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Global standards and Local Applications: Case of Implementing ICD-10 Standard in HMIS Tajikistan

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Abstract. This paper contributes to the ongoing debate on the interplay of global and local standardization processes and how can these be effectively managed. Based on the longitudinal case study of the Health Management Information System (HMIS) implementation in Tajikistan, the paper analyses how the adoption and usage of global standards of International Classification of Diseases (ICD) contributes to the improved quality of health data for clinical and statistical purposes and the related implications it has for the health service delivery. The analysis focus onto negotiation processes among various stakeholders of HMIS in interplay between the global standards and local implementation of these standards through the lens of proposed conceptual framework of 'global and local interplay of HMIS standards'. Three distinct approaches developed by stakeholders in redesign of HMIS standards were identified, each having advantages and limitations. Further varying level of ICD use in these approaches is discussed along with future prospects from gradual use and institutionalization of ICD.

Keywords. ICD; HMIS; Healthcare; Standard; Developing country; Tajikistan.

I. Introduction

Nowadays we live in a world of globalization, where initiatives and concerns are raised globally and measures for implementation are taken locally, often involving transnational and regional collaborations. The recent "2009 swine flu pandemic" (WHO, 2009) is a clear example of a global event involving an outbreak of influenza A(N1H1) followed by attempts of the World Health Organization (WHO) to rapid response to lower the risk of the virus, including through the use of global information systems and guidelines. Nations then seek to adapt these guidelines in their local contexts, for example in India with attempts also to use herbal medicines to combat this virus. This interplay of the global and local dynamics is an interesting phenomenon permeating nearly all domains of our everyday lives, including health information systems (HIS) which is the focus of this paper.

"World-level" data are built around standards and classifications with the promise to uniformly address local conditions of global concerns. One such case in the domain of health is the International Classification of Diseases (ICD), which is administered by the WHO to provide standards for recording diseases. A key function of ICD is to give stability of nomenclature and meaning over different sites and time (Timmermans & Berg, 2003). The history of ICD starts with the 1893 conference in Paris and

subsequent conferences related to eradication of cholera, one of the deadliest pandemics of the 19th century (Lee, 2003). Since cholera spread with travelers, the issue became global, requiring local actions at national level and to obtain global recognition of the state to be classified as cholera free. ICD represented inscriptions of a series of technical, social, political and economic decisions taken at different moments of time (Bowker & Star, 1999), which needed to be locally adapted to different contexts of use. Typically, different perspectives exist on these standards, for example, the cause of death as given on the death certificate by the physician is frequently not the same as that which enters into statistical records (Fagot-Largeault 1989). Classifications, by their very nature and design, constrain the kind of story that the statistics want to tell (Bowker & Star, 1999).

In the context of health information, a key challenge is around managing the interaction between the introduction of global standards and local appropriation (Braa et al., 2007; Jacucci, Shaw & Braa, 2006; Braa & Hedberg, 2002; Shaw, 2002). A key research finding concerns the use of a "flexible standard" strategy to meet the diversity of information needs, representing a defined set of obligatory data sets for all levels (Jacucci, Shaw & Braa, 2006), while simultaneously giving each level the flexibility to add standards for their local use. In contrast to this suggested "bottom-up" approach to implement standards, there are other "top-down" or "hybrid" strategies. "Top-down" approaches typically respond to national needs or to the demands of global agencies (Sahay, 2011), but will necessarily need to interact with local processes and conditions during implementation (Ciborra, 1994). These appropriation processes are shaped through negotiations amongst actors, often representing diverging interests and needs, with implications on the acceptance or not of the standard.

The intent of the paper thus is to contribute to the ongoing debate on the interplay of global and local standardization processes and how can these be effectively managed. The specific object of study is the global ICD standards, and the ongoing attempts to make them as an integral part of the Tajikistan's national HMIS. The ongoing interplay, is not only studied, but also I tried to intervene in during the course of this action research study from 2008 to date. The research questions addressed include:

a. What is the nature of interplay between the global and local dynamics around ICD standards and their introduction in the Tajikistan national HMIS?

b. What are approaches to best manage this interplay, so as to strengthen the national HMIS?

