IDENTIFYING ESSENTIAL COMPONENTS OF A DIGITAL HEALTH INNOVATION ECOSYSTEM FOR THE NAMIBIAN CONTEXT: FINDINGS FROM A DELPHI STUDY

Gloria Ejehiohen Iyawa
University of Namibia &
University of South Africa
Namibia & South Africa
gloria.iyawa@gmail.com

Marlien Herselman
CSIR Meraka &
University of South Africa
South Africa
mherselman@csir.co.za

Adele Botha
CSIR Meraka &
University of South Africa
South Africa
abotha@csir.co.za

ABSTRACT
The concept of digital health innovation ecosystems is an emerging body of literature which suggests that components of digital health, innovation and digital ecosystems are important in the administration and delivery of healthcare services. The current literature indicates which components of digital health, innovation and digital ecosystems constitute a digital health innovation ecosystem, but it is less clear as to which components of digital health, innovation and digital ecosystems are relevant to the development of such an ecosystem for the Namibian context. The purpose of this paper was to identify the components of digital health, innovation and digital ecosystems relevant to the development of a digital health innovation ecosystem for the Namibian context. Therefore, the Delphi method was adopted in which 22 knowledgeable professionals from within the Namibian context were purposively selected to take part. The findings revealed essential components of digital health, innovation and digital ecosystems which are considered relevant to the development of a digital health innovation ecosystem for the Namibian context. Additionally, there are differences noted between the components of digital health, innovation and digital ecosystems essential for the Namibian context and the components of digital health, innovation and digital ecosystems identified in literature. The essential components identified will inform decision makers in the Namibian healthcare sector on the implementation of a digital health innovation ecosystem for Namibia.

1. INTRODUCTION

In the last few years, there have been a growing number of studies supporting patients' involvement in healthcare management (Robinson et al., 2015; Lupton, 2013). Self-tracking (the quantified self) (Till, 2014; Lupton, 2014; Swan, 2013), mobile health (m-health) (Ahsan et al., 2013; Kazi & Jafri, 2016) and, health and wellness apps (Handel, 2011; Mosa et al., 2012) constitute some of many digital health technologies that support patient management of their health. However, Herselman et al. (2016) suggest that digital health alone is not sufficient in meeting the healthcare need of a developing country and should be supported by the concept of innovation ecosystems. Therefore, integrating the concepts of digital health and innovation ecosystems created the concept of: digital health innovation ecosystems (Herselman et al., 2016).

The concept of digital health innovation ecosystems has been studied in literature, with Iyawa et al. (2016a; 2016b) proposing the concept of digital health innovation

ecosystems as comprising of digital health, innovation and digital ecosystems. Iyawa et al. (2016b) define a digital health innovation ecosystem as a

> "network of digital health communities consisting of interconnected, interrelated and interdependent digital health species, including healthcare stakeholders, healthcare institutions and digital healthcare devices situated in a digital health environment, who adopt the best-demonstrated practices that have been proven to be successful, and implementation of those practices through the use of information and communication technologies to monitor and improve the wellbeing and health of patients, to empower patients in the management of their health and that of their families".

Iyawa et al. (2016b) indicate that the definition of a digital health innovation ecosystem incorporates digital health, innovation and digital ecosystems concept, and as a result, it is important to incorporate the components of digital health, innovation and digital ecosystems when implementing a digital health innovation ecosystem in any context. Herselman et al. (2016) conceptualised a digital health innovation ecosystem for the South African context. In addition, Iyawa et al. (2016a; 2016b) identified the components of digital health, innovation and digital ecosystems needed in a digital health innovation ecosystem. Despite the identification of the components of digital health, innovation and digital ecosystems needed in a digital health innovation ecosystem in literature (Iyawa et al., 2016a; Iyawa et al., 2016b), it is less clear as to which specific components of digital health, innovation and digital ecosystems constitute a digital health innovation ecosystem for the Namibian context. The purpose of this paper was to identify the essential components of digital health, innovation and digital ecosystems relevant to the development of a digital health innovation ecosystem for the Namibian context. To the best of the researchers' knowledge, this is the first time the components of a digital health, innovation and digital ecosystems is being evaluated towards the development of a digital health innovation ecosystem within this specific context, hence contributing to the emerging body of literature on digital health innovation ecosystems in developing countries. This paper is structured as follows: a background to the Namibian context as well as a review of digital health innovation ecosystems and its components in literature is presented in Section 2, the research methodology is described in Section 3. The results are presented in Section 4 and discussed in Section 5. Conclusions and future work are presented in Section 6.

2.   BACKGROUND
2.1.   The Namibian Context
Namibia is located in the southern part of Africa. Namibia can be described as a "semi-arid" country with an area of about 825,000 square kilometers (Government of Namibia, 2002, p. 6). Namibia is one the member states of the United Nations (UN) and the South African Development Community (SADC) (Mbuende, 2014). Based on the description of a developing country provided by the World Bank (2016), Namibia can be classified as a developing country. The Human Development Report (2016) also indicates that Namibia is a medium human development country.

The Namibian healthcare system has both private and public healthcare; the public healthcare is government owned and managed (World Health Organization [WHO], 2010). Eighty five percent of the population is dependent on the government for healthcare delivery services, while the remaining 15% make use of services provided by the private healthcare sector (WHO, 2010). The large number of people dependent on public healthcare has resulted in the system being overburdened with chronic medical staff shortages (Van Rooy et al.,

2012). This burden carried by the public healthcare system is further exasperated by the increasing number of health challenges including HIV/AIDS (Schellekens et al., 2009) and maternal and child mortality (Nakale, 2014).

Hamunyela and Iyamu (2013) indicate that despite the existence of health information systems (HIS) in the Namibian health sector, the Namibian Ministry of Health and Social Services (MoHSS) still mainly rely on paper-based records. In addition, most of the 61 health information systems used in Namibian government hospitals are not interoperable (United States Agency for International Development [USAID], 2012).

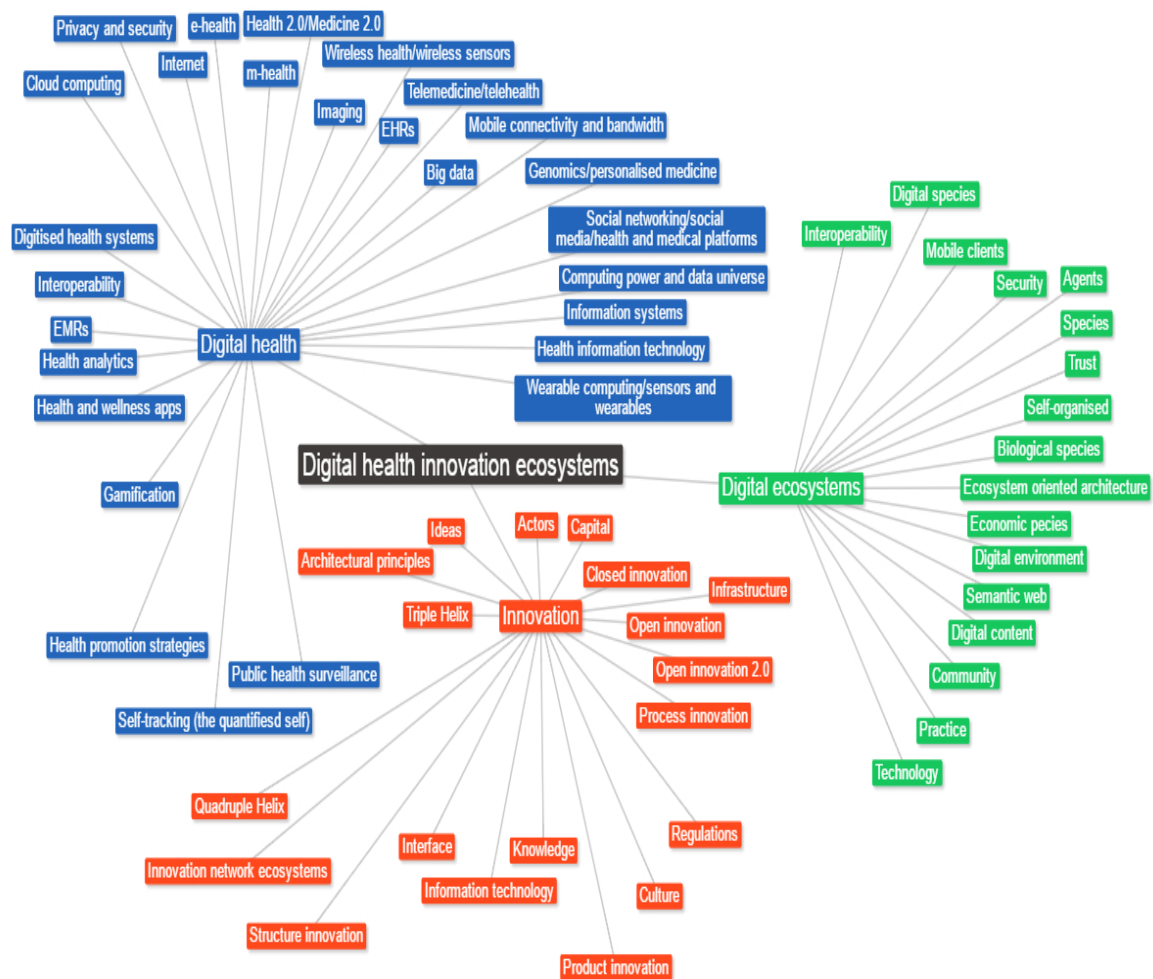## 2.2.   Digital Health Innovation Ecosystems for Namibia

