Integrated Health Information Infrastructure for the West Africa Health Organization (WAHO)

Group 4, Information Infrastructure Group Project Report
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1 Introduction

1.1 Purpose of this study

The group has opted to evaluate the implementation of a regional ICT solution for open health data amongst fifteen countries in the West Africa sub-region for its project work. It is a project which is new and has been ongoing for a number of years and is at different stages of its evolutionary trajectory. The group considers the conceptualization of this project and its characteristics as a suitable candidate for information infrastructure studies.

1.2 The Context of ECOWAS

ECOWAS is the acronym for the Economic Community of West Africa States. It is a regional organization consisting of 15 West African states with three lingua Franca namely English, French and Portuguese. The main aim of setting up ECOWAS was to facilitate economic integration among member states in achieving collective self-sufficiency. This vision is to see the free movement of its population, goods and services across borders without any impediments. The governing structure is as could be found in any democratic state consisting of three arms of governance, namely the executive, the legislature and the judiciary. At the head of this governance structure is the Chairman of the Authority of Heads of State and Government.

Economic integration have been high on ECOWAS developmental agenda and apart from flexible trade arrangements among member states there also exist economic partnership agreements between the community and other regional blocks for example Europe, Asia, etc. These agreements have seen the gradual removal of trade restrictions among the blocks. The ECOWAS several sectors fuelling its economic activities could be identified e.g. agriculture, energy, trade, telecommunications, ICT, etc. to mention a few. Within these sectors there are different organizations with special agencies contributing to the economic integration of member states and aligned regional blocks. Of interest to this project is one of such organizations namely the West African Health Organization (WAHO).

1.3 Research Method

Our research strategy is case study because this approach emphasizes detailed contextual analysis and understanding of the phenomenon under study (Miles and Huberman 1994). The research is also grounded in the interpre-

tive tradition where the subjective meaning of people on issues in their sphere of influence is studied and analyzed (Orlikowski and Baroudi 1991). Data collection and analysis were by qualitative means in order to facilitate knowledge claims premised on the meanings gathered from individual experiences through interviews. In conducting this research two faculty members who are directly involved in the case were interviewed. One has been involved in laying foundational work in terms of policy formulation and conceptualization of the architecture of the ICT solution. The second person interviewed is currently responsible for designing the actual database for WAHO. There have also been a number of informal discussions with these two people in order to get a better understanding of the case. This primary data was supplemented by secondary data from documents and internet search on WAHO website.

2   The WAHO Case Description

The West African Health Organization (WAHO) is one of the important organizations in the ECOWAS region. It was formed in 1987 when all 15 heads of member states adopted the Protocol creating it. The main objective of WAHO is to see to the health needs of the population within the community by mobilizing available resources in a collaborative manner in preventing and fighting health related problems in the sub-region.

In order to fulfil this mandate the WAHO recognized the importance of having a viable health information system (HIS) for the production and availability of health data for informed decisions relating to health issues in the sub-region. A number of tentative initiatives were taken towards achieving an integrated regional HIS in the past but these only led to fragmentation of the health sector along lingua franca with the French and English speaking countries forming their own health organizations. The combination of these two bodies into one led to the formation of WAHO which eventually had a significant breakthrough towards an integrated HIS in 2012 following regional situation assessment of HISs.

Seven countries namely Niger, Guinea, Guinea Bissau, Burkina Faso, Ghana, Liberia and Cape Verde, were selected for comparative situation analysis with focus on integration. There was high degree of complexities in the assessment of individual country HIS in view of the existence of diversities sociocultural, economic and healthcare practices. The overall findings of the assessment were that:

1. Integration was a topical issue in all the countries assessed because of fragmentations in the existing HISs. And those countries were at different levels integrating their systems with only Liberia succeeding in having all health programs reporting into one national system.

2. Fragmented information systems due to institutional complexity with respect to vertical health programs collecting and maintaining their individual HISs independent of other programs and the national system. It was also observed that these vertical reporting were donor-driven and well-funded and collecting quality data. Furthermore most of these vertical systems were on pilot bases and temporal with total disregard for sustainability when project period elapsed.

3. Countries see increased integration as a way of overcoming fragmentation but generally do not understand what integration entails.

4. The funding mechanisms by donors, partners and health programs in the region and globally is reflected in the manner in which data is collected, reported and used. This is because each funding agency has its own reporting format which is tailored for individual interest thus perpetrating fragmented systems which are unable to speak to each other because of inflexible software.

