GDN's Next Horizons Essay Contest 2014*
THE FUTURE OF DEVELOPMENT ASSISTANCE
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Winning Entry

A HOLISTIC APPROACH TO DIGITIZATION OF HEALTHCARE DELIVERY IN SUB-SAHARAN AFRICA AND BEYOND

Abstract
The Millennium Development Goals agenda is coming to an end, and sub-Saharan Africa is set to only partially meet one of the goals. Healthcare delivery in the region has been deteriorating, and the scarcity of high-quality, disaggregated and timely healthcare data exacerbates the problem. The post-2015 Sustainable Development Goals recognize the potential of digitization of healthcare service delivery to address these challenges. Recent years have seen an explosion of information and communications technology projects in the healthcare field. Many of these failed to achieve scalability and sustainability and to achieve the desired socioeconomic impact. Building on research conducted for a master's thesis at the London School of Economics and a research project in the Gambia, this essay reviews the antecedents of this failure and proposes a new agenda for digitization of healthcare delivery in developing countries. It discusses the limits of the contemporary approach to digitization and proposes a more holistic approach, which entails process mapping and better understanding of the reality underlying healthcare systems. It also calls for foreign aid to support realignment of incentives to create the long-term outlook necessary for this approach to succeed.

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**The GDN Next Horizon Essay Contest was launched globally by the Global Development Network (GDN) in 2014, with the support of the Bill & Melinda Gates Foundation. The contest invited contributions related to the future of development assistance to inform the ongoing discourse on development assistance with fresh thinking, and revamp policy debates with new voices. This essay is one of 13 winning entries selected by a high-profile Jury of aid policy makers, experts and practitioners chaired by Nancy Birdsall.*

Introduction

Sub-Saharan Africa (SSA) only partially met one out of the eight health-related Millennium Development Goals (WHO, 2011; UN, 2015a). Scarcity of high-quality, disaggregated and timely healthcare data poses a challenge to future progress, preventing evaluation of developmental projects (UN, 2013). One of the overarching themes of the new Sustainable Development Goals agenda is a data revolution and digitization of healthcare, making these the focus of policy and funding in the coming decades (UN, 2015b). Organizations such as the World Bank, World Health Organization, and United Nations (e.g. UN, 2012), as well as the African Union in the *Common Africa Position on the Post-2015 Development Agenda* (African Union, 2014) support this view. The global community recognizes the opportunity and need for digitization of healthcare delivery in SSA countries and other developing countries.

Informational infrastructure is a critical antecedent of achieving equity of healthcare delivery in developing countries (Alampay, 2006), and thus a critical factor in poverty alleviation. A number of studies support this view and argue that information and communications technology (ICT), defined as the "set of activities that facilitates the capturing, storage, processing, transmission and display of information by electronic means" (Cecchini and Scott, 2003, p. 73), leads to better decision-making and supports poverty eradication (Pigato, 2001; Cecchini and Scott, 2003; WHO, 2005; Bukachi and Pakenham-Walsh, 2007).

There is an urgent need for ICT interventions in SSA countries. The region suffers from severe constraints on economic growth (World Bank, 2014a). More than 40% of the population is illiterate, and 48.5% of the population lives below the poverty line (World Bank, 2014b). Communicable and noncommunicable diseases prevail (Unwin et al., 2001; Dalal et al., 2011). Researchers, practitioners and international organizations alike argue for the transformative potential that ICT could bring to healthcare delivery, education and economic development. The positive socioeconomic impact of data-driven decision-making, facilitated by effective health information systems, is clear (e.g., Jennett et al., 2003; Alampay, 2006; Ngwenyama et al., 2006; Bankole, Shirazi, and Brown, 2011b), with benefits including cost-effectiveness, access, transparency, reduced inefficiencies in the healthcare system, positive health outcomes and better quality of life.

While a World Economic Forum report shows that overall ICT readiness in SSA is still low (Dutta and Bilbao-Osorio, 2012), the past decade was characterized by an explosion of ICT projects in healthcare (Wamala and Augustine, 2013), with significant investments in ICT infrastructure (Bankole, Shirazi, and Brown, 2011). Such projects often benefit from substantial development assistance.

Yet the efficacy of health information systems and digital applications in developing countries in general, and SSA in particular, is disappointing (Wamala and Augustine, 2013). Most digitization efforts have failed to achieve scalability, sustainability, and ability to have a socioeconomic impact by improving decision-making and increasing the transparency of

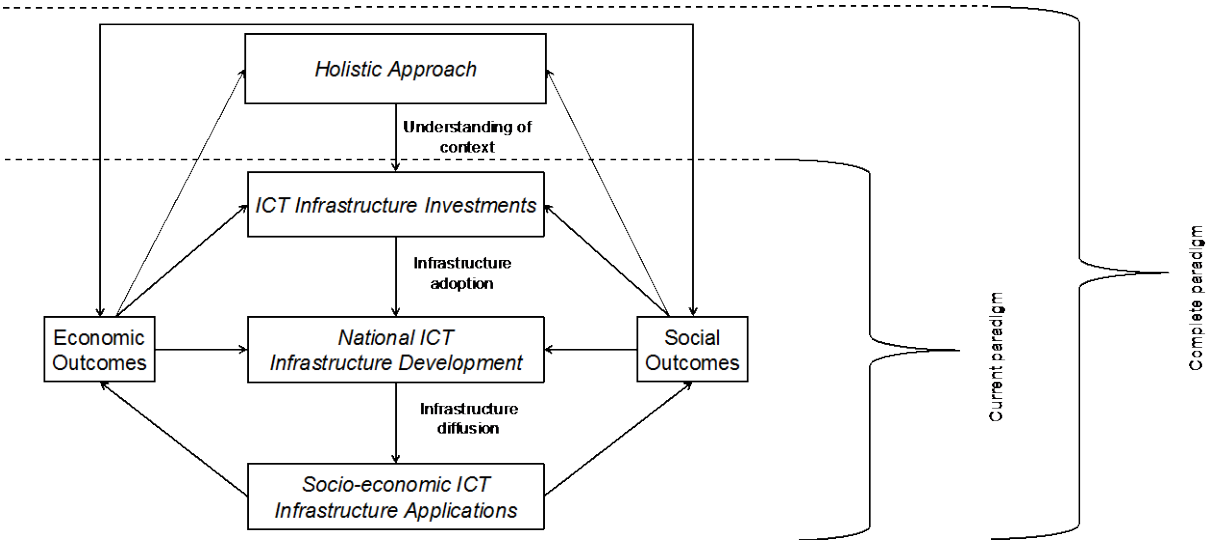
public services (Avgerou, 2008; Olajide, 2011). Bonair, Rosenfield and Tengvald (1989) state that failure to use technology effectively is one of the most salient concerns about applying technological solutions in the developing world.

This essay proposes a paradigm shift that would allow the digitization agenda to be grounded in local contexts and thus improve its chance of success. It builds on a London School of Economics (LSE) research project led by the author in the Gambia in collaboration with a nongovernmental organization (NGO), Riders for Health, into the challenges to digitization of healthcare delivery (Appendix 1).

Analysis of data from this research (Appendix 2), as well as additional case studies and related literature, revealed the overarching reason for the failure of digitization projects in the Gambia, and potentially in other SSA countries. It is not the lack of infrastructure, or other high-level barriers that have been suggested by scholars, but the lack of a holistic approach to digitization. Such an approach would start with an understanding of the inherent complexity of the healthcare system.

The lack of a holistic approach results in an incomplete digitization paradigm (Figure 1). Projects launched within this paradigm are often temporarily successful at addressing higher-level barriers and supporting government processes. However, because they do not take into account the broader context, they are prone to eventual failure.

Figure 1. Digitization paradigms with and without inclusion of a holistic approach.



Digitization, like any process improvement, should start with a thorough understanding of current conditions. The need for such a systemic approach appears obvious, yet has not been addressed in SSA. This essay reviews the existing (and, as argued here, incomplete) digitization paradigm, proposes a more complete paradigm, explores the challenges to achieving the latter, and proposes a way to resolve those challenges and implement a holistic approach to digitization. It promotes contextualized process mapping as a fundamental prerequisite of ICT-for-development projects, and calls for a realignment of international development priorities to support more long-term-oriented projects. The

impact of ambitious development endeavors cannot be measured using myopic, predefined metrics, which, while they may support the efficient allocation of resources in the short term, undermine the transformative potential of digitization in the long term. Through continuous commitment to building strong fundamentals, the international development community can facilitate an environment in which tailored, effective, sustainable and scalable solutions can be developed.