One of the goals of the Namibian Vision 2030 is to ensure that Information and Communication Technology (ICT) is disseminated into different sectors of the economy (Government of Namibia, 2004). This has been realised to a larger degree in the public sector (The Namibian, 2006) and to a lesser degree in the public healthcare sector (USAID, 2012). However, there is consensus that the implementation of electronic health (e-health) systems alone is not sufficient in meeting the healthcare needs of a developing country like Namibia. Robinson et al. (2015) argue that digital health holds much potential for not only healthcare practitioners, but patients as well. This potential extends to the developing context (Tambo et al., 2016; Jerry & Sunday, 2016; Gårdstedt et al., 2013; Herselman et al., 2016). As the body of academic, policy and business literature increasingly support arguments for digital health as put forward by the Organisation for Economic Co-operation and Development and the World Bank (Chetley et al., 2006; Qiang et al., 2011) the potential that digital health can have in the Namibian healthcare domain becomes apparent.

Digital health "implies ubiquitous change throughout the existing healthcare system, as well as the expansion and re-definition of the traditional boundaries between patients, consumers, citizens, healthcare professionals, innovators, organisations and sectoral policies" (Herselman et al., 2016, p. 4). This is particularly relevant as the conceptualisation of digital health for the Namibian context is in its emerging stage. With relatively sparse research publications emanating from within the Namibian health domain, and the concept of Namibian digital health as an emergent phenomenon, a Namibian digital health innovation ecosystem would provide a start to conceptualising, developing and implementing such an ecosystem for Namibia and unlocking the potential of what this ecosystem can hold to stimulate Innovation in this country.

As suggested by Iyawa et al. (2017), for a digital health innovation ecosystem to be established, there have to be specific components from digital health, innovation and digital ecosystems domains that need to be identified.

2.3.   Components of Digital Health, Innovation and Digital Ecosystems

The components of digital health, innovation, digital ecosystems are illustrated in Figure 1.
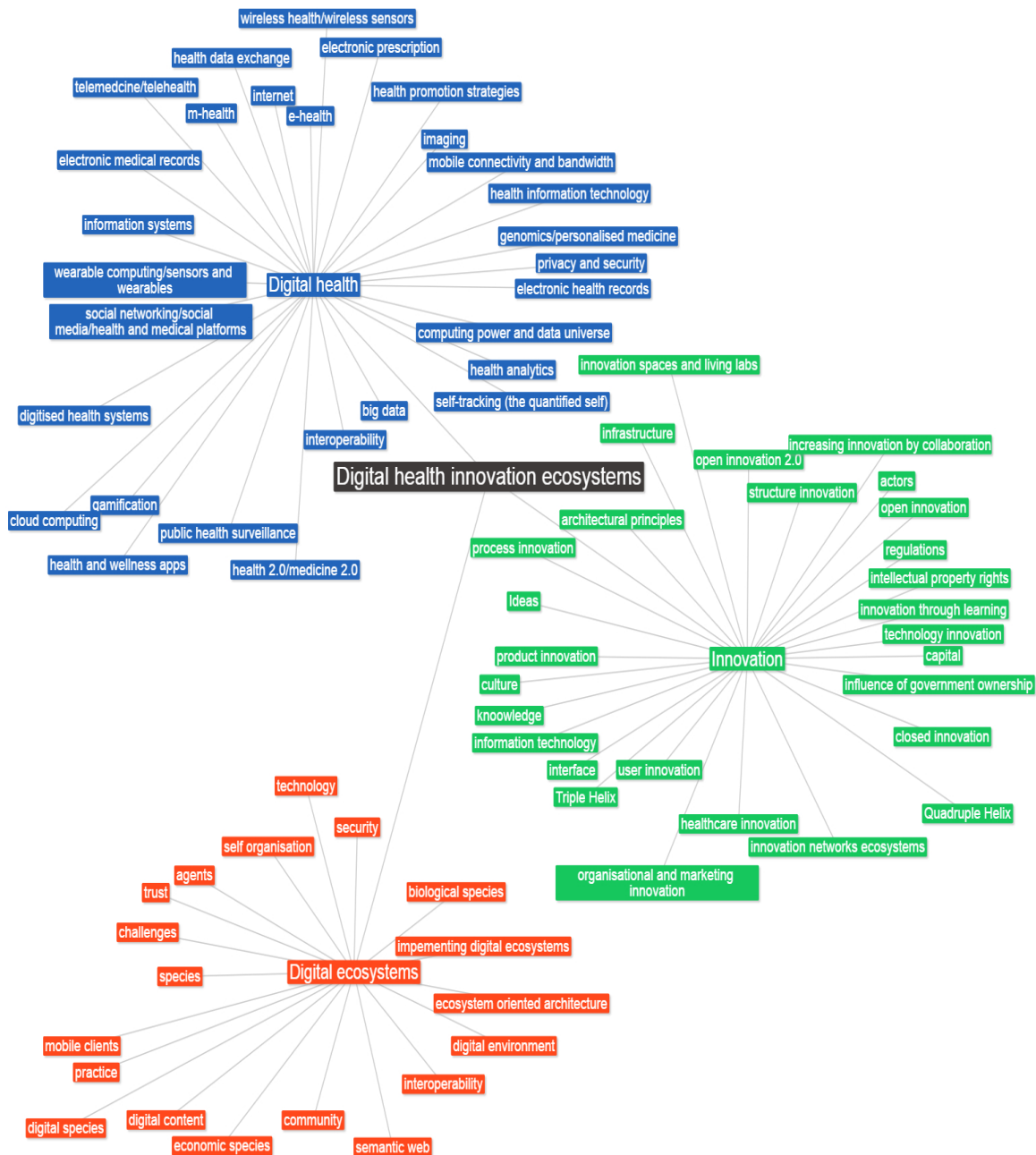
Figure 1: Components of a Digital Health Innovation Ecosystem (Iyawa et al., 2016a)

As shown in Figure 1, a digital health innovation ecosystem consists of the components of digital health, innovation and digital ecosystems. These components were identified from literature through a systematic literature review conducted in 2016 and published in 2016 (Iyawa et al., 2016a; 2016b). In addition to the components of digital health, innovation and digital ecosystems identified by Iyawa et al. (2016a; 2016b), Iyawa et al. (2017) also identified other components of digital health, innovation and digital ecosystems through a scoping review. Table 1 lists the components of digital health, innovation and digital ecosystems identified by Iyawa et al. (2016a; 2016b) and Iyawa et al. (2017).

Table 1: Components of Digital Health Innovation Ecosystems Identified by Iyawa et al. (2016a; 2016b; 2017)

Components of digital health	Components of innovation/Author	Components of digital ecosystems/Author
e-health	Ideas	Interoperability
m-health	Architectural principles	Digital species
Health 2.0/medicine 2.0	Triple Helix	Mobile clients
Wireless health/wireless sensors	Quadruple Helix	Security
Telemedicine/telehealth	Innovation networks ecosystems	Agents
Electronic Health Records (EHRs)	Structure innovation	Species
Mobile connectivity and bandwidth	Interface	Trust
Genomics/personalised medicine	Information technology	Self organisation
Big data	Knowledge	Biological species
Computing power and data universe	Regulations	Ecosystem oriented architecture
Information systems	Product innovation	Economic species
Health information technology	Culture	Digital environment
Wearable computing/sensors and wearables	Process innovation	Semantic web
Public health surveillance	Open innovation 2.0	Digital content
Self-tracking (the quantified self)	Open innovation	Community
Health promotion strategies	Infrastructure	Practice
Gamification	Closed innovation	Technology
Health and wellness apps	Capital	Implementing digital ecosystems
Health analytics	Actors	Challenges
Electronic Medical Records (EMRs)	Increasing innovation by collaboration	
Interoperability	Innovation through learning	
Digitised health systems	Technology innovation	
Cloud computing	Healthcare innovation	
Privacy and security	Intellectual property rights	
Internet	Organisational and marketing innovation	
Social networking/social media/health and medical platforms	User innovation	
Electronic prescription (e-prescription)	Influence of government ownership	
Health data	Innovation spaces and living labs	
Imaging		

The combination of digital health, innovation and digital ecosystems components identified by Iyawa et al. (2016a) and Iyawa (2017) can be illustrated in Figure 2.

