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An Institutional Perspective on the Adoption of Open Dashboard for Health Information Systems in Tanzania

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Abstract. This article attempts to understand the adoption and institutionalisation of open dashboards in the health information system in Tanzania as part of the national initiative in strengthening the routine health information systems through data-driven approaches. Using an institutional perspective, specifically the concept of institutional work, the article analyses the efforts of a group of actors aimed at disrupting existing structures, thereby creating new ones and diffusing them within and across organisations. We argue that for the institutionalisation of open dashboards in health information systems, serendipity moments are necessary and should be coupled with actors willing to mobilising others within the network. Furthermore, we argue that the use of participatory approach has the potential to align interests from diverse stakeholders hence providing a mechanism for transforming rooted organisational routines.

Keywords: Dashboards, Open Data, Open Dashboard, Institutional Work.

1 Introduction

Dashboard can simply be termed as a visualisation tool which summarise and present information from multiple data sources in a single screen. With organisations adopting a data-driven approach, the application of dashboards in various sectors has seen a surge of interest. An increasing number of organisations are or in the process of adopting dashboards as a means of staying close to their data [1] leading to its various naming conversions and applications; such as intelligent dashboards [2]; performance dashboards [3]; interactive dashboards [4]; traffic light dashboards, commonly known as scorecards [5]. Some of the factors attributing to the growing interests in dashboards include their ability to monitor performance, to convey information easily to diverse or specific stakeholders, to be used for planning purposes and to enforce consistency in measurements across organisations [6]. In this era of information where managers are faced with increasing data volume, information complexity and diversity; dashboards have the potential of playing a prominent role in responding to such

challenges as well as tipping the balance between information load and decision accuracy.

In the healthcare domain, dashboards have also seen a larger share of interest and use. Specifically, they have been used as a tool to provide information and feedback to the central organisational structure down to the specific health provider. In a sector characterised by information systems fragmentation and a multitude of diverse stakeholders [7, 8], dashboards provide data managers, practitioners, donors, implementing partners, and the public at large the ability to access and analyse information from different data sources and monitor progress at various administrative levels through a comprehensive set of visualisation configurations. They can be used to monitor organisation's performance and progress towards reaching global, national and sub-national goals such as Sustainable Development Goals (SDG) and national strategic plans. For example Edward et al. [9], through a five years evaluation of Afghanistan health systems, reports that the application of dashboards helped in improving health service capacity and service delivery. The enhancement of evidence-based decision making culture and organisation learning are some of the elements attributed to the application of dashboards.

Nonetheless, despite the wider application of dashboards, still organisations are faced with several challenges in dashboard implementation ranging from design [10] to organisational issues [6]. For example, Few [10] emphasises the challenges dashboard implementation faces with some of them failing to live up to their potential, mentioning '*visual design*' as a key component to '*most dashboard implementations fail[ing] miserably*'. While the advance of technology has enhanced the dashboard design, little has been reported in the scientific literature and studies understanding the adoption of dashboard in organisations are still few [6]. With this backdrop, our study positioned itself to understand how dashboards could be adopted and institutionalised within the Health Information Systems (HIS) in developing countries. Taking an institutional perspective, we aim at understanding the change process needed to introduce and diffuse dashboard within existing organisational structures. Applying the concept of open data, we broaden our understanding to how organisations can embrace the idea of 'open dashboard' when much reluctance to publically shared information is observed; even more from public agencies [11]. An institutional perspective provides a better insight on how open dashboard can be institutionalised within an organisation while challenging existing institutions. Using the concept of institutional work [12], we seek to address the research question of "what are the required institutional change processes in adopting open dashboards in the health information systems". We argue that for the optimum adoption of the open dashboard in HIS, serendipity moments are necessary and should be coupled with actors willing to mobilising others within the network. Empirically, we draw on experiences of a group of actors in Tanzania, aimed at implementing a web-portal to disseminate routine health information to Ministry of Health's stakeholders.

