Modelling the Dynamics of e-Health Systems Assimilation by Healthcare Providers in Kenya

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Definition of Terms I

Convergence between ICTs (Internet) with healthcare (Oh et al, 2005)



An e-Health System: Hardware and or software that is used to electronically create, maintain, analyse, store, or receive information to aid in the diagnosis, cure, mitigation, treatment, or prevention of disease (Castro, 2014).

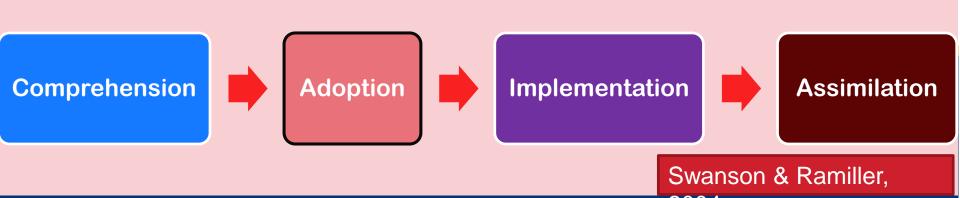
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Definition of Terms II

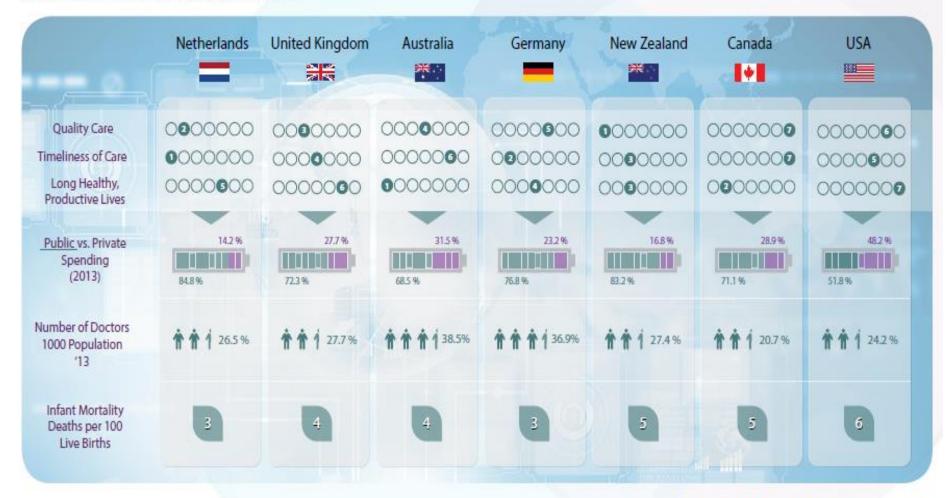


- Assimilation: The extent to which the use of a technology diffuses across organizational work processes and becomes routinized in the activities associated with those processes" (Purvis, Sambamurthy, & Zmud, 2001)
 - -Is an emergent process (Baird, 2017)



A health care system is the organization of people, institutions, and resources to deliver health Acare services to meet the health needs of target populations.

Based on the infographic below, how would you rank the following international health care systems?



Data taken from the Word Health Statistics 2013 (World Health Organization).

Global e-Health usage is low & suffers from the "ceiling effect" (Trudel, 2017; Baird, 2017)

