

## The role of Social Capital in the Integration of Health Information Systems

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**Abstract:** In recent times, the agenda of strengthening ICTs mediated integration of Health Information Systems (HIS) has been emphasized in research and practice of health reforms in both developed and developing countries. However, its realization remains to be challenging especially in the context of developing countries. The paper presents a case study from Gujarat state of India describing the efforts of a HIS project to implement an integrated computerized system to manage the routine health information. A central argument in this paper is on the role that social capital plays in the process of building such a system, and also the role of ICTs in building such social capital.

**Key words:** Health information system. HIS integration. Social capital, social networking

## **The role of Social Capital in the Integration of Health Information Systems**

### **1 Introduction**

In recent times, the agenda of integration of health information systems (HIS) has been emphasized both in research and practice of health reforms in both developed and developing countries (Health Metrics Network 2008). As a result, the identification of 'best' practices has been observed taking the attention of contemporary HIS researchers. While integration in simple terms refers to the linking of various disparate systems and associated practices, its importance is emphasized by the adverse effects of fragmented HIS with respect to data quality, utilization of resources, and the adoption of a coherent and comprehensive health systems approach to health reforms. Integration may not always be the most efficient approach, as there may be particular problems such as the management of epidemics which may be more suited to a management approach around vertical programs rather than a district based geographical area focused approach as advocated by the primary health care model. This then raises the questions of what should be integrated, how and by whom. However, this paper is not thematized to respond to this question. Rather, we focus on how trust, social relation and networking may contribute for integration efforts.

The dominant approach to the research and the practice of HIS integration remains largely technology focused, concerning how newer and more modern technologies can be applied to address hitherto unaddressed fragmentation challenges. So, we tend to find different types of technologies at different points of time such as Enterprise Resource Planning systems, Service Oriented Architectures, Web-based systems, and in the health domain, Electronic Patient Record systems being tried out as tools for spearheading integration initiatives. The unrealized potential of such technology focused initiatives have led research to also focus on the social and political determinants of integration initiatives (see for example, Chilundo and Aanestad 2003; Aanestad et al. 2005; Smith et al. 2007). As a result, it is increasingly being recognized that integration of information systems in general and HIS in particular, is as much a technical exercise as it is about addressing the institutional, social and political conditions. In continuing with this line of research, this paper analyzes the role of social capital in the integration of HIS in the context of developing countries.

The notion of social capital has its roots in social sciences, and commonly refers to the investments made to build cooperative activities in organizations that have a potential rate of return (Prusak 2001). When we invest in infrastructure, we get infrastructure in return, and in the same vein, when we invest on building social networking, we get more of what makes the infrastructure work in practice and also to enable of the development of the infrastructure itself. Since integration is very much about creating cooperative activities to enable the building of technical and institutional linkages, it is very appropriate to study it within the framework of social capital. We address the following two fold research questions in the context of this paper:

- 1) *How does social capital shape the realization of ICT based HIS efforts in the context of developing countries?*
- 2) *What is the role of ICT in building social capital?*

Empirically, the paper draws upon the study of ongoing efforts of a NGO called HISP India to design, develop and implement integrated HIS in the state of Gujarat in Western India. Specifically, the focus is on understanding the nature and role that social capital plays in the realization of the integration efforts.

The rest of the paper is structured as follows. In the next section, we discuss key concepts around social capital, and the manner in which it has been appropriated in the domain of information systems research. Next, we outline the research methodology employed, followed by a description of the case study. In the analysis and discussion section that follows, we discuss the nature and role of social capital in shaping and being shaped by the integration efforts. Finally, some brief conclusions are presented.

## **2 Social capital and its application in IS research**

One of the founders of the concept of social capital, Pierre Bourdieu (1986), defines the term as “the aggregate of the actual or potential resources which are linked to possess of a durable network of more or less institutionalized relationships of mutual acquaintance and recognition”(pp.248). Husman and Wulf (2004) provides a more elaborate definition, saying: “*Social capital refers to the network ties of goodwill, mutual support, shared languages, shared norms, social trust, and a sense of mutual obligation that people can derive value from. It is understood as the glue that holds together social aggregates such as networks of personal relationships, communities, regions, or even whole nations*” (pp.1). In short they say that: “*Social capital is the value derived from from being a member of a society or community. By being a member, people have access to resources that are not available for nonmembers*” (Husman and Wulf, 2004). Social capital can thus be seen as an important ingredient for knowledge development within and between organizations (Cohen and Prusak 2001), with also potential negative effects if there is a condition of high dependency on the central actor (Uzzi, 1997).