2 Literature Review

2.1 Open Data and Open Dashboards

Recently, government institutions have experienced increased pressure to openly make available their dataset to the public. The motivations behind such pressures are arguments that open data could involve the citizen in analysing the large quantity of datasets [13] as well as promoting policymakers to address complex problems through the use of data [14]. By far, public organisations lead the path in creating and collecting a huge number of data in various sectors [15]. This is very true in the health sector as well. Making the data available openly has the potential to mend the traditional boundaries existing between government institutions and the public, its largest client and beneficiary. Through interviews, Janssen [16] identified some benefits from open data ranging from political and social, to economic, operational and technical benefits. However, despite the significance of open data, one needs to be wary of the potential challenges to its adoption. Exposure of incomplete, inaccurate, obsolete information and failure to enable users to understand and use information have the potential to raise significant barriers limiting the potential for open data. Thus having useful structures and support in handling open data within an organisation are seen as significant elements in reducing the organisation's 'red tape' and shift them from the traditional reporting structures.

Dashboard is a concept attracting significant attention in various sectors and plays a role in information dissemination within and across organisations. Generally, dashboard is a visualisation tool that collects, summarise, and present information from multiple data sources so that the users can view at a glance how various organisations' indicators are performing. Stephen Few [10] defined the dashboard as '*visual display of the most important information needed to achieve one or more objectives that fit on a single computer screen so it can be monitored at a glance*'. Dashboards are not new and started as normal reports. In recent years and with the advancement of visualisation tools, dashboard has evolved into metric reports and taking up a new purpose by being able to present information from different data sources and allow users with different background to understand the information and manipulate them, thus, giving it a ubiquitous status [17, 18]. The adoption and application of dashboards in the health care system have also seen some of its shares. Edward et al. [9] report on a five years evaluation on how dashboards were adopted to improve the health service capacity and service delivery within the Afghanistan health care system. The application of dashboards enhanced transparency in the decision-making process and created a culture of accountability at all levels within an organisation. On the other hand, the dashboard's application in providing regular information to the public particularly from data collected by the government institutions has yet to receive extensive attention. The notion of open dashboard containing collection of information and allowing them to be accessed publicly is of interest and has not been explored enough. Open dashboards have taken different names at different times such as web-portal and open web-portal. The understanding of how public organisations can adopt open dashboards is of interest and this article seeks to address it.

2.2 Institutions and Institutional Work

Institutions are considered as formal rules and informal constraints which guide individuals in their routine activities. Once established, institutions become authoritative guidelines for social behaviour and facilitate the social interactions and actions among groups of individuals [19]. The concept of institutional work examines the agency of actors in creating, maintaining, and disrupting existing institutions [20]. It illustrates the internal shifts within the structured processes as the consequences of actions taken by actor or group of actors, concurrently being shaped by the same institutions. Institutional work concerns with what an actor or group of actors can do in order to create, maintain or disrupt the institutional structures in a manner which suits their interests and needs. It contributes to the understanding of agency in institutions by bringing to the forefront the routine and mundane efforts aimed at affecting existing organisations structures [21].

Lawrence and Suddaby identified three categories of institutional work with potential different institutional effects, namely creative, disruptive and maintenance institutional work [12]. The creative institutional work entails the activities to reconstruct rules, and shuttering the existing boundaries within the organisations [22]. It puts attention to the planned actions performed by actors in the construction of new organisational structures as opposed to or beyond the existing ones. In disruptive institutional work actors may strategically choose to undermine the ‘existing mechanisms’ by tearing them down or rendering them ineffectual should their interests no longer be served by the existing arrangements. On the other hand, the institutional maintenance involves supporting, repairing or recreating the social structures ensuring the introduced institutions continue to be reproduced and routinized [23].

