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Orchestrating 'Institutional Network' for the Sustainability of IS Program: Evidence from Indian Public Healthcare

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Completed Research Paper

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Abstract

Sustaining an IS program in healthcare encounters the complexities of the dynamic and loosely connected network of institutionally powerful actors. We apply 'orchestration' framework to examine the orchestration of public healthcare by a low power stakeholder for sustaining an IS program. We study the case of a hospital information systems running across 20+ hospitals in Himachal Pradesh, India, for more than a decade. Analysis informs that institutional network orchestration goes through multiple interconnected stages, each presenting unique dilemmas. The orchestrator takes different roles to perform various relation and material institutional work across these stages and often leverages on unanticipated events, just by being physically and temporally present. We identify four orchestration stages—promoting member engagement, building distributed ownership, managing partnership, and managing coherence. Initial stage institutional work helps orchestrator accumulate 'symbolic power', which proves critical in later stage orchestration. Findings contribute to orchestration framework and inform IS in healthcare literature.

Keywords: Hospital Information Systems; Public Healthcare; Orchestration

Introduction

Sustaining an Information Systems (IS) program in the 'loosely coupled' public healthcare network is a critical challenge. It requires attending to the two challenges simultaneously. It must address the distinct interests of the different 'loosely' connected institutionally powerful actors (Hansen and Baroody 2020; Klecun et al. 2019). On the other hand, it also requires managing the dynamism associated with constantly changing stakeholders, their interests and their institutional needs (Mekonnen and Sahay 2008; Nancy et al. 2016). Literature has noted the potential of a low-power external stakeholder in managing an IS program in institutional networks (e.g., Braa et al. 2004). However, such a stakeholder faces a constant threat of being 'thrown out' amidst the dynamism associated (Sahay et al. 2009). This leaves us with an interesting question of *how a low-power external stakeholder coordinated IS program sustains over time in public healthcare within a low and middle income country context.*

Network literature has underlined the importance of the 'orchestration' framework in loosely coupled network. It enables studying the various purposeful activities performed by a focal actor, lacking the hierarchical power, in coordinating the loosely connected actors (Dhanaraj and Parkhe 2006). Extant literature has located two forms of orchestration[1]—closed-system orchestration, and open-system orchestration. In closed-system orchestration, the focal actor usually holds prominence by its centrality, it controls member's admission, and conducts various orchestration activities to create a collective value and extract its maximum share form it (e.g., Nambisan and Sawhney 2011, Sydow et al. 2012). In open-system

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[1] Orchestration refers to various purposeful actions performed by a focal actor in coordinating the loosely connected network members.

orchestration, member's admission may be voluntary, the focal actor may lack prominence, and it carries orchestration activities to support the dispersed and multiple goals of the network members.

However, neither the open or closed forms of orchestration fully attends to the dynamics of institutional networks like that in public healthcare within a *low and middle income country* context. Public healthcare can be seen as being simultaneously closed and open. It is closed that all institutional members pursue, to an extent, a collective institutional goal (e.g., public health). At the same time, it is open where each actor also cares for their own institutional interests, and the network remains open to constantly evolving actors (e.g., technology vendors may change). Hence, orchestrating an institutional network could neither be a closed orchestration (where all the actors are 'orchestrated' toward one collective outcome), nor a complete open orchestration where each actor is pursuing diverse and dispersed goals only. The institutional network orchestration becomes more intriguing when the orchestrator is an external actor with no institutional power required to orchestrate the institutionally powerful and constantly evolving actors. Hence, this research examines how a low power external stakeholder orchestrates the loosely connected institutional network of healthcare for providing sustainability to the IS program.

We carried out this study in the context of an open source hospital information systems in Himachal Pradesh, India, running now for more than a decade. The study focused on the processes that followed the development of all HIS modules to scale and manage it across 20+ geographically distributed district hospitals. Our findings inform us that orchestrating an institutional network goes through distinct stages, causing distinct dilemmas for the orchestrators to attend to while leveraging opportunities which may become available unexpectedly. The orchestrator adopts various roles in responding to this dilemma through different relational and material institutional work. The relational and material work performed in the early stages help the low power orchestrator accumulate symbolic power' (Bourdieu, 1991), which matter critically in performing later stage orchestration activities to 'sustain' the IS program. Findings contribute to the existing knowledge on sustainability of IS initiatives in public healthcare by informing that sustainability needs to be seen as *ongoing process—sustaining by orchestrating* the constantly evolving challenges through various relational and material works.

The following section discusses how institutional networks differ from other loosely coupled networks. Subsequently, we review the work on sustaining IS initiatives in public healthcare to discuss the challenges noted in the existing literature. We then discuss our research context. We discuss our data collection and analysis process in detail. We present our findings and discuss them subsequently. We close by discussing the limitations and future research directions.

Types of Networks: Open, Closed, and Institutional Network

Weick (1976) proposed the concept of 'loosely coupled' network to characterize "a situation in which elements are responsive but retain evidence of separateness and identity" (p, 3). An example of this concept could be found in universities, where multiple academic departments form a "loosely coupled" network. In this setup, each department maintains its individual identity and autonomy while simultaneously contributing to the university's common mission. Drawing upon this conceptualization, Dhanaraj and Parkhe (2006) called high centrality/low-density networks as 'loosely coupled'. They proposed 'orchestration framework' to study how a central actor, lacking hierarchical power, brings 'subtle leadership' to conduct various purposeful actions to create and extract value in a loosely coupled network. For instance, Apple, as a focal actor of its 'App store' ecosystem may need to bring subtle leadership in coordinating with the various App developers. Scholars applied this framework to several other loosely coupled networks such as tourism networks (Milwood and Roehl 2018), Government-sponsored program networks (Leven et al. 2014), R&D Networks (Sydow et al. 2012), and industrial network (Paquin and Howard-Grenville 2013). Taken together, orchestration studies focused on these networks revealed crucial insights on the role of a central actor throughout the network stages. For instance, Dattèè et al. (2018) informed how a focal technological leader like IBM *creates* a new network. It showed that the orchestrator pulls members into the ecosystem when the value propositions of the network are not known *ex-ante* by delaying its resource commitments and establishing dynamic control throughout the ecosystem creation process. Paquin and Howard-Grenville (2013) showed the role of the focal actor in resolving a constantly emerging set of dilemmas throughout the network stages. They discussed that in the initial stage, an orchestrator needs to resolve the dilemma of getting legitimacy from the broader audience instead of reaching only a selected set of relevant stakeholders. Later, the orchestrator must resolve the dilemma of enabling serendipitous connections or targeting connections among network partners to create values.

Giudici et al. (2018), however, said that all the above-mentioned networks belong to just one type of 'loosely coupled' network, closed network. They are closed networks because while all the network members retain distinct identity, they are together committed toward 'one' network value. The central actor uses its power and prominence in admitting members and orchestrating them toward a collective value creation. For Giudici et al. (2018), some loosely coupled networks like 'venture associations' or 'trade associations' could be 'open networks'. In an open network, the focal member may not necessarily enjoy the centrality and power. The network members may be loosely coupled around, say a membership to trade association, however, their participation may be voluntary and ad-hoc. While some network members may have prior connections, others may be disconnected. Further, all the network members might pursue their distinct interests. The focal actor's primary role would be to facilitate network members in achieving their distinct goals. Giudici et al. (2018) coined 'open-system orchestration' term to capture the orchestration in open networks, and 'closed-system orchestration' to explain orchestration in closed networks. Open-system orchestration framework found great utility in networks such as knowledge networks (Ritala et al. 2023) and membership-based networks (Pinnington et al. 2021).

