. Further, when such digital content is made centrally available, it helps to increase the usage of the network.

JISC has provided support to research communities, not only through the high bandwidth network connected internationally, but also through creation of shared data centres, domain specific project infrastructure, availability of survey maps, etc.

The composition of the JISC Board and NKN HLC both represented the underlying communities they were to serve. Whereas JISC has specific committees to oversee the interests of different communities, in NKN, the representation of different stakeholders was limited to the HLC.

The subsequent creation of JISC as a company highlighted the perspective that there was a need for JISC to function outside the government framework and have a management orientation. The reorientation of focus areas also reflected the responsiveness to its review and sensitivity to the larger environment of public policy regarding funding of HE and research.

Shared Services

Examples of providing shared services include the common licensing for digital content through JISC Collections and Shared Business Services UK, a public-sector company providing shared IT services to a number of public entities, including the research councils.

Funding

Since HE and Research Councils are publicly funded, there have been periodic reviews of JISC. These have led to organizational restructuring and changes in the orientation. JISC had been responsive to the changing policy environment of HE in UK, as for example when some FE institutions transitioned to become HE institutions. It also had to respond to the cuts in public spending by implementing alternate models of funding and bringing in cost effectiveness in its operations. This orientation is also a part of its objectives.

In India, as in many other emerging economies, the low resource base of many user institutes would preclude them from paying for its services. However, there are several institutes who do not have this resource crunch. Such institutes could pay. Such a mechanism would ensure that NKN provided cost effective infrastructure and services, as otherwise these institutes could get such services from other agencies.

Pricing

Although initially, JISC user institutes did not have to pay, subsequent to the review in 2011, they have to pay subscription to services. In NKN, user institutes do not pay.

Outcomes

It would be premature to compare JISC's outcomes with those of NKN. Both NKN and JANET have extensive coverage. JISC had more international collaborations and higher speed connectivity. There were several shared tools such as databases, ontologies and digital content repositories and services. NKN had limited availability of such tools and services.

Review Mechanisms

A large part of JISC's outcomes such as provision of services and shared services is driven by its objectives and independent evaluations of the same. For NKN, there were no plans for a

third party evaluation for its effectiveness. In the absence of such mechanisms, a government initiative is unlikely to change its strategic focus or delivery mechanisms. This is true in general of several government initiatives and is not limited to NKN. Most government initiatives do not have evaluation built as a part of design and hence do not provide scope for improvement. But given that ICT networks like NKN are seen as a critical tool to enable India to participate in the knowledge and service economy, there should have been a greater orientation to assess its effectiveness.

Summary and Conclusions

Both JISC and NKN play a very important role in supporting national ICT networks. A broader scope for NKN that includes service provision and greater responsiveness to the underlying HE and research communities that it serves would enable NKN to be more effective. It is important that such critical national ICT infrastructure has an evaluation of its effectiveness, built as a part of its design. This will enable NKN to evolve in a manner that it supports Indian HE and research to be more competitive.

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Table 1 Framework for Comparison of JISC and NKN

	Dimension	JISC	NKN
1	Rationale	Largely user driven	Largely driven by high level policy makers
2	Objectives	a. Extensive: Cover all public institutions b. Wide: Besides academic activities of education and research, covers management support and JISC's cost effectiveness	a. Extensive: Cover all public institutions b. Covers only academic activities of education and research
3	Organizational Structure and Processes	Multi-dimensional: provides for a. both network infrastructure and services b. responsive to user communities c. shared services	Narrow: a. covers only network infrastructure b. User communities represented only at the highest level
4	Funding	User Communities (through the HE and FE Councils and related government departments Now shifted to part grants and part subscription by user institutes	Funded by the GoI
5	Pricing	Of late, user institutes have to pay subscription charges	User Institutes do not pay
6	Outcomes	a. Coverage: Wide coverage of - HE and research institutions - Extended to FE and schools b. Types of services: - Diverse and suited to specific communities - Common: shared subscriptions to digital content, databases, ontologies and domain specific requirements)	Coverage: Connectivity provided to a large number of HE and research institutions, however, adoption and exploitation is low User Institutes expected to develop on their own
7	Review Mechanism	Periodic	None, built as a part of design

Source: Authors' analysis