5. As the different programs and HMIS promote systems that are inefficient and do not satisfy integrated information needs, users tend to go back to developing their own individual systems and abandon efforts of integration. This leads to a vicious cycle of continued proliferation of systems which do not interoperate and thus lead to further fragmentation.

6. The absence of data standards and guiding policy framework to ensure integration.

Through a participatory process the findings from the situation assessment report were discussed and verified to identify problems and solutions. Proceedings from this discussion were formulated into WAHO HIS policy document with the following vision:

> *Achieve quality health information that is easily accessible and used at all levels in countries and the ECOWAS region for informed policy formulation and decision making, improved health services and better health for the population.*

From this broad vision were couched three thematic areas with corresponding strategic objectives. Thematic areas identified were policy and resources, systems development within an integrated framework, and information use and dissemination. Under these thematic areas the policy identified 8 key objectives which are to be achieved by member countries with WAHO having the oversight responsibility of coordination. These objectives are:

1. All countries should develop/update their National HIS policy and strategic planning documents. This, the policy states should be based on Health Matrix Network technical framework for developing an integrated health information data warehouse.

2. Ensure improved integration of health information in all the ECOWAS countries by involving all stakeholders, including the private sector.

3. Create / strengthen a "HIS Partners Forum" for the coordination and harmonization of HISs at regional and country levels.

4. Strengthen capacity building of human resource in health information management and use in all the ECOWAS countries.

5. Develop and continuously update a regional essential indicator list for reporting, comparative monitoring and health information sharing between the WAHO countries. Because of lack of uniform data standard it has not been possible to report routine data to WAHO and an essential indicator list will serve as a basis for developing reference standards for such routines. As information and health needs evolve, it is important that the indicator lists are also constantly adapted to reflect the national and regional requirements.

6. Develop a web-based integrated central data warehouse – at country and ECOWAS levels. Findings from the assessment show that poor and inefficient software tools represented an important obstacle to data management in many countries. The web based central data warehouse being targeted in this objective is representing the state of the art, both in terms of software based tools for data management and internet based infrastructure. The data warehouse is also acknowledged as a key strategy for dealing with institutional fragmentation and for dealing with legacy systems.

7. Ensure regular dissemination of health information products at sub-country, country and ECOWAS levels.

8. Promote and develop a culture of information use at all levels of the health system. Creation of an information culture is a strategic process and takes years to achieve. Therefore there has to be a constant and ongoing process of capacity building and data use to achieve a strong information culture.

To operationalize the implementation of this policy the regional bodies ECOWAS, WAHO and member countries have been assigned roles and responsibilities. The ECOWAS HIS Forum (EHPF) is mandated to oversee the HIS harmonization and standardization process. In addition to EHPF a technical committee is to be responsible for managing the essential indicator list. The WAHO on the other hand continues to play their leadership role for member countries in HIS strengthening, ensure the availability of quality health information in the region, and internal integration and harmonization of data collection efforts.

Development partners are asked to coordinate their work and to share relevant information within the framework of the EHPF. This model is replicated at the country level, where development partners are asked to take part in the National HIS Forum and to provide resources to strengthen the overall country HIS within this integrated framework. Within each country and under the MOH, the designated Health Information unit is responsible for implementing the policy at all levels of the country's health systems.

3 The WAHO Case and II

We will in this section try to fit our case to an information infrastructure in the making. The section is divided into two, that is, in the first part we give a brief definition of II as we understand it from the course and in the second part we will to justify why we think our case fits the definition.

3.1 What is an II?

Research have shown that the traditional top-down closed system thinking for designing IS solutions to be used in single organizations cannot be used to design today's IS solutions. This is because with technological advances in for example the internet and telecommunication, infrastructures demands that IS solutions transcend single organizational boundaries and assume network characteristics. Consequently scholars have used for example the internet which is itself an II to conceptualize what constitute an II. Accordingly an II

has been defined as shared, open (unbounded), heterogeneous and evolving socio-technical system (installed base) consisting of a set of IT capabilities and their users, operations and design communities (Ole Hanseth and Lyytinen 2010, Ole Hanseth and Monteiro 1997). Contrasting this broad definition with traditional IS set IIs as complex actor networks of social and technical components.

- Shared: Unlike a single closed traditional system in unitary organization an II is shared by many users across different organizations.

