ASSESSING THE HEALTHCARE LANDSCAPE WITHIN DEVELOPING NATIONS: IMPACT ON DESIGN REALITY GAPS

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ABSTRACT
There is a lack of documentation within the healthcare sector that depicts the context of the services that are currently provided within the developing world in hospitals. This has led to a mass failure of healthcare projects that are information technology based as a result of design reality gaps. We therefore use landscape methodology and case studies to illustrate how documentation can be extracted and used before developing the projects to understand the context of the project domain and as a result avoid design reality gaps. Therefore in this paper we provide information flow in a simple graphical form using the landscape methodology and multiple case studies that were carried out in Nyanza province in Kenya. From the methodology the results depicted include geo political structure of the province in a "canvas form", followed by different layers depicting flows of information. These layers include the organisation, stakeholders and services, structures of management, financial structures and information flows around the object study as observed within the five hospitals that were assessed within Nyanza province. If such information is availed especially to researchers and NGOS which work within the developing nations then it may contribute to avoid the design reality gaps.

KEY WORDS

Healthcare landscape, e-health projects, design reality gap, landscape methodology

1. Introduction

There are a lot of ICT projects that are currently taking place within the healthcare sector in the developed and in the developing world within the healthcare sector. Sadly, the potential of these healthcare applications are not being realised at the moment [1].

In the case of developing world, there is an overwhelming evidence from researchers that various barriers exist which act as a handicap to such implementations. The authors in [2], point out these challenges and provide frameworks of implementing e-health solutions in developing world.

However, the problem of "design reality gap" is never mentioned as part of challenges in the developed world since users of these systems may not be able to out rightly point it out as a cause.

Few researchers have mentioned the problem to research design gap, but have not offered tangible solutions to address the matter.

Design reality gap exists when various stakeholders design a system in their context using the technology that is available to them and that which fits into their surrounding although the system is to be used in other settings [3].

In a good spirit and effort to improve efficiency of services offered in developing nations within hospitals, the countries in the west have been coming up with e-health systems and implementing them in the developing world. As a result some projects have succeeded but majority of the projects have failed due to various factors [1].

One of the reasons for failures of such e-health systems within the developing world has to do with the "design – reality" gap [3]. This occurs because most of the information systems that are currently in place within the healthcare sector are designed from the developed nations' perspective for universal use without sufficiently looking into the contexts that exist in different settings [4].

Various forms of design gaps exist in the forms of the technology being used, information gaps, and differences in processes, variation of staffs and skills and disparity management systems [3].

We argue that if concrete documentation is available that depicts the healthcare landscape of developing countries, then various e-health stakeholders who are interested to participate or contribute in the e-health sector within the developing nations can use them and therefore avoid

failures of the majority of projects.

This in turn can save costs and time taken to investigate information available. Projects that are affected by design reality gaps within the developing nations in the healthcare sector include e-heath solutions such as electronic health records, Hospital information systems and telemedicine which are briefly described below:

a. Electronic Health Records (EHR)
The general functions of electronic health records includes; the availability of information needed by external stakeholders, accessibility of message transfer of health records and provision of security [5].

b. Hospital Information Systems (HIS)
Hospitals Information Systems allows managers and clinicians to make various decisions by providing tangible data which can be translated into facts within various departments of the hospital [6, 7].

c. Telemedicine Services
A lot of telemedicine services are currently being implemented within the developing nations. Telemedicine refers to the provision of medical services at a distance [8, 9].

2. Materials and Methodology

In this section the methodological approach used is discussed. This includes the study design, data collection methods and participants. The last part highlights how data was analysed.

a. Study Design
We used a qualitative approach to illustrate how the use of case studies and landscape methodologies can be used, to avoid a research design gap in various hospitals when developing e-health systems. Hence multiple case studies were applied to this study to compare how the hospitals operate. The case studies were conducted in Kenya within Nyanza province in the following health centres: Kisumu district hospital, Bondo district hospital, Chulaimbo health centre, Homabay district hospital and Nyamira district hospital. By using the landscape methodology, the context of the hospitals is considered. This consists of the canvas which is used to portray the graphical layout and political structure of the investigated hospitals. We also include the four layers of the canvas from the landscape methodology as proposed by [4]. This includes:

- the organisational, stakeholders and services in layer one,
- structure management in layer two
- financial structures in layer three and
- information flows around the studies in layers four

Landscape methodology is used extracts information in regard to existing healthcare landscape allowing e-health stakeholders to understand the background of the object of study.

b. Data Collection Methods
Empirical data was collected by use of open ended questionnaires, interviews and secondary data from conducting a literature review. The questionnaires were divided into categories for managers, staff and patients in order to collect relevant data. Additionally, semi-structured interviews were conducted. Literature revives were also used to collect secondary data that could help describe the situation on the ground.

c. Participants
Participants were chosen representatively and also based on their presumed ability to answer the questions. A purposive sampling was used to select a total of 60 participants from Kenya. The number of participants is as shown in table 1 below.

