Dissertation

ARTIFICIAL NARROW INTELLIGENCE-DRIVEN DIAGNOSTICS:

Impacts, Inequities, and Policy Imperatives in Global Healthcare.

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This dissertation is the culmination of insights from many intelligent, qualified, and caring individuals. For which, it is my hope that we have provided a small step towards a more equal AI-enabled future.

"Wir behalten von unsern Studien am Ende doch nur das,
was wir praktisch anwenden."

- Johann Wolfgang von Goethe

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Abstract

The greater societal penetration of Artificial Narrow Intelligence (ANI) has uncovered an interesting paradox: although emerging technologies have contributed many positive social benefits, they tend to disproportionately benefit high-resource regions compared to low-resource regions; thus exacerbating global inequalities. This trend is pervasive across many industries, yet the impact to global health is particularly poignant.

To better understand these phenomena, this research paper employs a comparative case study approach to examine the societal, ethical, and policy paradigms in heterogeneous resource allocations. In total, the sample of literature involves over 175 sources of secondary data. Coding and thematic analysis were used to identify gaps and opportunities for policy improvement in intergovernmental organizations (IGOs).

As a result of this approach, various key themes became apparent. At a high-level, the data indicated that although there are instances of successful project outcomes on a micro-level in low-resource contexts (e.g. examples of ANI increasing accessibility of health services, etc.), macro-level trends tend to be less favorable. High-resource contexts are observed to receive a disproportionate share of the benefits of ANI, while low-resource contexts bear a disproportionate share of the risks.

Although the impact and severity of the following key themes varies between contexts, the data indicated strong patterns of differential exploitation and assimilation of ANI-enabled diagnostics between high- and low-resource contexts. Most notably, the more low-resource a region is, the more it was observed to be impacted by the challenges outlined. These themes represent significant under optimizations whereby current policies are either 1) absent 2) insufficient 3) inconsistently-applied 4) misattributed (in terms of the end goal, responsible stakeholder, etc.) and / or 5) lacking efficacy in real-world settings.

Theme 1: Power imbalances amongst stakeholders create substantial challenges and threaten ANI project success and ethical implementation.

Theme 2: Insular decision making and stunted collaboration significantly jeopardizes systemic improvements to delivering ethical ANI-enabled health services.

Theme 3: Current ANI-related ethics recommendations do not adequately capture the

scale and impact of industry disruptions and what this means to the healthcare system and the patient.

Theme 4: Commonly-used methods of ideation, communication, and implementation of ANI-related ethics policies limit the impact in real-world settings.

Despite the focus of this report being diagnostic systems, the key themes are observed to be industry agnostic in nature. Thus suggesting that although there are methods to increase the fairness of a particular ANI system / project, broader equitable ANI use starts far before a project begins and relates to the social, economic, and political contexts in which it is derived.

Within these key themes, there is a glaring lack of engagement with powerful stakeholders (i.e. 'Big Tech') and an underdeveloped strategic prioritization throughout IGO policy recommendations results in suboptimal and / or counterproductive policies that tend to favor high-resource contexts. The format of current IGO ethics recommendations is particularly problematic. Currently many AI ethics recommendations by IGOs are communicated via a list of broad and vaguely-defined policy suggestions (generally around ~40-80 recommendations depending on the IGO). However, presenting an extensive list of idealistic and cannibalistic recommendations represents an oversimplification of ANI recommendations and their relative priority / impact. Despite the well-intentioned nature behind this format structure, it ignores the practicalities and severe scarcity of resources in many locations. This format is typically more conducive to high-resource contexts which are able to select multiple priorities simultaneously. Whereas when resources are scarce, strategic prioritization becomes exceedingly important. Thus representing a subtle way that intergovernmental policy can be unintentionally perpetuating the biases it is attempting to reduce.

In response to these themes, a series of policy recommendations were developed through collaboration with subject matter experts in health, technology, and policy-related fields that represent policy 'choke-points'. That is to say, failure to address these recommendations will significantly limit the efficacy of other IGO recommendations. These include:

- Better alignment of AI policy to financial / operational goals for Big Tech, both positively and negatively (e.g. access to new markets, strategic partnerships, taxes, penalties for AI ethics violations, blocked mergers and acquisitions to limit size, etc.).

- Developing a strong coordinated approach between countries with shared AI values to increase bargaining power and through this, prioritize the implementation of AI and data security policies to prevent further exploitation.
- Designing decision making criteria (on an individual and organizational level) and related processes whereby the patient is at the forefront; which includes increasing the degree of patient input and collaboration and then legitimately integrating this patient feedback into laws and processes.
- Further advocating, articulating, and disseminating the value of patient and community empowerment / involvement throughout the project cycle.

Although this research is exploratory in nature and a plethora of outstanding questions remain, the data saturation in this report suggests sufficient understanding of the phenomena exists in order to assist IGOs, national governments, and policy makers in making more informed strategic decisions on how they support digitally-enabled healthcare services. By which, the aim of this report is to provide an additional perspective and foundation for academic discourse in order to make future ANI usage as accessible and fair as possible.