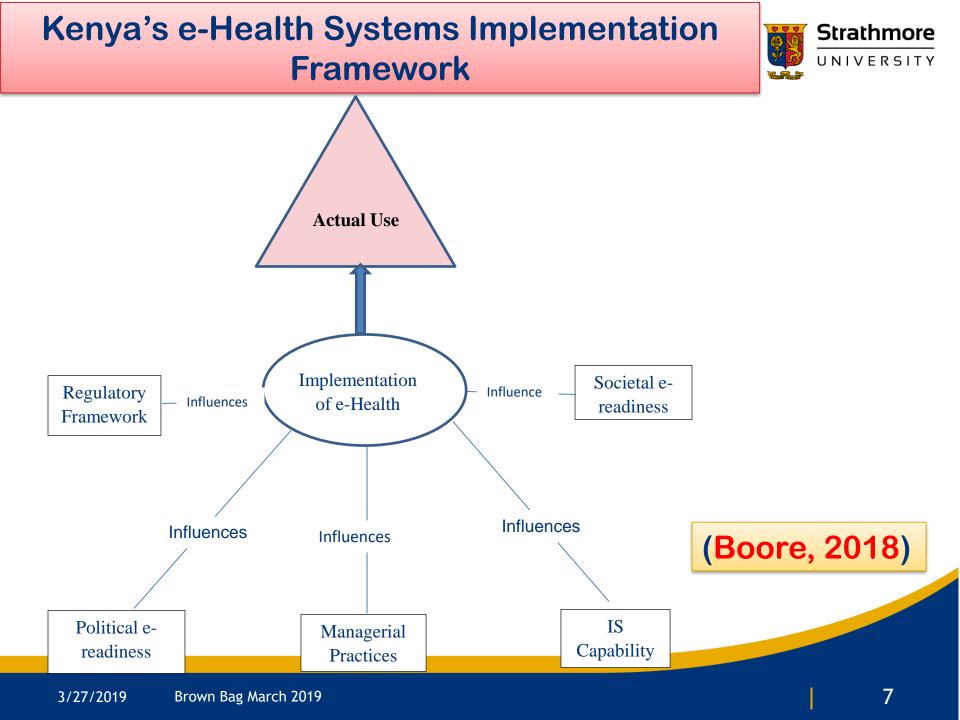
EMR MATURITY MODEL (Omar, 2014)



- Globally 28% use for primary care & at level 3 of the Model (Jha, 2008; Trudel, 2017)
- Local level is unknown but low (Kihuba et al, 2014; Njoroge et al 2017)

Background: Status of Healthcare in Kenya I

- Key for GOK's development agenda MDGs, vision 2030 & BIG four agenda 2018
- e-Health systems: Access to high quality, efficient & low cost services (Akanbi et al., 2012)
- ICTs identified as a key driver: The Kenya e-health strategy/policy 2016 to 2030
- ICTs in public sector highly fragmented focusing on billing & data collection e.g. DHIS2 (Macharia & Maroa 2014)
- Limited studies show slightly better assimilation in private facilities than public yet it covers 51% (Kihuba, 2014; Muema et al , 2014)