Table 1: Interview and Questionnaire Participants from Kenya, Nyanza Province

Name of hospital	Number of managers	Number of staff	Number of patients	Total
Homabay district hospital	1	6	5	**12**
Bondo district hospital	1	7	4	**12**
Nyamira district hospital	1	6	5	**12**
Chulaimbo health centre	1	6	5	**12**
Kisumu district hospital	1	6	5	**12**
Total	**5**	**31**	**24**	**60**

d. Data Analysis
In this paper, inductive strategies were used to analyses the data provided, from the observations, literature review, interviews and questionnaires. This as a result of its capability to identify patterns that exist after observations have been carried thereby leading too a particular theory through tentative hypotheses.

3. Findings

This section looks into findings concerning the canvas, financial flows, the flow of authority, service and the information flow presented as the different layers of the landscape model.

a. Canvas: Basic Geographic and Political Structure of Nyanza Province

Nyanza province is one of the eight provinces in Kenya. It is bordered by the Western province to the north, Rift Valley province to the east and the republics of Tanzania

and Uganda to the south and west respectively. The population comprises 2,291,069 females and 2,107,326 males with a total of 4,398,395 as per the 1999 population census. The total area of the province is about 15,788.3 square kilometres. The province is divided into twelve administrative district units namely Bondo, Gucha, Kisii Central, Nyamira, Kisumu, Homabay, Rachuonyo, Siaya, Suba, Kuria and Migori [10]. Figure 1 below the geo political canvas of Kenya, with a picture of Kisumu district at the center.
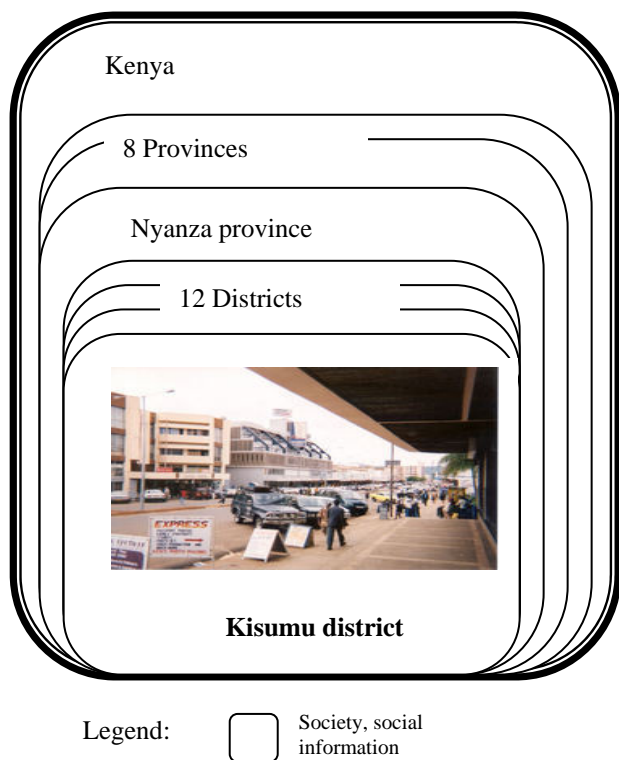

Legend: □ Society, social information

Figure 1 - Geo political canvas depicting
Nyanza province, Kenya

Kisumu District

The district lies between latitudes $33^{°}20^{|}$ East and $35^{°}20^{|}$ East and latitude $0^{°}20^{|}$ South and $0^{°}50^{|}$ East. The population size is 35,664. The average distance to a health facility is between 5 and 8 kilometres. Doctor to patient ratio in the district is one to 5,379. The most prevalent diseases within the district are malaria, anaemia and HIV/AIDS. More than half of the population in Kisumu district is estimated to be poor. The district covers an area of 918km^2 and is divided into four administrative units as shown on the map below [11].