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List of Abbreviations and Symbols

AI	Artificial Intelligence
AfCFTA	African Continental Free Trade Area
AGI	Artificial General Intelligence
ANI	Artificial Narrow Intelligence
APM	Action Priority Matrix
APSA	African Peace and Security Architecture
ASEAN	Association of Southeast Asian Nations
CAGR	Compound Annual Growth Rate
CDL	Creative Destruction Lab
COVID - 19	Coronavirus Disease
CSCW	Computer-Supported Cooperative-Work
CSR	Corporate Social Responsibility
CSV	Creating Shared Value
CT	Computerized Tomography
EDL	Essential Diagnostics List
EMR	Electronic Medical Records

EU	European Union
GDP	Gross Domestic Product
GII	Global Innovation Index
GIR	Global Infrastructure Ranking
GPU	Graphics Processor Unit
HD	Heart Disease
HHR	Human Health Resources
HR	Human Resources
HIS	Health Index Score
HIV	Human Immunodeficiency Virus
HAQI	Healthcare Access and Quality Index[1]
ICT	Informations and Communications Technology
IGO	Intergovernmental Organization
IoT	Internet of Things
KPI	Key Performance Indicator
LRI	Lower Respiratory Infections
MBDS	Mekong Basin Disease Surveillance network
MECIDS	Middle East Consortium on Infectious Disease Surveillance
ML	Machine Learning
MRI	Magnetic Resonance Imaging

[1] Please note, any inconsistent spellings of the word "healthcare" reflects the spelling within the official titles of the indices, organizations, etc.

NAPHS	National Action Plans for Health Security
NIS	National Innovation Strategy
NGO	Non-Governmental Organization
NRI	Network Readiness Index
OECD	Organisation for Economic Co-operation and Development
OKRs	Objectives and Key Results
OSIC	Open Source Imaging Consortium
PGD	Patient-Generated Data
PPE	Personal Protective Equipment
PwC	PricewaterhouseCoopers LLP
SADC	Southern African Development Community
SDG	Sustainable Development Goal
SME	Subject Matter Expert
TB	Tuberculosis
UN	United Nations
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNIDO	United Nations Industrial Development Organization
URI	Upper Respiratory Infection
VC	Venture Capital
WEF	World Economic Forum
WHO	World Health Organization

1 Introduction

1.1 Overview

"The greatest challenge facing societies and firms would be utilizing the benefits of availing artificial intelligence technologies, providing vast opportunities for both new products / services and immense productivity improvements while avoiding the dangers and disadvantages in terms of [...] greater wealth inequalities" (Makridakis, 2017, p. 46).

In an era marked by accelerated digitization and prominent social inequality, it becomes increasingly critical for academics to better understand the complicated symbiotic relationship between humans and technology. Emerging technologies, including Artificial Intelligence (AI) have engendered many societal benefits such as reduced poverty, increased global health, improved food quality and distribution, increased public safety, etc. with potential benefits expected to proliferate expeditiously (del Castillo et al., 2021; Forbes Technology Council, 2019; Singh, 2019). However, with greater AI penetration into various sectors, an interesting paradox becomes apparent: although emerging technologies have contributed many positive benefits, there is evidence to suggest that they have disproportionately benefited developed countries in comparison to their economically disadvantaged counterparts (Wahl et al., 2018). The paradox lies therein; while the adoption of emerging technologies offers possible social benefits, these technologies are simultaneously contributing to greater social inequality by increasing quality of life and human development opportunities in high-resource contexts, whereas developing countries fall increasingly further behind (Chatterjee & Dethlefs, 2022; Makridakis, 2017; McKinsey Global Institute, 2018a).

The 2022 World Inequality Report stated that global inequality remains hugely significant and profoundly entrenched (Chancel et al., 2022). This has been proven to result in negative outcomes such as economic, political, and social instability (Alvaredo et al., 2018). Social inequality in itself is a highly complex topic made up of many facets such as income equality and access to basic social services (Binellia et al., 2015). To better understand this phenomenon, this research breaks down one of the key elements of social inequality: healthcare. This topic was selected due to its prominence in the human experience. As substantiated by Maslow's Hierarchy of Needs, without basic standards of health and life, it

becomes very difficult for a group of people to acquire wealth, education, establish a competitive advantage, etc. which are all items that further contribute to inequality (Hagerty, 1999).

The relationship between inequality and healthcare is eminently nuanced based on social, economic, and demographic background (Roser, 2019). There has been long-standing academic and commercial bias in healthcare, where attention and spending have focused on healthcare topics prevalent in wealthy regions as opposed to low-resource regions[2] (Riley, 2012). This is commonly referred to as the 10 / 90 Gap whereby only 10% of global health research is devoted to conditions that account for 90% of the global disease burden; and consequently, the majority of diseases endemic in low-income regions are frequently overlooked (Stevens, 2004). Although this issue has been persistent over many decades, modern technological advances have added an additional layer of complexity.

Moreover, the emergence of the Coronavirus Disease (COVID-19) has served as a catalyst for intensified scrutiny of global health disparities, notably underscoring the imperative for the provision of timely, accurate, and accessible diagnostic services (Bagcchi, 2021; Lancet, 2021). Given this context, there arises a topical imperative to reassess the relationship between social inequality and healthcare due to the changing dynamics of healthcare becoming more intelligent and scalable via emergent technologies. Without further analysis and future policy intervention, global health, wealth, and technology gaps are expected to continue (Wahl et al., 2018; Alonso et al., 2020). Hence, this research aims to provide insights on broad barriers to ethical AI-enabled health solutions and manners in which intergovernmental policy can be used as a means to mitigate these. This report speaks specifically to Intergovernmental Organizations (IGOs) and their unique positionality characterized by their capacity to engage with national governments, academia, and the private sector, thereby assuming a pivotal role in the facilitation of these ethical implementations.

Owing to the wide breadth of intended audience, this report has been written in such a manner to reduce potential barriers to readability in order to increase clarity and accessibility of research outcomes (Hirst, 2003; Plavén-Sigray et al., 2017). Specifically, the superfluous use of academic jargon was intentionally removed from this report as it represents an

[2] An overview of what qualifies a region as "low-resource" (along with other key definitions) can be found in section 1.7 Criteria and Definitions.

antiquated method of communication within academia that leads to greater misunderstandings and barriers to communication particularly in research topics with a heightened practical societal relevance (Mayrhofer, 2021). Markedly, it contributes to information silos between academia and the private / public sectors; of which this paper is specifically attempting to disavow.