An institutional network like public healthcare, however, is a distinct, loosely coupled network. Public healthcare is a fluid network consisting of loosely coupled powerful institutional actors[2] such as the federal government, state government, various autonomous hospitals, and constantly evolving stakeholders such as technological and pharmaceutical vendors. All the institutional members are 'coupled' around a collective goal of serving 'public health'. However, they are also autonomous and pursue distinct objectives. The federal or state government might design a particular health program (e.g., vaccination program). However, individual hospitals still hold great autonomy and local responsibility in implementing that program. A hospital might assess the program within its individual goal while implementing it. Further, the institutional stakeholders may not remain static. Over a period, new members may get added and others may get dropped. Neither of the two forms of orchestration, open or closed, can sufficiently capture the kind of orchestration required in such institutional network. Institutional network orchestration becomes further challenging when the focal actor responsible for it is an external member (e.g., a vendor), working on a contractual responsibility, having no institutional power. Whereas the other network members hold great institutional power. An institutional network may, thus, present a unique case where a less powerful external actor orchestrates the dynamic and loosely connected powerful institutional actors.

Sustaining Information Systems Program in (Public) Healthcare

Sustaining an IS project in public healthcare is a complex socio-technical phenomenon. It involves managing the social, political, and institutional complexities of public healthcare (Sahay and Walsham 2006). These complexities arise primarily from the involvement of multiple loosely connected institutional actors. Studies have noted that public healthcare's highly institutionalized set-up consists of diverse stakeholders (e.g., government bodies, hospitals, clinicians, vendors) pursuing distinct institutional interests. These distinct institutional interests provide stakeholders with different frames (Constantinides and Barrett 2015), and different relative power positions (Klecun et al. 2019; Nancy et al. 2016) through which they interpret the IS projects. Large-scale IS projects may interact with their institutional interests; while some stakeholders might find it complementary to their interests, others may find it contradictory (Hansen and Baroody 2020). For instance, while the state might view that digitizing hospital processes might bring efficiency, the hospital actors might find it hinderance to their primary clinical tasks. This may result in competition among different institutional actors, eventually making IS projects in the public healthcare system a political battlefield (Nancy et al. 2016). Those who perceive a benefit may support. In contrast, those perceiving a threat may resist it, leading to a potential conflict between different institutionally powerful actors threatening the sustainability (Constantinides and Barrett 2015).

Studies have shown that sustainability of IS programs may benefit from a low-powerful actor, often external to the healthcare institutional set-up, who can perform subtle political configuration (Sahay et al., 2009), for instance, by getting the support of the most powerful institutional actors (Braa et al. 2004). While the less powerful actor may benefit from getting less resistance from the otherwise powerful institutional actors, they have the threat of being 'thrown out', especially when there is a change in the institutional actors or policy change. Indeed, the plurality of institutional actors is only a part of the challenges in sustaining an IS program. The challenge is further attenuated due to the constant changes in the institutional actors and policies that may bring new actors and policies, requiring the frequent alignment of the constantly evolving

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[2] Institutional actors, here, simply means the actors such as hospitals, NHM, and state forming the public healthcare institutional network.

actors (Mekonnen and Sahay 2008; Nancy et al. 2016). Hence, while the external stakeholder may be apparently better positioned to coordinate with the institutionally powerful actors to avoid any direct power conflict, they need to attend to three critical challenges in achieving the collection action (Constantinides and Barrett, 2015) of sustaining an IS program—simultaneously serving the distinct institutional interests of the diverse stakeholders, managing the constantly emerging stakeholders, and thirdly, doing both while ensuring not being thrown out of the network. This eventually calls for an institutional network orchestration around sustaining an IS program by a focal actor, external to the context. The existing literature is silent on this understanding. We conducted this study to develop this understanding by examining the institutional network orchestration in sustaining hospital information systems in the public healthcare system of Himachal Pradesh, India for over a decade.

Research Context

The Ministry of Health and Family Welfare (MoHFW), Government of India, launched Health Management Information System (HMIS) portal in 2008 to capture all public health data on one platform. As part of this initiative, the National Health Mission (NHM), Shimla, and the Directorate of Health Services (DHS), Himachal Pradesh state government, entered a partnership with a private vendor, HISP India (referred as HISP hereafter), to implement HMIS in the state. The HMIS focused on capturing district-level monthly data on clinical service delivery, specifically focusing on NHM programs such as reproductive, maternal, and child health cases[3]. Data from each hospital were aggregated at the district hospital level, which subsequently uploaded the data to the HMIS portal. At that moment, the digital infrastructure at the state and hospital level was weak. Hospitals worked on paper-based systems. Realizing this challenge in collecting information from hospitals for HMIS, NHM Shimla[4] decided to implement a hospital information system (HIS) at each district hospital[5]. The NHM expected that implementing HIS will lead to better access and reporting of hospital performance by digitizing the clinical, administrative, and managerial processes. In 2009, the NHM invited a request for proposals to develop and implement an open source-based HIS across district hospitals in Himachal Pradesh. The objective was to document longitudinal patient records, produce aggregate digital data for hospital administrators, and provide data for HMIS reporting. The proposal asked for features such as Telemedicine, SMS based appointment, digitizing medical images among others. At the same time, the proposal emphasized a low-cost solution. No vendor could satisfactory bid for this.

HISP had been the technical support partner since 2007 for the National Health Systems Resource Centre, , a think tank for the central Ministry, and running HMIS across 20+ states, including Himachal Pradesh in 2008. The NHM was very convinced of the support received from HISP. Furthermore, the NHM had appreciation of the kind of analytical features HISP had provided in HMIS back then. Hence, with no success in getting a vendor, the NHM approached its long-term partner, HISP India to lead this project too. Although HISP had no prior experience with hospital systems but were eager to learn and work. A tri-party MoU was signed between the NHM, National Health Systems Resource Centre, and HISP with the scope of work including design, development, and implementation of HIS (with ten modules) for 20 district hospitals. A district hospital typically caters to approximately 800-1000 out patients and 40-50 in-patients daily.

The NHM Mission Director (MD) realized that HISP did not have prior experience with hospital systems and neither did the hospital staff had any experience. He developed an innovative tender document. Unlike typical such documents, which would specify the requirements and have payments linked to deliverables based on these requirements, he made the development and evolution of requirements as a part of the contract. Further, he specified the use of a free and open source platform, which would be flexible and enable experimentation and learning, and also provide a low cost approach. The contract also allowed to develop the LAN-based system that could work within the modest technological infrastructure at that moment. Finally, the contract terms were not based on deliverables *per-se*, but based on HISP establishing a 6-7 person team based in the capital city of Shimla, and a fixed monthly cost was estimated which included the person cost for the team, the cost of setting up an office, and travel costs. It was agreed that all work required to build, implement, and support the system over time would be included in this cost.