In our research what we found more interesting, and which is not given much emphasis in the social capital discourses, is the value derived from being part of multiple network. Why we used social capital is because of its central focus on ‘trust’ but not much of authority. However, we argue that this trust gained through being part of multiple networks is the source of power and authority for the institutional entrepreneur who wants to bring change let's say in organization.

Nahapiet and Ghoshal (1998) identified three analytical dimensions of social capital: structural; relational; and the cognitive. The structural dimension refers to the overall pattern of connections between actors, who you reach and how. The presence or absence of network

ties among or between actors is a key facet of this dimension. When connection and interaction between members of the network gets stronger, other individuals are more likely to be involved Chou and Chang (2008). The relational dimension focuses on the particular relations people have, such as respect and friendship, that influence their behaviour. Trust and trustworthiness are key facets of this dimension. The cognitive dimension refers to those resources providing shared representations, interpretations and systems of meaning among parties. This framework has been applied by various researchers. For example, Martin et al (2005) adopted it to evaluate relational computer based change management initiatives.

The concept of social capital is in recent times also being drawn upon in technology studies and information systems research. For example, Syjann and Kuutti (2004) in their study of a technology mediated hunting dog breeding community, described how technology helped them to generate and maintain trust, acceptance and alignment which was necessary for building successful cooperation. The use of information technology was described by the authors to make the actions of the key actors more visible to each other which in turn facilitated the emergence of trust and social capital. In the same vein of understanding the role of social capital in civic engagement, Blanchard (2004) explored how participating in virtual community affects social capital in a face-to-face community. Drawing empirical material from a Multiple Sport News group virtual community, the authors argued how active participation in the group positively affected face-to-face social capital and norms of trust amongst members in both the virtual and face-to-face groups. As a result, members were seen to be less attached and obligated to the virtual community as compared to the face-to-face.

Quan-Haase and Wellman (2004) argue that unlike determinists who suggest that technology is diminishing or transforming social capital, the Internet is enhancing it. They argued that those who use the Internet also would continue to communicate by phone and through face-to-face encounters. Information technology also can play an important role in knowledge sharing by enabling communication amongst proactive individuals regardless of time and geographic location (Hoof, Ridder and Aukeme, 2004). Social capital, it can thus be inferred, is not only developed by group actions or collective norms but is also enabled through individual characteristics such as the eagerness and proclivity to share.

In summary, information systems research which has drawn upon the concept of social capital has largely focused on how technology mediated interactions contributes to the development or not of social capital and its various constituting aspects. However, what has not been given adequate attention is the constituting and constituted relation between technology and social capital. This implies the need to understand how the technology itself is a function of the existing social capital, and how the interaction between the two reconfigures both the technology and the social capital. This analytical relation is explored in the context of a HIS integration initiative in India.

### **3 Methodology**

The study is framed within an ongoing action research initiative involving the design, development and implementation of HIS within a public health setting in India. Data collection took place through a variety of means. Firstly, the whole process of action research engagement for over a period of 2 years in the state provided us with deep insights into the people involved, their interests, the problems they faced with the existing fragmentation of systems, and what was their visions and expectations of an integrated HIS. For example, we periodically met with the head of the health department to understand the challenges he was experiencing due to the fragmented information channels within the reproductive child health programs, and his vision of developing integrated and cross cutting indicators to allow for more effective monitoring.

To develop more specific insights into the social capital and integration relation, qualitative semi-structured interviews were conducted of key stakeholders. Specifically, we tried to understand the nature of socio-technical challenges to integration, and how they were trying to be addressed by the implementors (HISP India) and the users. The key assumption underlying this inquiry was that integration is a complex phenomenon that is deeply embedded in historically existing technical, institutional and social conditions. This assumption guided us to use largely open-ended questions allowing the respondents to give their views on how they see integration and also the nature of their social networks and interactions around the technology initiative.