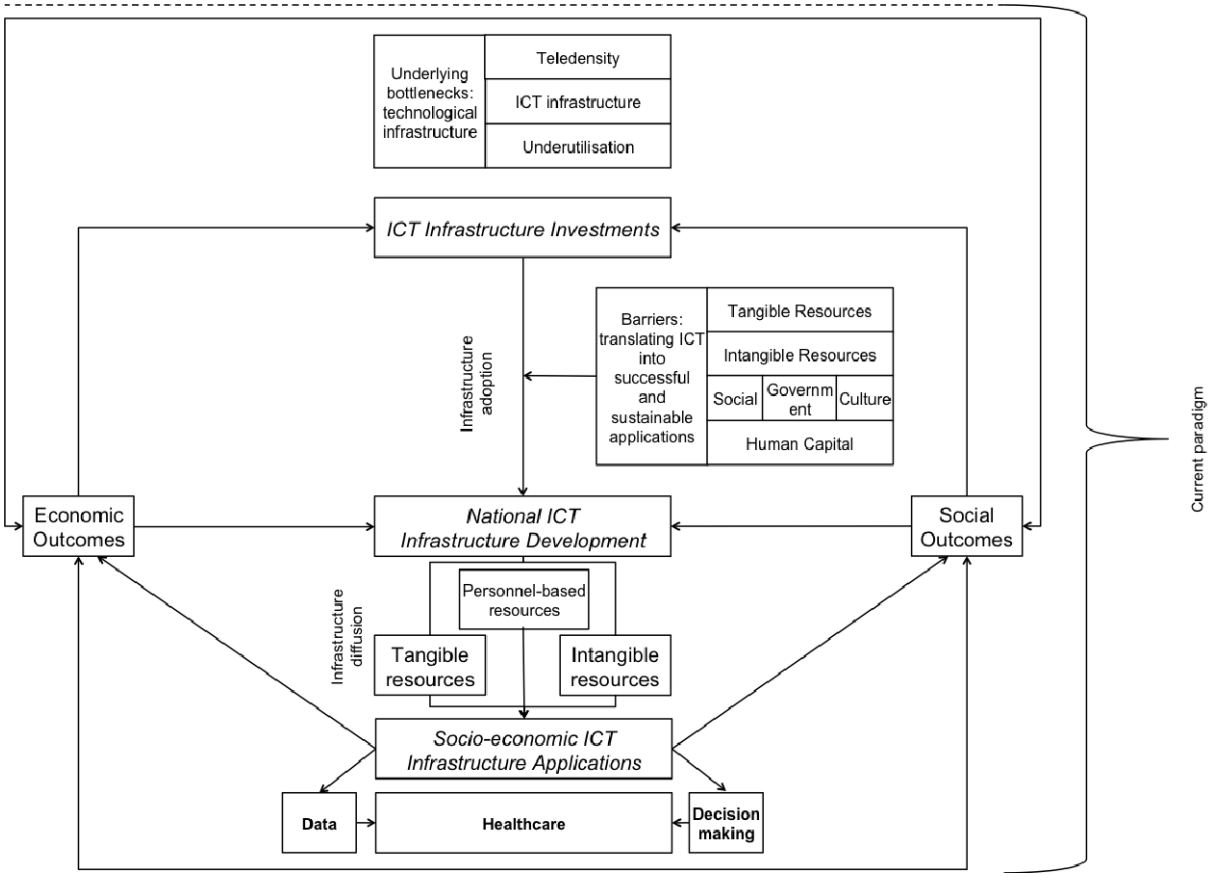
The Current Paradigm of Healthcare Digitization

Theoretical Basis

An understanding of the current digitization paradigm starts with a review of relevant literature. ICT for healthcare in developed countries has been explored extensively. The literature on ICT in developing countries, especially the SSA region, is underdeveloped in comparison (Meso, 2008), despite ICT's recognized potential to transform the region's healthcare and contribute to its socioeconomic development (Ngwenyama et al., 2006; Mars, 2013). A recent review of academic literature on ICT in developing countries (Avgerou, 2008) found no discussion of the critical topic of digitization. There is a lack of new approaches that could transform foreign aid into effective, sustainable and scalable digitization efforts (Hirschheim, Klein, and Lyytinen, 1996; Avgerou, 2008).

Figure 2, which represents the current digitization paradigm, is based on a framework developed by Mbarika et al. (2005) and summarizes current research and analysis on the topic, which calls for transforming ICT infrastructure into tangible and intangible resources that can have a positive socioeconomic impact. It focuses on the issue of healthcare, and includes an overview of the barriers to digitization in SSA. These barriers are discussed in detail in Appendix 3. In this paradigm, ICT infrastructure investments are seen as the critical antecedent of successful digitization in SSA, and their scarcity as the main barrier (Odedra, 1993; Mbarika et al., 2005; Meso, 2008).

Figure 2. The current digitization paradigm (source: adapted from Mbarika et al., 2005, p. 137).



Under this paradigm, a digitization effort must start by establishing an appropriate ICT infrastructure, investing appropriately and overcoming any associated barriers. Then, through simultaneous deployment of tangible, intangible, and human-capital resources, sustainable and scalable digital interventions can be deployed to improve healthcare delivery.

ICT applications are essential to improving healthcare data flows (Cecchini and Scott, 2003; Fraser et al., 2005). Effective information systems empower decision-makers to better utilize and allocate scarce resources (Mutemwa, 2005; Stansfield, 2005) and help ensure the quality and responsiveness of healthcare delivery (Walsham and Sahay, 2006). The transparency and effectiveness of healthcare data flows are essential. ICT not only drives frugal decision-making, salient in a low-resource, developing-country setting, but also makes it possible to monitor and evaluate the digitization efforts aimed at all other areas of healthcare delivery.

Resolving SSA's dire healthcare problems is critical to reducing poverty and promoting sustainable development. ICT is seen as a powerful equalizer that can support data-driven decision-making to guide efficient and effective delivery of healthcare services both to urban and rural areas in SSA, where resources and medical personnel are scarce (Drucker, 2001;

Wootton, 2001; Rowe et al., 2005; Gebremichael and Jackson, 2006; Kifle, Mbarika, and Bradley, 2006).

Theoretically, healthcare digitization interventions that follow this paradigm and overcome the barriers reflected in Figure 2 should be successful, sustainable and scalable. But many such interventions fail—because, this essay will argue, of a major barrier not recognized in the paradigm.

Application in Practice

Limits of the theoretical model

When the paradigm described above was used to analyze digital interventions in the Gambia, it did not provide sufficient explanation of the failure of those interventions. Many of the standard explanations appeared shallow and failed to address underlying problems. A typical barrier, lack of funding, was not related to scarcity of resources or unwillingness of the decision-makers to direct resources to digitization. Rather, the salience of the particular projects was never made clear to senior officials. They were not perceived as an integral part of the healthcare system they were designed to improve.

For example, SMSforHealth, a text-messaging solution that was widely appreciated by MoH officials, failed for this sole reason. It was intended to digitize a critical aspect of the healthcare system in the Gambia: planning and distribution of medicines. But it failed to recognize that this requires effort throughout the supply chain, from planning and decision-making bodies to regional health centers where medicines are stockpiled to the end users. Such systemic understanding is not required in the current paradigm.

A public health nurse who oversees the distribution of drugs at the regional level said, "There was no feedback from the higher level. It was a one way communication."[1] This suggests that the officials at higher levels of the ministry were not participating in the project. The chief pharmacist said:

> "The key stakeholders could have utilized the data more. On a day-to-day activities, in terms of procurement and so on.... the project should have undergone some management. All the data should have been analyzed, with some key stakeholders. [Only then] can the solution be developed and data disseminated."[2]

The standard paradigm would suggest that such problems are a manifestation of, for example, inappropriate design or lack of human capital. In fact, the digitization effort failed to take into account the complexity of interactions among actors within the healthcare

[1] 6/04/2014, on way from Tendaba to Banjul, the Gambia

[2] 04/03/2014, Banjul, the Gambia

system. This was a recurring problem. The subsections that follow review existing approaches to digitization with their respective shortcomings.