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[3] https://main.mohfw.gov.in/documents/forms-procedures/forms/revised-integrated-mies-format/monthly-quarterly-annual-formats-excel/hmis-formats

[4] Hereafter referred as simply 'NHM'

[5] http://164.100.117.80/sites/default/files/Hospital%20Information%20System%20in%20Shimla%20Himachal%20Pradesh.pdf

The HIS implementation went through two stages. The first stage involved pilot development and implementation at Deen Dayal Upadhyay Zonal Hospital, Shimla. While developing HIS modules, HISP followed a participatory approach. It discussed with various stakeholders, including NHM, DHS, and hospitals, to solicit requirements. It reviewed and converted those requirements into ten basic modules (such as registration, billing, and pharmacy). Once these modules went through a pilot run, HISP developed the complete modules and started scaling to, and managing it at other district hospitals. In doing so, HISP had to engage with various loosely connected stakeholders to scale and at the same sustain for over the last 10 years. These stakeholders included (1) the autonomous district hospitals, (2) the NHM (and its officers such as MD, State Program Officer (SPO)[6], and a project coordinator for HIS project), and (3) the DHS. These stakeholders were loosely connected physically, institutionally and goal wise (Table 1). The present study focuses on the process that followed the development and implementation of all HIS modules at the pilot hospital to tease out the insights on the sustainability of the initiative.

Stakeholders (Physical Set up)	Institutional Set up	Primary Goal(s)
NHM (Shimla)	An autonomous body under the MoHFW	Implementing and managing various central government run health programs in each state.
DHS (Shimla)	The state government level body.	Critical role in taking various financial and administrative decisions with respect to healthcare in the state.
Hospitals (Distributed across various districts of Himachal Pradesh)	Autonomous units.	Independent hospitals focus on delivering best clinical care by taking day to day level administrative, operational, and small financial decisions (e.g., lab items)
Table 1: Loosely connected Institutional Network of Public Healthcare		

Data Collection and Analysis

We adopted an interpretive case study approach (Walsham 2006) and drew upon multiple sources of data to understand the complexities involved with the sustainability of HIS project. Two authors of this paper were 'participant researchers', part of the HISP team involved with HIS project, and another two were external researchers. Both groups of researchers were critical to making sense of the embedded theoretical and cultural nuances of the scaling process. To avoid any potential positive disposition from the participants researchers, the data collection was done by the external researchers. Data collection started in 2019 (Table 2). We started with reading publicly available reports and archival documents stored with HISP. These archival documents included MoUs, letters to the MDs and secretaries, and other critical communication with the hospitals, NHM, and the DHS. Subsequently, we did in-depth interviews with various stakeholders of HISP, NHM and hospitals. One author also conducted detailed field studies at seven hospitals from December 2019 to June 2022. During the field study, the researcher used various data collection approaches. The researcher interacted with various stakeholders at each hospital, including the medical superintendent (MS), the Head of Nursing Staff, the Head of the Laboratory, doctors, nurses, IT staff, and the patients. The researcher also spent a longer time observing activities at various sites in the hospital, such as registration, billing, pharmacy, store, emergency, out-patient-department, and in-patient wards. The researcher also shadowed the stakeholders, such as doctors and patients, wherever allowed.

Data Collection Modes	Research Participants/Data Sources	
Documents	Publicly Available Reports, MOUs, Letters, Emails	
In-depth Interviews	**Actors**	**Respondents**
	HISP	Project Coordinator, Various Engineers leading different aspects such as design, server and testing.
	NHM/DHS	Project Coordinator, SPO (1) – One who was involved with HIS project in the beginning, SPO (2)- Current

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[6] NHM has a program officer assigned for each program. Digitizing health information through HMIS was one such program having a dedicated program officer.

	Hospital	MS (including Ex MS), Head of Nursing, Lab, Pathology, and RKS among others	
Field Study	**Field Study Sites**	**Participants**	**Data Sources**
	Zonal Hospital Solan, Zonal Hospital Shimla, District Hospital Dharamsala, District Hospital Tanda, District Hospital, Hamirpur, District Hospital, Nurpur	Doctors, MS, Nursing Staff, Lab Staff, RKS Head, Head Lab, Head- Pharmacy, Administrative Staff in Pharmacy, Billing, Store, RKS, Lab. Third party vendors (SRL Labs), IT Staff in Registration, and Billing	Interviews, observation, shadowing, and reading various hospital level documents
Table 2: Data Collection Details			

In the spirit of interpretive study (Walsham 2006), data analysis happened in parallel with data collection. The cultural embeddedness of the two participant researchers mattered critically at this stage. A regular discussion with these researchers helped in making sense of the emerging data. For instance, while the external researcher read the MoU letters and found it different from any other traditional MoUs, the participant researchers helped understand the context behind the design of such a contract allowing flexibility to the vendor. Further, since the data collection started in 2019, the participant researchers' insights were critical in understanding the historical perspective of the project. While the participant researchers provided this cultural understanding, the external researchers looked for the theoretical grounding. In this process of continuous dialogue between the data and theoretical underpinning, and after creating multiple data-theory links, we uncovered several contextual grounded issues such as the 'orchestration role of the vendor', 'less power position', 'distinct and evolving dilemmas' (Appendix A gives for evidence). Accordingly, we identified that the sustainability of HIS program involved addressing constantly evolving dilemmas. The identification of these distinct dilemmas helped us locate the four distinct analytical phases (Langley, 1999), each characterized by distinct dilemmas, and identify the appropriateness of 'orchestration framework' to capture the story. Subsequently, we drew upon orchestration in our analysis and findings. We built upon this framework to show how the distinct dilemmas and challenges of each phase were addressed by a low-power orchestrator by adopting different roles and performing various distinct orchestration activities. We discuss these findings in more detail below.

Findings

We found that sustainability of HIS project was tied to the constant deliberations and actions performed by the orchestrator, HISP, since the time of scaling it from the pilot to the other hospitals. This finding further led us to locate four analytical phases, having significance on the sustainability of HIS over the years. These four phases were—*promoting members engagement, building distributed ownership, managing partnership, and managing coherence.* Each phase was characterized by unique institutional, technological, and people-specific challenges, posing distinct dilemmas, necessitating the orchestrator to adopt different roles to perform distinct orchestration activities to keep the HIS program going (Table 3).