- Open: A traditional closed system is normally designed for a specific purpose whilst an II is open and permits unlimited connections to other user communities and new ICT capabilities. Leveraging on its open characteristic and network capabilities an II in essence can enable other activities aside what it is meant for.

- Heterogeneous: It is heterogeneous in the sense that its constituent components are made up different social and technical elements such as users, institutions, technical artefacts, etc. Because of their size and nature IIs cannot be designed from scratch as traditional ISs but can only be modified and extended through evolution.

- Installed base: The installed base refers to what was in use in an organization prior to conception of the new II. This is made up of both technical and non-technical components including work practices, existing institutions, technologies, social and organizational structures which can either enable or constrain the growth of the II.

The main distinguishing factor between traditional ISs and contemporary IIs is the degree of complexity exhibited by each. Because IIs are open and heterogeneous the interaction and interdependencies amongst its sociotechnical elements introduces complexity that need to be managed during their evolution (Monteiro et al. 2013). Standards are important in IIs in view of their network characteristics which demand that they interface other II components through gateways (Ole Hanseth and Lyytinen 2010, Ole Hanseth and Monteiro 1997).

3.2 WAHO ICT Solution as an II

Having defined II and explain the meaning of each of the attributes we now focus our attention on whether the WAHO regional ICT solution could be described as an II.

The overall objective of WAHO is to develop one integrated ICT solution called Integrated Health Information Architecture (IHIA) to be shared by the 15 member states. Each member state has individual country HIS which is to be ported to the WAHO regional system based on a common standard indicator set made up of 80 selected indicators using the DHIS2 data warehouse. This feature where different actors (15 countries) are networked to share resources and information is characteristic of IIs.

The WAHO system is to be used by the 15 member states to share health information. Hence it is open as far as the 15 member states are concerned but closed to other countries outside the ECOWAS sub-region. Contemporary ICT solutions characteristically appropriate other technologies and ICT solutions by leveraging on positive network externalities/effects (Ole Hanseth 2000). This points to the fact that individual country IIs which are networked with WAHO II may not be bounded in terms of appropriation of socio-technical elements into the network. Hence apart from the limit in membership to ECOWAS the regional IHIA is open, a property of IIs.

ECOWAS is made of different countries which are heterogeneous in terms official languages (English, French and Portuguese) and other social characteristics. These countries also have different health systems with corresponding health IIs which come to bear on the WAHO standard making processes. This heterogeneity introduces complexity in the integration process because of the interdependencies among the actors in the network (Ole Hanseth et al. 2006; Ole Hanseth 2002). By increasing the complexity by bringing an external actor because of financial constraint, the WHO, the integration became reflexive and WAHO could not implement its standardized indicator set but just its IDSR subset thus compromising on initial its objectives (Poppe, Sæbø, and Nielsen 2014).

Before the inception of the WAHO project individual countries had their own IIs. WAHO on the other hand its own II consisting of the human resource, institutions and ICT solutions. These together with the 15 member country IIs constitute the installed base for the WAHO project. The installed base serves as the foundation for the evolution of every II. The WAHO project started with series of meetings and international works among the member states. This was followed by regional assessment of IIs of selected member countries the outcome of which culminated into a regional standard policy on information systems and flexible standard indicator set. Input into the resultant WAHO portal was also from individual country IIs interfacing with

the portal. It is therefore clear that the WAHO IHIA was not built from scratch but rather it was cultivated from its installed base made up of member country's IIs.

By and large one can infer from this discourse that the WAHO IHIA have the main features of an II. The ICT solution is shared by its member states and the possibility of it being shared in the future with actors that may join the community e.g. WHO. It is also open in the sense that the ICT solution is a network of different country's IIs which are being extended and restructured in different ways that appropriate socio-technical components during the course of evolution. Hence by extension the WAHO IHIA is opened and appropriating those elements into its infrastructure. However the IHIA may be said to be closed in one respect, that is, it is open to its member states but closed to other countries. In terms of number of countries which can join the WAHO it may be said to be not fully exhibiting the open property of IIs. The IHIA is heterogeneous in all respects, that is, membership is from different countries with different sociocultural practices which will reflect in their health systems and also in their respective IIs. These cumulatively introduce complexity in WAHO standardization process as is expected from IIs. The IHIA was not built from scratch but by harnessing the installed bases of member countries and building upon it by extending them through pottering which is reminiscent evolution of IIs. It can therefore be said that the WAHO case is an II which is evolving.