In this study, we take the institutional work lens to analyse the changes needed for a group of actors to adopt open dashboards in the Health Information System (HIS) in Tanzania. We analyse how a group of actors, through a set of activities, purposefully aimed at introducing and changing existing routines in disseminating routine health information. The lens allows us to see the adoption process as a process involving a group of actors engaged not only in the design and development process but rather in establishing new practices of information dissemination within the organisation.

3 Method

The empirical setting for the study was in Tanzania as part of the larger global Health Information Systems Programme (HISP). HISP initiatives have been ongoing for the last 20 years involving software development and country implementation of District Health Information Software 2 (DHIS 2) in several countries in Africa, Asia, South America and Europe [24]. DHIS 2 is a platform adopted by several ministries of health as their preferable Health Management Information System (HMIS) backbone software to collect, analyse and share routine health information.

This study entails the project established to formulate open dashboard in Tanzania as a joint effort to improve access to routine health information. The project work followed an action research model which involved joint participation in the planning,

implementation, evaluation and data dissemination activities [25]. The project planning and its evaluation took place in various periods throughout the project life cycle in terms of face to face meetings and electronic communications with other evaluation mechanisms centred on workshops and fieldwork. Discussions on the key findings were conducted during and along the implementation phases giving insight to the next planning phases and in several peer to peer meetings. Knowledge dissemination has been done by documenting the processes, challenges and recommendations in the final project documentation.

Authors of this article were actively involved in the project work from its conceptualization to the implementation phases in Tanzania. Throughout the study, principal data collection methods used includes semi-structured interviews, participatory observation during the meeting and workshops and participation in the database design. Additional data were drawn from meeting minutes and email correspondence, informal discussions and reports submitted by the authors. It is worth noting that, one of the authors heads the HMIS unit in the Ministry of Health in Tanzania, a unit among other things, responsible for the routine collection, analysis and dissemination health information within the ministry. Other authors have been part of the global HISP network for over a decade and engaged in similar projects in other countries in Africa and Asia. Two of the authors are part of the Tanzania HISP group supporting the Ministry of Health in HIS strengthening activities. Both their experience and historical background provided additional information to the study.

The iterative review was employed in analysing the data collected from various sources for example: field notes, transcripts and meeting minutes. Thematic analysis which involves examining, and recording patterns as a means to identify themes which formulates the basis of interpretation was used as an analytical technique during the study [26]. The results have been presented and discussed in multiple occasions in peer review sessions and in other general meetings and workshops.

4 Open Dashboard Implementation

The health structure in Tanzania mainland is organized at four main levels; the health facility, as the point of service delivery for health; the district council level, as the lowest administrative centre for HMIS activities after the health facilities; the regional level, coordinating between the districts and national level and lastly the national level where the HMIS unit address the information processing and dissemination for MoH. During a period of 2011-2013, the MoH with the support from its implementing partners and donors implemented an open source, web-based system named DHIS 2 as part of its Monitoring and Evaluation Strengthening Initiative (ME&SI) to strengthen the routinely HMIS. The national-wide implementation of the system in Tanzania enabled data collected by paper tools at the facility level to be entered in the online DHIS2 national system at the district council level enabling information analysis based on the analytical tools and dashboards configured in the system. Following the national wide implementation covering mostly data collected by HMIS, other vertical health programs (such as HIV, Human Resource, Logistics,

Malaria and TB) were integrated in the national system either by the national system to collect their data or by facilitating systems interoperability. Access of information in this online DHIS2 national-wide system was through credentials provided by the MoH. Alternatively, information could be extracted with request to the HMIS unit at MoH or through the production of Annual Health Sector Performance Profile Report (AHSPPR), presenting a clear picture on the performance of routine health delivery as well as trends in key health indicators, performance of interventions and comparisons over different regions and time. The AHSPPR is annually produced after series of data validation processes, compilation using national standards and endorsement from high-level officials in the MoH.