In the next section, I sketch out key concepts that inform my analysis drawing from Institutional Theory and the Information Infrastructure (II) perspective, including the discussions on standards. Then an account of the methodology is provided, following which the case study is presented. The analysis and discussions, and then conclusions follow.

II. Related Research

In this section, a theoretical framework is developed based on three sets of founding concepts from institutional theory, an II perspective, and standards. The underlying perspective is of HIS, including the relevant standards, as a socio-technical process where the social and technical dimensions are seen to be intertwined with each other.

2.1 Institutional Theory, Information Infrastructure Perspective and Standards

The process of IS implementation involves institutionalization (Silva and Backhouse, 2003), and this is greater for large scale and networked systems as they span across different contexts and administrative divisions. Information systems represent a web of technical artefacts, people, and procedures immersed in a particular context (Kling & Scacchi, 1982), influenced by a socio-technical installed base (Hanseth & Monteiro, 1997). Standards provide the socio-technical back-bone to information infrastructures, defining the framework to regulate communicative patterns.. As such, "These standards are neither ready-made nor neutral. They are currently being developed, and they 'inscribe' behaviour in complex and non-transparent ways" (Hanseth & Monteiro, 1997:183).The role of standards becomes increasingly important as systems becomes networked and complex (Fomin, Keil & Lyytinen, 2003) as the need for coordination is heightened.

"Organizations are suspended in a web of values, norms, beliefs, and taken-for-granted assumptions" (Barley & Tolbert, 1997:93) that guide and constrain organization and individual actions (Scott, 2001). Institutions thus represent "multifaceted, durable social structures, made up of symbolic elements, social activities, and material resources" (Scott 2001:49). Information systems represent institutionalized material resources inscribing daily organizational routines, and "represent constraints on the options that individuals and collectives are likely to exercise, albeit constraints that are open to modification over time" (Barley and Tolbert, 1997:94). They take effort and long time to both institutionalize and deinstitutionalize (Oliver, 1992).

Existing systems are an indivisible part of an organization's institutional arrangements, representing the "installed base", which need to be accounted for whilst planning the change. Challenges in change may be magnified in globally distributed systems because of the multiplicity of installed bases in use, requiring different "workarounds" and adaptations (Rolland & Monteiro, 2002) to weaken and erode 'old institutions' and for new ones replace them. This involves a process of deinstitutionalization and reinstitutionalization where new ones are created and gradually embedded in the local context (Oliver, 1992). Changes necessarily take place around the installed base (Hanseth & Monteiro, 1997), and as it becomes increasingly deep rooted and impossible to change, they start to become irreversible (Hanseth & Monteiro, 1998).

Implementing and institutionalizing global standards like ICD into local contexts requires building similarities between global definitions and local contexts (AbouZahr & Boerma, 2005). Often we are biased towards building context sensitivity while dealing with global solutions (Pollock, Williams & D'Adderio, 2007; Rolland & Monteiro, 2002), ignoring the similarities that different contexts may also have. In their study of a maritime classification company, Rolland and Monteiro (2002) describe a 'moving context', where ships of varying dimensions and characteristics travel from one dock to another, when surveys are being performed, magnifying the complexity of the locale context and the work of surveyors. They propose finding a 'pragmatic balance' between the global and local which is based on various political, operational and economic considerations.

Incentives also play an important role in mediating the interplay between the global and local. Incentives can encourage purposeful action of individuals as it creates expectations of some sort of rewards (Armstrong, 2002). Incentives can be positive or negative depending on individual's perception of changes resulting from particular actions within a particular physical and social context (Ostrom, Schroeder, & Wynne, 1993). For example, "pay for performance" is a mechanism being used by healthcare providers for improving quality of care by providing incentives to medical practitioners (Garber, 2005).

Based on the discussions above, I propose a theoretical framework to support the analysis process.

2.2 Theoretical Framework

Based on the discussions above, I propose a theoretical framework to support the analysis process. The proposed theoretical framework is based on three key components:

- Institutional actors;
- The existing installed base in the system; and,
- The interplay between global and local standards.