Limited approaches to digitization

Thematic analysis of case studies revealed three broad types of approaches, focused on solutions, data flows, and narrow streams of healthcare delivery. The literature suggests three associated types of failure—failure of implementation, sustainability and scalability (Avgerou, 2008).

The *solution* approach focuses on a digital solution to a socioeconomic issue, often developed in the West and then implemented in SSA. These projects tend to fail as their *implementation* is impaired by not reflecting the underlying context of SSA. Development is removed from context and does not fully recognize the various data collection, aggregation and dissemination points as well as healthcare delivery processes that pertain to them.

A prime example of the problems with this approach is the DHIS2 Open Source healthcare database system that is supposed to serve as the focal point in data collection and decision-making in the Gambia. While the reports on DHIS2 suggest that the system has been completely implemented in the country (DHIS2.org, 2015), in fact, the fieldwork revealed that the system does not encompass all the relevant actors and institutional relationships in the country and is practically not used by decision-makers. For example, in an interview with the chief pharmacist, supposedly a key stakeholder, said, "I know that it is web-based, and that's about it. ... It's there and apparently when you log in you can get it, but that's it. ... There's something not quite right with that."[3]

The *data flows* approach focuses on a particular data stream—for example, related to collecting, storing and disseminating information on HIV/AIDS prevalence. These applications fail as they are not *sustainable* and are frequently abandoned after the pilot phase. The approach does not embed the particular problem with data flows as part of a larger systemic issue that can only be addressed when a complete understanding of the entire healthcare system exists.

The approach that focuses on a *narrow stream of healthcare delivery* attempts to address the needs and problems of a single set of institutional actors. These applications fail as they are not *scalable*—they cannot be applied to other parts of the healthcare system. The approach does attempt to clarify the underlying complexity, but does so only in a limited scope so that the solution implemented cannot be applied to the whole system and benefit from interactions between different actors.

These three approaches are summarized in Figure 3.

[3] 04/03/2014, Banjul, the Gambia

Figure 3. Approaches to healthcare digitization in SSA.

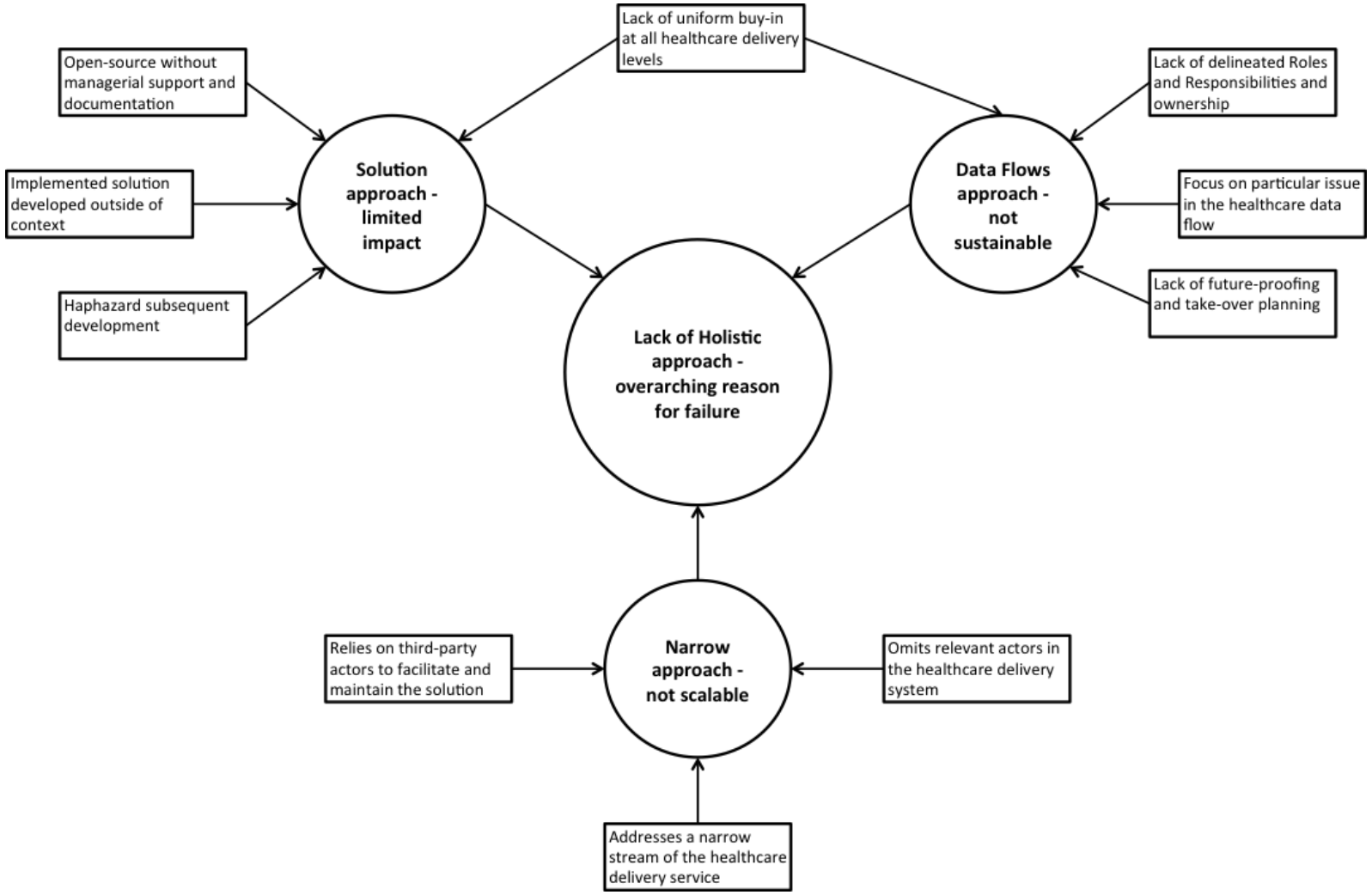
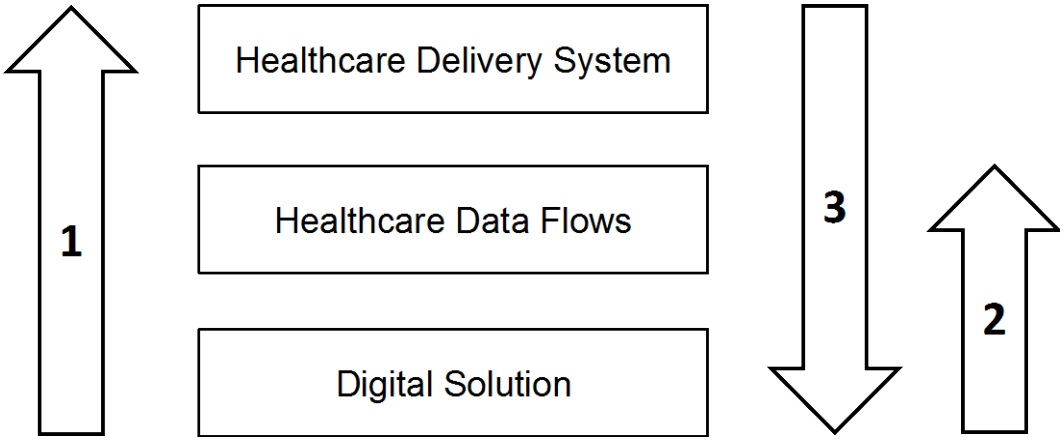


Figure 4. The three existing approaches to digitization.



While all three approaches may have different reasons for failing, they share one common flaw: not taking into account the complexity of healthcare delivery in SSA—in other words, the lack of a holistic approach.

As healthcare systems have been growing organically since the Alma Ata Declaration (WHO, 1978; Gillam, 2008), there is little understanding of the relationships between the different actors and stages of the healthcare system, because data collection, storage and dissemination processes have often grown and been defined in a haphazard, unstructured and unreported manner.

Ultimately, whatever the barriers identified by researchers or practitioners might be and however successful a particular solution might be in addressing them, such approaches will never be fully successful. According to the current paradigm, removing these obstacles is critical to successful digitization of healthcare services in SSA. However, without taking into account the underlying complexity of those services, applications designed to address these barriers individually are likely to fail. Hence, the current paradigm is incomplete and results in the failure of digital efforts and misallocation of resources.