Challenges/ Orchestration	Phase-I	Phase-II	Phase-III	Phase-IV
Institutional Challenges	Low-cost scaling	Constantly Changing Stakeholders	Constant introduction of new policies	Demand for an integrated Digital Health
Technological Challenges	Modest hospital level infrastructure	Frequent updates and regular maintenance	New technologies	Need for transitioning toward web and cloud based
People - specific Challenges	Lack of support staff	Skills for regular maintenance and constant feedback	New Partners	Re-skilling human resource
Orchestration Activities	**Prioritizing Easy Wins**	**Creating Local Level Solidarity**	**Facilitating Connections**	**Future Shadowing**

	Scaling only three modules	Training IT staff for routine software issues Appointing site in-charges Taking feedback during refreshers	Getting letters from the secretary Writing Emails	Constantly showing its progress and the value in continuing
	Temporarily involving hospital level staff	**Regular Incremental Updates and Refreshers**	**Technology Integration**	**Prioritizing Easy Wins** Focusing on building registration modules only
	Going beyond the contract Coordinating with NHM on behalf of hospital. Setting up server and LAN cables	**Going beyond the contract** Supporting in day-to-day running of hardware equipment Helping hospitals in buying and installing hardware.	**Going beyond the contract** Offering help to lead technology integration. Finding pilot hospital Managing "Mera Aspataal" portal	**Facilitating connections** Making hospitals and state connect on giving it contract renewals.

Table 3: Challenges and Orchestration Across Phases

Phase I: Promoting Member Engagement (Orchestrator as a Partner)

Initially, HISP required 'engaging' various autonomous district hospitals to implement HIS at their respective sites. These hospitals operated with a degree of independence, maintaining a loose connection with the NHM and the DHS. While these hospitals did receive some support from NHM in implementing their policies, most day-to-day management responsibilities fell on the hospitals themselves. As per the contract document, NHM provided an initial financial support of USD 25,000 for procuring computers and supporting infrastructure resources to each hospital for HIS implementation. However, the individual hospitals were responsible for covering any additional expenses related to system installation, improving the hospital's general infrastructure, and covering day-to-day operational costs. This loose coupling arrangement, where hospitals and NHM were connected but retained their independence, resulted in the emergence of distinctive challenges on institutional, technological, and people-specific challenges, further creating a dilemma for the orchestrator (HISP) to solve.

Hospitals traditionally worked on paper-based systems. The existing infrastructure, including the staff and work processes, was designed to suit this manually working structure. For example, patients got physical files during registration, and doctors wrote consultation notes on the physical copies. Given the lower doctor-patient ratios and resultant high volumes of patients for each doctor in a district hospital in India, doctors preferred writing on physical copies. Further, patients carried those consultation notes to the pharmacy counter for drug distribution. Implementing HIS required setting up huge supporting technological infrastructure, including a new set of computers, LAN wiring, hosting local servers, and setting-up printers and network devices. Further, since the existing staff at each hospital were primarily clinical, paramedical, and administrative, lacking severely in IT skills, there was a need to establish a supporting technical team to support the HIS implementation. Developing these supporting technological and human infrastructure had significant cost implications. However, the institutional conditions demanded a low-cost approach. The NHM had no provisions for providing operational budgets for implementation support. Each hospital was required to employ staff independently for this purpose. However, structurally, the hospitals had a corpus of funds only for routine running expenses, which was inadequate to support new initiatives such as computerization. Institutionally, NHM could not mandate hospitals to implement HIS, nor could they demand that the hospitals hire new staff.

The given challenges severely constrained promoting engagements from the autonomous district hospitals. This, in turn, required HISP to resolve the dilemma of—going for a full-scale implementation of HIS or implementing select technological modules. As an orchestrator, HISP had to carry out various activities to resolve this dilemma (table 3). But HISP alone could not take any decision. Provisionally, the data collected in the local server of each hospital through the HIS had to be sent to HMIS. Knowing this, HISP coordinated with the DHS and NHM to understand the minimum expected information from each hospital's HIS. Further it considered the NHM requirements of low-cost scaling and understood hospitals' infrastructural constraints. Subsequently, in coordination with these different stakeholders, HISP leveraged the flexibility and modularity provided by the open-source nature of HIS, to start small and add more features later. It started with three essential modules: patient registration, billing, and pharmacy. For instance, the NHM state program officer recalled:

> *"We tried a lot of things..including OPDs, Lab,,but considering the challenge [infrastructure and manual processes, hiring new people] we finally decided to go ahead with these [basic] modules..at least something to start with..." (The incumbent NHM Program Officer)*

While an agreement on implementing three modules was reached, there was another parallel challenge of setting hospital-level technological infrastructure such as computer systems, printers, cable wires, and servers. NHM provided funds for decentralized procuring at hospital levels. However, even after almost a year, in the existing set-up of loose coupling between the NHM and the hospitals, many of the hospitals could not procure, and the NHM was unaware of this. Locating this gap, HISP wrote a letter to NHM requesting for the centralized procurement of computers. After a round of deliberations and follow-ups, the NHM MD accepted HISP's request to facilitate this.

> *"Initially they had tried to make it very decentralized..Then I don't know [why] one year went by and no procurement happened at the hospital level. So, when we started taking it up.. then they decided that they will have to do centralized procurement.." (Project Officer, HISP)*

Computer procurement was only a part of the challenge in building supporting infrastructure. More technical expertise was required at the hospital level for installing infrastructural equipment. For instance, when hospitals were doing LAN wiring, it often did not happen as per the requirements, eventually causing delays. At this moment, if a hospital required any immediate help, it reached out to HISP. HISP had to go beyond its contractual terms to assist hospitals during initial stages. For instance, one MS recalled the moment when she reached out to HISP in an emergency during HIS implementation for correcting the servers.

> *"You know they sent their own staff to help us set up the server overnight."]"..(The Medical Superintendent, of a hospital managing HIS implementation)*

Since only three features were implemented, and HISP offered extensive support to each hospital in building the technological infrastructure, HISP could now seek hospital-level support in getting the required manpower for those HIS features. It coordinated with the hospital MS to work out local level innovative solutions to find out people from the existing hospital staff for this purpose temporarily. At most of the hospitals, pharmacists and trainee students were involved on an ad-hoc basis for this purpose.

> *"We had 3 staff in the pharmacy. We took one for billing and one was dispensing medicine, and for the registration counter we took the student who came here for first aid training"..(The Medical Superintendent, of a hospital managing HIS implementation")*

However, using trainee students and pharmacists was only a temporary solution. Hospitals could not provide the services of pharmacists and trainee staff for long. There was a long-term association between HISP and DHS while working for state level HMIS solution. Leveraging this deep connection, HISP coordinated with the DHS to get permanent manpower support. Each hospital's daily registration and billing data went to the HMIS. HISP used this as an argument with the DHS to provide permanent data entry operators for the registration and billing counters and continue with hospital pharmacists for the pharmacy modules. HISP wrote a letter to DHS requesting for the manpower support.

> *"We made a written request to the [DHS]Secretary that you will have to introduce data entry operators..students or any trainee cannot do data entry.. So, there were two places where they gave us two data entry operators" (Project Officer, HISP)*

While the initial effort on scaling HIS produced significant technological, institutional, and people-specific challenges, prioritizing easy wins to start with three modules laid a strong foundation for subsequent implementation. While keeping its low power status, HISP became a 'partner' to the NHM, DHS and hospitals and went beyond contractual obligations to collaborate closely with them to develop locally improvised means to address various emerging challenges.

Phase II: Building Distributed Ownership (Orchestrator as Facilitator)

The next challenge in continuing HIS was of developing ownership (table 3). In the given institutional peculiarities of public healthcare, the actors responsible at each stakeholder end (e.g., hospital MS, the SPO and MD at NHM, and the DHS secretaries) changed frequently. This frequent change had critical implications for HIS. For instance, while one MS could be very supportive of the initiative, the subsequent one often would not continue the same level of support. For example, while one MS at a hospital made huge efforts to install and run the HIS, the new MS stopped every planned activity.