Many institutional actors are involved in HMIS implementation, playing different roles in the localization of global standards. These actors include global actors like WHO; development partners providing expertise to countries; global open source software vendors; local ministries, their regional and sub-regional offices. These actors provide varying influences on the standardization process. While WHO drives the content of global standards like ICD, national ministries take decisions to adopt them, while district and other sub-national systems implement them. Donor agencies provide funds and expertise to deploy standards, while software vendors seek to enable this process through technical systems.

Installed base consists of existing applications of paper and computer based HMIS, including standards for data collection, their formats, and periodicity of data collection. Installed base, which is spread across geographic locations, is composed of heterogeneous elements, including actors and standards, becoming the arena for negotiations between actors seeking to find a balance in global and local standardization. This process is confronted with constrains and affordances coming from the installed base, the global standards themselves, and the existing local practices.

The process of standardization involves both local and global actors, and their interplay has to engage with the installed base. Incentives become one important instrument to mediate this interplay. Actors constantly seek incentives from the actions they perform in balancing between different constraints, and incentive seeking, be it material or moral. If incentives received are positive and accepted by actors, it may lead to the acceptance and legitimation of a standard (Markus & Gelinas, 2006), while a negative incentive could lead to further negotiations, local workarounds or even the abandoning of a standard. Negotiation is important in managing this interplay, often involving countries to request global actors for technical support. "Negotiation is an interaction in which parties start out with different understandings about something, disagreement, and via the interplay of offer and counter-offer, or at least an exploration

of contending views, try and reach a common understanding, agreement." (Cohen, 2000:317). Negotiation seeks to reach consensus and balance global/local requirements through working solutions.

The relationships between these three elements of actors, installed base and interplay, are guided by formal rules and informal constraints, shaped within particular institutional contexts. These linkages and influences can sometimes be multiple and contradictory in shaping processes of standardization as they simultaneously involve generification (Pollock, Williams & D'Adderio, 2007), and also localization involving the embedding of a standard in a particular setting. Contextualization (Jarulaitis & Monteiro, 2009) is ongoing, representing the process where local actors adopt local implementation into their context. In each of these above processes, actors play specific roles and their interactions are shaped by incentives received from the standards implemented. Further, present actions are guided and restricted by their past experiences and existing routines and artifacts - the installed base.

The schematic below sketches the above described conceptual framework:

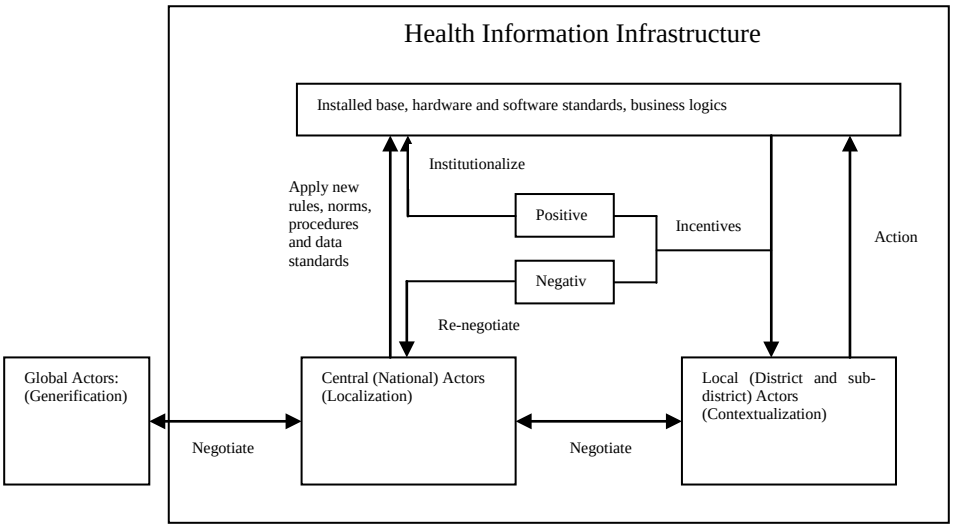

Figure 1. Global and local interplay around HMIS standards

The theoretical framework helps to identify relevant institutional actors at the different levels, and their respective influences on the standardization process. I focus on both the formal and informal mediators to this relationship, including incentives which provide alternative strategies to manage this global/local interplay, and a more effective balance between them.