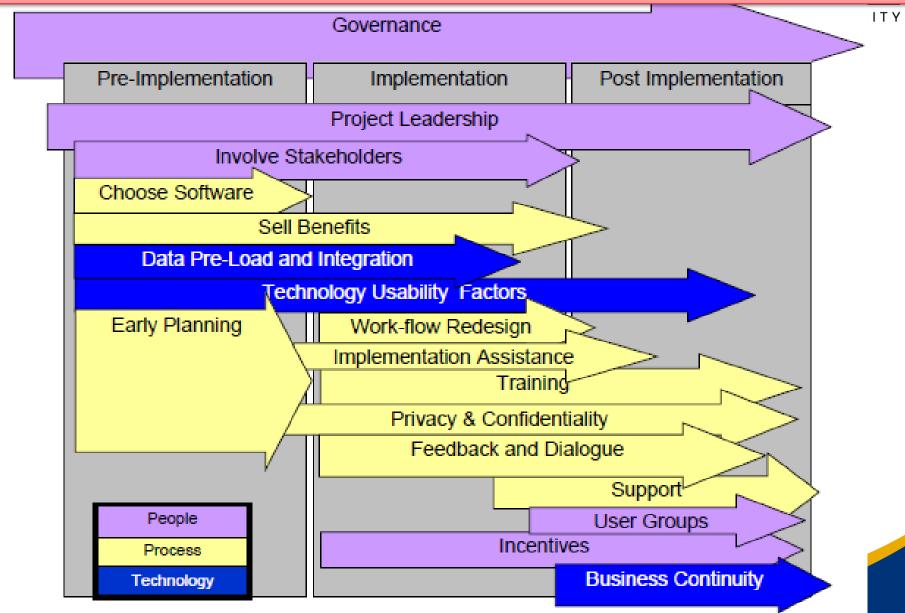


Background: Dynamism in Assimilation

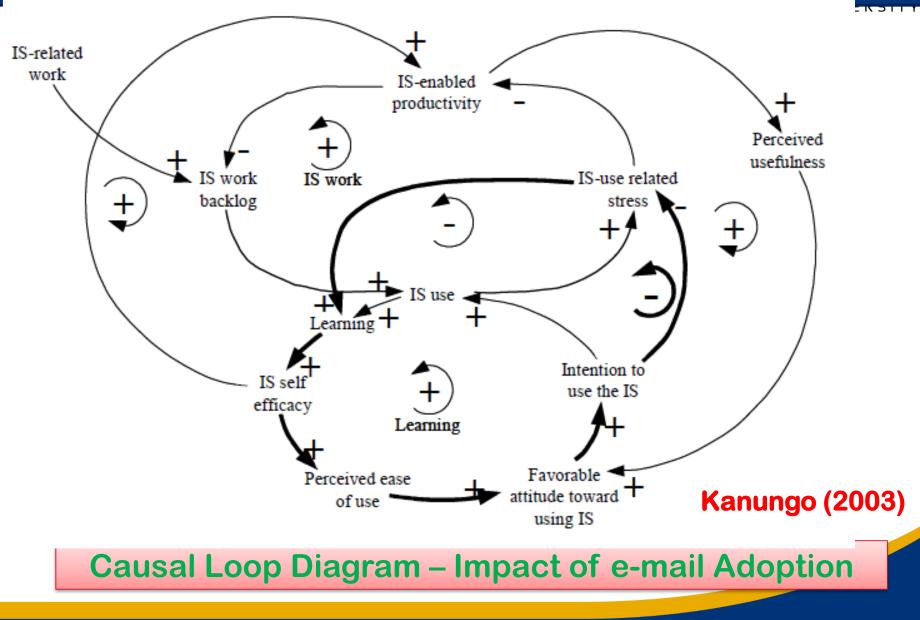
REFLEXIVITY = A influences B, and B in turn influences A (Kanungo, 2003)



Dealing with Dynamism – Keshavjee 2010



Reflexivity Example



Systems Thinking

- It takes a pluralist view such the behaviour of a system is greater than that of the sum of the parts that make up the system.
- The complexity of a problem/system is in interrelationships of the parts that make the system and the level of coupling between the parts (Sterman, 2000)
- It therefore involves understanding the interdependencies or interrelationships within complex systems

How Does Assimilation Happen?

Assimilation involves social, technological and political forces integrated

- It is a process of "interactions within networks" ANT (Latour, 1993)
- Through the translation process:
 - Continuous shaping and reshaping by the interplay of a range of heterogeneous forces within e-Health assimilation networks (Latour, 1987).

Problem Statement

- Application of e-health systems would improve accessibility to quality low cost healthcare (Lau et al, 2012)
- In order for this to be achieved, the systems must be adopted and assimilated within the work practices of healthcare providers (Baird et al, 2017; Trudel et al, 2017).
- However, the adoption and assimilation of these systems has remained low especially in low and medium income countries (Kihuba et al, 2014; Juma et al, 2012; Njoroge et al, 2017; Silva, et al, 2015).
- There is thus a need to identify alternative ways in which the adoption and assimilation of these systems can be enhanced in order to achieve expected outcomes (Baird, 2017; Fanta et al, 2016, Trudel, 2017)

Purpose of Study

 The purpose of the study is to apply Actor-Network-Theory (ANT) in exploring the dynamic behaviour of e-Health systems assimilation by healthcare providers in Kenya and thus develop an e-Health systems assimilation framework

Research Objectives

1) To evaluate the current frameworks and models of ehealth assimilation = compared models of assimilation

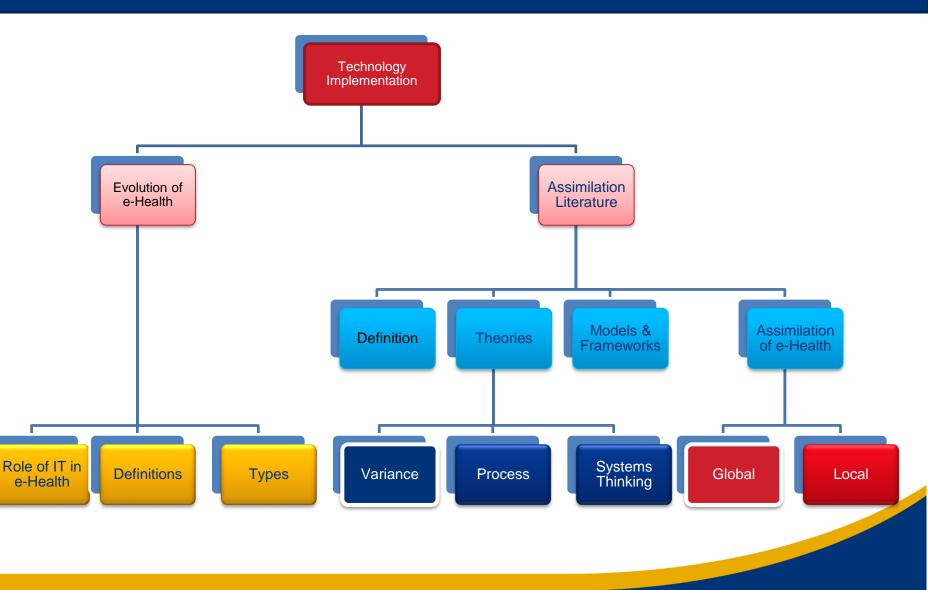
2) To investigate end user issues associated with e-Health assimilation by healthcare providers = challenges