The Complete Paradigm and Holistic Approach

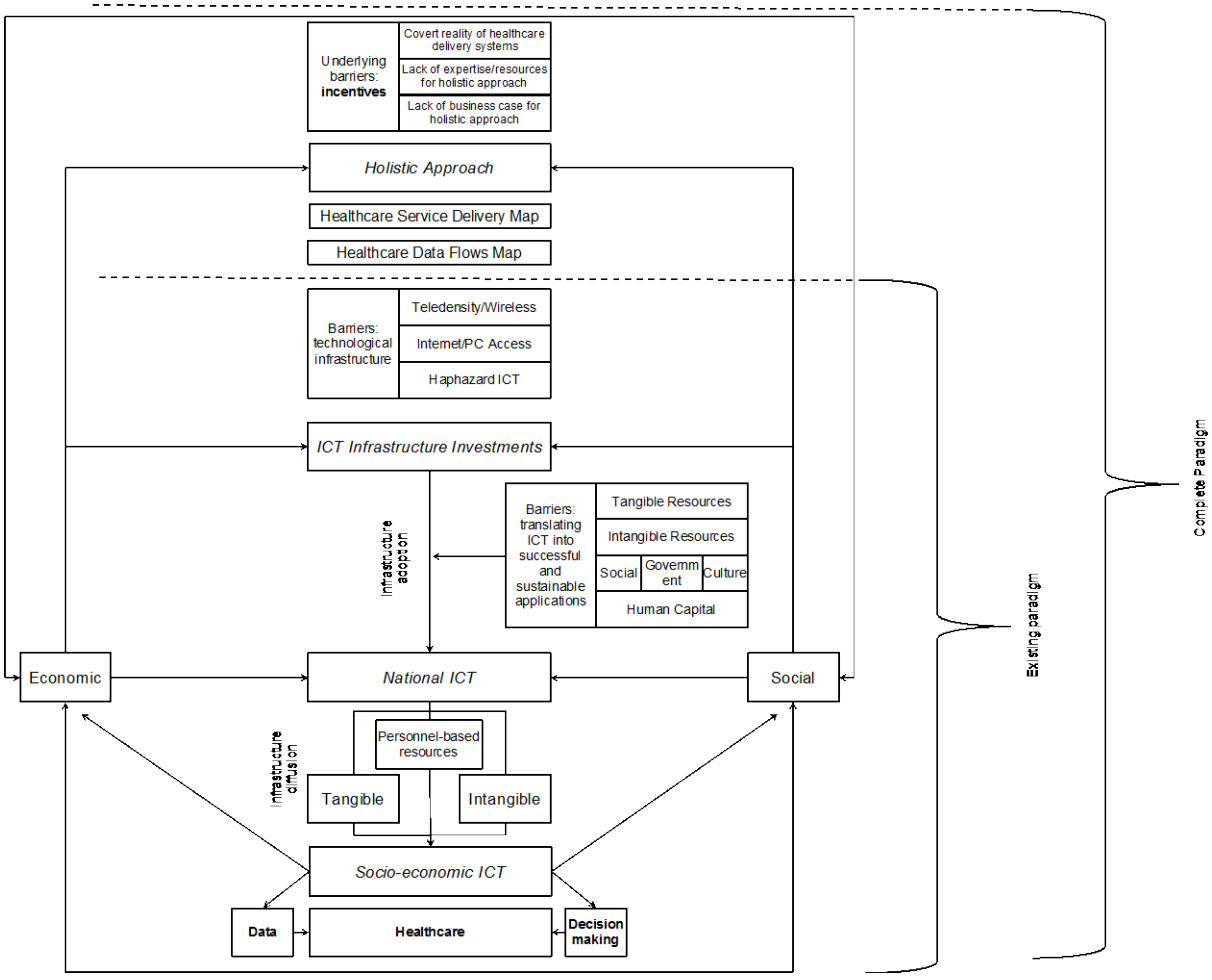
An approach that puts aside development of the digital solution, as well as consideration of particular data or service delivery problems, and instead begins by developing a thorough understanding of the context, will address the limitations of the current paradigm. The vice chancellor of the University of the Gambia said:

> "A substantive approach … integrates all the functionalities of the health infrastructure. To do this you have to go to the fundamentals … the basic. Zero. We assume that not everything is done right, but we are not discarding it. What is the delivery and data ecosystem in the Gambia in health?

> Forget digitizing. Sorry. Forget digitizing. If you don't understand the current workflow, the current data flow, the current process mapping of the health ecosystem here … what are you digitizing?
>
> This is why you have 60, 70, 80 prototypes that fail! It's not looked at from a systemic view and approach … this is a humongous task."[4]

Analysis of the evidence, discussions with practitioners and experts and in particular the brainstorming session at the University of the Gambia led to conceptualization of the holistic approach. This approach suggests an agenda for tackling this "humongous task," embedding it within the current paradigm so that the desired socioeconomic outcomes of healthcare digitization in SSA can be achieved (Figure 5).

Figure 5. The complete paradigm.



Studies that attempt to explain the failure and success factors for digital healthcare interventions in SSA often start within the incomplete paradigm. For example, Omary et al.

[4] 08/04/2014, Farabanta, the Gambia

(2009) review a range of barriers to digitization. However, they begin their analysis with barriers specifically to the adoption of digital healthcare applications.

In contrast, the holistic approach calls for refocusing on the healthcare system as a whole, including through detailed process mapping that could form a strong foundation for future digitization efforts.

The complete paradigm offered in this essay is not intended to replace the current paradigm but to enhance it. The value of such a systemic approach appears obvious, but digitization efforts in the Gambia and other SSA countries have not thus far embraced it. This lack of a strong foundation threatens to continue to undermine digitization efforts.

Challenges to Adoption of the Holistic Approach

Several challenges exist to the adoption of the holistic approach; these are discussed below.

Nontransparent nature of the healthcare system

Government functions that support healthcare delivery in SSA are often unstable, with high staff turnover even in higher positions. Access to relevant actors within government and service-delivery structures is restricted, especially for foreign practitioners. Sociological and cultural differences pose a challenge to conducting the mapping processes. Ultimately, access to the healthcare system is often restricted for actors who do not have the ability or inclination to deal with its complexity.

Lack of expertise and resources

SSA countries tend to suffer from poor governmental capacity and overall lack of human capital. Complete mapping of the healthcare system would require significant expertise and funding. The chief pharmacist of the Gambia's MoH said, "You need someone else to process it, package it and then give it to us [decision-makers] so we can make sense of it [the data], but we didn't have that."[5] A similar opinion was voiced by the permanent secretary of the MoH. Foreign expertise in process mapping is essential to lay the foundation for a successful digitization effort.

Lack of a business case for the holistic approach

Mapping of the healthcare delivery and data processes in SSA is a formidable challenge that would require significant financial and human resources. The return on this investment is unlikely to be realized over the short term. The management myopia and short-term-focused, shareholder-value-driven outlook of multinational enterprises may prevent large IT organizations from engaging in the endeavor. It can be argued that this is one of the reasons for the early criticism of multinationals by Odedra (1993), who claims that such companies

[5] 04/03/2014, Banjul, the Gambia

tend to dump technology on SSA countries to realize profits without the subsequent support that such technology requires to bring socioeconomic benefits. At the same time, these are the organizations that have the capability to engage in successful projects that would push the holistic agenda forward.

In the international development arena, incentive structures often resemble those in the private sector. Focus on short-term, output-based projects that deliver measurable outcomes does not incentivize long-term undertakings that provide indirect benefits.

The complete paradigm reveals the underlying barrier to digitization of healthcare in SSA to be the issue of incentives. Without vision, commitment and collaboration of donors, international organizations, technology sector MNEs, manufacturers, distributors and IT consultants, the holistic approach will be difficult to realize.

A New Agenda for Digitization of Healthcare Delivery

The New Paradigm—A Cost–Benefit Perspective

The digitization agenda is becoming increasingly engrained both in local policy and the strategic direction of international organizations. It can be argued that digitization of healthcare in SSA is inevitable. If we accept that the lack of a systemic approach is the primary barrier to successful digitization in the region, then it becomes apparent that funding of projects that do not address this issue is misguided.