1.2 Covid-19 Impact Statement

With regards to contextual transparency, it is relevant to note that the research approach associated with this report was impacted by the Covid-19 pandemic. As a digital health topic that involved a comparative and international research approach, many elements of the research design were refined in response to the decreased ability to collect / analyze data as a result of travel restrictions, workplace compliance procedures, health responsibilities, and additional ethical considerations. A key implication of this was the requisite to adjust the direct focus of research towards a systems-level of assessment. The original approach was designed as an "on the ground" evaluation of the ethicality and implications of project-level AI implementations in dichotomous resource environments. However, during the Covid-19 pandemic this was no longer a viable research approach as safe, sufficient, and enduring access to end users / patients was no longer possible. To account for these circumstances, the research questions were pivoted to consider broader macro-level trends within this research topic whereby adequate secondary data was available.

Both macro- and micro-level considerations are required to develop a robust understanding of the ethics associated with AI in a global health context. The macro-level approach used in this report infers an inherent distance from the originally intended human-centered approach and subscribes to a more informational / meta perspective. Therefore, an improved micro-level understanding of ethical AI usage is highly encouraged to supplement the higher-level perspective included in this report to ensure that a patient / end user perspective is well represented.

Further insights on how the research approach was adjusted due to the pandemic can be found in sections 1.9 Limitations and 3.2 Data Sources.

1.3 Background and Significance

Thus far, rapid technological change has outpaced the literature devoted to understanding its impact on society, both positive and negative (Hecht et al., 2018; Horvitz, 2022). AI in particular is uniquely nuanced in its ability to adjust to new inputs to complete human-like tasks and behaviors moreso than preceding technologies; resulting in the potential to disrupt entire industries through advanced analytical insights, predictive modeling, and automation.

Although the concept of AI has been around for decades, earlier attempts to implement AI failed to produce societally pervasive or medically-practical results. Data sets were limited and computers lacked the requisite computational / analytical power to handle complex data sets, thus diminishing the success of initial experiments. Early AI expert systems were attempted to encode the decisions of physicians into a set of rules that computers could execute (Schmidt-Erfurth et al., 2018b). This proved impractical however, given the complexity and contextual nature of medicine and variations in diseases (Ahuja, 2019). Therefore, these expert systems were replaced in the 1990s by machine learning where the logic was learned by algorithms directly from a set of examples instead of being manually encoded (Schmidt-Erfurth et al., 2018b). Furthermore, conversations on ethical AI guidelines generally did not proliferate until the later half of the 2010s, rendering this a relatively underdeveloped field of study (Casilli, 2022; Russell et al., 2015).

AI has become ever more prevalent today as computing power has rapidly increased due to the greater availability of Graphics Processor Units (GPUs) that allow for faster parallel processing as well as expansive compute resources on demand in the cloud. Big data is also well supported by practically infinite cloud storage (Ahuja, 2019). Additionally, learning algorithms became increasingly precise as they interacted with training data, yielding novel insights into diagnostics, treatment options, and patient outcomes (Bresnick, 2018). With the continued drive of leading-edge systems such as neural networks and deep learning, the possibilities of AI have exploded in the past decade (Pratt, 2018). As such, AI has begun to permeate many aspects of society. Yet the question now remains, how can we use AI to improve quality of life rather than reduce it?

AI offers a myriad of benefits to the healthcare industry such as decreased costs, increased accessibility, enhanced disease detection and treatment, etc. (Bresnick, 2016; Hsieh, 2017; Ahuja, 2019; Organisation for Economic Co-operation and Development, 2019b; Collier et

al., 2020; Insider Intelligence, 2023). The global market size for AI in healthcare was valued at USD 15.4 billion in 2022 and is expected to grow at an extraordinary Compound Annual Growth Rate (CAGR) of 37.5% from 2023 to 2030 (Grand View Research, 2022). Yet, current applications, investments, and academic research have demonstrated a bias towards high-resource contexts. Special consideration should be accorded to less-resourced contexts due to their unique circumstances, such as relatively under-developed infrastructure, weaker economic position, and digital immaturity, to enable the successful deployment of AI in these settings.

This digital disparity aggravates both inter- and intra-country inequalities (Chatterjee & Dethlefs, 2022; Dittoh et al., 2021). Annually there are significant financial costs associated with inequality and the instability it perpetuates, including (but not limited to) the need for greater spending on health and social services (Alvaredo et al., 2018). This is highly problematic as social inequality is expected to grow given the absence of conscious and substantial efforts to redistribute wealth and promote universal access to emerging technologies (Bushwick, 2023; McKinsey Global Institute, 2018a).

As the feasibility and potential applications of AI continue to broaden, so does the interest in the technology from both private and public companies. AI has been listed as a strategic priority for numerous companies (technology and otherwise) and governments. Microsoft has recently extended its multi-year multi-billion dollar investment into OpenAI (Microsoft, 2023). SAS has also committed a $1 billion investment over 3 years to fund AI research and development (Avidon, 2020). Even the Russian Direct Investment Fund raised $2 billion to support its domestic companies developing AI solutions (Moltzau, 2019). In addition to many large technology, analytics, and professional services firms developing think tanks to grow this area of understanding (European Parliament, 2023).