**Figure 2: The Components of Digital Health, Innovation and Digital Ecosystems
Identified by Iyawa et al. (2016a; 2016b) and Iyawa et al. (2017)**

Although the components that constitute digital health, innovation and digital ecosystems have been identified in literature (Iyawa et al., 2016a; 2016b) (Iyawa et al., 2017), it is not enough to depict exactly what is necessary for the Namibian context and as such, it is important to understand from the Namibian perspective which components are relevant to the development of a digital health innovation ecosystem for Namibia. The study thus identified relevant stakeholders within the Namibian context who participated in ranking the different components of digital health, innovation and digital ecosystems relevant to the Namibian context.

3.   RESEARCH METHODOLOGY
3.1.   Delphi Method
One approach which has been popularly used in gathering consensus of experts' rankings is the Delphi method (Evans et al., 2016; Morgan et al., 2016), which was also applied in this paper. The Delphi method allows the collection of information from knowledgeable participants usually referred to as experts through a repetitive process until the judgements of all participants correlate (Hsu & Sandford, 2007; Morgan et al., 2016). The Delphi method uses a process called "rounds" to solicit feedback from participants (Hsu & Sandford, 2007). Different number of rounds has been applied in different studies, for instance in the study by Evans et al. (2016) two rounds were used, however Morgan et al. (2016) used three rounds and Hsu and Sandford (2007) recommended four rounds. This suggests that the rounds applied in Delphi method should not be less than 2 rounds. At the end of each round, the results are statistically analysed and anonymous responses of each participant are sent to all participants with a chance to modify the feedback (Hsu & Sandford, 2007), until participants' feedback reach a consensus.

3.2.   Panel Formation
Glaser and Chi (1988) describe an expert as an individual with information that can be utilised at any given opportunity. Maclellan and Soden (2003, p. 110) further define experts as individuals who "are able to think more effectively about problems." This implies that for an individual to be considered an expert, he/she must have adequate knowledge regarding the subject matter at hand to enable him/her to make relevant decisions. Due to the multi-disciplinary nature of the study, professionals that have acquired adequate knowledge on the concepts of digital health, innovation and digital ecosystems were included. However, for the purpose of the study, Delphi participants will be referred to as knowledgeable professionals, rather than experts. The different components of digital health, innovation and digital ecosystems were described to the participants before they were able to take part.

The number of participants needed in a Delphi study varies in the literature. For example, Hogarth (1978) suggests that 6 to 12 participants are enough, Clayton (1997) indicate that 5 to 10 are enough if participants from various fields are utilised, while Malone et al. (2005) suggest that fewer than 10 participants are needed. Taking into consideration the discussions from the literature on the selection of participants in a study that utilizes the Delphi method, 10 knowledgeable professionals with digital health knowledge and experience in the health domain in Namibia were selected. 10 knowledgeable professionals in digital health were selected based on the heterogeneous nature of their backgrounds and experiences which needed to include both healthcare practitioners and Information Technology (IT) practitioners who have worked on one or more domains of digital health. A brief description of the professionals who were purposively selected to participate in the evaluation of important digital health components within the Namibian context is provided in Table 2.

Six knowledgeable professionals in innovation from within the Namibian context were selected because knowledgeable professionals in innovation have the same background. A brief description of the professionals who were purposively selected to participate in the evaluation of important innovation components within the Namibian context is provided in Table 3.

Table 2: Description of Knowledgeable Professionals in Digital Health Who Took Part in the Study

Digital health Knowledgeable professionals (KP)	Occupation of knowledgeable professionals in *Digital Health*	Domain	Age range	Gender	Country	Expertise level in *Digital Health* domain	Highest level of education	Work setting	Years of experience in *Digital Health* domain
KP1	Medical doctor	E-health	46-60	Male	Namibia	Intermediate	Bachelor degree	Private hospital	7-10 years
KP2	Medical doctor	E-health, health information systems, wireless sensors and wearables	46-60	Male	Namibia	Expert	Bachelor degree	Private hospital	More than 10 years
KP3	Lecturer	E-health, m-health research	46-60	Female	Namibia	Intermediate	Masters degree	University	4-6 years
KP4	Medical doctor	Health information systems	36-45	Male	Namibia	Intermediate	Bachelor degree	Public hospital	7-10 years
KP5	Systems analyst	E-health, health information systems	25-35	Male	Namibia	Intermediate	Bachelor degree	Public hospital	4-6 years
KP6	Systems analyst	E-health, health information systems	36-45	Female	Namibia	Expert	Bachelor degree	Public hospital	7-10 years
KP7	Analyst programmer	E-health, health information systems	25-35	Male	Namibia	Intermediate	Bachelor degree	Public hospital	4-6 years
KP8	Medical doctor	E-health	25-35	Male	Namibia	Beginner	Bachelor degree	Public hospital	4-6 years
KP9	Senior systems analyst	E-health, health information systems	25-35	Male	Namibia	Intermediate	Bachelor degree	Public hospital	7-10 years
KP10	Medical doctor	E-health	25-35	Male	Namibia	Beginner	Bachelor degree	Public hospital	4-6 years

Table 3: Description of Knowledgeable Professionals in Innovation Who Took Part in the Study

Knowledgeable professionals	Occupation of knowledgeable professionals in innovation	Domain	Age range	Gender	Country	Expertise level in *Digital Health* domain	Highest level of education	Work setting	Years of experience in *Digital Health* domain
KP11	Associate Professor	Innovation research	46-60	Male	Namibia	Intermediate	Doctorate degree	University	4-6 years
KP12	Lecturer	Innovation research	26-35	Male	Namibia	Intermediate	Masters degree	University	1-3 years
KP13	Lecturer	Innovation research	36-45	Male	Namibia	Intermediate	Masters degree	University	1-3 years
KP14	Lecturer	Innovation research	26-35	Female	Namibia	Intermediate	Masters degree	University	1-3 years
KP15	Lecturer	Innovation research	46-60	Female	Namibia	Intermediate	Masters degree	University	4-6 years
KP16	Lecturer	Innovation research	36-45	Female	Namibia	Intermediate	Masters degree	University	4-6 years

Table 4: Description of Knowledgeable Professionals in Computer Networks, Networks and Design Who Took Part in the Study

Knowledgeable professionals in computer in specific digital ecosystems domain	Occupation of knowledgeable professionals in *Digital Ecosystems*	Domain	Age range	Gender	Country	Expertise level in *Digital Health* domain	Highest level of education	Work setting	Years of experience in *Digital Health* domain
KP17	Systems engineer	Computer networks, network design	26-35	Male	Namibia	Intermediate	Bachelor degree	Software organisation	4-6 years
KP18	Systems engineer	Computer networking, network design	26-35	Male	Namibia	Intermediate	Bachelor degree	Software organisation	4-6 years
KP19	Senior systems administrator	Computer networks	36-45	Male	Namibia	Expert	Masters degree	Banking environment	More than 10 years
KP20	Systems administrator	Computer networks, network design	26-35	Male	Namibia	Intermediate	Bachelor degree	Public hospital	4-6 years
KP21	Systems administrator	Computer networks	26-35	Male	Namibia	Intermediate	Bachelor degree	Public hospital	4-6 years
KP22	Systems administrator	Computer networks	36-45	Male	Namibia	Intermediate	Bachelor degree	Public hospital	4-6 years

Within the Namibian context, digital ecosystems have not been implemented and as such there is a dearth of professionals within the field of digital ecosystems. Moreover, 6 knowledgeable professionals with a background in computer networks, networks design and analysis were selected based on what Chang and West (2006) indicated about digital ecosystems. They indicated that digital ecosystems evolved from network related background. A brief description of the professionals who were purposively selected to participate in the evaluation of important components of digital ecosystems components within the Namibian context is provided in Table 4.