3.3 Departure of the WAHO Case as an II

According to the II literature IIs exhibit definite characteristics which put them in the class of contemporary ICT solutions adopted in organizations. The WAHO case by and large exhibit similar characteristics as explained in the previous section. As a regional standard it is shared and available (open) to the 15 member states, and considering its temporal dimension it is still at its infancy and still evolving. However, critically examining the openness of the WAHO case one could clearly see that apart from it being opened to technological appropriation to its infrastructure it is restrictive in terms of membership beyond the 15 member states. The only exception as noted in the case description was the admission of the World Bank as an external actor which financed the initial project take-off based on the IDSR indicators. This 'intrusion' could be considered as positive unintended side-effect during the evolution of the WAHO standard making (Ole Hanseth et al. 2006). In this regard the WAHO case could be seen as potentially closed to new members. We therefore think that this is an obvious mismatch between the WAHO

case and what the theory stipulates.

4   Challenges of the WAHO II Change

In implementing the policy for regional integration of HISs in the ECOWAS region, WAHO encountered a number of challenges.Initially a set of 80 essential indicators covering a wide spectrum of health data were identified for the data warehouse e.g. demographics, disease burden, health service utilization, health financing, human resources and epidemic diseases. Collection and reporting of these indicators to WAHO require some standardization in terms of frequency of reporting, level of reporting and the different modes of collection and archiving. For instance different countries have different administrative levels which determine the level of reporting. To resolve this issue it was agreed that two sub-national levels were to be reported to WAHO and these levels have to be decided by individual countries (Poppe, Sæbø, and Nielsen 2014;Sæbø and Poppe 2015).

In adopting the DHIS2 as the data warehouse it was decided to phase the implementation process by first piloting in 5 countries of which 4 were already using the DHIS2, a situation considered to be advantageous to the standardization process and also producing a good learning curve. The results from the pilot phase were unexpected as there were marked variations among the countries in terms of frequency of reporting, availability of data, source and format of data even though 4 out of the 5 countries were already using the DHIS2. The local specificity and variety of work practices and organizational structures (Ole Hanseth and Monteiro 1997) in these countries were found to have introduced some complexities and side-effects in the result of the pilot phase. It also came out that in most of the countries 'silos' of health programs with their information systems still persists despite the introduction of National HIS making it difficult in identifying who the local actors are i.e. health units or departments from within countries who are to report data to WAHO.

Another challenge for this regional integration is the standardization of routines and procedures for individual countries reporting to WAHO and accessibility to country data. The adopted protocol was WAHO could access country data but cannot publish the data until countries certify that WAHO has the right data. In effect WAHO does not have the authority or control over the regional data as member countries are autonomous and can decide who uses its data or otherwise. This complexity challenge could be

counter-productive to the regional integration process by introducing element of reflexivity (Ole Hanseth et al. 2007 ; Ole Hanseth et al. 2007).