Billions of dollars are spent annually on AI research and development worldwide. Global spending is increasing 19.6% year-over-year to $432.8 billion in 2022 and expected to exceed $500 billion by 2023 (International Data Corporation, 2022). While interest is growing in various sectors across the globe, healthcare is one of the industries most likely to be affected (International Data Corporation, 2022).

Within healthcare, poor accessibility of diagnostics has been a pervasive issue. The inability for one country to successfully manage disease can quickly become a global concern. This is especially true given increased globalization and microbial unification of the world caused by

massive increases in worldwide movement of people / animals / goods, rapidly growing population density, and uneven public health systems (Berlinguer, 1999; Kennett, 2008; Long, 2011); making public health a shared international responsibility.

"*Without timely accurate diagnostics, medicine is largely blind. This has major socio-economic impacts as it leads to poorer outcomes for patients and their families*" (Bagcchi, 2021, para. 15). Inline with this, the World Health Organization (WHO) published an Essential Diagnostics List (EDL) to recognize the importance of diagnostics as numerous global health priorities (including universal health coverage, antimicrobial resistance, and global health security) each require better access to diagnostic services (Lancet, 2021; World Health Organization, 2021c). Additionally, the COVID-19 pandemic has significantly raised awareness of the crucial importance of diagnostics (Kaikkonen, 2021). The combination of these factors and significant informatics and technology innovations in the past decade will likely heighten the political will to accelerate change (Lancet, 2021).

To better inform this political discourse, this report focuses on analyzing the use and impact of AI in healthcare in both high-resource and low-resource environments in order to identify gaps and opportunities within IGO policy. The inspiration for this research project was conceptualized over seven years of work experience in Management Consulting, during which the lead researcher worked globally on digital transformation projects with large technology companies such as Google, Microsoft, and Workday. This experience prompted observations on the commonalities, differences, and recurring themes between projects. The result is a report that offers an additional perspective on macro-policy development which originates from a mixed business and technology background and is founded in real-world implementations. Although some may find this review critical of current organizational structures, it is important to emphasize that this report has been developed out of a reverence for the tremendous potential of AI and the evolving role of IGOs in a modern context. Furthermore, most of the themes discussed in this report transcend AI (and more specifically, Artificial Narrow Intelligence (ANI) which will be the focus of this report) and may be relevant to other technologies being used to improve quality of life and help alleviate poverty[3].

[3] M-PESA's is a strong case study in the banking sector, healthcare examples include HelloDoctor, Peek Vision, and Vula Mobile (Rouganne, 2018). These examples involve other types of technologies beyond AI, yet indicate the potential for emerging technologies to solve challenging and pervasive problems in low-resource contexts.

1.4 Problem Formulation

While the advent of emerging technologies has led to significant benefits (and expected future benefits) to society including applications in healthcare, security, economic stimulation, etc., these advantages have been unevenly distributed, predominantly favoring high-resource contexts. Conversely, many lower-resource contexts have thus far realized marginal benefits (if any) associated with AI; although this technology has the potential to yield substantial benefits for these regions.

1.5 Research Questions

Based on the above, the following research questions were identified. Of which, the research approach, corresponding case studies, and method of analysis have been strategically chosen in this regard.

- What lessons learned can be derived from early implementations of diagnostic systems enabled by ANI?
- How have economic, political, and social factors hindered progress and adaptation of ANI in diagnostics, primarily in low-resource settings?
- What frameworks, policies, and / or technology principles can be proposed to enable low-resource regions to better benefit from ANI?

1.6 Research Objectives

Although it can be argued that emerging technologies have thus far contributed to widening the wealth and technology gap between low-resource and high-resource regions, it is hypothesized that this can be mitigated through a better understanding of this phenomenon and careful management / implementation moving forward. Through policy updates and thoughtful implementation, this report aims to enable more successful ANI diagnostic projects in low-resource locations, whereby emerging technologies such as ANI have a tremendous potential impact. This research will highlight key themes based on real-world projects and will cross-reference these with current policy recommendations in order to highlight any gaps or areas for further optimization. With that broader context in mind, please see the following subsection for specificities related to this report including key definitions and the scope of research.

1.7 Criteria and Definitions

Prior to the in-depth literature review, methodology, and results portions of this report, it is constructive to consider the terminology being used in this research and the corresponding implications. Key definitions are discussed below, whereas other definitions that are helpful yet less consequential to the foundations of this research have been included within footnotes throughout this report.

As previously established, this report considers the impact and implications of ANI use in the context of global diagnostics. The broader umbrella term of "AI" frequently serves as a comprehensive nomenclature and refers to the combination of ANI and *Artificial General Intelligence* (AGI)[4] and represents a merger of their similar / interdependent themes. "AI" is a term commonly used in colloquial language (e.g. in news articles or popular science magazines) when discussing current usage and future potential of the technology, yet as of writing this report the vast majority of current "AI" implementations include only ANI rather than AGI or a combination thereof. Therefore a source may still be included in this research even if it does not specifically state ANI[5]. The definition of ANI as it relates to this report is described below:

Artificial Narrow Intelligence (ANI)[6]
a type of AI in which a learning algorithm is created to perform a single function (i.e. any knowledge acquired through this activity will not be applied to other activities) (Dataconomy, 2022). The implication of which is that it is designed to successfully complete a single activity without the need for human interference or assistance. Although it is used in many industries, there are clear applications for the technology in the healthcare field. ANI is an umbrella term for a number of specific solutions related to medical diagnostics, such as expert systems, image and signal processing, machine / deep learning, fuzzy logic systems, and natural language processing.

[4] Artificial General Intelligence (also referred to as Strong AI or Full AI) enables a computer program to understand or learn intellectual tasks that a human can perform, resulting in computer programmes potentially having sentience, self-awareness, or even consciousness (Thamm, 2021).
[5] Although all sources that specify "AGI" exclusively have been excluded.
[6] It is also commonly referred to as *Narrow Intelligence* or *Weak AI*.