The international development sector is already operating on stretched resources. Engaging in short-term, output-based digitization efforts distracts the community from building a strong foundation for future success. Taking a long-term perspective and accepting the need for building such a foundation makes it clear that current efforts do not make appropriate use of scarce resources. This poses a challenge in itself. The development community is highly complex, with thousands of stakeholders with different objectives, strategies and goals. A potential collective action problem may also arise if some organizations opportunistically continue attracting donors to short-term, relatively “easy win,” but misaligned projects.

Therefore, the leadership of a multilateral actor such as the United Nations or the World Bank is required so that the funding community can take the lead in changing the incentive structure.

"One way of achieving this would be by placing an emphasis on near-term funding of projects that focus on developing expertise in process mapping, which is lacking in the SSA context and yet critically needed. Funding and advancing process mapping initiatives would yield tangible outcomes in the form of detailed process maps of the health systems in SSA as well as the expertise in process mapping. Established process-maps and process mapping expertise would offer a stable foundation upon which ICT for healthcare solutions (be they ICT infrastructure for healthcare or computer/software applications for healthcare) can be developed. Additionally, it would enhance the effectiveness, sustainability and cost-efficiency of such digitization projects. Detailed process maps would also serve as tools for selection, evaluation and assessment of prospective and funded projects. Since the donor community will now be able to compare promised project deliverables to detailed country-specific process maps and better ascertain if the proposed projects align correctly with the country's health ecosystems. The net benefit of this proposed approach would be mitigation of misallocation of funds that is currently rampant within the SSA ICT-for-health development environment." (Professor Meso)

Roadmap to Implementing the Holistic Approach

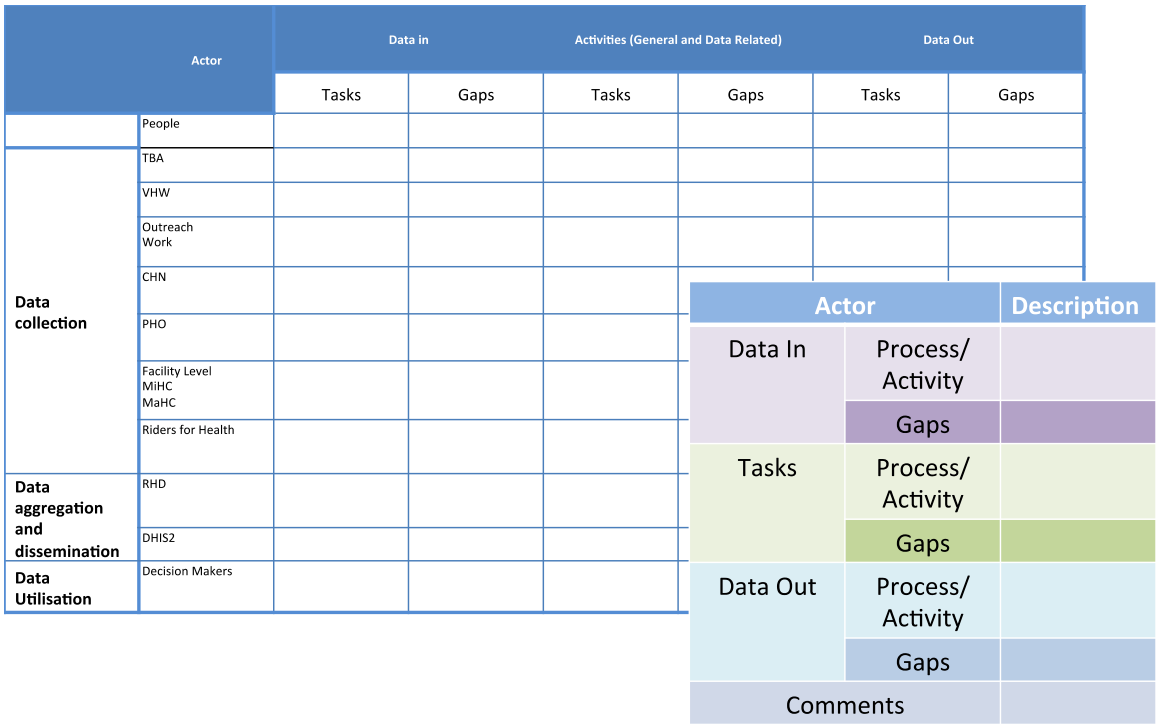
The holistic approach can be represented as a roadmap to systemically unpacking the contextual complexity of healthcare delivery and healthcare data flows in SSA (Table 1). Figure 6 provides an example of a template developed for the LSE research project in the Gambia. (The tables and maps presented here are intended to provide an example of the concept rather than a complete representation of the Gambia's healthcare system.) At each of the stages of healthcare delivery, all the tasks will be described. Understanding of the processes and interactions will allow understanding of the corresponding data points and flows.

Table 1. Roadmap for establishing healthcare digitization.

Stage	Activities	Deliverable
Healthcare system mapping	• Investigate the interactions between all actors in the healthcare system and all institutional processes at the macro and micro levels in the public and private sectors. • Map the existing healthcare system.	Service delivery map
Healthcare data flows mapping	• Analyze data that have already been gathered and stored. • Analyze the data that are continuously being produced. • Map the data flow to identify relationships between the data points.	Data flows map

Stage	Activities	Deliverable
Digitization	• Use the maps generated in the previous stages to analyze the gaps in the existing system. • Develop data architecture and modeling tools to design a clear and uniform way of capturing data that is compatible with the old data infrastructure. • Follow propositions of the current paradigm.	Digital solutions Contemporary output-based measures

Figure 6. Sample template for mapping healthcare services.

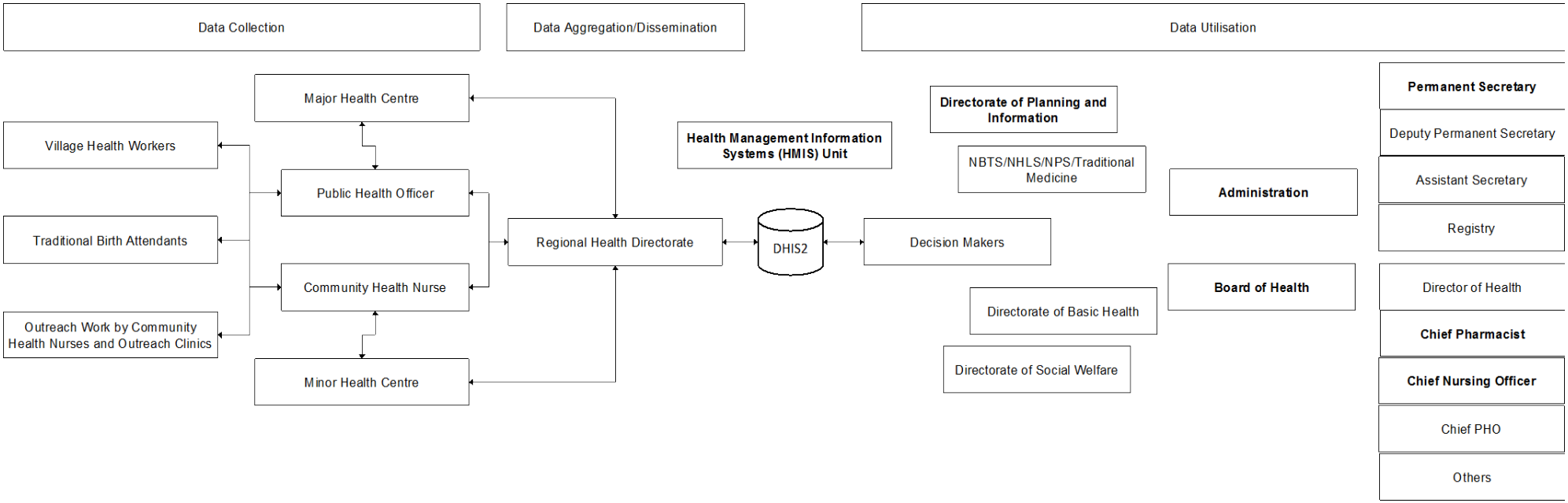


Actor		Data in		Activities (General and Data Related)		Data Out	
		Tasks	Gaps	Tasks	Gaps	Tasks	Gaps
	People						
Data collection	TBA						
	VHW						
	Outreach Work						
	CHN						
	PHO						
	Facility Level MiHC MaHC						
	Riders for Health						
Data aggregation and dissemination	RHD						
	DHIS2						
Data Utilisation	Decision Makers						

Actor		Description
Data In	Process/ Activity	
	Gaps	
Tasks	Process/ Activity	
	Gaps	
Data Out	Process/ Activity	
	Gaps	
Comments		

An example of a data flows map is shown in Figure 7.