The availability of an online DHIS2 national system comprising of vast information from various health programs prompted a wide scale demand for system access from the implementing partners supporting the MoH and the local administrative councils. Previously, implementing partners could access data directly from the health facilities or at the district councils they support. However, with now a nation-wide system in place, MoH emphasised DHIS 2 as the source of data for all health stakeholders, putting pressure on implementing partners and local health officials to report and use health information emanating from the national system. While annually, the AHSPPR and other statistical information bulletins were produced and shared with health stakeholders; partners had ad-hoc demands for information, requiring more regular access to the health information, posing a new challenge.

University of Dar es Salaam (UDSM) DHIS2 project being part of the global HISP network and the local partner of MoH in health information system activities was thus involved to address such a challenge. UDSM supported the MoH in the national wide implementation of DHIS2 and had a Memorandum of Understanding (MoU) to provide technical and user support for MoH and its partners. An initial assessment which included participation from various departments under the MoH, vertical health programs, implementing partners and agencies from other sectors such as National Bureaus of Statistics (NBS) revealed that the information demands were quite diverse and needed a comprehensive solution to be addressed. While AHSPPR addressed some of the demands, partners required a more regular information outlet and with different granularity i.e. multi-level, processed information vs raw data. For example some required raw data disaggregated by health facilities to import into their organisation's software for further internal analysis while others were content with processed information shared routinely such as monthly or quarterly.

With the limited available resources, the HMIS unit and UDSM took the task head on and designed an online web-portal, also called 'open dashboards', extracting routine health information collected by the DHIS2 nation-wide system. Combining the previous experience of using national system dashboards, which resonate well with data managers, as a tool which summarises and visually presents information for instant data interpretation and the knowledge assimilated from similar efforts in the HISP network; prototypes of the 'open dashboard' were constructed and presented to stakeholders for feedback and review. This proved to be another challenge with conflicting feedbacks at a time, as one interviewee noted.

"So we ended up showing at sometimes all three versions (of the web-portal), of course, we had to go an extra mile doing three things all together just to show why one thing is better than the other two, That was one of the selling points to get the idea across."

"Trick was to have a simple design without a lot of information to the extent of becoming crowded. People cannot really process too much information. But still putting enough information across without holding back a lot of details was necessary."

Feedback gathered through workshops and internal meetings provided a good stream for improvements and localising the web-portal to the stakeholders needs. Compromises had to be reached to enable progress to be made. For example, limiting information presented on the web-portal to district council level only, with a provision to the health facility data upon access request and agreement for quarterly data cleaning processes, were some of the issues which needed clarification and resolution. Other thorny issues raised were the use of data for publication and availability of raw data, requiring member's agreement prior to the open dashboard deployment. Nevertheless, these challenges and their resolution enabled the open dashboard to gain acceptance and trusts among stakeholders as well as facilitate its localisation to their needs.

While AHSPPR had more regulated processes in its formulation and had been used for several years: the dissemination of information through open dashboard seemed to by-pass some rigours standardised processes. However, its use by partners to extract key indicator performance by districts and regions they support or national wide, enable some of the data quality elements to improve. For example, completeness and timeliness of routine data submission improved significantly because information was now available not only to the users accessing the national system but rather to the public in general with easy accessibility mechanisms. When asked about this, one interviewee said.

"In one session, two conflicting data were presented, with one coming from the web-portal. We showed the information from web-portal and pointed the data source being the DHIS2 system from the health facility to the web-portal. This alerted the partner supporting the region to streamline their activities and data quality processes."

The design of the web-portal categorises its information by key health programs (i.e. HIV, TB, Malaria, Maternal and Child Health, Human Resource) enabling users to access a full yet coherent picture of the health status (see Fig. 1).

The number of requests and feedback for new features increased, indicating it's acceptance among the health stakeholders. Similarly, other units within the MoH adopted and used the open dashboard to disseminate their information. In one of its presentation to a high level manager's meeting from several sectors, one senior official from another sector said:

"During my working experience, it is quite rare to come across a sector in the local government able to compile a comprehensive set of its routine sectorial information and regularly share them publically. This will definitely be a good example for other sectors to follow suit."