The financial backbone for WAHO is weak as it has to depend on donor funding and the individual countries for its activities. A case in point is the involvement of the World Bank in WAHO's activities. The initial plan was to implement the 80 essential indicators in the DHIS2 data warehouse from 2013 but they were not having the necessary funds and had to be funded by the World Bank late into the roadmap and on the funder's terms. Because of lack of funds WAHO was compelled to adjust its plan to incorporate the World Bank's 3 year Integrated Disease Surveillance Reporting (IDSR) project in the region. Hence instead of implementing the 80 essential indicators it ended up implementing only the IDSR component to align its interest to that of the World Bank, causing a drift in the integration process due to network side-effects (Tilson, Lyytinen, and Sørensen 2010; Monteiro et al. 2013) as a result of bringing on board a new actor.
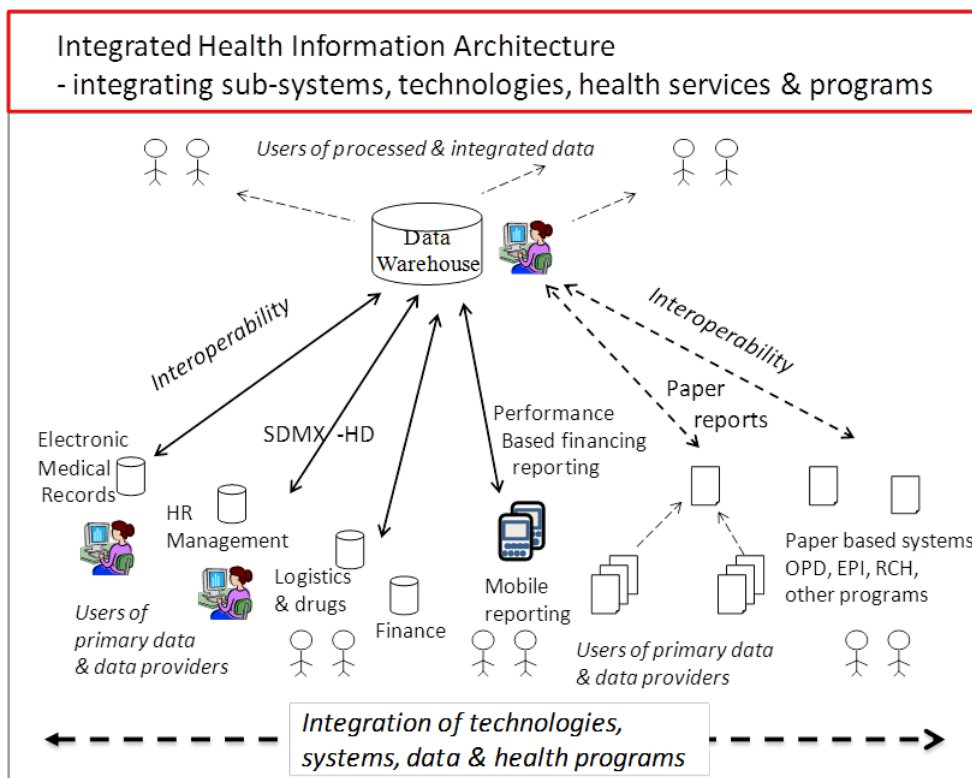

Figure 1: Integrated Health Information Architecture

4.1 Integration Strategies

The WAHO effort towards regional health data integration is multi-levelled because of the different actors which creates complex interdependencies. Initially the idea was to achieve regional integration through interoperability of country systems by exchanging data using WHO/HMN standard called Statistical Data Metadata Exchange in the Health Domain (SDMX-HD). This was developed in Sierra Leone for the transfer of ART (Anti-Retroviral Treatment) data from OpenMRS medical record system to the District Health Information Software (DHIS) data warehouse. Bootstrapping from the 'Sierra Leone architecture, WAHO took the initiative to include also the iHRIS application for human resource management in this architecture. Following this, the SDMX-HD standard was officially launched at a workshop jointly organized by WAHO, WHO and others in Accra, September 2010.

Regional integration through a tightly coupled physical integration of interoperable member countries' health information systems is the long term goal supposing that can be attainable at all within the uncertainties of these complex independencies. This is because even within the member countries themselves full HIS integration of tightly coupled national systems are still at various stages of implementation. To mitigate this challenge in the short term, the ECOWAS regional web portal was introduced (refer to figure 2) with a loosely coupled architecture (O Hanseth and Henningson n.d.) which puts less emphasis on interoperability and more on flexibility of reporting.

To date all member countries are reporting on Integrated Diseases Surveillance Report (IDSR) (weekly, others monthly) standardized regional indicator set with some countries achieving over 90% data completeness reporting for 2015. The next step is for automatic reporting to WAHO and inclusion of standardized dataset for routine health data reporting.

The strategy of flexible standards has also been used in the WAHO case. According to Ole Hanseth and Monteiro 1997, a standard's total flexibility is the sum of its use and change flexibility. Use flexibility refers to the ability to use a standard in a number of different environments like in this case, whereas change flexibility is achieved through the principle of modularization which means instead of having one overarching complex set of standards, they are broken into several small and simple standards with simple interfaces or gateways between them. Because of the heterogeneity of the member countries within WAHO and the federated nature of its architecture, a flexible standardization strategy has encouraged local adoption of modular

standards towards gradual integration of the regional standards. This has been largely adopted as it preserves local autonomy of participant countries while improving regional collaboration at the same time.

Lastly within WAHO and its member countries, many installed base systems exist. Especially within countries, deep national health information systems fragmentations have been caused by the existence of these multiple and parallel health information management tools. To minimize the complexities associated having all these varied installed base and the inherent path dependencies towards the IIs evolution, the strategy is to embark upon new system adoption by WAHO and the various national HISs based on the DHIS2 data warehouse system. Under this strategy of new system adoption, they are to integrate all other systems as possible into the centralized data warehouse solution of the DHIS2. In this way, the variations of systems they have to deal with will be reduced to make it much more manageable for the IIs evolution.