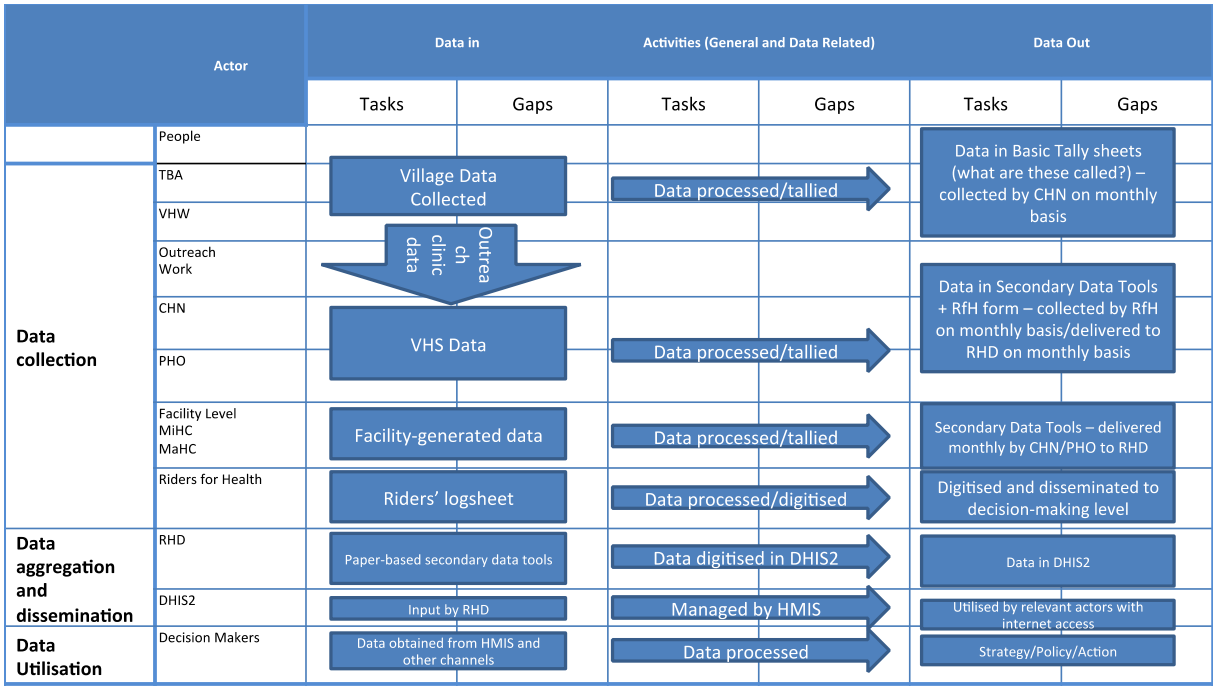
Figure 7. Healthcare data flows and primary data sources in the Gambia.



The data flows map should be accompanied by a rich description of the depicted data flows and data-capturing processes. (In the exercise carried out for the LSE research project that formed the starting point for this essay, this consisted of a 37-page gap analysis.) The initial healthcare delivery map ensures that these are tamed systematically, not haphazardly targeting an isolated stream.

When the data flows map is superimposed on the healthcare delivery map, a complete picture of the healthcare system emerges (Figure 8).

Figure 8. Snapshot of healthcare delivery and data flows in the Gambia.



Finally, once the institutional processes at the macro and micro levels have been systematically understood, building the data architecture can commence. The gaps and potential solutions can now be embedded within a broad and deep understanding of the context of the healthcare system.

One Way of Implementing the Holistic Approach

The roadmap provides a clear agenda for mapping healthcare systems in SSA. However, there remain the aforementioned obstacles to adopting the holistic approach—difficulty accessing information about the healthcare system, and scarcity of resources.

One way of addressing these could be by establishing public–private partnerships that leverage the distinct capabilities of various players to develop synergies that can tackle these issues. For the holistic agenda to be successful, such a partnership must bring the following capabilities and resources:

- Expertise in process mapping of governmental healthcare delivery processes and data flows and in developing appropriate, eclectic data architectures.

- Local human capital that will take part in untangling the underlying complexity and will contribute to and eventually take over the management of data architectures built upon this understanding.

- Ability to bridge the gap between Western capabilities and resources and local, developing-country contexts.

- Ability to influence and shape policy and strategic governmental decisions to support the holistic agenda in the long term.

In the Gambia, such a public–private partnership could consist of the following:

- A multinational enterprise that has the capability, knowledge and expertise in healthcare delivery, data management, and process mapping—for example, IBM.

- Local academic institutions that recognize the potential of digitization and engage in local capability building in relevant fields such as IT and public health. For example, the University of the Gambia, with its recently established Science, Technology & Innovation Park, strongly supports the digitization agenda. The institution is graduating students in the fields of public health and ICT. Its leaders are willing to collaborate with NGOs and international institutions alike and engrain themselves in the process of developing and maintaining a data culture in the country (University of the Gambia, 2012).

- A local NGO that works closely with the healthcare system that has developed ties on the ground. For example, Riders for Health enjoys widespread recognition and support within the MoH in the Gambia and who have the critical understanding of the country's healthcare system.

- Decision-makers in the MoH and other government departments who support the digitization agenda. In many SSA countries, digitization is being increasingly engrained in the strategy and vision of the leaders as suggested by various governmental documents. For example, in the Gambia, the Ministry has been infused with young, progressive, educated individuals who recognize this opportunity.

Such a partnership would have the required capabilities and resources to first gain a complete picture of the healthcare system and its data flows and then build a data culture and applications that would fully address the great need for digitization of healthcare in SSA.

Aligning the interests of profit-driven MNEs poses the last challenge. An organization that will successfully facilitate and become part of the partnership will be at the forefront of the digitization agenda that will unfold over the coming decades. A partnership that successfully implements the holistic approach and that develops a thorough understanding of current

healthcare delivery and data processes in SSA will hold the key to further digitization. Such expertise can be considered, in the resource-based view nomenclature (Grant, 1991), a unique resource and a source of sustainable competitive advantage. The first to start carrying out these projects should gain an unsurpassable advantage over competitors. Showcasing this expertise in one country should induce governments of other countries to seek support of the partnership in digitizing their healthcare systems. As the vice chancellor said:

> "In the realm of such an MNE, they can put a digital application to digitize the entire health ecosystem of the Gambia. And it will not take them much, but what it gives them, is they will show other African countries the way to go for better health delivery."[6]

Showcasing a successful holistic approach to digitization in the Gambia, by building on public–private partnerships to develop an understanding of the healthcare system and then implementing a successful digitization program, is possible within a relatively short time. While the business case for such a project in the Gambia might be small due to the size of the country (which creates the opportunity to conduct the project in a limited time frame), achieving this success would open doors for such a partnership to engage in digitization of the whole sub-continent and beyond. Clearly, the economic benefit to such an endeavor would be significant.

This is merely one potential route to making the holistic approach part of a digitization paradigm. However, it shows that the factors necessary for success are in place. The question that remains is whether the international development community is ready to embrace a more long-term outlook and abandon short-term, output-based efforts.

Conclusion

This essay shows that the current paradigm of digitization of healthcare in SSA is incomplete, proposes a more complete paradigm based on a holistic approach, and argues that the main barrier to digitization of healthcare systems in developing countries is the lack of thorough understanding of those systems. The holistic approach calls for systemically investigating this complex system before any digital solutions are funded, developed and deployed.

The need for such a systemic approach is obvious, yet it remains to be undertaken. It appears that the primary reason for this is the lack of appropriate incentives in the international development community. The focus on predetermined deliverables and output-based efforts encourages efficient use of scarce resources in the short term, but undermines the digitization agenda in the long-term.

Without a strong foundation, future digitization efforts will be prone to failure as they are detached from the context of healthcare delivery. Therefore, a realignment of incentives in

[6] 08/04/2014, Farabanta, the Gambia

the development sector is needed. This will require collaboration across major international organizations and potentially the leadership of a multilateral actor such as the United Nations or the World Bank in a mutual effort and commitment to realizing the tremendous potential social benefits of digitization of healthcare—which can only be realized over decades.