Gujarat state, the site for the empirical work, is composed of four hierarchically arranged administrative levels: state, region, district and block. Gujarat has 5 regions, 25 districts, with each having 5-7 blocks. The block is where the computer was placed and where the entire data entry and reporting of all the health facilities in the surrounding catchment area took place. From the block, the aggregated data was sent (either online or manually carried in flash drives) to the district, where further aggregation took place in the online application called District Health Information System (DHIS). The region served as an administrative unit responsible each for 5-6 districts, but where no specific HIS related activities took place. At the region, the person responsible was the “regional program coordinator” (RPC), the “district program coordinator” (DPC) at the district, and the M&E (Monitoring and Evaluation) Assistant or the Block Health Officer (BHO) were responsible at the block.

A series of focussed interviews were carried out with staff from the different levels (see Table below), when we visited each of the regions during the period 4-8, August 2008. During each of these visits, the state level team (including us researchers) the State Director made presentations of the new version of the system, attended to problems the district and block level staff pointed out to, and gave them CDs containing the new system. It was during the breaks of these meetings, interviews were conducted with some of the district and block staff. Listening to the overall interactions between the state and district/block teams also served as very useful sources of data.

<b>District/Block</b>	<b>No. Respondent</b>
Ghandinagar region	1 RPC
Ghandinagar district	1 DPC
Ghandinagar block	1 M & E assistant
Mansa Block	1 BHO and 1 M & E assistant
Baruch District	1 DPC and 1 M & E assistant
Jamanagar corporation	1 M & E assistant

Surat District	1 DPC
Dagen District	1 DPC
Navasari District	1 DPC
Vododra District	1 DPC
Panchmhal District	1 DPC
Amerli District	1 DPC
<b><i>Total Respondents</i></b>	<b>14</b>

Table 1: Number of District and Block respondents

There were various other sources of data. For example, emails written from and to the state and district teams helped to understand specific issues being raised. Emails between the HISP India staff also helped to understand how they were trying to find solutions to the issues of support being raised. Practical engagement of one of the authors in some of the technical tasks such as cleaning up the problems in report generation and solving software bugs further helped to gain insights to the technical challenges to integration.

The data analysis was shaped largely within an interpretive framework, where different aspects of the nature and implications of social capital and its interaction with the integration initiative were inductively interpreted. Both the authors of this paper carried out their respective interpretation and then collectively tried to understand the variations in the interpretations. Subsequently, these interpretations were analyzed in the backdrop of the theoretical construct of social capital and integration to understand the specificity of the findings with the research phenomenon studied.

#### **4 Research setting**

The case is set in the public health system of the state of Gujarat. There are two key actors involved in this research: HISP India, a NGO that was engaged in the design, development and implementation of an integrated HIS for the state; and, the Health department of the state who were the users of the system and the information being generated by the system. Since HISP India was a node in the larger global R&D network established by the University of Oslo, Norway, around HIS (called Health Information Systems Project – HISP) ongoing in about 15 different countries in Africa and Asia, they drew upon the expertise offered by Oslo research and masters students to address particular technical problems (such as for optimizing server performance). HISP India also tried to draw upon “social capital” nationally, especially the personal networks of the President of the organization, for example, in getting friends in local software companies to look at the software code or in getting their advise on establishing software testing protocols.

Gujarat is a state on the west coast of India with an estimated population of about 50 million (as per census India, 2001). The state is in the forefront of economic and infrastructure (including e-infrastructure) development in the country, reflected in the fact that nearly all

district and sub district level health facilities have computers, and there is internet connectivity available down to the sub district (called block) level. With respect to the organization of primary health care delivery, the state is divided in to six sub-national regions, 26 districts, 250 Blocks, 950 Primary Health Centers (PHCs) and 450 Community Health Centers (CHCs). Each PHC has under it about 5-7 Sub Centers (SCs) that are responsible to provide outreach based services to the community.

Generation of health information starts at the SC which is the first contact point between the community and the primary health care system. Field level male and female nurses are expected to visit the villages assigned to them (one nurse typically is responsible for a catchment population of 5000) for providing various public health related services such as related to deliveries and immunizations. Data generated through this service delivery is first noted in the field diaries, then posted to various registers (typically about 15 to 20 in a SC relating to Malaria, TB, Family Planning, Antenatal care, Immunization etc), and finally taken on a monthly basis into the Form 6 which is then sent to the parent PHC for further processing and upward transmission. The health supervisor at the PHC level compiles this Form 6 data together with Form 7, which includes data from the PHC level service delivery, and prepares Form 7A (an aggregate of all SCs and the PHC services) which is then sent to the Block Health Office (BHO). The CHCs in turn compile their service delivery in Form 8 and also send it to the respective BHOs. At the BHOs, Forms 7A and 8 are aggregated to Form 8A and sent to their respective district offices where an aggregated Form 9 is compiled and transmitted to the State office. The schematic below summarizes this rather complex and fragmented information flow.