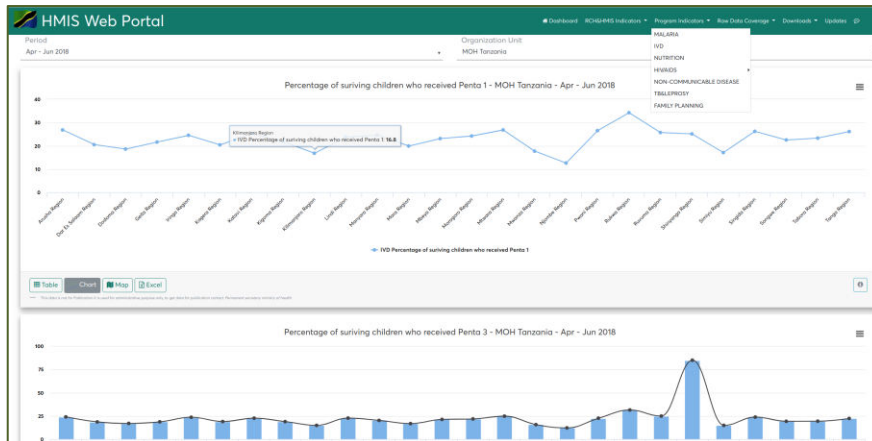


Fig. 1. Tanzania HMIS Open Dashboard.

5 Analysis

Using an institutional work lens, this section analyses the efforts of a team of actors engaged in the implementation and diffusion of an open dashboard as set of changes using the three categories of creating, maintaining and disrupting as suggested by Lawrence and Suddaby [12].

5.1 Disruptive Works

DiMaggio and Powell [27] described institutions as norms, practices and logic which structure organisations as 'iron cage' limiting one's actions or reaction to some of the emerging challenges. When not appropriately addressed, the emerging challenges from disruptive elements to the existing structures eroding their legitimacy. Our study illustrates a regulated and 'taken for granted' process which the MoH has for several years used to communicate and share the routine health information to its stakeholders. While not the only means for communication, the annual health sector performance profile report was a prominent mechanism with regulated process for MoH to communicate with stakeholders, its performance and achievements. The process involved but was not limited to the validation and verification of information, supported by endorsement from high-level managers prior to sharing the report with the public. The introduction of online national wide system aimed at strengthening routine health systems; however, its adoption had unforeseen consequences to MoH's routines for information sharing and dissemination triggering disruptive elements to the existing routines for information sharing and dissemination. The massive demand for up-to-date routine health information could not be handled by the existing regulated processes, creating an opportunity for actors to tinker the existing structures. While the actors did not initiate the breaching of the existing structures, their mobilisation and continuous work towards undermining the existing structures while introducing

alternative ones are seen as disruptive works. Their activities aimed at providing opportunity for new structures to challenge the existing ones within the organisation

5.2 Creation Works

Zietsma and McKnight [28] illustrate the institutional creation work as *'a process of collaborative co-creation and/or competitive convergence, involving experimentation undertaken by multiple actors'*. They further argued that, to attain a common template among diverse stakeholders, the interests of multiple actors should be embedded in the solution through multiple iterations of negotiations and active co-creation. This underpins the need for actors in such a competitive environment to focus on translating some of the requirements and feedback from others' stakeholders into the emerging solution for it to gain legitimacy.