One avenue would be to create public–private partnerships to develop an understanding of the underlying reality of healthcare systems in developing countries. The argument in this essay does not undermine or present an alternative to the current approaches that tend to focus on specific parts or problems in the healthcare system. Overcoming the significant barriers to digitization through ICT projects that build on appropriate infrastructure is critical. However, for the socioeconomic benefits of digitization to be realized in the long term, the systemic, holistic approach must be taken.

There exists an exciting opportunity to solve this persistent puzzle. The international community recognizes the need to support digitization under the Sustainable Development Goals. This will increasingly be reflected in the strategy of developing countries and allocation of scarce resources, especially when foreign aid is directed toward the agenda. This in turn will create a fertile ground for international organizations, IT sector MNEs, NGOs, social entrepreneurs and other actors to engage in digitization initiatives.

Providing funding according to the complete paradigm will ensure that these actions align with local conditions. Supported with appropriate financing to follow the premises of this new approach, the actors will be better prepared to undertake successful and complete digitization of healthcare delivery in SSA and beyond. As decision-making and policy begin to benefit from complete digital data architectures developed in this systemic manner, and digital applications built around them that reflect the underlying reality of healthcare systems, digitization will bring its anticipated impact, transforming millions of lives.

Appendix 1—Case Selection

The Gambia was chosen for this study for two main reasons. First, the country is representative of SSA and faces similar challenges in digitization. Second, the author was granted access to data and support from Riders for Health, who also could validate the outcomes of the study due to their extensive operational expertise in the region.

Riders for Health is a United Kingdom–based organization that first came to the Gambia in 1989. The organization provides transportation services for the Ministry of Health in the Gambia and seven other SSA countries to enable health workers to reach remote areas. The NGO enables these ministries to deliver healthcare services in an equitable manner while controlling the costs and using scarce resources in the most effective and efficient way.

The organization has been delivering excellent results and transforming the lives of millions of people in SSA. It enjoys widespread support from the government, which allowed our research team to engage with all the relevant actors and develop a thorough understanding of the healthcare situation in SSA. This was critical to the success of the project and to the insights it yielded.

Andrea Coleman, chief executive officer of Riders for Health, said: “Gambia is a very small country, but very typical of the whole continent of Africa.” Barry Coleman, chief executive officer of Riders for Health, said: “People die from easily preventable diseases. If you’re a child, your chances of dying before you’re five are about one in eight. It’s disgraceful. It’s something of which we all should be ashamed.”

Both the state of Gambia’s healthcare system and its potential for digitization are similar to those of other countries in the sub-Saharan region. The country suffers from inequitable and inefficient healthcare. Life expectancy is 12 years shorter than the global average, and infant mortality is twice as high. Prevalence of communicable diseases such as tuberculosis and HIV is also double that observed globally. Malaria takes a particular toll, with over one-quarter of the population contracting the disease, compared with the global average of 4% (WHO, 2014). Some of these trends are in fact deteriorating, both in the Gambia and across SSA.

The *World Malaria Report* (WHO, 2013) calls for improving healthcare data availability for assessing trends and tackling not only malaria but also other diseases. Ultimately, as discussed in the first section of this study, digitization of healthcare delivery is a significant opportunity to improve its impact and allow SSA countries to embark on a path toward effective healthcare delivery despite their low-resource context.

The Gambia can also be considered somewhat representative in terms of the potential for digitization to succeed, despite the prevailing argument in the literature that emphasizes the poor state of ICT infrastructure as the key barrier to digitization. In the last decade, Gambia’s mobile penetration level is comparable to that in Europe (Deloitte, 2012), namely 120%.

An International Telecommunication Union report shows that in 2012, 83.6 percent of Gambians subscribed to mobile services. Furthermore, 3G mobile broadband gained

significant popularity, with access costs dropping to levels that allow for uniform adoption (BuddeComm, 2014). I also observed this during fieldwork. It became apparent that the country enjoys almost 100% coverage provided by four mobile network providers—Gamcell, Q-Cell, Comium and Africell. The improvements in teledensity occurred alongside significant improvements in ICT infrastructure. Ultimately, teledensity, claimed by many scholars to be one of the greatest barriers to digitization in the region, ceased to be a valid explanation for the failure of digital efforts as discussed in this essay.

Appendix 2—Data Sources

Evidence gathered for this study consisted of a wide range of sources including focus groups, informal and semistructured interviews, communications with NGOs, consultations with practitioners and experts, and archival data such as government documents, internal documents, websites, news articles, press releases and statements by international organizations. Additional sources included case studies of healthcare data interventions in SSA.

Input gathered during fieldwork included the following:

- A total of 48 interviews, together lasting 22 hours, with individuals at different levels of the Gambia's healthcare system, from outreach workers to the permanent secretary of the Ministry of Health.
- Personal field observations and other notes totaling 300 pages.
- Two focus groups with the Health Management Information Systems unit at the University of the Gambia.
- A brainstorming session at the University of the Gambia.
- Follow-up meetings, e-mails and other communications with practitioners and experts.
- A 37-page gap analysis and associated notes.
- Governmental and other documentation obtained from the Ministry of Health, Riders for Health and the University of the Gambia.

The brainstorming session at the University of the Gambia was led by the university's vice chancellor, who is also an advisor on IT matters to the president of the Gambia. The vice chancellor has decades of experience working on and teaching ICT for development across the world. The vice chancellor also provided advice on the ideas in this essay.

These primary sources made it possible to develop a complete understanding of two digitization projects, DHIS2 and SMSforHealth, which were the focus of this study. Additional case studies came from a comprehensive report on digitization efforts conducted by Vital

Wave Consulting (2009) for the United Nations, as well as other studies collated through an online search. Further online research on those projects was conducted with a focus on identifying their success and failure factors.

This study also drew on recordings and notes from a London School of Economics panel on mobile health that took place on March 14, 2014.

Appendix 3—Barriers to Successful Digitization

Mbarika et al. (2005) describe ICT resources in the SSA context, following Grant's (1991) classification, in terms of their tangible and intangible nature. Tangible resources relate to the physical ICT infrastructure and are thought to be the key barrier to digitization in SSA, while intangible resources relate to the supporting processes, synergies and structures of governance that enable ICT deployment. These resources, when coupled with human capital, given the complexity of the contextual environment in sub-Saharan countries, could become a source of sustainable competitive advantage. They would be difficult to imitate by other countries due to causal ambiguity and time compression diseconomies that would arise in their development and deployment. The stages of technology diffusion, subsequent governance and translation into successful applications depend on sound strategic decisions regarding national ICT adoption and utilization. Authors argue that digital applications, which follow these stages will bring positive socioeconomic outcomes.

The ICT literature identifies a range of barriers to the development and implementation of successful, sustainable and scalable digital healthcare applications. The digitization model offered by Mbarika et al. (2005) only showed the particular stages in ICT infrastructure: investment, adoption, development, diffusion and application. This view can be expanded to include barriers to digitization at each of the stages of the model.

1. Barriers to the scaling of existing ICT infrastructure and investments for the purposes of digitization of healthcare delivery and healthcare data flows in particular.

2. Barriers to the adoption, development, diffusion and application of this ICT infrastructure for the purposes of digital healthcare. These barriers are related to the deployment of the following resources:

    a. *Tangible resources*—the ICT infrastructure must be translated into tangible resources that, when developed and managed appropriately, are a source of competitive advantage in the context of the sociocultural complexity of the SSA setting.

    b. *Intangible resources*—these are the resources that are embedded in sociocultural norms and practices of development. They should complement the tangible resources so that they can become a source of sustainable competitive advantage or, in this context, a source of the desired socioeconomic outcomes. Intangible resources pertain to the synergies and complementarity of the physical infrastructure with governmental, cultural, social and national norms. If such

synergies do not exist, the physical infrastructure cannot be leveraged to build successful ICT healthcare applications and interventions.

c. *Human capital*—these are personnel resources developed through training and participation in the development and deployment of the physical infrastructure that support the integration of ICT infrastructure into ICT resources. ICT personnel operate, maintain and develop through innovative ideas the ICT infrastructure to better align it with the needs of the SSA context. Thus, human capital is the source of complementary capabilities that are required to ultimately translate the physical infrastructure into digital healthcare applications that carry the desired socioeconomic impact.