The participants were purposively selected to include professionals who had knowledge of e-health, innovation or computer networks, networks design and analysis. The components of digital health and innovation reached consensus after three rounds. The components of digital ecosystems reached consensus after two rounds. Figure 3 illustrates Delphi process applied in this study.
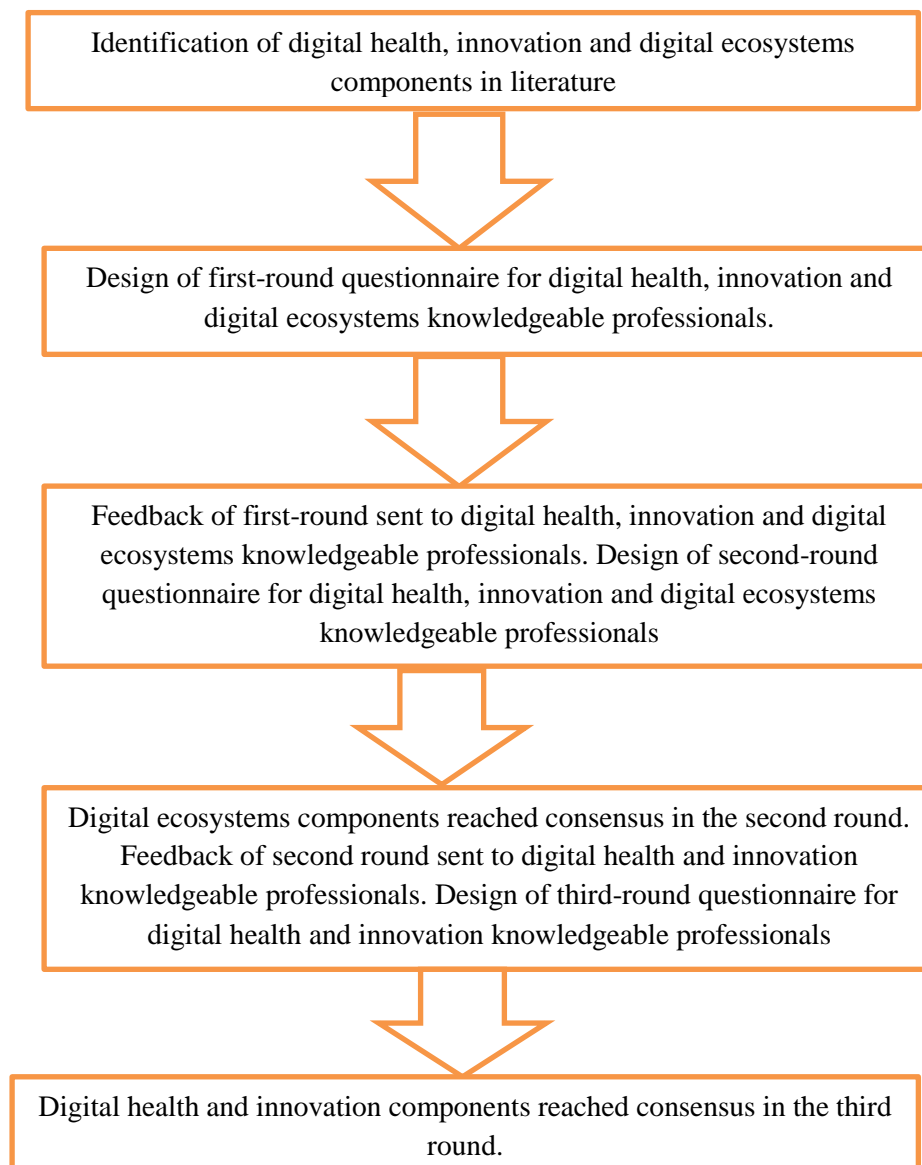
Figure 3: Delphi Process for This Study

The key point noted in Delphi studies is that the participants remain unknown to each other in order to avoid chances of dominating an opinion based on the influence of a particular participant (Hsu & Sandford, 2007). This principle was also applied in this paper as the results of the previous round were shown to all participants anonymously. The major instrument which has been used to do the recordings in Delphi studies is the use of questionnaires (Morgan et al., 2016; Evans et al., 2016). Online questionnaires were used to solicit feedback from participants who took part in this study.

Knowledgeable professionals were contacted through email and asked to show their willingness to participate by responding to the emails. This was done to ensure that the experts willingly participated in the study. As part of completing the questionnaire the participants also had to provide consent to take part in the study. The response rate for each round was 100 percent.

3.3.   Data Analysis
The participants were asked to rank the components of digital health, innovation and digital ecosystems on a five-point Likert scale. The frequency of the results was first recorded in which the central tendency (mean) and standard deviation (SD) were derived. Statistical Package for Social Sciences (SPSS) software version 21 was used to measure the mean and SD. Jirwe et al. (2009) and Mcilfatrick and Keeney (2003) agree that on a five-point Likert scale, rankings on the 1-2 scale means that experts totally disagree, rankings on scale 3 represents a nonaligned judgement, while rankings on the 4-5 means experts agree. This same principle was applied in this study.

4.   RESULTS
4.1.   Digital Health
4.1.1   Round 1
The focus of the first questionnaire was on the identified components of digital health and consisted of 29 components (figure 2). The questionnaire also included an open-ended question section, which requested knowledgeable professionals to include any other relevant component of digital health which was not included in the list presented, based on their knowledge. No responses were derived from the results from this section. They were asked to rank the components of digital health on a five-point Likert scale based on the order of relevance to the Namibian context. (n=23) components of digital health met the 4-5 range and were considered relevant to the Namibian context. (n=1) component (health data exchange) met the 1-2 range which means that knowledgeable professionals in digital health totally disagree and hence, considered irrelevant to the Namibian context. (n=5) components that did not reach consensus among selected knowledgeable professionals in digital health because the central tendency (mean) fell between 3 and 4. These components together with their mean and standard deviation (SD) are presented in Table 5.

Table 5: Round 1 Digital Health Components That Did Not Reach Consensus

Digital health components	Mean	SD
Genomics /personalised medicine	3.5	1.08
Computing power and data universe	3.6	0.69
Imaging	3.3	0.67
Gamification	3.7	0.94
Digitised health systems	3.9	0.87

4.1.2   Round 2

Based on the results of round 1 (digital health), a second questionnaire was developed. The questionnaire included the components that did not reach consensus in round 1, as shown in Table 4. (n=23) components that reached consensus in the first round were presented to the 10 selected knowledgeable professionals in digital health, however, the components could no longer be rated. The results of the first round were presented anonymously to the participants and were asked to view the rankings and comments of other knowledgeable professionals in digital health as well as their own rankings and comments. The selected knowledgeable professionals in digital health were asked to reconsider ranking the (n=5) components again as the components did not reach consensus in the first round. In the second round, (n=4) components of digital health met the 4-5 range and were considered relevant to the Namibian context. (n=1) component (gamification) did not reach consensus among selected knowledgeable professionals in digital health because the mean fell between 3 and 4. This component together with the mean and SD is presented in Table 6.

Table 6: Round 2 Digital Health Component That Did Not Reach Consensus

Digital health components	Mean	SD
Gamification	3.3	0.82

Gamification reached consensus in round 3. With regards to digital health, there seems to be consensus with majority the components identified among the knowledgeable professionals in digital health. This could be an indication that the components of digital health identified in the literature are relevant to Namibian context. However, it took two or three rounds to reach consensus on some components such as genomics/personalized medicine, computing power and data universe, imaging, digitised health systems and gamification. An explanation for this could be that these terms are not popular within the Namibian healthcare context. Health data exchange was not considered a relevant component of digital health for the Namibian context, this could be because health data exchange and interoperability are similar concepts, hence, the knowledgeable professionals considered having health data exchange and interoperability as a repetition. The findings also revealed that digital health components such as telemedicine/tehealth, e-health and m-health were regarded as essential components for the development of a digital health innovation ecosystem for the Namibian context. This is consistent with other studies which indicate that telemedicine (Cilliers & Flowerday, 2014), e-health (Kalema & Kgasi, 2014), and m-health (Noutat et al., 2016) have been considered important in developing countries.

4.2.   Innovation
4.2.1. Round 1

The first questionnaire was developed to include the 27 components of innovation as was identified earlier in Figure 2. The open-ended question in this questionnaire revealed that one knowledgeable professional in innovation indicated that "challenges" should be reworded to "measures for addressing challenges" and another knowledgeable professional indicated that "research and development" should be included as a component of innovation towards the development of a digital health innovation ecosystem for the Namibian context. They were asked to rank the components of innovation on a five-point Likert scale based on the order of relevance to the Namibian context. (n=15) components of innovation met the 4-5 range and were considered relevant to the Namibian context. (n=3) components (closed innovation, architectural principles and influence of government ownership) met the 2-3 range which means that knowledgeable professionals in innovation totally disagree and hence, considered

irrelevant to the Namibian context. (n=9) components did not reach consensus among selected knowledgeable professionals in innovation because the central tendency fell between 3 and 4. These components together with their mean and SD are presented in Table 7.