> "When I was there, I liked it so much…successful launched in pharmacy, registration, billing, and also in other parts..but when I left everything stopped.."..(The Medical Superintendent, of a hospital managing HIS implementation)

The change in secretaries in DHS or the NHM leadership could potentially change the functionalities required of the HIS. For instance, the following incident says how the change in DHS secretary required changes in the registration module mandating the use of Aadhar ID[7].

> "There was one secretary we had who said, "no no you had to take the Aadhar…So, these kinds of things and these kinds of changes continually we had to do. Just because there were various people who were involved [at different times] (Project Officer, HISP)

On some occasions, the NHM or DHS directly communicated some changes to the hospital, having implications for incorporating changes in the HIS functionalities (e.g., making certain drugs free). However, such change requests often bypassed HISP, leading to coordination challenges. The open-source nature of HIS allowed these changes to take place rapidly. These constant changes created challenges of having relatively permanent owner(s) within the institutional network who could keep track of the entire process. However, in the given nature of constantly changing actors, having the constant owner(s) at either NHM, DHS, or the hospitals' end looked challenging. The deep and intimate involvement of HISP in the early stages left it with the complete responsibility of managing HIS at each hospital. This created a critical dilemma for HISP to unravel—whether to continue with complete ownership or develop an alternative form of ownership. While deliberating on this dilemma, HISP also required considering that alongside major changes in the form of new initiatives, running the HIS at each hospital required day-to-day maintenance and solving regular issues such as minor software bugs or server breakdowns. Facing this challenge, it identified the need for local owners at hospital level. It realized that whereas the higher-level officials (e.g., MS) kept changing, the lower-level administrative staff (e.g., staff in the laboratory or the Medical Records Department and pharmacies), and the IT staff appointed by the DHS remained relatively constant. At this moment, HISP took the role of a 'facilitator' to building 'distributed local level ownership' at each hospital end by involving lower-level staff and IT staff greatly and encouraging them to take increased ownership in the daily functioning of the system. It trained the IT staff to restore some minor software bugs and to be able to restart the server after a power breakdown. Particularly, they trained the data entry operators to do some of these tasks since they had developed a degree of familiarity with the system. However, while HISP trained data entry operators, it still required 'one' point of contact for regular contacts. Hence, it made one of the staff, either from the IT team or the Medical Records Department, the designated HIS in-charge at every hospital. During our observations across seven hospitals, we found that these in-charges, along with the IT staff, also helped HISP in getting constant feedback about any changes required at the hospital.

> "These [top level] people keep changing but you know there are some people who recognize your core, at least because the data entry operators are there, they will recognize you, RKs (Rogi Kalyan Samiti) people will not change..because they are the one who are taking money and the billing, so. So, even if the support staffs knows you, it's of good help, so that helps.." (Project Officer, HISP)

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[7] It is a 12-digit unique identity number

Further, alongside the encouragement of the involvement of the local staff, HISP continued its active role in running HIS by doing periodic refresher training at each hospital. Our analysis of the refresher training reports informed that the training focused on educating the IT staff to understand the major changes in the software modules and took their feedback and made continuous improvements to the system. This helped strengthen local level solidarity and distributed local ownership of the operational HIS. This strengthening of distributed local ownership enabled HISP to continue its extensive involvement with the project without being locally present at each site. These local-level owners also solved minor bugs through remote coordination with HISP. While HISP was primarily required to support running the HIS modules, hospitals were responsible for organizing the maintenance of the hardware components. Some hospitals contracted with third-party vendors for those maintenance activities by developing annual maintenance contracts. However, apparently, due to budget constraints, all hospitals could not develop these contracts, in which case HISP needed to chip in to support these maintenance gaps:

> *"We asked them [hospitals] several times for getting an annual maintenance contract...but..we continued doing those tasks...we did all those things deep cleaning of servers or going to correct printers.." (Project Officer, HISP)*

Similarly, whenever hospitals had to purchase any hardware components, HISP often extended its help in enabling those purchases (without specifying any brand) and installing them properly at the hospital. In these ways, amidst the constantly changing stakeholders, HISP focused on developing local-level solidarity with the help of lower-level staff and IT staff, who remained relatively constant. Close involvement of these stakeholders helped HISP get constant feedback from the hospital and continue its deeper involvement at each hospital without necessarily being locally present.

Phase III: Managing Partnership (Orchestrator as Champion)

Until now, HISP managed the challenges emerging from the involvement of loosely connected powerful institutional stakeholders. Network orchestration encountered another critical moment when the changes in policies by the institutional actors brought 'new' external stakeholders. The orchestration activities now required managing these emerging actors alongside the incumbent challenges (Table 3). This was critical for sustaining HIS. In 2017, DHS launched an initiative to centralize the procurement and distribution of drugs and vaccines across all hospitals in the state. The DHS partnered with an external actor, the Centre for Development of Advanced Computing, to design the centralized Drugs Vaccine Distribution Management System. This software platform could automate the drugs and vaccines procurement and distribution at the state level. All the pharmacy inventories had to be stored in this system while the pharmacy module of HIS ran in parallel at the pharmacy counters of each hospital. Further, in 2019, as part of national e-health initiatives, the MoHFW decided to launch a 'Mera Aspataal[8]' initiative. The primary objective of this policy was to provide patient-centric care and enable patients to submit their feedback on their encounters at hospitals. This policy required each hospital to upload their daily patients' visit data to the 'Mera Aspataal' portal. The patients' visit data were captured through the registration module of HIS. These policies brought new systems such as Drugs Vaccine Distribution Management System and 'Mera Aspataal' portal and newer actors such as 'Centre for Development of Advanced Computing', eventually creating a new dilemma for HISP— whether to continue focusing on running HIS modules alone or make efforts to align and partner with emerging stakeholders and technologies constantly. Operationally, the newly introduced technologies had significant interaction with HIS. Without the integration of the registration module, the 'Mera Aspataal' portal could not function properly, which could compromise the interests of NHM. Similarly, integrating pharmacy inventory stored in the Drugs Vaccine Distribution Management System was essential to have a correct stock of medicine in the pharmacy module of HIS. During our observation at a hospital in Solan, we found that a lack of integration between the two created several operational challenges in maintaining the correct stock of medicines. While these technologies and stakeholders were emerging, HISP was also constantly working to ensure its continuity through annual contract renewals. A lack of integration with these emerging technologies and actors could potentially lead to the replacement by another vendor. Further, the integration had to happen while also serving the interests of various hospitals.