Note: The definition of this term has been left intentionally broad in order to capture the many uses of ANI in diagnostics. Due to the systems-level analysis used in this report, small variances in different ANI systems are inconsequential to the broader research outcomes.

Additionally, this paper focuses on the implications of ANI implementations in order to establish research conclusions based on real-world usage. Therefore, it is prudent to qualify what potential forms of ANI implementation this includes:

Implementation of ANI-Enabled Diagnostic System(s)
refers to either: 1. an integration of an ANI-enabled diagnostic system into current diagnostic (or supportive) services / processes; 2. a redesign of current processes or systems to accommodate an ANI-enabled diagnostic system or; 3. the creation of new services / processes using ANI-enabled diagnostic services.

Therefore, applications of ANI that satisfy one or more of the abovementioned implementation approaches are considered in this report. The outcomes of which have certain ethical implications. Although there is a lack of well-specified definitions of what constitutes an ethical AI system, there are vague yet generally accepted principles of ethical AI as defined by IGOs such as the United Nations Educational, Scientific and Cultural Organization (UNESCO) as described below.

Ethical AI (AGI + ANI)[7]
the adherence to fundamental values, including such things as individual rights, privacy, non-discrimination, and non-manipulation, which specifically include the following principles: 1. proportionality and do no harm - AI systems should not go beyond what is necessary to achieve a legitimate aim;

[7] Based on this definition, it is important to note that the ethical evaluation of an ANI system may be related to (but is generally independent of) the legal requirements of ANI systems within a certain country.

2. safety and security - unwanted harms and security risks should be avoided;
3. right to privacy and data protection - privacy must be protected and promoted throughout the AI lifecycle;
4. multi-stakeholder and adaptive governance and collaboration - international law and national sovereignty should be respected in the use of data;
5. responsibility and accountability - AI systems should be auditable and traceable;
6. transparency and explainability - the ethical deployment of AI systems depends on their transparency & explainability;
7. human oversight and determination - AI systems should not displace ultimate human responsibility and accountability;
8. sustainability - AI technologies should be assessed against their impacts on constantly evolving goals (such as Sustainable Development Goals (SDGs) as defined by the United Nations (UN));
9. awareness and literacy - public understanding of AI and data should be promoted through open & accessible education, civic engagement, digital skills and AI ethics training, media & information literacy and;
10. fairness and non-discrimination - AI actors should promote social justice, fairness, and non-discrimination (United Nations Educational, Scientific and Cultural Organization, 2022).

Of which, the evaluation of whether the practical meaning, utility, and efficacy of these criteria (and other similar criteria) are sufficient in managing global AI ethical concerns are the main premise of this report. As such, researchers propose an extended AI ethics definition which subscribes to this aim.

Ethical AI (extended)

11. organizations that have a broader ability to promote more actionable ethical AI solutions (such as IGOs) can and should be obligated to do so;
12. IGOs have a moral obligation to consider the fixed-resource model associated with their member states and the implications this has on how the organization delivers outputs and communications;
13. IGOs have a duty to reassess their scope, project delivery-model, and associated impacts in order to ensure they are a) delivering a strong value proposition to their

member states and b) acknowledging their unique role in global coordination in a modern digital context.

This definition will serve as the foundation for the discourse included within this report; most notably, the closing framework and associated actionable insights.

Relating to the case studies, dissimilar cases were selected in order to draw broad yet meaningful research conclusions. Through using a comparative case study approach, data points were compared across three general categories (economic indicators, health indicators, and technology indicators) between the three case study countries. This broad categorization was selected in order to mitigate any limitations associated with individual measures (e.g. the inadequacy / inaccuracy associated with solely using Gross Domestic Product (GDP) to measure a country's economic performance), whereby the aggregation of these metrics is intended to operate in a mutually reinforcing manner; giving an overall view of the state of these systems. The implication of this categorization and case study comparison is that when something is described as "high-resource", "low-resource", "robust", etc. it is a *relative* not *absolute* measurement based on the above metrics / criteria.

For instance, a comparative assessment of the Cameroonian health system in relation to the Canadian counterpart indicates discernible quantitative disparities such as fewer doctors per hundred thousand citizens, longer wait times, fewer available diagnostic tools, higher costs (relative to median income), etc. suggesting a comparatively less robust health system. In this assessment it is important to emphasize however, that researchers are not suggesting that Cameroon is absent of elements or regions that can be considered "high-resource" or "robust". Or conversely, if you asked a Canadian healthcare professional "*would you benefit from more resources?*" the answer would not be "*yes, absolutely!*". Yet for the purposes of this research, it is pertinent to take a comparative or relative interpretation of results that align to global parameters of healthcare, such as those defined by the WHO (World Health Organization, 2023a). Please see below for the official definition of (relative) low-resource contexts that is used throughout the case study selection and analysis.

Low-Resource Context[8]
is characterized by a lack of funds to cover healthcare costs (either on an individual or societal basis), leading to one or more of the following conditions: • limited access to medication, equipment, supplies, devices; • less-developed infrastructure (electrical power, transportation, controlled environment / buildings, etc.), which results in an inability to count on electric grid, batteries, or dedicated devices[9]; • fewer or less-trained personnel; • equipment that is relatively high-cost compared to personnel[10]; • limited access to maintenance and parts; • limited availability of equipment, supplies, and medication; • proper disposal facilities (e.g. incineration) are not always available; • level of regulation / enforcement varies significantly by region; • patients that are potentially far (in terms of travel time) from care facility[11]; • less education about health in general, but often a lot about specific risks (University of Washington, 2014).