Table 7: Round 1 Innovation Components That Did Not Reach Consensus

Innovation components	Mean	SD
Product innovation	3.83	0.75
Structure innovation	3.5	0.83
Open innovation	3.66	0.81
Triple Helix systems	3.16	1.32
Quadruple Helix systems	3.66	0.81
Infrastructure	3.83	0.98
Interface	3.66	0.81
Culture	3.66	0.81
Teaching	3.66	0.81

4.2.2. Round 2
Based on the results of round 1 (innovation), a second questionnaire was developed. The questionnaire included all components that did not reach consensus in round 1, as shown in Table 6. (n=15) components that reached consensus were presented to the 6 selected knowledgeable professionals in computer networking, network design and analysis, however, the components could no longer be rated. The results of the first round were presented anonymously to the participants and were asked to view the rankings and comments of other knowledgeable professionals in computer networking, network design and analysis as well as their own rankings and comments. In addition, "research and development" was presented to the knowledgeable professionals in round 2, available to be rated. The selected knowledgeable professionals in innovation were asked to reconsider ranking the (n= 9) components again as the components did not reach consensus in the first round, as well as the new component suggested in round 1. In the second round, (n=5) components of innovation met the 4-5 range and were considered relevant to the Namibian context. (n=5) components (product innovation, open innovation, Triple Helix systems, infrastructure and culture) did not reach consensus among selected knowledgeable professionals in innovation because the mean fell between 3 and 4. This component together with the mean and SD are presented in Table 8.

Table 8: Round 2 Innovation Components That Did Not Reach Consensus

Innovation components	Mean	SD
Product innovation	3.33	0.81
Open innovation	3.33	1.03
Triple Helix systems	3.5	0.54
Infrastructure	3.66	0.51
Culture	3.66	0.51

Product innovation, open innovation, Triple helix Systems, infrastructure and culture reached consensus in round three. With regards to innovation, components such as closed innovation and product innovation were considered irrelevant to the Namibian context. This could be as a result of open innovation being demonstrated through the existence of Demola as a model of innovation (National Commission on Research Science & Technology, 2016) in Namibia, after a recent contract between Demola and the Namibian government was

signed to stimulate innovation. Furthermore, Cunningham et al. (2016) imply that open innovation is considered relevant to developing countries, which is in line with the findings of this study which indicates that knowledgeable professionals in the field of innovation consider open innovation as a component of innovation relevant for the development of a digital health innovation ecosystem for the Namibian context. Product innovation might be considered irrelevant, although it has been identified in developing countries (Selfano & Robert, 2014; Waribugo et al., 2016) because products are not to be produced in a digital health innovation ecosystem rather services are provided in the digital health innovation ecosystem.

4.3. Digital Ecosystems
4.3.1. Round 1
The first questionnaire containing components of digital ecosystems (19) as was illustrated in Figure 2 of this paper were mailed to knowledgeable professionals in computer networking, network design and analysis. They were asked to rank the components of digital ecosystems on a five-point Likert scale based on the order of relevance to the Namibian context. The questionnaire also includes an open-ended question which requested knowledgeable professionals to add any other relevant component of digital ecosystems which was not included in the list presented. In the first round, one knowledgeable professional in computer networking, network design and analysis indicated that "cloud computing" should be included as a component of digital ecosystems towards the development of a digital health innovation ecosystem for the Namibian context. (n=14) components of digital ecosystems met the 4-5 range and were considered relevant to the Namibian context. (n=2) components (agents and species) met the 1-2 and 2-3 range which means that knowledgeable professionals in computer networking, network analysis and design totally disagree and hence, considered irrelevant to the Namibian context. (n=3) components did not reach consensus among selected knowledgeable professionals in computer networking, network analysis and design because the mean fell between 3 and 4. These components together with their mean and SD are presented in Table 9.

Table 9: Round 1 Digital Ecosystems

Digital ecosystems components Round 1	Mean	SD
Economic species	3.5	0.54
Practice	3.16	0.75
Measures for addressing challenges	3.66	0.81

The remaining four components of digital ecosystems, economic species, practice, measures for addressing challenges and cloud computing reached consensus in round two. When evaluating the components of digital ecosystems, components such as agents and species were considered irrelevant, this could be that knowledgeable professionals in computer networking, network design and analysis believe that agents and species mean the same thing as biological, economic and digital species. Cloud computing which was suggested as a component of digital ecosystems by one of the knowledgeable professionals reached consensus. It was also observed that cloud computing is a component of digital health that reached consensus by digital health knowledgeable professionals. This indicates that cloud computing is essential in the development of a digital health innovation ecosystem for Namibia specifically. Other components such as interoperability and security seem to be consistently accepted by knowledgeable professionals in the field of digital health and computer networking, network design and analysis. This indicates a strong need for

interoperability and security in the development of a digital health innovation ecosystem for the Namibian context.

5.   DISCUSSION

The aim of the study was to identify the essential components of digital health, innovation and digital ecosystems towards the development of a digital health innovation ecosystem for the Namibian context. The use of the Delphi method helped in reaching consensus among knowledgeable professionals in the field of digital health, innovation and computer networking, networks design and analysis regarding the essential components of a Namibian digital health innovation ecosystem. To the best of the researchers' knowledge, this is the first study which identifies the essential components of digital health, innovation and digital ecosystems relevant to the development of a digital health innovation ecosystem for the Namibian context. This study therefore contributes to the emerging body of literature on digital health innovation ecosystems in developing countries. The participants (knowledgeable professionals) of the study are professionals in their various fields with experience within the Namibian context, as such their opinion of relevant components of digital health, innovation and digital ecosystems can be seen as valid as they have experience of the Namibian context. The 100% response rate indicates the participants' willingness to take part in the study and hence, the results suggest a true reflection of the essential components of digital health, innovation and digital ecosystems as at the time the study was conducted.

It was interesting to observe how knowledgeable professionals in the different fields such as innovation and digital ecosystems were able to suggest other components of innovation and digital ecosystems not identified in the literature. The components identified by knowledgeable professionals reached consensus. This is one of the advantages of using Delphi method as it solicits input from experts in the field (Hsu & Sandford, 2007).
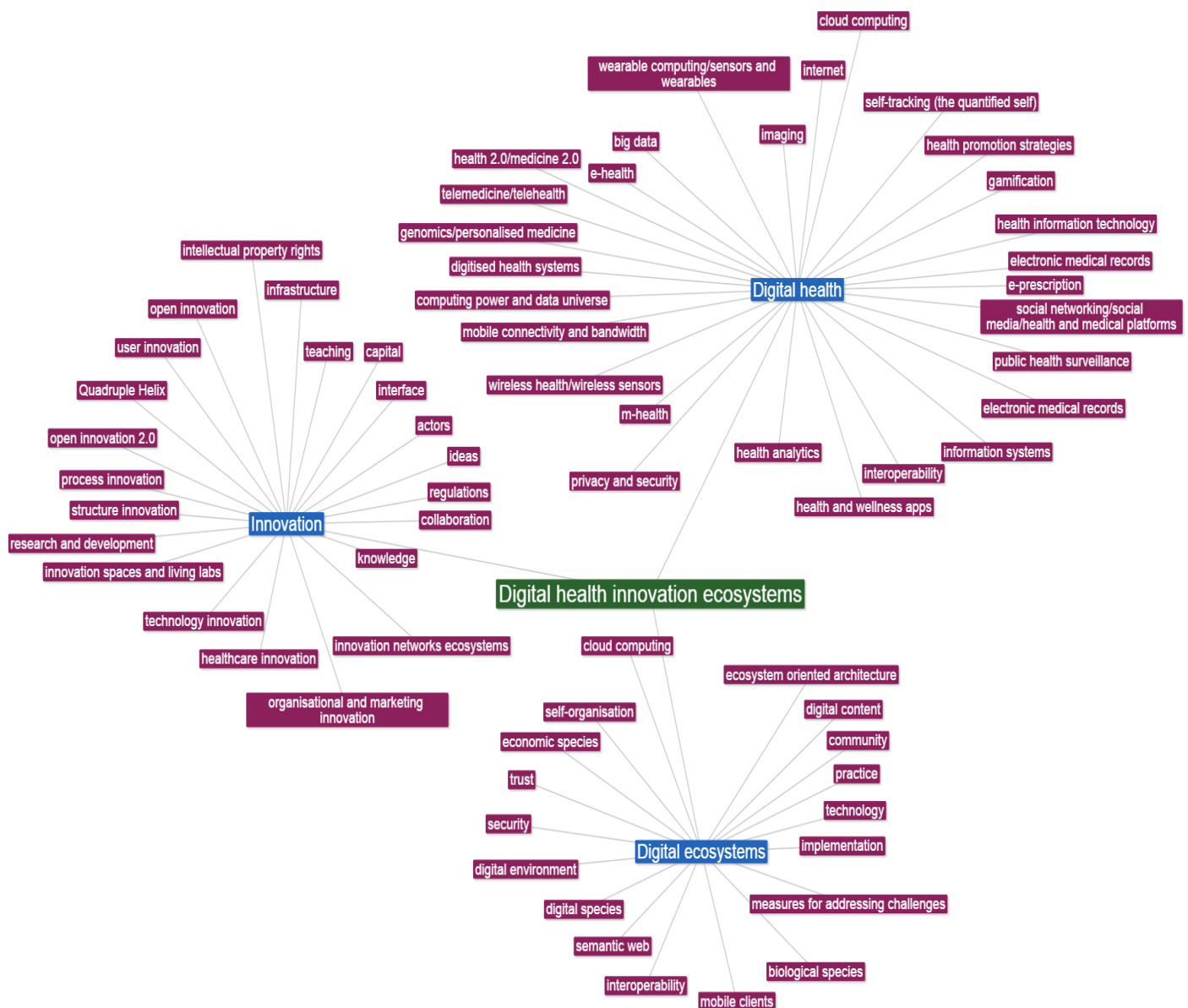
The summary of essential components of digital health, innovation and digital ecosystems are presented in Table 10.