Facing this challenge, without necessarily waiting for the initiative from the other end, HISP made efforts to integrate the HIS with newly introduced systems and partner with emerging stakeholders. For instance,

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[8] Its English translation is – "my hospital"

when the Drugs Vaccine Distribution Management System was introduced, HISP contacted 'Centre for Development of Advanced Computing' through emails and phone calls to partner and do technology integration. The integration required the mutual sharing of API codes[9]. Nevertheless, the 'Centre for Development of Advanced Computing' showed reluctance to partner with and integrate its system. Despite several emails and phone calls, HISP did not receive the API code. HISP leveraged its long-trusted relationship with the DHS here. It reached out to the DHS through email, narrating its challenge and made it aware of the criticality of the integration. Moreover, going beyond its contractual obligations, HISP extended support to lead the integration once it received the API. As this project aligned with DHS's interests, it issued a letter directing 'Centre for Development of Advanced Computing' to support integration.

> *"When* Centre for Development of Advanced Computing *was not supporting us despite several efforts, we thought [DHS] secretary' stick is the only way. Once we get a letter from secretary, it will have to cooperate…" (Project Manager, HISP)*

The DHS allowed the HISP to lead the integration. This acceptance of HISP's integration effort by DHS provided it legitimacy and credence to carry out subsequent actions. For instance, when HISP started coordinating integration tasks, occasionally, it faced further reluctance from the Centre for Development of Advanced Computing. At this moment, HISP wrote emails directly to DHS, raising its concerns or copying it into all email communications. However, API integration could be achieved only when tested at a pilot site. This, in turn, required HISP also to get at least one hospital on board. HISP had built local-level ownership and solidarity by having an on-site in-charge. The long-term continued trusted relationship with these on-site in-charges was vital here. HISP leveraged this historically created relationship to onboard one hospital for doing a pilot run of integration.

> *"We have our people at each hospital. When Centre for Development of Advanced Computing was creating all these issues, we also got one pilot hospital..we were only waiting for them to share API" (Project Manager, HISP)*

Further, when the MoHFW launched 'Mera Aspataal', each hospital had to maintain its portal and update the patient's visit daily. When the hospital received this intimation, it contacted its long-term partner, HISP. Going beyond the contractual terms, HISP took charge of integrating the registration module of HIS with the 'Mera Aspataal' portal. Further, it took the lead in regularly managing and updating the patients' visit records on the portal. This eventually consolidated the relationship between hospitals and HISP.

The above findings indicated that HISP encountered a fresh set of challenges of sustaining HIS program when newer technologies and stakeholders emerged. At this juncture, HISP drew upon its long-term-trusted relationship with the existing loosely connected institutional actors and performed the role of 'champion' in technological integration and managing partnerships with the evolving external actors.

Phase IV: Managing Coherence (Orchestrator as Catalyst)

HIS historically operated on a LAN-based local server at each hospital, essential to the local institutional and technological infrastructure. However, the LAN-based operation received a major threat from the increasing push from the central government (another institutional actor, making the loosely connected network of public healthcare) to move towards a cloud-based system. The call for cloud resulted from various national initiatives that pressed for an integrated patient-based data architecture. It notably received a major push from the introduction of Ayushman Bharat Digital Mission. To increase the equitable reach of use of its flagship Ayushman Bharat Pradhan Mantri Jan Arogya Yojana, the central government, through its specially formed institute, National Health Authority, launched a flagship scheme of Ayushman Bharat Digital Mission in September 2021[10]. As part of this initiative, National Health Authority aimed to create a seamless online platform to enable interoperability within the digital healthcare ecosystem. It has created an interoperable API, and it invited healthcare technology providers to integrate their solutions with its architecture. It also offered an 'Ayushman Bharat Digital Mission-integrated' certificate to all the health technology providers who integrated their solutions with its architecture. Alongside asking health technology providers to integrate with its of Ayushman Bharat Digital Mission architecture, NHA also

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[9] API stands for Application programming interface (API), which make two software to communicate.

[10] https://pib.gov.in/PressReleasePage.aspx?PRID=1796553

advised the healthcare facilities to make their health technology solutions compliant with this architecture[11]. NHM was the responsible body in the state for implementing this initiative.

Migrating to a cloud architecture required completely redesigning the technology systems, revamping its supporting architecture, re-aligning the hospital infrastructure, re-skilling the human resources, and restructuring its network actors. This created a dilemma for HISP to address—of whether to continue with its current LAN-based architecture, where it has made huge investments, or migrate to the required cloud-based system. HISP was resolving this dilemma while they were also facing the survival threat. A non-migration to the cloud could potentially lead to discontinuity. However, at the same time, migration was a huge transformation. HISP continued with its LAN-based system while also developing a cloud-compatible system in the background. However, instead of developing all the cloud-based modules at one go, HISP once again went small. It prioritized those modules immediately that were essential for getting an Ayushman Bharat Digital Mission -compliant certificate. The compliance certificate required allowing patients' registration through modes such as AADHAAR, ABHA ID[12], and bar code scanner. HISP prioritized developing registration modules initially. However, this also required managing the heterogeneous interests of other actors, including NHM, DHS, to continue with LAN while it developed its cloud-compliant module and also getting approvals from the NHM to do a pilot run of its module once ready. Running a pilot was essential for getting the compliant certificate. Indeed, HISP encountered delays in contract extension and subtle demands from the state to implement cloud-based architecture to get contract extensions. HISP used its long-term trusted relationships with the hospitals to overcome this challenge. The hospitals relied on HISP for any help related to running HIS. When HISP faced delays in contract extensions, it reminded the hospital MS of its continued support for the long term. It brought their attention to the hospital-level infrastructure challenges in going for the cloud. The hospital's MS was responsible for upscaling the hospital infrastructure if the cloud-compatible system was implemented. Getting this constant nudge from HISP, the MSs further pushed the NHM to continue with the LAN-based system and extend the contract for HISP. In parallel, HISP worked on its cloud-compatible registration module. While leveraging its long-term relationship, HISP constantly met the NHM In its meetings, HISP updated NHM about the progress made on the cloud module, and while nearing completion, it constantly asked for approval to run a pilot. In the meetings, HISP also constantly reminded NHM of its long-term relationships and the infrastructure challenges in going for the cloud. This dual reinforcement of the long-term relationships and need for continuation mattered critically for NHM in giving contract renewal to HISP. Talking about the reasons behind continuing with HISP, the NHM project coordinator said:

> *"We get formal and informal feedbacks form the hospitals...we also want stability and continuity.. We will like to continue with them [HISPI] when going for cloud.." (NHM project coordinator)*

Thus, we found that when the demands for moving toward cloud-based architecture increased, causing a fresh set of institutional, technological, and people-specific challenges (table 3), it was essential for HISP to be a 'network catalyst' and orient the dispersed interests of the different institutional stakeholders toward its vision of the reality—to continue with HISP's LAN-based architecture. Its long-term relationships, acceptance, and legitimacy among the actors enabled HISP to do this.

Discussion

We studied the sustainability of a large-scale IS program in the public healthcare system of Himachal Pradesh, India, by understanding the processes involved in an institutional network orchestration. The findings show that institutional network orchestration is a complex process of achieving a collective network goal alongside serving distinct interests of loosely connected dynamic institutional stakeholders. The orchestrator requires adopting different roles for attending to constantly evolving dilemmas posed by the emerging challenges of the institutional network.