Mbarika et al. (2005) see lack of ICT infrastructure as the main barrier to implementation of successful digital healthcare applications. This barrier has to be overcome through appropriate investments. Then, through simultaneous deployment of tangible, intangible and human-capital resources, the ICT infrastructure can be successfully developed to deploy sustainable and scalable digital healthcare applications.

Therefore, it is imperative to identify the barriers at every stage of the process to draw a complete picture of successful digitization efforts. Understanding of these barriers then should make it possible to identify the antecedents of failure of digital healthcare interventions and elucidate the key aspects of successful applications that overcome these barriers. Mbarika et al.'s (2005) framework was used to assess the current state of the literature and its theoretical propositions on the barriers to successful digital healthcare interventions by applying it to the situation in the Gambia and the additional case studies as described above. The following tables summarize these barriers. They substantiate the initial Mbarika et al. (2005) framework to provide a complete theoretical tool for analysis and digital application development both within the current, incomplete paradigm, as well as the complete one proposed in this essay. The tables are not exhaustive, but they present the main issues identified in the literature and contribute to understanding of the failure and success of digital healthcare applications.

Table A1. Barriers to digitization related to physical infrastructure.

Description: The poor state of ICT infrastructure in SSA is seen as the barrier to digitization in the region. Without scaling up the infrastructure, there can be no successful development and implementation of digital healthcare applications.	
Barrier	**Representative studies**
Lagging teledensity: Teledensity is used as an operationalization of ICT adoption in a country and is considered the "fundamental factor for ICT development" (Mbarika et al., 2005). Lagging teledensity is, thus, seen as the key obstacle to digitization of healthcare in SSA.	Bashshur, Reardon, and Shannon (2000); Musa, Meso, and Mbarika (2005); Mbarika and Byrd (2009); Wamala and Augustine (2013)
Lack of ICT infrastructure: Many studies point to the simple scarcity of ICT infrastructure in developing countries and SSA in particular, which prevents development of successful digital healthcare applications.	Braa et al. (2007); Omary et al. (2009); Barnett and Galegos (2013)
Underutilization of existing ICT infrastructure and failure of technology transfer: Much of the existing ICT infrastructure came from foreign aid that dumped technology on the SSA countries without instruction on how to operate it and that does not meet their needs. Therefore, the existing infrastructure is underutilized and inadequate and cannot be translated into tangible resources.	Woherem (1991); Odedra et al. (1993); Odedra-Straub (1993)
Inconsistent power supply: Energy shortages in SSA and ineffective solutions, such as rotating power supplies, inhibit the potential of existing and developing ICT infrastructure.	Rotich et al. (2003); Fraser et al. (2005); Eberhard et al. (2008)

Table A2. Barriers to the development of tangible resources.

Description: ICT infrastructure, even if appropriate and sufficient, only has an impact if it is translated into tangible infrastructure resources. These resources become a source of competitive advantage when they are "unique" (Mbarika et al., 2005). In the SSA context, resources become unique through their adoption in their idiosyncratic environment where time compression diseconomies, embeddedness in this context and causal ambiguity make them a source of rents and socioeconomic outcomes when complemented with intangible resources and the supporting human capital.	
Barrier	**Representative studies**
Restricted access: ICT infrastructure cannot be translated into ICT resources because access to it is restricted to elites or relevant actors are prevented from using it.	Jensen (2001); Pigato (2001); United Nations (2014)
State monopoly on ICT: Privatization of the ICT sector is seen as one of the key ways to transform ICT infrastructure into resources and successful digital healthcare applications. State monopolies on infrastructure hinder widespread, efficient digitization.	Kimura, Omole, and Williams (2010); Mlay et al. (2012)
Prohibitively high access costs: A number of studies have found that access costs are higher in SSA than in the developed world—too high to enable widespread adoption. This inequality stems from inadequate public policy, economic conditions in SSA, and monopolistic structure of telecommunication providers.	Adam (1996); Mbarika et al. (2005)
Regulation that promotes vested interests: While SSA has suffered from haphazard investments by foreign donors in ICT that was inappropriate for local conditions, some authors point to the fact that SSA governments continue to encourage such investments thus perpetuating the problem.	De Boer and Walbeek (1999)

Table A3. Barriers to the development of intangible resources.

Government-related barriers to deploying intangible resources	
SSA governments suffer from poor capability. Regulation and policy do not create an environment conducive to the intangible ICT resources needed for development of successful digital healthcare applications.	
Barrier	**Representative studies**
Lack of financial resources: SSA governments struggle with extremely scarce resources, and the healthcare digitization agenda is not seen as a priority in spending despite the substantial benefits it carries in terms of cost-effectiveness, efficiency and socioeconomic impact.	Wicklein (1998); Foster (2009)
Lack of appropriate policy, strategy and vision: The digitization agenda is not made explicit in governmental strategy and is not reflected in policy.	Ngulube (2007); Makoza and Chigona (2013)
Lack of regulation on privacy and confidentiality: The privacy and confidentiality of digitized healthcare data are not engrained in policy, which hinders use of existing ICT resources and development of digital healthcare applications.	Omary et al. (2009)
Regulation that promotes vested interests: Many international ICT manufacturers engaged in dumping of inadequate technology at elevated prices with little true technology transfer or after-sales support. This was particularly prevalent in light of poor governmental capability, inadequate regulation and opportunism.	Odedra (1993), Odedra-Straub (1993); De Boer and Walbeek (1999)
Lack of government support and collaboration: Government and nongovernment healthcare officials do not recognize the opportunity that ICT carries and are not inclined to cooperate in development of digital healthcare applications.	Braa et al. (2007); Gichoya (2005), Igira et al. (2008)
Cultural barriers to deploying intangible resources	
African cultures vary, and these cultural contexts determine the likelihood of adoption and deployment of tangible ICT resources for healthcare. Most SSA cultures are traditionally oral. The transition to a reading culture and one that could embrace data, and digital data in particular, is still underway. This has slowed the adoption and weakened the sustainability of digital healthcare applications.	

Barrier	Representative studies
Resources that do not reflect cultural needs: ICT infrastructure and resources do not take into account SSA cultural values, languages, and behavioral norms.	Bonair, Rosenfield, and Tengvald (1989); Gyamfi (2005); Schuppan (2009)
Lack of a data-oriented culture: This makes applications unsustainable as users retreat to culturally embedded modes of operation.	Bukachi and Pakenham-Walsh (2007)
Social barriers to deploying intangible resources	
Social conditions in SSA include deep socioeconomic inequality within societies, which leads to disparities in the potential for ICT adoption and translation of ICT infrastructure and resources into successful digital healthcare applications.	
Barrier	**Representative studies**
Limited demand for technology: There is little appreciation of the potential of ICT to enable positive socioeconomic outcomes, and thus little demand for it.	Bonair, Rosenfield, and Tengvald (1989); De Boer and Walbeek (1999); Alvord, Brown, and Letts (2004)
Urban/rural divide in access to and understanding of technology: For the benefits of digital healthcare applications to be realized, access has to be universal rather than confined to urban areas. The urban/rural divide in access is frequently cited as an obstacle to digitization.	Pigato (2001); Bukachi and Pakenham-Walsh (2007)

Table A4. Barriers to the development of human capital.

Description: Human capital is critical for appropriate deployment of tangible and intangible resources towards the development, diffusion and application of digital healthcare interventions. Without local human capital, these efforts will not be sustainable.	
Barrier	**Representative studies**
Lack of ICT personnel: Underinvestment in education, especially in IT, and "brain drain" leave SSA a region without the adequate human resources that are critical to the success of digital healthcare applications.	Ngulube (2007)
Poor ICT literacy: This has been cited as one of the key barriers to development in the information age.	Braaksma (2004); Ngulube (2007); Igira et al. (2007)
Lack of ICT training: Digital healthcare applications, especially those developed in Western countries and implemented in SSA in a haphazard manner, have been established without appropriate training of local personnel, which further undermines their sustainability.	Kuruvilla et al. (2004) and various case study reports of digital healthcare interventions
Lack of local involvement in the development process: This undermines the sustainability of applications once foreign aid ends, discourages the scaling up of local human capital, and hinders context-specific application development and adoption.	Norris (2001); Mbarika et al. (2005)

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