Table 10: Summary of the Essential Components of Digital Health, Innovation and Digital Ecosystems

Essential components of digital health within the Namibian context	Essential components of innovation within the Namibian context	Essential of components of digital ecosystems with the Namibian context
e-health	Process innovation	Biological species
m-health	Structure innovation	Economic species
Telemedicine/telehealth/telecare	Open innovation	Digital species
Health 2.0/medicine 2.0	Open innovation 2.0	Mobile clients
Wireless health / wireless sensors	Innovation networks ecosystems	Digital environment
Internet	Quadruple Helix	Interoperability
Genomics/personalised medicine	User innovation	Security
Mobile connectivity and bandwidth	Intellectual property rights	Trust
Social networking/social media/health and medical platforms	Actors	Ecosystem oriented architecture
Computing power and data universe	Capital	Self-organisation

Essential components of digital health within the Namibian context	Essential components of innovation within the Namibian context	Essential of components of digital ecosystems with the Namibian context
Information systems	Infrastructure	Semantic web
Imaging	Regulations	Digital content
Self-tracking (the quantified self)	Knowledge	Community
Wearable computing/sensors and wearables	Ideas	Technology
Health information technology	Interface	Practice
Big data	Collaboration	Implementation
Cloud computing	Organisational and marketing innovation	Measures for addressing challenges
Public health surveillance	Technology innovation	Cloud computing
Health promotion strategies	Healthcare innovation	
Electronic medical records	Teaching	
Electronic health records	Innovation spaces and living labs	
Gamification	Research and development	
Interoperability		
Health and wellness apps		
Health analytics		
Digitised health systems		
Privacy and security		
e-prescription		

The components of digital health, innovation and digital ecosystems relevant to the development of a digital health innovation ecosystem for the Namibian can be visualised in Figure 4.

Figure 4: The Components of Digital Health Innovation Ecosystems Relevant to the Namibian Context

The contextualised digital health innovation ecosystem components for the Namibian context support the concepts of digital health, innovation and digital ecosystems as presented by relevant stakeholders of the Namibian context. The contextualised components of the Namibian digital health innovation ecosystem suggest what is required currently to develop a Namibian digital health innovation ecosystem. The development of a digital health innovation ecosystem for the Namibian context will not only benefit the healthcare practitioners, it will also be of benefit to patients and the Namibian healthcare sector. Patients will be able to take part in the healthcare delivery process through use of digital health technologies indicated in figure 3, such as m-health, telemedicine/telehealth, social networking and health and wellness apps. The Namibian healthcare will experience a different perspective in the healthcare delivery process as principles of innovation will be incorporated into the healthcare process.

6.   CONCLUSIONS

The study identified essential components of digital health, innovation and digital ecosystems within the Namibian context. The novelty of this study lies in the identification of the essential components of digital health, innovation and digital ecosystems relevant to the development of a digital health innovation ecosystem for the Namibian context.

The findings of the study suggests that it is important to identify what is essential to this particular context towards developing a digital health innovation ecosystem for Namibia, rather than taking into consideration all the components identified in literature as the knowledgeable professionals from the Namibian context who took part in this study did not consider all the components of digital health, innovation and digital ecosystems relevant to the Namibian context.

As a result of digital ecosystems not being implemented in the Namibian context as at the time of the study, knowledgeable professionals who evaluated the components of digital ecosystems within the Namibian context were from the computer networks, networks design and analysis background which has a similar background to digital ecosystems (Chang & West, 2006), however, the concept of digital ecosystems and the components identified in this study were presented and discussed with the knowledgeable professionals in computer networks, networks design and analysis before questionnaires were administered. This was to ensure that were familiar with the terms and could provide useful information on the subject. The researchers also made sure that only participants who felt comfortable with the concept of digital ecosystems took part in the study.

The components of digital health, innovation and digital ecosystems identified in literature as well as for the Namibian context reflects the components that were identified at the current time of the research and is bound to change or expand as time evolves.

Although the essential components of digital health, innovation and digital ecosystems relevant to the development of a digital health innovation ecosystem for the Namibian context were identified in this study, this study did not provide any specific guidance towards implementing these specific components of a digital health innovation ecosystem for the Namibian context. Future work would be to present the guidelines for implementing a digital health innovation ecosystem for the specifically for the Namibian context, implement the different components of digital health, innovation and digital ecosystems identified in this study and investigate its impact within the Namibia context.

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APPENDIX A

Dear Participant,

The aim of this study is to determine the components that constitute a digital health innovation ecosystem hence contributing towards the development of a framework for a Namibian Digital Health Innovation Ecosystem Framework.

A systematic literature review was conducted to explore the concepts, digital health, innovation and digital ecosystems to identify the components that constitute a digital health innovation ecosystem.

As a result, an initial framework for a digital health innovation ecosystem was developed. However, the components of the digital health can only be useful within the Namibian context once it has been evaluated by knowledgeable professionals like you.

The purpose of this questionnaire is for you to identify and rank relevant components of digital health within the Namibian context. Please note that your contribution is vital to the completion of this study as the findings will help accurately determine which identified digital health component is relevant and useful to the Namibian context to appropriately develop an intermediate framework for a Namibian Digital Health Innovation Ecosystem.

Are you male or female? *
- Male
- Female

What is your age range? *
- 18-25
- 26-35
- 36-45
- 46-60
- Over 60 years

What is your occupation? *

Have you worked on e-health, m-health, or digital health related projects? *
- Yes
- No

If you answered yes to the previous question, how many years of experience do you have in that domain? *
- 1-3 years
- 4-6 years
- 7-10 years
- More than 10 years

In what country do you work? *

Describe your expertise level if you have worked on e-health, m-health, or digital health related projects *
- Expert
- Intermediate
- Beginner

What is your highest level of education? ✱
- ○ Bachelor
- ○ Masters
- ○ Doctorate
- ○ Other:

Describe your work environment
- ○ University
- ○ Hospital
- ○ Clinic
- ○ Health organization

Please rank "e-health" as a component of digital health relevant to the Namibian context from 1 being not important to 5 being most important
- ○ Not Important
- ○ A Bit Important
- ○ Moderately Important
- ○ Important
- ○ Very Important

Please rank "m-health" as a component of digital health relevant to the Namibian context from 1 being not important to 5 being most important
- ○ Not Important
- ○ A Bit Important
- ○ Moderately Important
- ○ Important
- ○ Very Important

Please rank "telemedicine/telehealth/telecare" as a component of digital health relevant to the Namibian context from 1 being not important to 5 being most important
- ○ Not Important
- ○ A Bit Important
- ○ Moderately Important
- ○ Important
- ○ Very Important

Please rank "Health 2.0 / medicine 2.0" as a component of digital health relevant to the Namibian context from 1 being not important to 5 being most important
- ○ Not Important
- ○ A Bit Important
- ○ Moderately Important
- ○ Important
- ○ Very Important

Please rank "wireless health/ wireless sensors" as a component of digital health relevant to the Namibian context from 1 being not important to 5 being most important
- ○ Not Important
- ○ A Bit Important

- ○ Moderately Important
- ○ Important
- ○ Very Important

Please rank "internet" as a component of digital health relevant to the Namibian context from 1 being not important to 5 being most important
- ○ Not Important
- ○ A Bit Important
- ○ Moderately Important
- ○ Important
- ○ Very Important

Please rank "Genomics / personalized medicine" as a component of digital health relevant to the Namibian context from 1 being not important to 5 being most important
- ○ Not Important
- ○ A Bit Important
- ○ Moderately Important
- ○ Important
- ○ Very Important

Please rank "health data exchange" as a component of digital health relevant to the Namibian context from 1 being not important to 5 being most important
- ○ Not Important
- ○ A Bit Important
- ○ Moderately Important
- ○ Important
- ○ Very Important