III. Research Methods and Data Collection

This study is part of larger action research carried out during 2008-2012 in collaboration with Republican Centre for Statistics and Medical Information (RCSMI) of MoH Tajikistan, and the European Union (EU) delegation in Tajikistan. Empirically this research is a longitudinal and qualitative case study based on an interpretive analysis of the HMIS of Tajikistan. The Tajikistan HMIS reform process has been organized over three phases: phase I – assessment of existing systems (2009-10), phase II - planning for implementation (2010-11) and the forthcoming phase III on implementation (2013-15). My involvement started in Phase I which was funded by an Asian Development Bank loan, serving as an entry point for me to carry out an action research intervention together with University of Oslo researchers.

I actively participated in Phases I and II, collaborating with multiple stakeholders. Action research tasks included the customization of the data warehousing application for local needs, assisting the RCSMI with the creation of the national meta-data dictionary of indicators and data elements. In both these tasks, I dealt with issues around the ICD including how they were understood, used and expected to improve the data quality. Through continuous evaluation of the interventions together with MOH colleagues, I sharpened my understanding of the situation and improved the focus of my interventions. Important was to understand how inter-subjectivity was achieved (Baskerville, 1999), by "understanding a phenomena through accessing the meaning that participants assign to them" (Orlikovski & Barudi, 1991:5) and the nature of "hidden" meanings (Walsham, 1995).

Data collection took place at multiple levels, including global partners (such as EU), central ministries and sub-national actors. Data collection methods included interviews, observations, questionnaires, participation in stakeholder meetings, conducting prototyping and secondary documents analysis. Interview respondents included donor organizations (e.g. ADB and EU), development partners, various national government agencies such as the Ministry of Health, the State Statistics Agency (SSA), and Civil Registry Office (CRO). In Tajikistan, SSA official statistics and coordinates data exchange among different parties. CRO processes birth and deaths in collaboration with HMU and SSA. Questionnaires helped to compile data such as related to: number of health facilities; number of computer equipment in use; availability of Internet; and "whether ICD-10 codes were used? And how?"

With respect to the ICD, the following was done:

1. To understand how ICD codes could be included in the data registration forms?
2. To develop software application to include ICD codes based on individual case records, and its integration with the national HMIS.
3. The development of reports depicting the ICD based disease profiles.

I conducted three sets of interviews in Sogd and Khatlon provinces. The first was in Aug'11 lasting for 10 days and covering 10 districts and also the Sogd province centre. The second covered 3 districts and the provincial centre during Nov'11 over 4 days. The third visit to Khatlon province and four of its districts took place in March 2012, with a key focus on the CRO at the district level and the health management units (HMU). A focus of these visits was to understand data exchange between the

health department and CROs, representing two different ministries (health and justice), and their respective uses of ICD in recording the cause of death for which both were signatories.

IV. Case Study

4.1 Setting the Context

The MoH Tajikistan inherited the 70 year legacy of the Soviet system, reflected also in the HMIS. "Gosplan" was the central government organization for planning and distribution of resources nationwide, including for healthcare. In the turbulence of the post 1991 Soviet collapse period, there was the rapid shift from planned to open market economy; the emergence of new states across Soviet borders; new forms of property ownership; and the sharp splintering of formerly existing economic and financial systems which also affected health (Braguinsky & Yavlinski, 2000). Furthermore, Tajikistan suffered from a brutal civil war that lasted from 1991 to 1997, which ruined the national economy and led to a rapid decline of public transport, utilities like electricity and water supply, affecting the well being of the entire population, including their access to health care services.

The case study is presented in two broad parts: The agenda for reform which highlights the existing situation with a focus on ICD; and, the process of managing the interplay in implementing the ICD codes in the national and sub-national systems.

4.2 Reforming HMIS: The National Agenda

A key reform agenda of the government was to strengthen the health system, including the supporting HMIS. Different evaluations of the HMIS by experts concluded that the HMIS had many redundancies including number of the data elements being collected (Sahay et al. 2009; Latifov & Sahay, 2012). This volume (representing nearly 30,000 data elements being collected) made the HMIS both inefficient and largely irrelevant as it continued to collect data on parameters defined during the Soviet period (for example, "number of airplane vibrations heard") which had little meaning in the contemporary context.