Conversely for the purposes of this research, "high-resource" contexts are generally characterized by resource availability at opposite end of the spectrum. Due to the country-level analysis conducted in this report, a country may be considered generally high- or low-resource although there may be significant variance / distribution of resources within that country.

Lastly, it is judicious to clarify the semantic meaning of health and health inequality within the scope of this research. There are many different definitions of health, however this research aims to consider the broader context of health systems in order to understand reasons for differences in health status across populations. Therefore, this research follows a broad definition of health systems to consider the full continuum between public health (population-based services) and medical care (delivered to individual patients). The health of

[8] Depending on the source, these contexts may also be referred to as 'resource-poor' (with the converse scenario being 'resource-rich') within this field of study. For consistency, this report will refer to it as low-resource (with the opposite scenario being referred to as high-resource).
[9] However, this may be mitigated via the use of cell phones.
[10] Which results in equipment being replaced less frequently.
[11] Which may result in low rates of follow-up care.

a population depends on not only clinical medicine but other public health services and policies as well to safeguard a population against health risks and injury (Institute of Medicine, 2011; National Research Council (US) et al., 2013). Particularly in a world with growing chronic health conditions (World Health Organization, 2023c), there is mounting evidence to suggest that suitable care requires better integration of professions and institutions to enable patients to manage their conditions, and that healthcare systems built on "*an acute, episodic model of care are ill equipped to meet the longer-term and fluctuating needs of people with chronic illnesses*" (National Research Council (US) et al., 2013, chapter 4, para. 1). Therefore in the context of this report, the overarching objectives of these systems are delineated as follows:

Public Health Goals
the aim of preventing disease, promoting health, and prolonging life among the population as a whole via the following objectives: • assessing and monitoring the health of communities and populations in order to identify health problems and priorities; • ensuring that all populations have access to cost-effective and appropriate care, which includes health promotion and disease prevention services; • conducting strategic planning and decision making to formulate public policies designed to solve local and national health problems and priorities (Marks et al., 2011).

These definitions and classifications are limited to the scope of this research and any extrapolations of the definitions or research conclusions to other high- or low-resource contexts should include a significant review of localizations and other specificities to ensure sufficient relevance.

With this conceptualization in mind, the inclusion criteria for this research can be defined in two phases: 1) case study rationalization and 2) case study analysis. The former is discussed in depth in section 3.3 Case Study Rationalization, whereby a percentile comparison was completed on economic, health, and technology indicators for three case study locations. The inclusion criteria for the latter includes 1) systematic online searches for publicly available reports, data sets, and news articles by international research organizations, IGOs, national / regional governments, large technology companies, local startups / accelerators, and

healthcare facilities and 2) systematic searches on PubMed and SpringerLink, Wiley, and Google Scholar for academic and peer-reviewed literature. Whereby the following keywords were used: "*artificial intelligence*", "*digital health policy*", "*diagnostics*", "digital diagnostics", "*AI* diagnostics", "*health inequality*", "*low-resource*", "*health gaps*", "*emerging technologies in healthcare*", and "*healthcare startups*" as related to the specific case study locations. Additional keywords include "*global diagnostic trends*", "*global health gaps*", "*AI in global health*", "*AI in developing countries*", "*digital health in developing countries*", and "*intergovernmental organizations*" in order to capture data sources that have information including (but not limited to) the case studies discussed in this report. Whereby the case study locations are either specifically mentioned by name or by which like-characteristics / categorizations are described (e.g. "developing / developed countries", "high-income / middle-income / low-income countries", "rich / poor nations", "established / emerging economies", "Global North / South", "African", "Sub-Saharan Africa", "Pan-African", "BRICS", "WHO member [states]", "UN member [states]", "UNESCO member [states]", "OECD member [states]", etc.).

Video and written testimonials from relevant stakeholders were also considered in addition to conference material that satisfied the following acceptance criteria:

The individual / group:

- *has previous experience implementing health, technology, and / or policy projects;*

OR

- *is a recipient of these services and can reasonably determine project efficacy;*

AND

- *has previous experience in one or more of the case study locations;*

AND

- *has previous experience whereby they can reasonably be considered knowledgeable in their field*[12].

[12] For subject matter experts this criteria was based on validated work experience (including years of experience and job title) and for recipients of these services, the criteria was more malleable as it was based on their own experience. However, in general, it was based on a

Despite the inherent implication of broadness and subjectivity in exploratory research, the aforementioned definitions and criteria were used to provide structure and a means of academic transparency. Each of the applicable sources have been cited throughout this report where relevant.

1.8 Scope of the Study

This study aims to explore the impact of ANI on growing social, health, and technological inequalities. The research involved a thematic analysis of three case study locations each emblematic of a distinct resource paradigm: a high-, low-, and dichotomous resource environment. The study also assessed associated intergovernmental policy gaps and areas of under optimization in order to provide suggestions for future recommendations. The origins and nuances of these themes will be further elucidated below.

The aforementioned research questions presuppose key social, political, economical, technological, and geographical factors related to this research. This section will elaborate on the applied meanings of these terms and the implications of these on research outcomes[13]. Although many components contribute to global social inequality, such as social differentiation, social stratification, and social distributions of wealth / income / power / status, this research focuses specifically on healthcare due to its reinforcing social and economic outcomes (Little, 2022). Within healthcare, there are typically three subsections of care:

- **Diagnostics -** the process, practices, and / or techniques by which medical professionals can identify the nature of an illness, disease, injury, etc. by examination of the symptoms (Oxford Languages, 2022a).
- **Treatment -** the medical care given to a patient to treat and / or manage an illness, disease, or injury (Oxford Languages, 2022b).
- **Prevention (or preventative health) -** the use of proactive health screenings, counseling, and / or maintenance to detect and prevent future illness and treatment (George Washington University, 2021).

subjective assessment of whether the individual had sufficient interactions (including duration of participation and number of touchpoints) to provide a value judgment.