Sustaining HIS went through four stages, posing distinct challenges, which, in turn, put unique dilemmas for the orchestrator, HISP, to address. HISP took different roles at these stages to perform various purposeful activities in resolving those dilemmas. In the first stage, HISP required nudging the autonomous hospitals to 'engage' with the network by implementing HIS. However, the modest technological and human infrastructure, coupled with the institutional challenge of low-cost HIS required solving the dilemma of

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[11]https://www.thehindu.com/news/national/nha-issues-hardware-norms-to-healthcare-institutions-for-implementation-of-ayushman-bharat-digital-mission/article65797367.ece

[12] ABHA is a unique ID for Ayushman Bharat Health Account

whether to go ahead with all modules of HIS or go small. The next challenge was building ownership. In the given peculiarities of public healthcare, actors representing each institution (e.g., NHM, DHS, and hospitals) kept changing, and it was difficult to have a relatively constant owner at either end. This created a critical dilemma of developing appropriate ownership. HISP took different roles to perform several orchestration activities. We interpret that the orchestration activities at these early stages were various types of 'institutional work' (Lawrence and Suddaby 2006). The institutional work belonged to two broad types—relational and material work. While relational work may mean collaborating with large, loosely connected institutional actors "to work in a seemingly independent manner towards a common goal with minimal formal coordination." (p. 29), material work may mean using material objects to extend one's agency in performing institutional work. Indeed, we found 'material work' in HISP's orchestration activities. When HISP struggled to get hospitals' engagement in the early days, it leveraged open source's 'flexible' and 'modular' nature to 'prioritize easy wins' and started with only three modules. Similarly, when facing the challenge of building ownership, it drew upon the 'openness' feature of HIS to promote local-level ownership. Evidently, HISP extended its agency by leveraging the materiality of HIS in its orchestration activities and adopted a modular approach to managing HIS amidst modest technological and human infrastructure. Further, these orchestration activities also included a great extent of relational work. For instance, building the local level ownership was equally an effort toward building a local level of solidarity and constant communication between the hospitals' actors and the HISP as it was material work. Similarly, while deciding on the 'three modules', it engaged in extensive relational work between the NHM, DHS, and the hospitals and drew upon its long-term relationship with the DHS in getting IT staff to use HIS. Importantly, leveraging its low power position, HISP went beyond its contractual obligations in performing these various relational and material orchestration activities. These extensive relational and material works (table 4) during the initial two stages helped HISP gain legitimacy and credence from the other actors (including hospitals, NHM, and DHS), which in turn granted them a higher symbolic status and 'symbolic power' (Bourdieu, 1991)— a "magical" and invisible form of power, which could operate in an underrecognized and tacit way in influencing other actors. While not an objective institutional power, a symbolic power is achieved by making other beliefs in one's legitimacy, and it comes to effect only "*in* and *through* a relationship between those who exercise power and those who submit to it" (p. 170). Thus, symbolic power does not exist *per-se* unless exercised" and "*recognized*, that is misrecognized as arbitrary' (p. 170) , which further leads to the reproduction of that symbolic power. In other words, symbolic power is a 'structured structure', resulting from the constant reproduction in and through the relationships. The 'structured structure' further acts as 'structuring structure' to make actors subconsciously accept and (re)produce it in their relationship, allowing those exercising symbolic power a special privilege to mobilize other actors to conform to its version of the social reality. Symbolic power, when exercised, enables "a power of constructing reality, and the one which tends to establish a gnoseological order" (Bourdieu, 1991, p. 166) by making people see and conform to its vision of the world. The symbolic power accumulated through these relational and material orchestration work in the initial two stages were critical to increasing HISP's symbolic position in the network and for doing orchestration activities in the later stages.

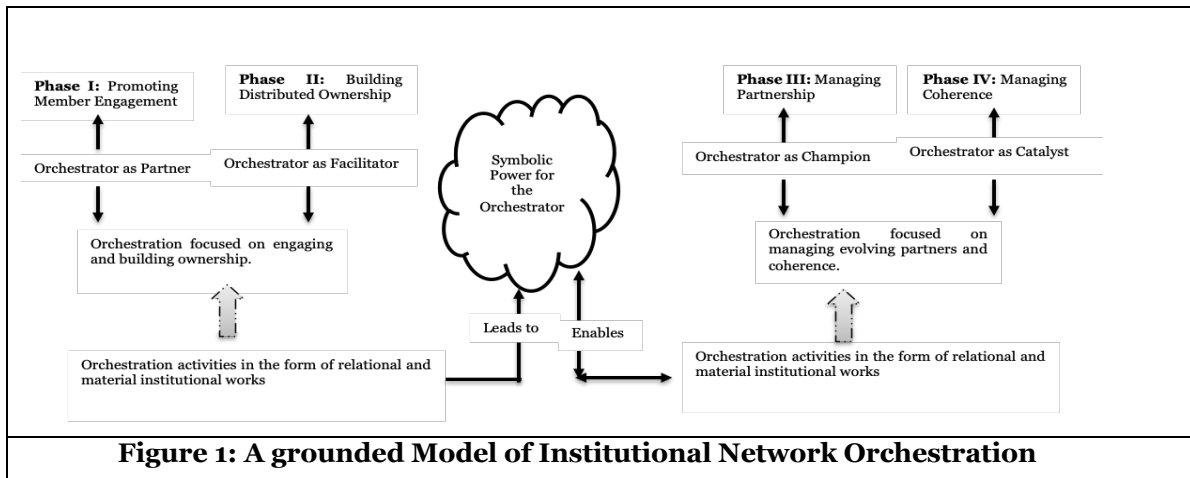| Stage	Relational Work	Material Work
Promoting Member Engagement	Coordinating with DHS on behalf of the hospital to procure computers. Temporarily involving hospital level staff	Scaling only three basic modules—registration, billing, and pharmacy Setting up LAN and Servers
Building Distributed Ownership	Training IT staff for routine software issues Appointing site in-charges at each hospital Taking feedback during refreshers	Supporting in day-to-day running of hardware equipment Helping hospitals in buying and installing hardware.
Managing Partnership	Getting letters from the secretary Writing Emails	Technology integration Managing "Mera Aspataal" portal
Managing Coherence	Future Shadowing Making hospitals and state connect on giving contract renewals	Focusing on building registration modules only first.
Table 4: Relational and Material Institutional Work of HISP			

Indeed, our study found the manifestation of, and hence the existence of HISP's symbolic power in the later stages. Until stage II, most of the orchestration activities (relational and material works) focused on coordination among the given institutional actors. However, around 2017, newer policies toward digitizing healthcare brought new actors and new systems. These changing circumstances also required HISP to align emerging actors and evolving interests of the diverse actors, including hospitals, state, and the new demands coming from central government stipulations. This was critical for the sustenance of the HIS program. However, the institutional setup of the public healthcare system did not provide for any provisions for using power to enroll and align these emerging actors. We found the exercise of HISP's symbolic power at this moment, resulting in the sustenance of HIS program. For instance, when DHS brought the policy to implement the 'Drugs Vaccine Distribution Management System', HISP faced the challenge of integrating it with HIS and partnering with a new actor, the Centre for Development of Advanced Computing. However, it lacked the institutional power to issue commands. It brought its long-term association and legitimacy from the DHS in getting a letter for the integration. Further, extending its symbolic status and acceptance among hospitals, it took the lead in doing the integration. Later when the push for a cloud-based system emerged, it drew upon its symbolic power in convincing the actors by 'future shadowing' and, at times, 'showing the importance of its long-term continuity' to continuing with its LAN-based system while it worked for migrating toward cloud-architecture. We found that while bringing its 'symbolic power' at these later stages, HISP continued its relational and material work. For instance, when it encountered a new system from the Centre for Development of Advanced Computing, it drew upon the material feature of 'open source' for easy API integration. However, when it faced reluctance, it performed relation work of writing emails and getting letters. The relational and materials work while exercising symbolic power in orchestration activities at these later stages further reproduced HISP's higher symbolic status and contributed to the continuation of HIS. These findings extend our understanding of network orchestration, particularly in institutional network, and enrich the knowledge of sustaining a larger scale IS program in public healthcare.