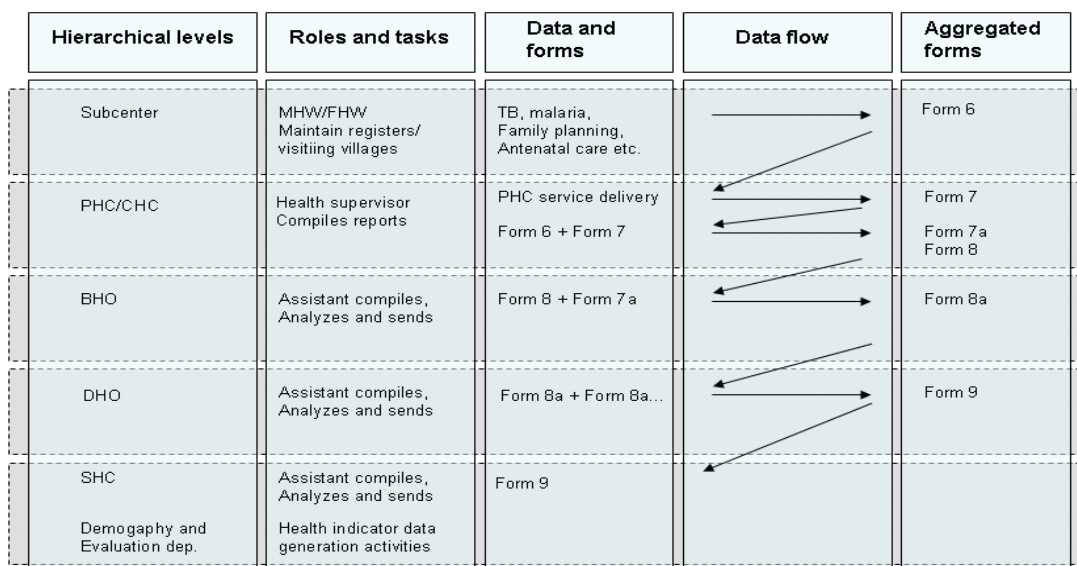


Figure 1: Fragmented information flow in the RCH program

It must be noted that the above schematic is primarily concerned with the RCH program. In the larger picture there are various other programs such as TB, Malaria and Integrated Disease

Surveillance Program with their own respective information systems. This was however, not seen as a problem by some, like a district staff who remarked:

*It is impossible to mix all the programs since they have their own agenda...what is wrong in working separately. they are working fine and it is very easily to monitor a single program than the whole.*

Given this brief contextual background, we now discuss the specific initiative studied.

## **4.2 Implementation process of the integrated e-HIS**

In what can be called as the first phase of the project, in early 2006, HISP India was invited by the State to implement an integrated HIS on a pilot basis at the block level in one district in the state (called Valsad). The notion of integration involved in this phase was taking the data entry forms of the different Reproductive and Child Health (RCH) related activities into one format (Form 6) in order to try and eliminate various redundancies and duplications. The project involved the deployment of the HIS application (called DHIS) at the BHO office computer and training the staff from the different facilities in the block to carry out the basic data entry and reporting activities. Similar processes were also undertaken at the district office. Six months into the process, the project results were evaluated, and happy with the outcome the State Health Commissioner extended the project to four further districts (Rajkot, Surendranagar, Kutch and Baruch). However, in early 2007, for various institutional reasons unknown to HISP, the State terminated the project stating their plan to use another application.

In late 2007, HISP India to Gujarat was recalled by the Health Commissioner as he was unhappy with the application bought in place of the DHIS, especially its weak analysis capabilities such as related to the generation of indicators and their graphical and map-based presentations. In the presentation made when recalled, HISP India emphasized the dashboard facilities of the application, and the value it provided in monitoring both the data quality and health status in the districts. To address the previous unsuccessful implementation of HISP India in the 5 districts, the Commissioner changed the model from a block level deployment to a server based state level deployment arguing that such a “top down” approach would help to develop ownership of the senior state managers who would then be able to provide the impetus for the lower levels of district and block implementation.