Please rank "mobile connectivity and bandwidth" as a component of digital health relevant to the Namibian context from 1 being not important to 5 being most important
- ○ Not Important
- ○ A Bit Important
- ○ Moderately Important
- ○ Important
- ○ Very Important

Please rank "social networking/social media/health and medical platforms" as a component of digital health relevant to the Namibian context from 1 being not important to 5 being most important
- ○ Not Important
- ○ A Bit Important
- ○ Moderately Important
- ○ Important
- ○ Very Important

Please rank "computing power and data universe" as a component of digital health relevant to the Namibian context from 1 being not important to 5 being most important

- ○ Not Important
- ○ A Bit Important
- ○ Moderately Important
- ○ Important
- ○ Very Important

Please rank "information systems" as a component of digital health relevant to the Namibian context from 1 being not important to 5 being most important

- ○ Not Important
- ○ A Bit Important
- ○ Moderately Important
- ○ Important
- ○ Very Important

Please rank "imaging" as a component of digital health relevant to the Namibian context from 1 being not important to 5 being most important

- ○ Not Important
- ○ A Bit Important
- ○ Moderately Important
- ○ Important
- ○ Very Important

Please rank "self-tracking (the quantified self)" as a component of digital health relevant to the Namibian context from 1 being not important to 5 being most important

- ○ Not Important
- ○ A Bit Important
- ○ Moderately Important
- ○ Important
- ○ Very Important

Please rank "wearable computing / sensors and wearables" as a component of digital health relevant to the Namibian context from 1 being not important to 5 being most important

- ○ Not Important
- ○ A Bit Important
- ○ Moderately Important
- ○ Important
- ○ Very Important

Please rank "health information technology" as a component of digital health relevant to the Namibian context from 1 being not important to 5 being most important

- ○ Not Important
- ○ A Bit Important
- ○ Moderately Important
- ○ Important
- ○ Very Important

Please rank "Big data" as a component of digital health relevant to the

Namibian context from 1 being not important to 5 being most important
○ Not Important
○ A Bit Important
○ Moderately Important
○ Important
○ Very Important

Please rank "Cloud computing" as a component of digital health relevant to the Namibian context from 1 being not important to 5 being most important
○ Not Important
○ A Bit Important
○ Moderately Important
○ Important
○ Very Important

Please rank "public health surveillance" as a component of digital health relevant to the Namibian context from 1 being not important to 5 being most important
○ Not Important
○ A Bit Important
○ Moderately Important
○ Important
○ Very Important

Please rank "Health promotion strategies" as a component of digital health relevant to the Namibian context from 1 being not important to 5 being most important
○ Not Important
○ A Bit Important
○ Moderately Important
○ Important
○ Very Important

Please rank "Electronic medical records" as a component of digital health relevant to the Namibian context from 1 being not important to 5 being most important
○ Not Important
○ A Bit Important
○ Moderately Important
○ Important
○ Very Important

Please rank "Electronic health records" as a component of digital health relevant to the Namibian context from 1 being not important to 5 being most important
○ Not Important
○ A Bit Important
○ Moderately Important
○ Important
○ Very Important

Please rank "Gamification" as a component of digital health relevant to the Namibian context from 1 being not important to 5 being most important
- ○ Not Important
- ○ A Bit Important
- ○ Moderately Important
- ○ Important
- ○ Very Important

Please rank "Interoperability" as a component of digital health relevant to the Namibian context fro 1 being not important to 5 being most important
- ○ Not Important
- ○ A Bit Important
- ○ Moderately Important
- ○ Important
- ○ Very Important

Please rank "Health and wellness apps" as a component of digital health relevant to the Namibian context from 1 being not important to 5 being most important
- ○ Not Important
- ○ A Bit Important
- ○ Moderately Important
- ○ Important
- ○ Very Important

Please rank "Health analytics" as a component of digital health relevant to the Namibian context from 1 being not important to 5 being most important
- ○ Not Important
- ○ A Bit Important
- ○ Moderately Important
- ○ Important
- ○ Very Important

Please rank "Digitized health systems" as a component of digital health relevant to the Namibian context from 1 being not important to 5 being most important
- ○ Not Important
- ○ A Bit Important
- ○ Moderately Important
- ○ Important
- ○ Very Important

Please rank "Privacy and security" as a component of digital health relevant to the Namibian context from 1 being not important to 5 being most important
- ○ Not Important
- ○ A Bit Important
- ○ Moderately Important
- ○ Important
- ○ Very Important

Are there any relevant components of digital health which have not been added to the list?

- ○ Yes
- ○ No

If your answer to the previous question is yes, what are those components? Please explain why they should be added.

APPENDIX B

Dear participant,

The aim of this study is to determine the components that constitute a digital health innovation ecosystem hence contributing towards the development of a framework for a Namibian Digital Health Innovation Ecosystem.

A systematic literature review was conducted to explore the terms, digital health, innovation and digital ecosystems to identify the components that constitute a digital health innovation ecosystem.

As a result, an initial framework for a digital health innovation ecosystem was developed. However, the components of the innovation can only be useful within the Namibian context once it has been evaluated by knowledgeable professionals like you.

The purpose of this questionnaire is for you to identify and rank relevant components of innovation within the Namibian context.

Please note that your contribution is vital to the completion of this study as the findings will help accurately determine which identified innovation component is relevant and useful to the Namibian context to appropriately develop a framework for a Namibian Digital Health Innovation Ecosystem.

Are you male or female? *
- Male
- Female

What is your age range? *
- 18-25
- 26-35
- 36-45
- 46-60
- Over 60 years

What is your occupation? *

Have you worked on innovation related projects? *
- Yes
- No

If you answered yes to the previous question, how many years of experience do you have in that domain?
- 1-3 years
- 4-6 years
- 7-10 years
- More than 10 years

In what country do you work? *

Describe your expertise level if you have worked on innovation related projects
- Expert
- Intermediate
- Beginner

What is your highest level of education? *
○   Bachelor
○   Masters
○   Doctorate
○   Other:

Describe your work environment *
○   University
○   Hospital
○   Clinic
○   Health organisation
○   Other:

Please rank "process innovation" as a component of innovation relevant to the Namibian context from 1 being not important to 5 being most important
○   Not Important
○   A Bit Important
○   Moderately Important
○   Important
○   Very Important

Please rank "product innovation" as a component of innovation relevant to the Namibian context from 1 being not important to 5 being most important
○   Not Important
○   A Bit Important
○   Moderately Important
○   Important
○   Very Important

Please rank "structure innovation" as a component of innovation relevant to the Namibian context from 1 being not important to 5 being most important
○   Not Important
○   A Bit Important
○   Moderately Important
○   Important
○   Very Important

Please rank "open innovation" as a component of innovation relevant to the Namibian context from 1 being not important to 5 being most important
○   Not Important
○   A Bit Important
○   Moderately Important
○   Important
○   Very Important

Please rank "information technology" as a component of innovation relevant to the Namibian context from 1 being not important to 5 being most important
○   Not Important
○   A Bit Important
○   Moderately Important

○   Important
○   Very Important

Please rank "closed innovation" as a component of innovation relevant to the Namibian context from 1 being not important to 5 being most important
○   Not Important
○   A Bit Important
○   Moderately Important
○   Important
○   Very Important

Please rank "open innovation 2.0" as a component of innovation relevant to the Namibian context from 1 being not important to 5 being most important
○   Not Important
○   A Bit Important
○   Moderately Important
○   Important
○   Very Important

Please rank "innovation network ecosystems" as a component of innovation relevant to the Namibian context from 1 being not important to 5 being most important
○   Not Important
○   A Bit Important
○   Moderately Important
○   Important
○   Very Important

Please rank "Triple Helix system" as a component of innovation relevant to the Namibian context from 1 being not important to 5 being most important
○   Not Important
○   A Bit Important
○   Moderately Important
○   Important
○   Very Important

Please rank "Quadruple Helix system" as a component of innovation relevant to the Namibian context from 1 being not important to 5 being most important
○   Not Important
○   A Bit Important
○   Moderately Important
○   Important
○   Very Important

Please rank "User innovation" as a component of innovation relevant to the Namibian context from 1 being not important to 5 being most important
○   Not Important
○   A Bit Important
○   Moderately Important
○   Important

- Very Important

Please rank "Intellectual property rights" as a component of innovation relevant to the Namibian context from 1 being not important to 5 being most important

- Not Important
- A Bit Important
- Moderately Important
- Important
- Very Important

Please rank "Actors" as a component of innovation relevant to the Namibian context from 1 being not important to 5 being most important

- Not Important
- A Bit Important
- Moderately Important
- Important
- Very Important

Please rank "Capital" as a component of innovation relevant to the Namibian context from 1 being not important to 5 being most important

- Not Important
- A Bit Important
- Moderately Important
- Important
- Very Important