Contributing significantly to this volume of data was the MOH requirement to collect disease specific data detailed by ICD codes, covering almost all chapters of ICD-10 code list. For example form 32 - "Report about medical aid to pregnant, parturient and puerperal women" covered almost all categories under "O" (Pregnancy, childbirth and the puerperium) and "P" (Certain conditions originating in the perinatal period) chapters of ICD-10, and also some of "J" (Diseases of the respiratory system) and "L" (Diseases of the skin and subcutaneous tissue) chapters. These codes were also largely duplicated in form "1" – "Report about infectious and parasitic diseases". Duplications arose because these forms collected data from the same source, even though there was no need to record them more than once. Since the reporting forms were thematically designed, they mixed administrative and health related data, making it difficult both in terms of data entry and analysis.

While the reporting forms had an advanced use of ICD-10 codes, the adopted list of ICD-10 codes for use (data collection) was much smaller (2500 in count), not covering all the codes used in forms. For example form "32" had data elements

"Endocrine, nutritional and metabolic diseases" corresponding to the ICD-10 "O" chapter, code "99.2", which is not listed in the handbook (Saifuddinov & Kurbanov, 2010). The list of adopted ICD-10 codes represented only 4% of the total ICD-10 codes, which the doctors felt was not sufficient for clinical use, but useful for statistical purposes only. In order to provide understandable and exact description of the diagnosis, doctors used free text to record diagnosis and lab orders so that staff of the lab and radiology departments understood the instructions they needed to perform, and what ICD-10 codes to assign to the free text diagnosis. The limited use of the ICD 10 codes was seen inadequate for clinical use (Watzlaf et al., 2007).

In 2009, the EU following HMN framework insisted on the inclusion of the CRO as a part of the HMIS because CRO is responsible for recording and reporting of birth and death and these data are used for indicator calculation. This flow of data back and forth needed to be standardized with the use of ICD-10 codes between district HMUs, CROs and SSAs. Three scenarios existed in exchanging data between these organizations and the recording of ICDs. In some districts, a medical doctor placed ICD codes on the report, in others, the medical doctor reported to the CRO, and jointly with the CRO specialist filled the form with ICD codes. In other cases, the report was submitted by the HMU statistician to the CRO and then to the SSA without coding, and only the SSA coder placed ICD codes into the report.

Lack of common standards and formats for data exchange resulted in discrepancies between the CRO and HMU reports, as cases registered in one organization were not communicated to other. For example, if birth took place outside delivery house, the HMU most likely would not record it, but the CRO would record the case if it was reported by the parents. Also there were cases that the CRO would not record due to legislative restrictions if the complete set of legal documents was not present, even if the case was reported by the HMU.

4.3 Managing the interplay in implementing the ICD in HMIS of Tajikistan

From initial stages of the HMIS reform (2007), there existed dilemmas of standardization with respect to the existing HMIS and the proposed new data warehouse solution. In Tajikistan, a "bottom up" approach was not taken as a basis, and instead national health managers redesigned the existing system with national standards for data processing and storage. During the planning phase (II) of the project, two working groups were formed, bringing together national experts from various healthcare fields, including the CRO and SSA. One working group was dedicated to the revision of recording and reporting forms and the other for the indicators. Addressing the gap between the "old" and "new" systems and finding approaches to standardize the national data sets was of high priority, including finding ways of incorporating global standards like ICD. These working groups served as negotiation arenas for experts of different specialities and backgrounds, who helped formulate of three distinct approaches, which are discussed next.

The first approach proposed to standardize data sets by taking the list of national indicators and work out the data elements needed for the calculation of these indicators identified by the National Health Strategy (NHS). While this approach optimized data elements for the national level, it overlooked lower level needs. Some district representatives participating in working said "this approach only serves NHS purposes

and does not address local priorities at district and facility levels". The RCSMI senior official replied: "We used this system for so many years, and it was fulfilling all the information needs of the ministry, why to change it?" A district representative responded: "We know that system was doing well, but so many things have changed in the recent past, which we also want to see in the system. For example, as a district health manager I would like to know prevalence of this or that disease in the district during the winter session to prepare for the next year. This is only possible if we have standardized and electronic record of individual cases".