In retrospect, this implementation model has in general worked quite well with the district level implementation stabilizing to a large extent within a period of 2-3 months. This involved a server based deployment which has been the medium for the use of the integrated application. The very fact that all the districts were required to access the same application over the same internet infrastructure required the need to further integrate processes such as related to data entry and technical support. Further, the integrated application placed additional pressure on the performance of the database because of the sheer volume of data that needed to be stored, accessed and processed at one source. The server based application also created the need for developing new kinds of capacities both for the users (who

previously had not worked on an internet based HIS), and for HISP India for whom it was their first such experience of implementation. Three challenges to integration related to server, database and capacity are now discussed.

#### **4.2.1 Server performance**

The DHIS application was deployed on a Windows based server that was rented from a private provider based in North America. The server had a 2 GB RAM, which with time as data started to be entered for a few months became paralyzing slow. The slowness was further magnified by the local Wide Area Network in use in the State which had an extremely limited bandwidth. These technical constraints coupled with the institutional practice of the monthly data being entered by all the users in the last week of the month, meant that the server was significantly overloaded during this period and also with the peak working time in the day (10am to 8pm). For example, we tested that importing a file during this peak period took nearly 10 to 20 minutes, while outside this period (in the night) the same file could be downloaded in less than a minute. In the interviews and email correspondence conducted, the respondents expressed their disappointment regarding server performance, both while entering data and also in using the export-import functionality. The following email extract from a District staff to his state in-charge reflects this problem:

*Respected Sir,*

*This is to bring to your kind notice that most District Blocks have completed of Data Entry in Offline DHIS2.0 for April-May-08 Sir. They export the Data by Data Set Wise as advised by HISP India Sir. But when they try to import the same Data to the online application, they are facing problem Sir... We are getting several calls from the Blocks everyday regarding the above problem Sir. Could you please request HISP India to find a solution to the above problem at the earliest Sir.*

A DPC from another district summarized his server related problems in an email:

*Subject: Problem in DHIS*

*Respected Sir,*

*As per your instruction to finish the DHIS entry, we have completed, 40% of entire, but we are facing a lot of problems.*

- 1. Server is very slow.*
- 2. Data is not getting saved.*
- 3. Software is not accepting zeros.*
- 4. Software is getting closed automatically.*
- 5. It is taking 1/2 hrs to save one entry and for the cursor to move to next column.*

*Kindly help us in the above mentioned regards so that we can finish the entry as soon as possible.*

In addition to the earlier problems of server performance, the 3<sup>rd</sup> problem related to “not saving zeros” was because HISP India in trying to find a solution of the ever expanding database analyzed the database to identify that nearly 70% of the data included was

systematically being reported as “zero” or “blank.” This was pointed to the state HIS in charge, and it was suggested that we don’t store the zero and blank values in the database. While he was not agreeable to this suggestion completely, we were forced to do that to prevent the almost complete paralysis of the server application. Further, it was found that the same user name and password were being shared by multiple users which were magnifying the load on the application. To try and work around the slowness of the internet, some of the users tried to use the internet from a cybercafé with nearly the same results. The following email reflects this attempt and the outcome from the same:

*On Mon, Jun 23, 2008 at 11:28 AM*

*Hello*

*As discussed on Saturday since there is some problem with the importing process at my end, I tried to do it from cybercafé on Saturday, but it did not happen because the server was too slow. Then I went there yesterday early in the morning and I tried the same procedure again. But the same problem is still there. Now I did it from our computer for two other centers, it is giving the same message like 57% or 100% import process completed. But in the data entry screen, no such data is seen. Please again look in to the matter seriously. May be there is some problem of importing with my username/password.*

Since dealing with server related problems was new experience for the HISP India, they tried to draw upon the “social capital” available through the Oslo network of PhD and masters students. Suggestions were made to enhance the server RAM, which was done first from 2 to 4 GB and then to 8 GB. Another suggestion was made to shift the server from a US based provider to one which was local to address the problem of data transfer speed. This was also done to an Indian based provider, whose server was however based in the United Kingdom. While all these measures have greatly helped in enhancing performance, the rapidly expanding database size and number of users continue to prove as challenges to performance. Further measures are being worked on including the optimization of the DHIS application, splitting the database and the application part of the DHIS into separate servers, and further moving the server to Gujarat.