[13] Although attempts have been made to speak categorically, there is often overlapping influence and relevance between these factors. Therefore, some will be discussed in combination with each other. Elaborations of these factors can be found in section 3.3 Case Study Rationalization.

Of which, diagnostics was identified as a key hinge-point for healthcare and the focus of this report for the following reasons:

1. its relative upstream position in the patient journey and operational processes (Bagcchi, 2021);
2. its compelling impact on the patient experience and patient health outcome(s) (Balogh et al., 2015);
3. the degree to which it can reduce the operational costs for a healthcare facility (World Health Organization, 2021c);
4. its suitability for disruption via ANI (and other emerging technologies) (Kumar et al., 2023);
5. its increased temporal relevance due to the COVID-19 pandemic (World Health Organization, 2021c).

In order to maximize the impact of research outcomes, this dissertation focuses on diagnostics due to its causal relationship and downstream implications for the other above-mentioned areas of care. Accurate and quality diagnostics is a critical prerequisite to the development and implementation of effective treatment and prevention strategies (World Health Organization, 2021c). "*Most health conditions could be prevented or treated with early diagnosis, while weak diagnostic capacity increased rates of hospitalization and deaths and contributed to antimicrobial resistance, one of the biggest threats to global health*" (Bagcchi, 2021, para. 19). That is to say, without accurate and timely diagnostics, treatment or prevention of an illness / disease can be extremely difficult (or potentially impossible) and becomes increasingly resource-intensive.

The impact of (in)effective diagnostics on the patient experience / patient health outcomes is also quite compelling. Instances of diagnostic errors, inaccuracies, or delays are observed ubiquitously across various care settings, whereby the majority of people will experience at least one diagnostic error in their lifetime (Balogh et al., 2015). The outcomes of which can be nil / minor or it can have devastating consequences (Balogh et al., 2015; Kaikkonen, 2021). Diagnostic errors may prevent or delay appropriate treatment, provide redundant or harmful treatment, or result in psychological or financial repercussions (Balogh et al., 2015; World Health Organization, 2021c). As such, groups of Subject Matter Experts (SMEs) such as the Committee on Diagnostic Error in Health Care state that "*improving the diagnostic*

process is not only possible, but also represents a moral, professional, and public health imperative" (Balogh et al., 2015, para. 1).

Furthermore, the escalative nature of most health systems implies that improving diagnostics is one of the most operationally and financially efficient ways to improve health services. "*In all countries, the use of appropriate diagnostic tests can help inform evidence-based treatment and responsible use of medicines, resulting in improved allocation of resources and better health outcomes*" (World Health Organization, 2021c, para. 5). An early and accurate diagnosis can save the health system a significant amount of time and money, in addition to giving the patient the highest likelihood of a positive outcome. Thereby making it a logical point of focus from an impact-minded perspective.

Diagnostics assumes particular notability in the context of communicable disease control, wherein early and accurate diagnosis plays a pivotal role in mitigating the potential for exponential disease transmission, as exemplified by the case of COVID-19 (World Health Organization, 2021c). The pandemic instigated unprecedented changes to the diagnostic industry, prompting further investment and reflection on industry strengths and weaknesses (Das & Dunbar, 2022). One component of this pertains to the prospective role of emerging technologies such as ANI in facilitating more accessible and cost-effective diagnostic capabilities (Kumar et al., 2023).

In order to establish an understanding of the interactions between ANI and diagnostic systems, it is prudent to first outline the overarching categories of diagnostic modalities:

1. cellular and chemical analysis (i.e. blood analysis, gastric fluid analysis, kidney function test, liver function test, pap smear, pregnancy test, etc.);
2. diagnostic imaging (i.e. brain scanning, ultrasound, magnetic resonance imaging, prenatal testing, echocardiography, etc.);
3. genetic testing (i.e. complementation test, preimplantation genetic diagnosis, etc.);
4. measurement (i.e. electrocardiography, pulmonary function test, semen analysis, lumbar puncture, etc.);
5. physical and visual examination (i.e. cardiac catheterization, biopsy, colposcopy, laparoscopy, nasopharyngolaryngoscopy, palpation, etc.) (Encyclopaedia Britannica, 2016).

"*Diagnostic tests range from blood, tissue, or urine-based tests, to diagnostic imaging such as x-rays, ultrasound, MRI*[14] *and CT*[15] *scans. Lack of access to such tests inevitably leads to poorer access to healthcare and timely treatment*" (Bagcchi, 2021, para. 12). Although medical scans and image processing is a large component of diagnostics, in reality there are much broader forms which must be considered and the tools and resources required to conduct a successful diagnosis vary substantially depending on the patient and their health concern(s). Deriving a timely and accurate diagnosis is becoming increasingly dependent on integrating diverse clinical, imaging, and molecular profile data (Holzinger et al., 2019).

As such, this report does not limit the role of ANI in diagnostics to scanning solutions. It may also include some degree of analytical, automated, or communicative ANI solutions combined with some degree of human collaboration[16]. The order and degree of tech-human collaboration is dependent on the type of diagnostic process and the available resources. Additionally, some diagnostic processes can be relatively conclusive after one scan (e.g. a compound or oblique fracture) whereas more ambiguous diseases (e.g. Lyme Disease) may require a series of tests and monitoring in order to get an accurate understanding of the patient's health (i.e. regular longitudinal testing, monitoring via wearable technologies, etc.). In the latter situation, medical tests analysis, automated patient scheduling systems, and wearables may be considered enablers.