4.2   Alternative Strategies for WAHO Standard Making

Alternative strategies that could have been pursued in the case of WAHO ICT integration and standardization effort include the active creation of an attractor which according to Jørn Braa, Ole Hanseth, et al. 2007, can lead to the emergence of new and better order. They further explained that, at the centre of this order will be a complex system of standards, crafted and maintained as a complex adaptive system where lock-ins are avoided. Such an attractor as an alternative strategy could be a much more flexible portal with generative characteristics. With time as the member countries come to appreciate the usefulness of reports coming out of the portal system, they will see the need for a more proactive collaboration towards the integration effort. In a sense there will be a positive feedback loop created involving portal strengthening that will lead to standardization which will in turn lead to integration strengthening.

Zittrain 2006, in his study of the internet defines generativity of technology as the technology's overall capacity to produce unprompted change driven by large, varied, and uncoordinated audiences. Building on the pioneering works of Zittrain among others, Ole Hanseth and Bygstad 2015, in studying standard making processes in the Norwegian healthcare system identified flexible generification as the most appropriate and suitable strategy for delivering successful solutions. The findings of their research were that flexible generification strategy embodies an evolutionary approach for developing simple
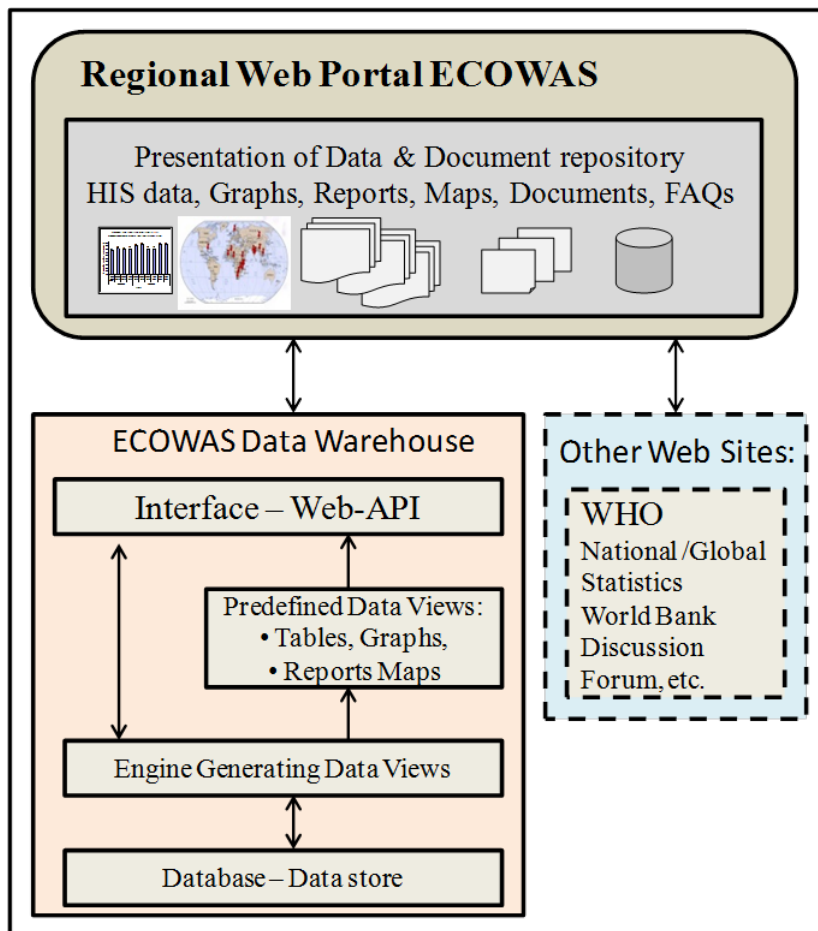
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Figure 2: The ECOWAS web portal

solutions that could be developed for reasonable costs within reasonable time frames. Furthermore the strategy facilitates early user feedback based on the use of running systems which was important for improving the systems to accommodate user needs and demands (Ole Hanseth and Bygstad 2015). In addition the experimental approach of strategy facilitate the generation of new ideas about how the technology can be designed to support new and improved health-care services and not just speed up existing paper-based practices (ibid).