3) To determine actor networks in which e-health systems assimilation are embedded = active actor networks

4) To investigate how the identified actor networks shape and constrain the assimilation of e-Health systems = practices

5)To establish a framework that might enhance assimilation of e-Health systems = association between elements that shape and constrain e-Health assimilation

Literature: Technology Implementation



Research Design

- Qualitative case study of assimilators
- Public hospitals have very low assimilation mainly billing systems (Kihuba, 2014)
- Identified 17 private hospitals at level 4 and above in Nairobi County (Boore, 2018)
- Telephone calls to establish level of ICT use
- Identified 8 hospitals to sample for study
- Sent e-mails to seek for approval (5 approved)
- Included a day clinic that met criteria
- Got approval from IRB & NACOSTI & County

Sample Interviewed

Institution	Categories of respondents in-depth Interviews 45 to 75 minutes									
	Doctors	Nurses	Radiology	ICT Unit	Lab	Registry				
A (Gamma) – a large level 5 private hospital in Nairobi	1 Outpatient	1 Champion	1 Radiologist	3 Managers	1 Technician	1 Manager				
	2 Pharmacists									
B (Alpha) – a large level 4 private hospital in Nairobi	1 Outpatient	1 Outpatient	1 Radiologist	1 Manager	1 Technician	1 Manager				
	1 Pharmacist									
C (Zeta) – a large level 4 private hospital in Nairobi	1 inpatient			1 Manager	1 doctor	1 Manager				
D (Beta) - a smaller outpatient university	1 Outpatient	1 Outpatient		1 Manager	1 Technician	1 Clerk				
medical centre	1 Pharmacist									
Total	8	3	2	6	4	4				
	G									

Data Analysis: Thematic Data Analysis I

- Qualitative data analysis using thematic analysis in NVIVO 12 Pro:
 - Data familiarity read and re-read all the data
 - Data coding Reduce data i.e. organize in a systematic and meaningful way
 - Search for themes systematically identify common terms or patterns
 - Review themes to tell a story in answering the research question (clustering)
 - Classify and explore- Content analysis (Huberman et al, 1994)

Data Analysis: Thematic Data Analysis II

- Looking for themes (deductive) on:
 - Issues or challenges being faced by end users during assimilation
 - Interaction between factors (Actornetworks)
 - -Emerging practices that shape and constrain e-Health assimilation
 - -Any others issues that may arise (inductive analysis)

NVIVO Ver12.3 Screenshot – Sample Nodes



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Initial Findings: Level of assimilation

- Alpha with in-house developed system had better spread and use - (registry, triage, physician, nurse, labs, radiology e.g. tele-PACs, pharmacy & partial inpatient). WHY?
- Use of paper is still rampant within functions

[A Dr @ Gamma]: ...that said and done, paper would still have to come in when we are stuck. We cannot get rid of paper first in terms of HIS in Kenya we are still very young, we are yet to evolve even if the rest of the world has moved forward

Initial Findings: Level of assimilation

- Short term Workarounds can be misconstrued and routinized e.g. through scanning & archiving of documents:
- [Records Manager @ Zeta]: the electronic document management system (EDMS) is in use after 10 years, it was really meant to last just a year as an archival system to help with our needs to manage archives. It is not an electronic health system

Initial Findings: Level of assimilation

• Upgrades have been episodic and troublesome

- [Nurse @ Alpha]: ...then we tried YYY system....but quickly reverted to XXXXX when we realized it had made our work worse than what we expected. It really gave us problems
- [Medical manager @ Gamma]: the new system is not serving our needs (functionality) thus has not had an impact on our work practices nearly two years since it was changed but to some extent it has caused more confusion than before