Homabay District

Homabay district is located in south western Kenya along the shores of Lake Victoria and is one of the twelve districts of Nyanza province. It borders Bondo to the North West, Rachuonyo to the north, Kisii central to the east, Migori to the south and Suba district to the west [12]. The district has six divisions covering an area of about 1160.4 km^2 and consists of a population of 312,885 people. The average distance to the nearest health facility is 10 km. Doctor to patient ratio is 1 to 38,707. The most prevalent diseases are malaria, acute respiratory infections, diarrhoeal diseases, skin conditions and eye infections. Human immunodeficiency virus (HIV) prevalence rate is 24 per cent. The poverty level currently stands at 77.49 per cent [13].

Nyamira District

The district lies betweenn latitudes $0^{°}30^{|}$ and $0^{°}45^{|}$ south and longitudes $35^{0}45^{|}$ and $35^{0}00^{|}$ east. It covers an area of 896 km^2 and has seven administrative divisions. The average population is 535,288 (2002) and the average distance to the nearest health facility is 7 km. Doctor to patient ratio is 1 to 65,000 while HIV prevalence is 16 per cent. In addition, 67 per cent of the populations are classified as living in absolute poverty [14]. Common health conditions in the district include malaria, respiratory tract infections, water-related diseases and sexually transmitted infections(STI), the human immunodeficiency virus (HIV), acquired immune deficiency syndrome (AIDS) and tuberculosis (TB). The high incidence and prevalence of malaria in the district has contributed significantly to high admission rates and deaths in most health facilities. TB cases are on the increase [15].

Bondo District

The district lies between latitude $0^{°}$ to $30^{°}$ south and longitude $30^{°}$ to $34^{°}$ east. The total area of Bondo is 1972 km^2 and is divided into five divisions. The total population is 248,003 (2002). The most prevalent diseases are malaria, diarrhoea and respiratory diseases. HIV prevalence rate is 30 per cent while 47 per cent of the entire population is poor [16].