These discussions led to the second approach in the redesign of HMIS, which compared data elements from the existing system against the actual work load in the districts. Information needs of districts demanded more detailed data than the national level. These details came also with recent reform efforts which involved the introduction of new financing mechanisms and structural reorganization of healthcare management at the district level. The idea was to compare two set of data elements (formally mandated by the national ministry and informal workarounds by medical professionals in the districts) and find out the difference, which could be than classified as redundant and removed from the national standard list. This approach was criticized by senior officials at RCSMI for being locale specific, and not accounting for variations across districts.

The third approach proposed by the expert group was to use ICD-10 standard for data collection at the patient record level. Though this approach did not reduce the number of data elements, it provided a better balance between the first two approaches. It eliminated lengthy data entry forms and also reduced the number of zero values against which data elements were being collected.

Several new reform efforts were introduced which potentially influenced the uptake of ICD codes, and subsequently their import into the HMIS. For example, the Guaranteed Benefit Package (GBP) - a mechanism to provide equitable access to the healthcare services, where government shared the cost of services with patients. The GBP was piloted in selected districts from 2007 onwards, including the "Form66" application which recorded all in-patient cases with ICD-10 codes, and costs of diagnosis and treatments provided. Similarly in another pilot project, a fee-for-service mechanism was introduced in six hospitals (Khojamurodov & Rechel, 2010), in which the performance of the facility was measured by recording disease cases using ICD codes.

EU supported the CRO and RCSMI with provision of computers, printers, servers and networking equipment. In 2013, this equipment is planned to be used for creating a network connecting all district offices of CRO and HMUs with central servers which will host the database and application. This would allow stakeholders to have more advanced and timely information. Also improvements in electricity supply and communication networks built by private and public sectors, were favourably enhancing the HMIS infrastructure, potentially with positive implications for the ICD implementation by providing users the possibility of recording ICDs in the computers at the point of diagnosis.

In the table below, the three approaches to HMIS redesign with implications on ICD use is summarized

Table 1. Summary of HMIS redesign approaches

Approach for the redesign	Pros and cons	Implications on ICD use
Top-down alignment of data sets with NHS indicators	Pros: fully compliant with NHS Cons: Does not account for local needs	No direct use of ICD, emphasis on aggregate and not patient based data
Bottom-up approach, where district priorities are included into national data sets	Pros: better suits local needs Cons: maybe overwhelming for districts given their high workloads	No direct use of ICD even though elements of individual case records are present
Individual record level data capturing using ICD-10 standard	Pros: Individual level records can easily be included into various reports. Cons: Requires advanced infrastructure and computing equipment, trained staff	Based on ICD as classification of diseases in processing and storing of individual records

V. Analysis

As the case study demonstrates, the existing HMIS did not fulfil national and local demands for analytical data. While data was collected on a daily basis on primary forms, districts reported annually, thus it would be more relevant if reported on shorter periods (e.g. quarterly or monthly). The situation could be improved if data was computerized and stored in standardized formats.

Actors at various levels had different expectations from the HMIS. For example, donor organizations tried to minimize gaps between global requirements, such as WHO mandated collection of vital statistics and its reporting to the national level. This required closer linking of the different HMIS stakeholders to help increase the reliability and quality of data for meeting both national and global demands. For example, improved CRO and MoH collaboration would improve quality of demographic data, strengthening thus the quality of the generated national indicators. Data quality would also be improved by minimizing the data collection burden and reducing data sets and reporting forms.

Reduction in data sets were integral to the first two approaches of national HMIS redesign as they focused on what to report and in which format. Indeed, the third approach – based on ICD-10 was to reduce the number of reporting forms, and distinguishing between recording and reporting forms. In the paper system, the reporting and recording forms were treated equally, no longer required in the computerized system. Almost 50% (21 out of 37 annual forms, see table 2) contained ICD-10 codes. In the third approach, all forms containing ICD-10 codes could be reduced, based on the basic principle that reports would be generated by the system once data is captured. Data can be stored as individual records and aggregated as needed to produce reports, thus radically reducing the number of forms to be filled in.