Please rank "Infrastructure" as a component of innovation relevant to the Namibian context from 1 being not important to 5 being most important

- Not Important
- A Bit Important
- Moderately Important
- Important
- Very Important

Please rank "Regulations" as a component of innovation relevant to the Namibian context from 1 being not important to 5 being most important

- Not Important
- A Bit Important
- Moderately Important
- Important
- Very Important

Please rank "Knowledge" as a component of innovation relevant to the Namibian context from 1 being not important to 5 being most important

- Not Important
- A Bit Important
- Moderately Important
- Important
- Very Important

Please rank "Ideas" as a component of innovation relevant to the Namibian context from 1 being not important to 5 being most important

○   Not Important
○   A Bit Important
○   Moderately Important
○   Important
○   Very Important

Please rank "Interface" as a component of innovation relevant to the Namibian context from 1 being not important to 5 being most important

○   Not Important
○   A Bit Important
○   Moderately Important
○   Important
○   Very Important

Please rank "Culture" as a component of innovation relevant to the Namibian context from 1 being not important to 5 being most important

○   Not Important
○   A Bit Important
○   Moderately Important
○   Important
○   Very Important

Please rank "Architectural principles" as a component of innovation relevant to the Namibian context from 1 being not important to 5 being most important

○   Not Important
○   A Bit Important
○   Moderately Important
○   Important
○   Very Important

Please rank "Collaboration" as a component of innovation relevant to the Namibian context from 1 being not important to 5 being most important

○   Not Important
○   A Bit Important
○   Moderately Important
○   Important
○   Very Important

Please rank "Organisational and marketing innovation" as a component of innovation relevant to the Namibian context from 1 being not important to 5 being most important

○   Not Important
○   A Bit Important
○   Moderately Important
○   Important
○   Very Important

Please rank "Technology innovation" as a component of innovation relevant to the Namibian context from 1 being not important to 5 being most important
- ○   Not Important
- ○   A Bit Important
- ○   Moderately Important
- ○   Important
- ○   Very Important

Please rank "Healthcare innovation" as a component of innovation relevant to the Namibian context from 1 being not important to 5 being most important
- ○   Not Important
- ○   A Bit Important
- ○   Moderately Important
- ○   Important
- ○   Very Important

Please rank "Teaching" as a component of innovation relevant to the Namibian context from 1 being not important to 5 being most important
- ○   Not Important
- ○   A Bit Important
- ○   Moderately Important
- ○   Important
- ○   Very Important

Please rank "Influence of government ownership" as a component of innovation relevant to the Namibian context from 1 being not important to 5 being most important
- ○   Not Important
- ○   A Bit Important
- ○   Moderately Important
- ○   Important
- ○   Very Important

Please rank "Innovation spaces and living labs" as a component of innovation relevant to the Namibian context from 1 being not important to 5 being most important
- ○   Not Important
- ○   A Bit Important
- ○   Moderately Important
- ○   Important
- ○   Very Important

Are there any relevant components which have not been added to the list identified above?
- ○   Yes
- ○   No

If your answer to the previous question is yes, what are those components?

APPENDIX C

Dear Participants,

The aim of this study is to determine the components that constitute a digital health innovation ecosystem hence contributing towards the development of a framework for a Namibian Digital Health Innovation Ecosystem.

        A systematic literature review was conducted to explore the terms, digital health, innovation and digital ecosystems to identify the components that constitute a digital health innovation ecosystem.

        As a result, an initial framework for a digital health innovation ecosystem was developed. However, the components of the digital ecosystems can only be useful within the Namibian context once it has been evaluated by knowledgeable experts like you.

        The purpose of this questionnaire is for you to identify and rank relevant components of digital ecosystems that you feel is relevant to the Namibian context.

        Please note that your contribution is vital to the completion of this study as the findings will help accurately determine which identified digital ecosystems component is relevant and useful to the Namibian context to appropriately develop a framework for a Namibian Digital Health Innovation Ecosystem.

Are you male or female? *
- Male
- Female

What is your age range? *
- 18-25
- 26-35
- 36-45
- 46-60
- Over 60 years

What is your occupation? *

Have you worked on digital ecosystems related projects? *
- Yes
- No

if you answered yes to the previous question, how many years of experience do you have in that domain?
- 1-3 years
- 4-6 years
- 7-10 years
- More than 10 years

In what country do you work? *

Describe your expertise level if you have worked on digital ecosystems related projects
- Expert
- Intermediate
- Beginner

What is your highest level of education? *
- ○ Bachelor
- ○ Masters
- ○ Doctorate
- ○ Other:

Describe your work environment *
- ○ University
- ○ Hospital
- ○ Clinic
- ○ Health organisation
- ○ Other:

Please rank "Agents" as a component of digital ecosystems relevant to the Namibian context from 1 being not important to 5 being most important
- ○ Not Important
- ○ A Bit Important
- ○ Moderately Important
- ○ Important
- ○ Very Important

Please rank "Species" as a component of digital ecosystems relevant to the Namibian context from 1 being not important to 5 being most important
- ○ Not Important
- ○ A Bit Important
- ○ Moderately Important
- ○ Important
- ○ Very Important

Please rank "Biological species" as a component of digital ecosystems relevant to the Namibian context from 1 being not important to 5 being most important
- ○ Not Important
- ○ A Bit Important
- ○ Moderately Important
- ○ Important
- ○ Very Important

Please rank "Economic species" as a component of digital ecosystems relevant to the Namibian context from 1 being not important to 5 being most important
- ○ Not Important
- ○ A Bit Important
- ○ Moderately Important
- ○ Important
- ○ Very Important

Please rank "Digital species" as a component of digital ecosystems relevant to the Namibian context from 1 being not important to 5 being most important
- ○ Not Important
- ○ A Bit Important

- o Moderately Important
- o Important
- o Very Important

Please rank "mobile clients" as a component of digital ecosystems relevant to the Namibian context from 1 being not important to 5 being most important
- o Not Important
- o A Bit Important
- o Moderately Important
- o Important
- o Very Important

Please rank "digital environment" as a component of digital ecosystems relevant to the Namibian context from 1 being not important to 5 being most important
- o Not Important
- o A Bit Important
- o Moderately Important
- o Important
- o Very Important

Please rank "interoperability" as a component of digital ecosystems relevant to the Namibian context from 1 being not important to 5 being most important
- o Not Important
- o A Bit Important
- o Moderately Important
- o Important
- o Very Important

Please rank "security" as a component of digital ecosystems relevant to the Namibian context from 1 being not important to 5 being most important
- o Not Important
- o A Bit Important
- o Moderately Important
- o Important
- o Very Important

Please rank "trust" as a component of digital ecosystems relevant to the Namibian context from 1 being not important to 5 being most important
- o Not Important
- o A Bit Important
- o Moderately Important
- o Important
- o Very Important

Please rank "ecosystem-oriented architecture" as a component of digital ecosystems relevant to the Namibian context from 1 being not important to 5 being most important
- o Not Important
- o A Bit Important
- o Moderately Important

- Important
- Very Important

Please rank "self-organisation" as a component of digital ecosystems relevant to the Namibian context from 1 being not important to 5 being most important

- Not Important
- A Bit Important
- Moderately Important
- Important
- Very Important

Please rank "semantic web" as a component of digital ecosystems relevant to the Namibian context from 1 being not important to 5 being most important

- Not Important
- A Bit Important
- Moderately Important
- Important
- Very Important

Please rank "digital content" as a component of digital ecosystems relevant to the Namibian context from 1 being not important to 5 being most important

- Not Important
- A Bit Important
- Moderately Important
- Important
- Very Important

Please rank "community" as a component of digital ecosystems relevant to the Namibian context from 1 being not important to 5 being most important

- Not Important
- A Bit Important
- Moderately Important
- Important
- Very Important

Please rank "technology" as a component of digital ecosystems relevant to the Namibian context from 1 being not important to 5 being most important

- Not Important
- A Bit Important
- Moderately Important
- Important
- Very Important

Please rank "practice" as a component of digital ecosystems relevant to the Namibian context from 1 being not important to 5 being most important

- Not Important
- A Bit Important
- Moderately Important
- Important
- Very Important

Please rank "implementation" as a component of digital ecosystems relevant to the Namibian context from 1 being not important to 5 being most important
- ○   Not Important
- ○   A Bit Important
- ○   Moderately Important
- ○   Important
- ○   Very Important

Please rank "challenges" as a component of digital ecosystems relevant to the Namibian context from 1 being not important to 5 being most important
- ○   Not Important
- ○   A Bit Important
- ○   Moderately Important
- ○   Important
- ○   Very Important

Are there any relevant components which have not been added to the list identified above?
- ○   Yes
- ○   No

If your answer to the previous question is yes, what are those components? Please explain why the component(s) should be added