b. Flow of Finances

As shown in figure 2 below, the government, community members, employers and the National Health Insurance Fund (NHIF) are the key players who contribute to the public healthcare sector within Nyanza province. The government subsidises the cost of services provided within the hospitals. The community also have to contribute a given potion. Some community members and employers also contribute to the NHIF which is an insurance organisation
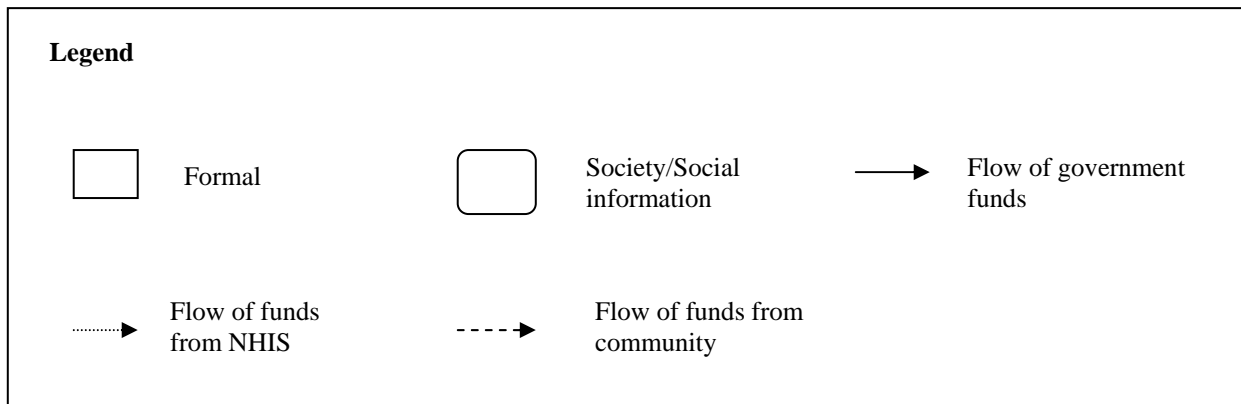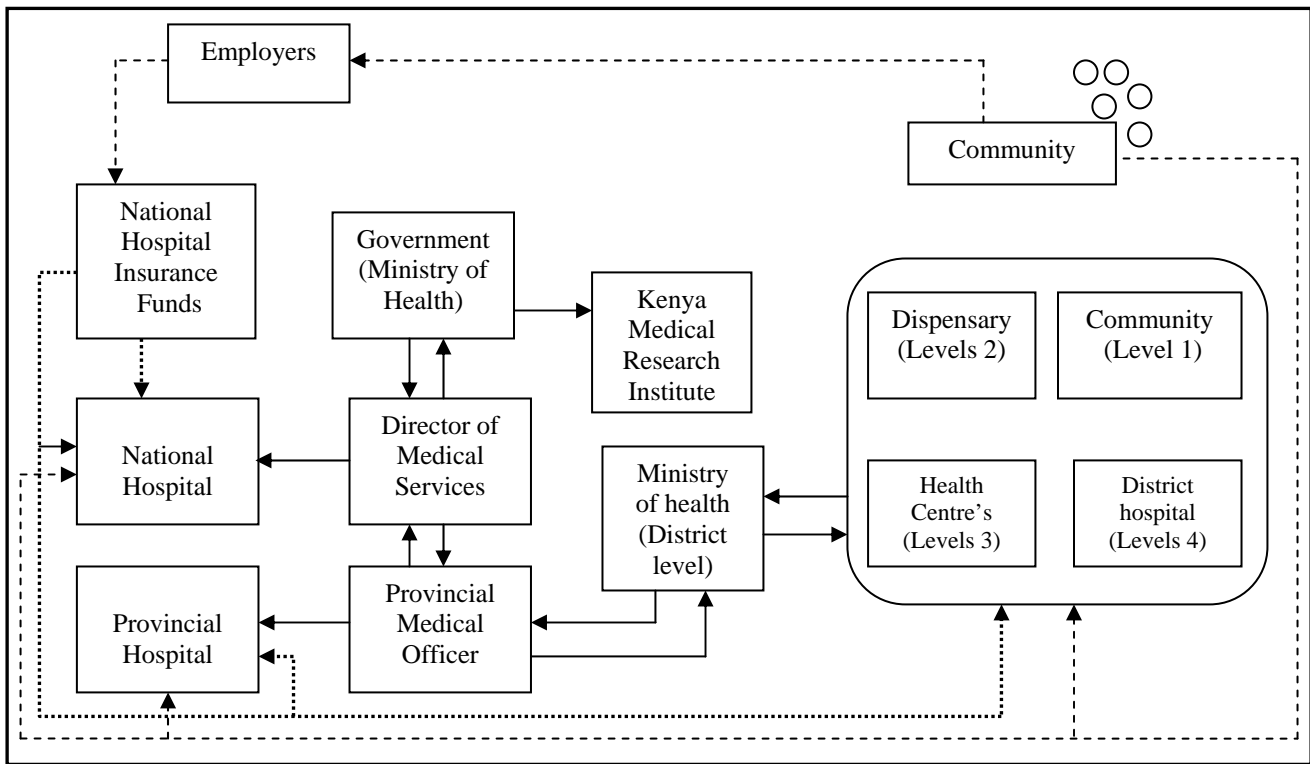
Figure 2: Flow of finances within Nyanza

c. Flow of Authority of Nyanza

In Nyanza province, medical operations are directed by the provincial medical officer who is assisted by medical hospital officers in the various districts. The provincial medical officer reports to the Director of Medical Services in Kenya, who is in charge of the Ministry of Health. Consequently, each district has a ministry health officer who reports to the provincial medical officer. However, when it comes to district organisation, various teams work hand in hand for effective operations within the districts(This includes the District Management Team, The Healthcare Centre management Team, The dispensary team and the Village Team). Figure 3 below shows the flow of authority up to the district level.

d. Service Flow

Referrals can be done from the dispensaries level, to health care centres to the district level. From the District level, referrals can be made to the Provincial level or to the National Hospital.