Our grounded findings inform how institutional network orchestration differs from that of closed, and open system orchestration (table 5). Orchestrating an institutional network may go through distinct phases, each posing distinct dilemmas for the orchestrator, triggering it to take different roles in performing its orchestration activities. Findings underscore the role of material and relational work, and the importance of symbolic power in orchestration activities. While the network members may exist apriori, pursuing distinct interests, a critical challenge before the orchestrator at an early stage is to nudge those members to engage in the network and build their ownership without creating a power conflict. Orchestrators may benefit from engaging in various relational and material institutional work, which may help them gain symbolic power over others in the forms of trust, reliance, and long-term relationships. The symbolic power, thus, acquired proves critical in performing later-stage relational and material work when the orchestrator encounters dilemmas emerging from the challenges of constantly evolving actors and their interests (Figure 1).

Dimensions	Closed-System Orchestration	Open-System Orchestration	Institutional Network Orchestration (Our addition)
Orchestration orientation	Directive, self-oriented	Pro-social, other oriented	Dual Orientation- institution as a whole, and distinct institutional actors
Value creation and appropriation	Centralized coordination of innovation efforts, and negotiated distribution of the benefits of the collective output	Facilitation of decentralized and independent entrepreneurial efforts, with local appropriation of their benefits from members	Coordination of centralized value creation alongside facilitating decentralized local value appropriation

Center vs. periphery interaction	Harness (exploit) distributed resources and capabilities of network members along a centrally coordinated innovation effort	Provide shared resources and nurture capabilities of network members to support dispersed entrepreneurial efforts	Nurture capabilities of network members to support dispersed goals within a collective institutional goal
Members' admission	(Relatively more) restricted: selection based on network needs and member-specific evaluation	(Relatively more) open: selection based on potential members meeting network-specific criteria	Network has both static and dynamic elements—loosely connected institutional actors exist priori. Another group of stakeholders remain dynamic, however their admission authority lies with the institutional network members
Members' engagement	Enforced contractually	Voluntary ad hoc participation in network activities	Discretionary; requires deliberate efforts by the orchestrator
Power	In the absence of a hierarchical power, the orchestrator draws power from its centrality or individual attributes such as size, or resources.	Neither party brings power to network	Institutional power lies with the network members; orchestrator may be external and hold no (objective) form of power. May bring symbolic power later on.

Table 5: Institutional Network Orchestration Vis-à-vis Other Network Orchestration

Figure 1: A grounded Model of Institutional Network Orchestration

These findings on the interplay of relational and material work, and symbolic power is unique to institutional network context, distinct from the other networks such as industrial networks (Paquin and Howard-Grenville 2013) and business ecosystems (Dattée et al., 2018). The distinction comes from the position of the orchestrator. In contexts such as business ecosystems, the orchestrator, like IBM (Dattée et al., 2018), may hold a powerful position. However, in the case of an institutional network, such as the one in this context, the central actor may lack the institutional power position; instead, the other actors are more powerful. Our findings underline the role of accumulating symbolic power through relational and material work in performing orchestration activities. In the absence of any objective institutional power, the higher symbolic status of the vendor, orchestrator, enabled it to perform the orchestration activities in this study.

These findings also add to the current knowledge on managing and sustaining a large-scale IS program in public healthcare. Extant literature has noted that sustainability faces challenges from the institutional power conflicts (Constantinides and Barrett 2015) and dynamisms involved with the constantly evolving actors (Nancy et al. 2016). This study brings a novel perspective to show how a low-power external stakeholder can bring sustainability to an IS program by performing orchestration activities in the form of various relational and material work to address the constantly evolving challenges and dilemmas. The low power stakeholder can orchestrate the evolving network complexities by taking up distinct roles, without creating a power conflict, which may help it gain legitimacy and become a 'trusted partner' for all the network members. This legitimacy and trust may result in a higher 'symbolic status for the orchestrator, which may prove critical in aligning actors and their interests to ensure continuity. Importantly, findings underscore the criticality of considering sustainability as a *process* (Borst et al. 2022). The study informs that *sustaining* IS initiatives involves *orchestrating* the constantly evolving challenges through various relational and material works. An institutionally low-power orchestrator may hold critical significance in performing these works by constantly accumulating its symbolic power in the process.

Conclusions and Future Research Directions

Sustaining a large-scale IS program in public healthcare requires addressing the challenges emerging from the 'loosely coupled' and 'constantly evolving' network of institutional actors. We drew upon the noted analytical power of the 'orchestration' lens to study the orchestration of a public healthcare network, by an external low power actor, for sustaining a hospital information systems project across 20+ public hospitals in Himachal Pradesh, India. The findings informed that institutional network orchestration goes through different stages, and each stage poses distinct dilemmas for the orchestrator. Findings underscored the significance of relational and material institutional work and orchestrator's symbolic power in orchestrating an institutional network. The study also extends the literature on sustaining IS programs in healthcare. It shows how a non-institutional actor can leverage its low-power status in performing various relational and material work that may contribute to its symbolic status and eventually help manage the evolving challenges from the dynamic and institutionally powerful actors. The findings also inform the need to see sustainability of IS initiatives in public healthcare as a *process*, which involves *orchestrating* the constantly evolving challenges through various relational and material works. These findings must be interpreted within the study's limitations. The current study focused on orchestration around a specific open source HIS. Indeed, technological features had a greater role in performing various relational and material works. Hence, these contextual findings may not immediately apply to other institutional network orchestration. However, the general understanding of the role of relational and material work and symbolic power may exist in other contexts too. Further, as patients are one the important stakeholders of public healthcare, there is a scholarly merit in including the patients' voices too.

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Appendix A: Representative Concepts and Evidence used in Data Analysis

Concept	Evidence
Institutionally less power position	HISP could not force any actor for supporting its actions (e.g., it could not force hospitals to implement HIS or hire a permanent IT staff)
	The power to renew the contract lay with the state and the hospitals, creating vulnerability of the vendor
Orchestration role of the vendor	The relative permanency of the vendor amidst changing actors at hospital and state level.
	The active role of vendor in initial days to coordinate with distinct actors such as hospitals, state secretaries, external vendors, and NHM,.
	Nature of the contract allowing centrality and flexibility to the vendor