#### **4.2.2 Database Size**

With time, as first all districts and then block level users started to use the application, the size of the database started to grow exponentially including data for about 8000 organization units. The HISP India team made a systematic analysis of the database, and wrote the following email to the State in charge:

*Date: Thursday, August 28, 2008, 4:44 PM*

*At the end of every month we have 1,15,30,220 records in the database, of which 78% of data belongs to the Sub Centre (the lowest level of data collection). This 78% of sub-centre data decreases the performance of the application to a great extent. To increase the performance and optimization of the application; we suggest that we maintain 3 to 4 level of data in the online system. But if and when State official want to drill down to*

*PHC or Sub Centre level, data can be made available on request. To do this we need to build a new functionality in the DHIS2 called "Aggregated Export" which aggregates the data to higher level from the field and then exports the data. By keeping the PHC and Sub Centre data at the district or block level, we will be reducing 94% of data load on the server. As and when required by the state official, specific PHC or Sub centre data can be made available for further clarification or scrutiny. This could be achieved by exporting the data in normal (Current) mode. At state office we suggest to maintain one high-end computer (which can act as local server or backup server) where all the data can be stored to easy access and retrieval.*

The above email highlights a policy issue of what level of data should be maintained in the online database. While HISP India were of the firm view that data from the lowest levels (Sub Centre and PHC) should not be kept in the online database (but in a local server) which would reduce the load by more than 90%, the state insisted that they wanted an “integrated database” including all available data. Even the suggestion made by HISP India on not saving zero values was not acceptable, as reflected in the following comment by a district staff:

*If we are worried about zeros at this stage in three months, what about the performance of the system in the long run.*

The option of using a commercial database like Oracle was also explored by HISP India instead of the existing free MySQL, but the costs and licensing considerations quickly made the state to discard this option. The problem of the database remains still not fully resolved, but temporarily the situation was made under control with the 8 GB RAM server being able to handle the database load. But as the database size continues to grow, the problem is bound to resurface.

At this stage, the main actor, in HISP India NGO joined National Health System Resource Center (NHSRC) as a consultant for the HMIS. This enabled the actor to make a suggestion on how to improve the existing HIS. One of the core suggestions were on setting essential data sets which serves as standard by bridging the fragmented program owned information flows. Specialists from the public health domain were invited by the consultant to get input in the process.

### **4.2.3 Capacity limitations**

There were capacity issues for both HISP India and the users. For HISP India, both the server and database related issues required a kind of expertise which did not exist in the current team. To solve them, they drew heavily upon the expertise of the Oslo doctoral students. Further, personal contacts of the HISP India in charge involving friends working in the sever business in private firms in both India and Oslo also helped to diagnose the problem and consider alternative solutions.

From the perspective of the users, many of the issues concerning the online system or the import and export of data were also new. A user from a district commented on their lack of experience in working with an integrated HIS:

*In the current situation, we have specialists to manage each program. And I hope they are effective. If we move towards an integrated HIS, then we need to have multi-skilled professionals. That should be the priority focus*

Contractual arrangements were set so that HISP India was seen to be responsible only for the development while the State was to take care of the capacity building processes. As a result, no HISP India staff was physically based at the state level. The problem with this arrangement was that the state staff who was responsible for capacity building did not themselves have the expertise to further do the job. To address this problem, HISP India suggested to the state to hire three technical staff for the areas of server, database and programming. But however, due to the prolonged procedures inherent in state recruitment, this suggestion could not be implemented.

In the absence of these physical support mechanisms, HISP India has relied extensively on electronic mail communication, telephone support and periodic visits by their members to the state. The positive aspect of this arrangement has been that many of the users have really developed skills to be able to work effectively with the application. For example, detailed emails were written by the HISP technical person in Delhi to the state, district and block level staff providing instructions on how to upload a new war file.

In summary, we have discussed issues of server performance, database size and capacity needs to serve as challenges in the implementation of an integrated HIS, which at the present mode is only including the information systems to support the Reproductive and Child Health program. At the national level, there are ongoing attempts to integrate other vertical programs such as related to TB, Malaria, Blindness Control etc into the HIS. As these reforms are operationalized and transmitted to the state, there will be increasing pressures, technical and institutional, on the integrated HIS.

We now discuss the case material drawing primarily on the notion of social capital.

## **5 Analysis and discussions**

The three dimensions of social capital identified by Nahapiet and Ghoshal (1998) – structural, relational, and cognitive – provide an analytical framework responding our examine the role of social capital in the implementation of the integrated e-HIS. This is now discussed.