Interim Findings: Innovative Use - 24 refs

- Pharmacist @ Alpha]: The system does all I would like to do and I have been involved in tailoring it. Stock management of medicines, procurement, time turnaround and performance of my staff and we fully dispense in the system. We are working on the issue of stock issuance that controls expiring of drugs such that the system can integrate with stores to ensure no expired drugs.
- [lab Tech @ Gamma]: ...yeah staff are innovating, people have discovered new things through use.
 Personally I have made some changes to the system.
 I have configured new reports not provided as part of the system

Interim Findings: Challenges - 134 refs

- 1. Functionality 58 refs
- [Doctor @ Zeta]: "We teach & research thus XXX is not able to support our needs for research especially the functionality to extract data for predictive analytics"
- 2. Resources availability & system speed 23 refs
- [Nurse @ Alpha]: "Internet for me stands out as number one challenge or general infrastructure that affects speed and availability "
- 3. Absorptive Capacity 13 refs
- 4. System Interface Usability 12 refs
- [Pharmacist @ Gamma]: "The system has brand names or generics but not both, it is very hard to clearly get the names ...why couldn't they have both the brand and generic, most of what we know are generic names"

Interim Findings: Challenges - 134 refs II

- 5. Cost to change 14
- 6. Data security 7
- 7. Delays in fixing issues raised 6
- 8. User involvement -6
- 9. Patient culture 4 (attention type and talk)
- 10.Training 5
- 11.National policy 3 (use of codes, unique number
- 12. Technology-task-fit- 3 (paperless vs efficiency)
- 13.Collaborative issues 3

A Summary Word Cloud for Challenges





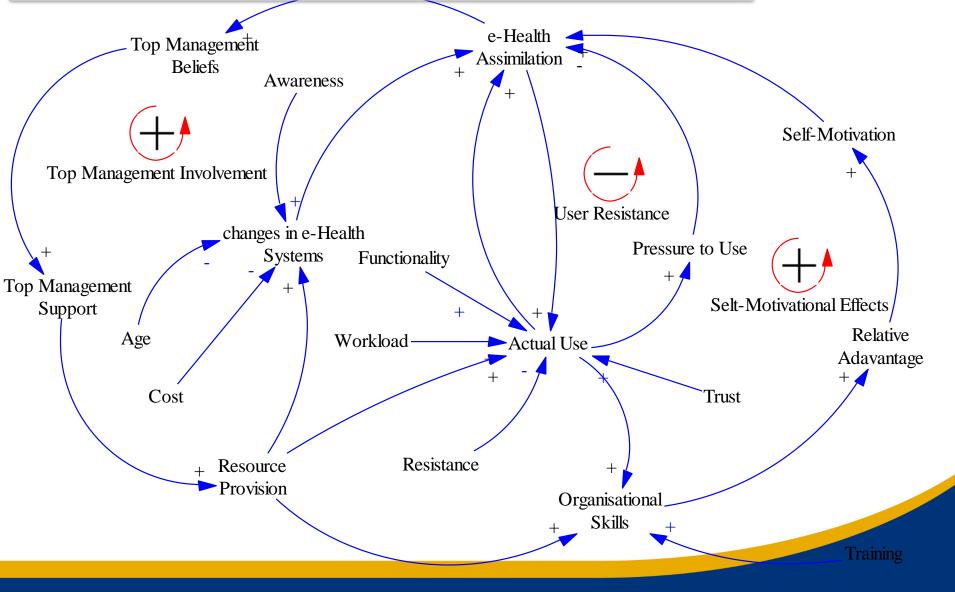
Factors of e-Health Assimilation (110)



Factor	Influences
User Age	Adaptation
Awareness	Adaptation
Resistance	Use
Training	Capacity
Top management support	Resources
Resources	Use
Capacity	Use
Trust	Use
Workload	Use
Incompatibility	Relative advantage
Cost	Adaptation
Adaptation	Assimilation
Functionality	Relative advantage
Infrastructure	Use
Support	Use and adaptation
Relative advantage	use

System Structure for e-Health Assimilation: Causal Loop Diagram





Conclusion: Interim Results



- 1) Top management don't take clinical systems very seriously (so long us billing is working)
- 2) Resources e.g. infrastructure & competence is low
- 3) Functionality remains biggest concern to most users
- 4) System adaptation is medium
- 5) Pressure to use system is high
- 6) Training style is inappropriate for assimilation
- 7) There is low user involvement
- 8) NB: Assimilation is low

Thank you!





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