Overall, the three approaches discussed each came with their pros and cons (see table 1), and their supporters and opponents.

Categorization of forms	Sub-categories	Description
Depending on report content	facility-based	There are different forms for hospitals, primary health care units (PHC) units, sanitary and epidemiology departments, ambulance stations, blood transfusion stations, children's hospitals and sanatoriums, forensic medicine units, TB hospitals, health management departments, post-graduate education unit, etc.
	specialty/disease –based	e.g. immunization, tuberculosis, skin and sexually transmitted diseases
	patient group or programme based	Patients with TB, oncological diseases, antenatal care patients, etc.
Periodicity	Annual	37 forms (21 contain ICD-10 codes)
	Quarterly	2 forms
	Monthly	2 forms + one operational data collection form
Reporting level	rural facilities	
	municipal/district level facilities	
	provincial facilities and units	
	republican facilities	

Table 1. Categorization of Reporting Forms in Use in Tajikistan HMIS

VI. Discussions

Consistent with prior research, the case study demonstrates how the existing HMIS, even though inefficient, shows resistance to change (Monteiro, 1998; Bisbal, 1999). This resistance firstly comes in form of individual actors having certain viewpoints and understandings of the nature and purpose of the HMIS, based on their past experience. Secondly, these institutionalized routines and norms are embedded into the existing HMIS itself – an installed base.

From the perspective of proposed theoretical framework, the various discussions raised by the different actors could be seen as part of an ongoing negotiation process where they try to balance or find a common solution for the given problem. Position of actors in reforming the HMIS and setting standards is driven by organizational imperatives and objectives for which they stand. The agreement comes from "incentives" actors receive in performing actions with new standards and procedures. If an incentive received is negative, actors may enter again into negotiations, which can lead to acceptance, rejection or another circle of negotiations relating to the underlying standards or procedures. Acceptance is achieved when actors receive positive incentives and they continue practicing certain routines around the standards. Through continuous practices, these new standards and procedures become institutionalized and inscribed into technological artifacts.

Actors play various roles in global/local standardization process. Global actors, may bring in new knowledge and at the same time learn from particular cases of implementing global standards. Their action falls between generification and

localization. National actors as central players work closely with global partners to localize global standards and negotiate with local actors to contextualize in local contexts. This helps to understand the dynamics in the interplay between global and local standardization processes from the perspectives of different actors.

VII. Conclusions

This paper identified and explored challenges of localization of global standards in HMIS implementation in a developing country context. Three distinct approaches to standardization with respect to ICD codes, were identified: 1). Top-down approach, where national health indicators are taken as final requirements; 2). District level local workarounds are incorporated into the national data sets; and 3). Use of ICD-10 codes to balance the load of top-down and bottom-up approaches. Each approach had its advantages and limitations, stemming from their relationships to the installed base (Hanseth & Monteiro, 1997; 1998). While the first two approaches presented national and district interests respectively, the third was in contrast transitive. It did not reduce data elements, but significantly lessened the load of manual data collection from health statisticians, opening new opportunities towards working with patient level data, contributing to timeliness and data quality.

This paper reinforces research findings that implementing global standards into a local context is complex and challenging task, involving various actors, each coming with their inputs and demands. Together this socio-technical ensemble – the information infrastructure - becomes a carrier of institutional changes applied by global standards and localized into specific contexts through negotiation and incentive seeking of actors.

While the use of ICD-10 in its current state is not feature-rich and advanced, it serves as a "gateway" opening new possibilities for the future adoption of ICD-10 in the developing country context. This requires benefits from the use of ICD-10 to become appealing and deeply rooted into the daily practices of the medical doctors, health and demographics statisticians. In line with new financing mechanisms and methodologies for healthcare delivery, coupled with improvements in the underlying information infrastructure, the ICD-10, I believe will play an important role in managing data exchange, measuring performance and recording the severity of diseases. The use of ICD-10 potentially enforces data accuracy, "if health records do not follow standardized content and predefined templates, they will defeat basic purpose of developing such content" (Mattison, Dolin & Laberge, 2004). However, for ICD to work effectively on the ground, a number of enabling conditions need to be in place including infrastructure, human resources capacity, diagnosis skills, and appropriate workloads.

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