*Structural:* This refers to the overall pattern of connections between the actors involved and the nature of the network ties that exist.

With respect to the case discussed, two aspects of the structural dimension are relevant. One concerns the top down implementation model adopted by the Commissioner, which first helped to create visibility of the initiative at the state level, and then senior state staff themselves took ownership and cultivated the virtues of an integrated system to the lower

levels of the district and block. This kind of local ownership, often lacking in HIS implementation projects, helped to create a network of institutionalized relationships and understanding of mutual benefits between the different administrative levels of the health department. The state level saw the benefits with respect to the richer analysis capabilities that an integrated HIS provided, but to realize this they needed the district level staff to take up the system in an effective manner. This mutual relationship was enabled through the structural top down model of implementation adopted, where the authority carried by the state level was crucial in initiating the process, and then the ongoing support and handholding provided to the users helped to cement the mutually beneficial network of ties. This provided the basis for the creation of positive social capital that helped the implementation of the integrated e-HIS.

The second aspect of the structural dimension concerns the relation HISP India has with the health organization. This relation is mediated by the focal actor who is part of three significantly influencing organizations: University of Oslo, HISP NGO and National Rural Health Mission-India. From these organizations, the actor extensively draw advices, human and financial resources that help gaining trust from the health sector about initial implementation in Gujarat and the expansion of the system functionally (e.g incorporating more health programs in the system other than RH) and geographically (including others states) which are basic to form integrated national HMIS. In general, this ability of the main actor to participate in different networks helped to create mutual trust between HISP India and the health department, with the latter learning to value the expertise, positive intention and objectivity of HISP India.

*Relational:* This focuses on the particular relations people have, including feelings of respect and friendship that influence their behaviour. Right at the outset, the Commissioner valued and respected the expertise that HISP India introduced into the initiative. These feelings were enabled by the fact that the President of HISP India was also a university professor with extensive global experience in field level implementation of HIS projects. Similarly, HISP India held the Commissioner in the highest regard, and valued deeply his vision and focus of an integrated HIS to support his and the State analysis needs. Gujarat undoubtedly is on the forefront of HIS use in India, and the personal status and visibility of the Commissioner nationally also helped to also provide HISP India with useful mileage in being accepted also by other states.

Outside the state networks, HISP India had strong personal relationships with friends who were working in technical positions in software firms both in India and Oslo. Whenever faced with a difficult technical problem such as optimizing server performance or using alternative databases, the HISP India President would call on his network of friends for advise, problem diagnosis and suggestions of alternative solutions. This very valuable advise was always made available without cost to HISP India who could then implement cost effective solutions.

*Cognitive:* This refers to those resources providing shared representations, interpretations and systems of meaning among parties. A key resource in this regard was the use of technology

which while serving as the object of shared representations, also served as a medium to circulate these interpretations. Starting with the server based application, the medium of deployment for the integrated HIS, helped to focus the attention of hundreds of users to the same application in the “same physical location.” Frequent discussions on problems related to the server performance had the positive effect of creating a common understanding of the issues influencing the integrated HIS implementation. Common forums (such as of training programs) helped users to discuss similar problems, and also to create user groups who could help each other to find solutions. The use of internet also proved very useful for users to directly be able to communicate with the HISP India technical team on the problems they were experiencing and be able to receive advise on how to address them. This direct line of communication was empowering for the users who could now subvert the traditionally existing hierarchical and centralized forms of communication.

## **6 Conclusions**

In this paper, we have argued that the key role that social capital has played in the implementation of integrated HIS in the public sector domain of Gujarat state. On one hand, the existing social capital helped the implementation at many levels from enabling the introduction of the initiative to being able to start including other vertical programs. On the other hand, the deployment of the integrated application and the use of the internet helped the creation of additional social capital, such as personal relationships between the district users and the HISP India technical team based on mutual trust and confidence. This helps us to draw two key theoretical inferences. The first concerns the point that social capital is not something given and static, but is a process that grows over time both shaping and being shaped by the processes of implementation. The second concerns the point that ICTs including internet and the e-HIS itself plays a key role in further building social capital that is helpful to integrate the fragmented HIS. The integrated application provided a common focus and site for people to come together and discuss similar problems and jointly seek and identify solutions. Further, the use of the internet helped to take these common resources and circulate it across a larger social group enabling the creation of a broader base of social capital.

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