The WAHO case is well suited for adopting flexible generification strategy as it is in the health domain. Scanning the installed base the financial backbone of WAHO is very weak and there is no indication from the case that it has mechanisms in place for internally generating funds for its activities rather

using classical sources of depending on donors. It will therefore be beneficial adopting strategies which will be cost effective as was exemplified in one of the Norwegian standard making processes (Ole Hanseth and Monteiro 1997). Having a standard indicator set is not enough as such the WAHO needs to go a step further to make their portal flexible, service oriented and generic if they are to achieve any success. As the case depicts the WAHO appears to be uncertain by first experimenting with SDMX for interoperability and currently with DHIS2.
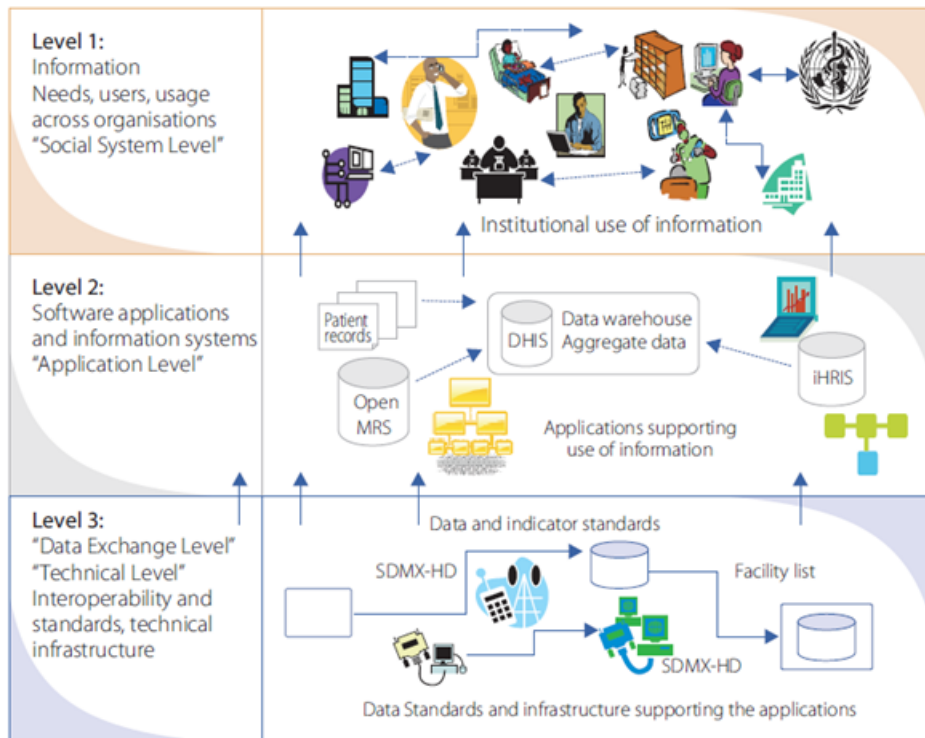

Figure 3: Three layers of enterprise architectures

5 Discussion

Information infrastructure (II) has been defined as "evolving, shared, open, and heterogeneous installed base" (Ole Hanseth 2000). Evolving as in enabling change over time, shared by a larger community, open in that there is no clear-cut boundary as to what it includes, heterogeneous in the sense that it consists of socio-technical networks and subnetworks, many of whom are very different in nature, and installed as in always building on something

existing. They are pervasive, existing for decades rather than years, and are entangled in yet other IIs beyond their own scope (Monteiro et al. 2013). In this respect the WAHO II as we have tried to present can be said to be exhibiting characteristics quite consistent with the behaviour of II systems evolution so far.

Looking at the emerging integrated health information architecture upon which the WAHO II is being built we see some aspects of generativity present. A generative architecture according Ole Hanseth and Bygstad n.d. is one that supports bootstrapping, adoption, restructuring and extensibility; and has generative fit with (generative) development and user collectives. The strategy of WAHO adopting a more Communication System Centric Architecture (CSCA) under the generativity concept makes it easier to evolve as it places much more emphasis on information flow rather than tight integration of systems. An II architecture based on flow of information can shape the development of the underlying socio-technical infrastructure into one that is much more adaptable to changes.