The UDSM team and HMIS represent a group of actors determined to formulate a solution to the emerging challenge. While they did not have a solution at hand, they had expertise and knowledge which proved to be valuable in addressing the problem. Their involvement on the national wide implementation of DHIS 2 provided them with a better position among the health stakeholders. Once the solution was identified, a participatory mechanism was employed in several iterative sessions to engage various key stakeholders and localise the new solution through negotiations and concession. This provided a common understanding in creating the open dashboard and its routines. For example, the team selected first the major vertical programs and stakeholders to diffuse the idea of open dashboard through workshops and working sessions while at the same time gathering their requirements. This enabled the stakeholders to come to terms and reach a compromise when faced with new requirements or difficult choices to take. The use of prototypes for experimentation and learning was central in such a collaborative environment with diverse stakeholders and provided an ideal approach for enhancing knowledge sharing and diffusion of the solution. The creation works cultivated by a group of actors was thus able to form new routines and root themselves in the organisation structures as they compete for dominance.

5.3 Maintaining Works

While the actors were engaged with adopting the open dashboard in the MoH routines, there was a need for antidotes to existing or emerging undermining elements threatening to destabilise the diffusion of the introduced solution. For example, the team needed to address the legal aspect of routinely sharing information publicly before launching the open dashboards. Through consultations with stakeholders in the government and outside as well, a compromising position was reached which allowed sharing of routine aggregate information to the public with limitation for publication. Furthermore, the diffusion and scaling of the solution across vertical health programs was another strategy deployed to ensure sustainability and strengthening ownership while resisting new and existing pressures. For example, key vertical health programmes were identified and took part in the initial negotiation processes. Identifying their requirements as well as hosting their indicators in the open dashboards generated

momentum for other programs to follow. Regular presentations of the routine health information using the open dashboard raised awareness as well as providing a way to disseminate information to diverse stakeholders. To further enhance the momentum, demonstration to senior level managers was necessary in cementing its legitimacy within the ministry. The nature and occurrence of such maintenance work underscore the Zietsma and McKnight [28] argument that, all three categories might occur simultaneously as actor's tries to undermine the existing organisational structures while at the same time creating their own and drive them to be diffused and maintained.

6 Discussions and Conclusion

Ciborra [29] argues for serendipity moments as a 'petri dish for tinkering' allowing effective solutions to be embedded into everyday practices. Recognising challenges as stepping stones for creating innovation and engagement in a collaborative process on unfamiliar territory, or even involving competitive agents, are some of the elements which can be attributed to such moments. When different organisational actors came together to discuss their information needs for the first time, it was a new situation ('moment') triggered by the potentials seen by the actors on the open dashboard concept. When the existing structures within the MoH did not address these new demands, some of their legitimacy eroded allowing new structures to potentially be introduced. However, such conditions required to be coupled by willing actors with capacity to instigate and drive such changes in the organisation as well as convincing others to align their interests. The team from UDSM and HMIS represent actors who were determined to formulate a solution to the presented challenges. While they did not have any solution at hand, they had experience, expertise and knowledge which proved to be valuable in addressing the problem. Drawing from experience in previous work formulating open access dashboards and their position in mobilising stakeholders in the implementation of the national wide health information system, the actors engaged in iterative processes of breaching the 'iron cage' while introducing new routines to the organisation.

While there are many benefits to rip from public organisations to routinely share information with the public, doubts still exist on how the public will react or not to the shared information. Previous research indicates that opening of information publically might reinforce existing practices rather than changing them [15], however, our analysis indicates the opening of data publically might stimulate change not only within the organisation but rather across public sectors.

We thus argue that for the optimum adoption of the open dashboard in health information systems, serendipity moments are necessary and should be coupled by actors willing to mobilising others within the network and align interests from diverse stakeholders. Furthermore, we argue that a participatory approach in formulating open dashboards has the potential of not only aligning interests from diverse stakeholder but also provides a better mechanism to transform rooted organisational routines and make them susceptible to new structures. Open dashboards have the potential to better connect the public organisations with the public mending the traditional separation

between them. Additionally, the participatory approach in the designing process enables dashboards to ‘live up to their potential’ and address the design challenges [10]. However, we argue that, it is not enough to publish the information publicly; rather there is a need to actively engage public stakeholders in gathering feedback and responding to issues raised.

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