According to the Ministry of Health (2006), Nyanza Province has 35 hospitals, 20 sub district hospitals, 127 health centres and 240 dispensaries. Services provided are the selected district hospitals include curative and preventive services: These include OPD, pediatric services, surgical services, medical services and obstetrics and gynecology, HIV support, maternity services, X-ray services, dental services, laboratory and physiotherapy services. Services that were provided within Chulaimbo
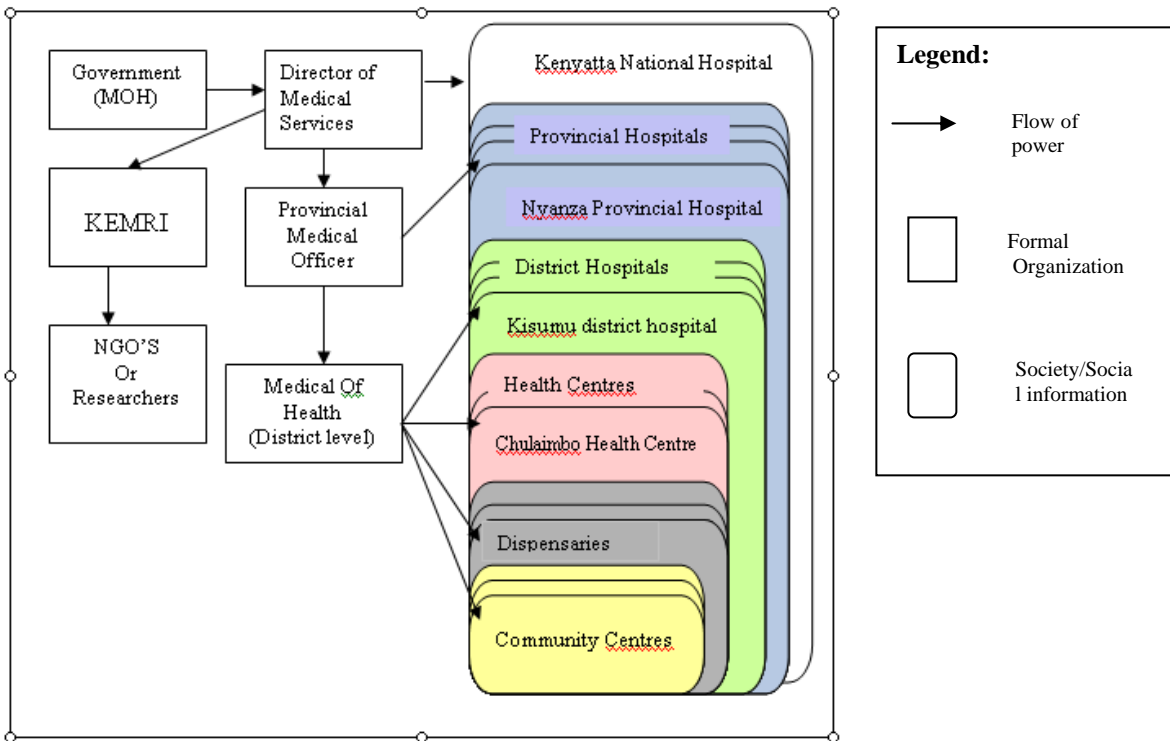
Figure 3: Flow of authority within the investigated hospitals

health centre includes curative and preventive services: These include OPD, pediatric services, medicine services and HIV support, x-ray services, laboratory and physiotherapy services etc

The service flow is as depicted in figure 4 in the next page. This if followed by a section which discusses the flow of information in Nyanza Province in page 6.

e.   Flow of Information

The flow of information can be shown in two forms. i.e. This From the top management to the community centers. The information can also flow upwards to the top management from the community centres, depending on the requested or required information as shown in figure 5 on the next page.

4. Discussions

In order to narrow the design reality gap, it is important to investigate the healthcare landscape. Hence e-health stakeholders should use methodology approaches that will assist in extracting the required information. In this study multiple case studies were used in addition to the proposed landscape methodology.

In particular, although landscape methodology may not solely be able to close the design reality gap, when used with other methodologies it can be possible to approach the problem of narrowing the design reality gap. As a

result, it may be used to guide e-health stakeholders to understand the situation on the ground when performing fact finding missions in concern to the object of design.

Additionally, the ratio of patients to doctors within the developing nations cannot be compared to the doctor/patient ratio within the developed countries where e-health solutions are used since there are fewer doctors within the developing nations and as described in section 3 of this article. These doctors therefore may not be able to find time to work with the e-health solutions as they may not have time to learn or engage with information systems since their time is fully dedicated to the patients.

The doctors may also reject to use such systems since they were not involved in the development of e-health solutions or proposed solutions and yet they are required to work with these systems.

5. Conclusion

It is important to assess and understand the healthcare landscape of particular countries especially within developing nations in order to close on the design reality gaps.

We propose the use of landscape methodology in addition to other various existing methods. It may not necessarily be a solution to all the factors that exist within the design

Figure 4 - How activities and services are provided in the district hospital

Figure 5 – Flow of information

reality gaps but it definitely highlights and deals with gaps in information, management structure, authority and financial flows.

Additionally it is important to bear in mind that there are few doctors or health experts within the developing nations compared to the developed world when proposing various forms of e-health solutions to be used since if such a factor is ignored then the proposed solution might fail since the health experts might be overwhelmed and might not find time to engage with the proposed systems.

Of more important it is paramount to engage the health experts in the developing nations when proposing the various e-health solutions to be used.

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