Standardization has been central in this case. It is however important to state that standardization goes beyond data reporting requirements as mostly discussed in this paper. Other factors that affect standardization efforts in a complex socio-technical actor-network environment like WAHO are standardization at the technical infrastructure and organizational levels. These two are the most challenging to achieve due to entrenched local practices and specificity of other prevailing conditions in each member country. Such conditions may range from the differences in the availability of ICT infrastructure, administrative boundaries and practices to health concerns. Standardization therefore needs to be looked as a continuous process with flexibility that allows change and evolution when required. WAHO has been pursuing this aspect of standardization efforts largely informed by the principles of a three layer Integrated Health Information Architecture (IHIA) proposed by Jørn Braa and Sahay 2012. This model (refer to figure 3) approaches standardization at three levels which are the social system level, application level and the technical level.

To a greater extent an II's evolution is dictated by the installed base from which it must evolve due to the inherent path dependencies within the existing installed base (Ole Hanseth 2000). Within WAHO and its member countries the multiplicities of the existing installed base systems will make it almost impossible to evolve towards the desired regional integration if left on their own. To mitigate the associated complexities, both WAHO and the

member countries have decided to adopt a common data warehouse solution based on the DHIS2. This is after having experimented with other standards such as SDMX for interoperability of member state HISs.

A critical look at the WAHO case reveals a level of chaos and uncertainty. The group feels that the whole WAHO project is over ambitious in view of the contextual characteristics of the region. The single most important component of the installed base that has not been properly addressed is mechanism for internally generating funds to finance its standard making activities. All the member states of the ECOWAS depends on donor funding for their development agenda and without external funds it is difficult getting projects started. And this is exemplified in the WAHO case where because of lack of funds the project drifted from initial objective of implementing an 80 indicator set standard (Ole Hanseth et al. 2006). Reflexively the project had to scale down from the initial indicator set to just IDSR indicators of the World Bank.

The group's recommendation is that because the WAHO is obviously donor dependent to fund its activities it should adopt a standard which is flexible and generic (Ole Hanseth and Bygstad 2015; Zittrain 2006). Flexibility could be introduced by scaling down the 80 indicator set to a manageable size to be implemented at a reduced cost. For example indicators from one service area could be chosen as in the present case of the IDSR indicators. Modular implementation of this will then serve as a learning curve for further addition in the future as the standard evolves. The heterogeneity of member country HISs and reporting schedules also need to be properly addressed. The current situation where countries have variable reporting schedules is a bit chaotic and must be addressed. For example in the IDSR case most countries report weekly in accordance with WHO standards and if the project could find a way of enforcing this it will be most beneficial.

The service oriented architecture of the WAHO portal is quite commendable as its generative characteristics will facilitate flexible adoption by member countries (Ole Hanseth and Bygstad 2015; Henfridsson and Bygstad 2013). But more needs to be done to make the portal valuable for member countries. Member countries will value the system when data becomes readily available and timely. Again the heterogeneity of the region and the autonomy of the member states make top-down governance regime and tightly-coupled standard making highly untenable. But rather a combination of both top-down and bottom-up governance structure combined with loosely-coupled architecture will be a workable solution to the WAHO standard making. This

has been found workable in similar contexts and domains as exemplified by Jacucci, Shaw, and Jørn Braa 2006, in South Africa. Finally it is absolutely crucial for the ECOWAS body to device a viable mechanism for internally generating the necessary financial resources for its developmental activities including the WAHO project. Otherwise the WAHO project is bound to drift from its set objectives into the usual vicious cycle that most donor driven HIS projects in developing countries end up.

6 Conclusion

In this article we have looked into the dynamics of how information infrastructures evolve over time using the West Africa Health Organization (WAHO) HIS as our case study. The case basically involves HIS strengthening of the member countries and the overall strengthening of integration efforts at the WAHO level with the assistance of HISP. Currently both WAHO and respective countries are at various stages of HIS strengthening through the implementation of the ECOWAS HIS policy and strategy document adopted in 2012.

We have discussed how the WAHO case fits II description because of its characteristics of being a shared platform, open to its heterogeneous member countries and evolving from a variety of existing installed base. We have also alluded to the complex set of interactions that have resulted in side-effects and adaptations as the II continues to evolve.

The strategy for developing the II further has generally been cantered on ensuring improved integration of health information in all ECOWAS countries through collaboration and harmonization efforts. This has been pursued through strategies such as flexible standardization, architectural bootstrapping and system adoption. We have also suggested strategies that could be used in this situation such as active creation of attractors around which integration can be driven through a positive reinforcing process and flexible generification which enables development of simple solutions within reasonable budget and time-frame with extensible capacities.

What has made case interesting for our study is the heterogeneous nature of its actor-network and the complex set of interactions involving policies, systems and people.

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