The actual diagnosis and overall patient experience may require numerous steps, tools, and touchpoints to enable a successful diagnosis. Only considering image processing for instance, without better understanding supporting or complementary tools and processes (i.e. Human Health Resources (HHR) to administer or read tests, scheduling / communication / coordination with the patient, systems to analyze tests, etc.) would lead to an incomplete understanding of these processes. Therefore various examples of ANI-enabled diagnostic processes (and complementary technologies) can be observed throughout the analysis used in this report in order to complete the high-level assessment of ANI's viability, impact, and risk

[14] Magnetic Resonance Imaging (MRI).
[15] Computerized Tomography (CT).
[16] An example is health recommender systems (suggestive machine learning systems) that can be used as a diagnostic tool in combination with human medical personnel (Calero Valdez et al., 2016; Tran et al., 2021).

in various contexts[17]. The final research outcomes are at such a high level of assessment that they are universal to the variations mentioned here.

From a technology standpoint, this research will focus specifically on ANI due to it being further along in its maturation cycle compared to its counterpart AGI, thus having greater relevance in the near future. Specific types of ANI used in diagnostics include the following[18]:

- Expert systems
- Image and signal processing
- Machine / deep learning
- Fuzzy logic systems
- Natural language processing

Additionally, this research considers the prevalence of the below complementary technologies due to the enhanced scale and effectiveness of diagnostic solutions when paired with ANI:

- Electronic medical records (EMRs)
- Cloud computing
- Mobile health
- Internet of Things (IoT)

All projects included in this research included some type of (typically multiple) complementary technology(ies). There were no found examples where ANI was used in isolation. The combination and degree of dependence / integration of complementary technology(ies) varied depending on the specific context and project goals.

[17] Each of the abovementioned functions and types of diagnostics listed above were represented in the research albeit to varying degrees. Due to the biases in academic research and real-world applications of medicine, there are currently more examples and empirical evidence in high-resource settings as compared to low-resource settings (Wahl et al., 2018). This was mitigated through investigating past successful and unsuccessful projects of comparable technologies, analyzing the associated lessons learned, and future wishlists for ANI projects in low-resource regions.

[18] In addition to automated planning and scheduling to facilitate coordination with the patient.

In order to coalesce instances of ANI-enabled diagnostics and its cumulative potential impact on broader health and social trends, this research considers a macro-perspective and associated metal-level analysis. Therefore, distinct use cases are used to better understand implementations of ANI in high- and low-resource contexts and the associated project outcomes / implications[19]. Due to the goal of strong external validity, case study locations with significant outlying characteristics (i.e. economic, political, social, etc.) were excluded, as they would require a separate, more specialized academic focus[20]. Research conclusions have been designed primarily for use by IGOs, although national governments may also find research outcomes relevant and insightful. Due to the macro-nature of this research, there may be discordant relevance depending on the implementation context. Therefore an evaluation of applicability to that specific context is suggested prior to any policy implementation.

Relating to policy, this research paper focuses on the early stages of intergovernmental policy development. Although there are current policy recommendations related to the ethics of AI (created by international organizations such as WHO, UNESCO, The Lancet, etc.) the relative newness of this subject matter suggests that there is still incomplete data on the impact and effectiveness of these recommendations. Therefore this research focuses primarily on the first three stages of policy development as outlined in Figure 1. Namely, establishing an understanding of how global health trends are impacted by emerging technologies (Stage 1: Problem Identification), cross-referencing these trends with current policy suggestions (Stage 2: Policy Analysis), and offering a forward-looking perspective on how intergovernmental policy can better support this (Stage 3: Strategy and Policy Development). The other phases of the policy development lifecycle are out of scope for this research. Yet further analysis, refinement, and prognostication of the recommendations outlined in this report is highly encouraged.

[19] The logic for the case study selection will be discussed in detail in chapter 3 Methodology. For the purposes of this report, researchers have considered international, national, and regional trends within and between the three case study locations (Canada, Cameroon, and South Africa).
[20] The criteria for this was two-fold: 1) elimination of locations with economic, political, or social characteristics that were substantially unique to their sub-region or socioeconomic context (e.g. for the sake of external validity, Canada was selected as one of the case study locations in lieu of a country such as the United States as it shares similarities to other high-resource contexts and 2) assertion from data and / or SMEs that the selected case studies had similarities / relevance to other locations (Marchildon, 2018). This will be discussed further in section 3.3 Case Study Rationalization.

Figure 1. Strategy and Policy Development (Centers for Disease Control and Prevention, 2021a).

This research topic involves a number of confounding factors, such as social inequality, health systems, and scalable technologies. The nomenclature and definitions stated above have been established to indicate the data sourcing and selection that has been used in this report. However, that does not imply an innate lack of relevance to other comparable systems. Much of the principles described in this report are not limited to ANI and can be applied to any intelligent system that has the ability to gather, analyze, and respond to the data it collects. Outcomes of this research may still be relevant to broader systems and trends outside of what has been studied in this report. Any related content will be outlined in detail in section 4.3 Suggestions for Further Research.

1.9 Limitations

Global health in a digitized world is a complex biological, social, statistical, and technological topic with some universal generalities but also many localized specificities. This complexity unequivocally makes this topic difficult to study and understand comprehensively. Accordingly, this report represents a well-intentioned effort to balance the perspectives of multiple research fields, including the applied sciences, computer sciences, and social sciences; because ultimately, a productive and ethical digital implementation requires a strong understanding of each.

Although the selected research methodology is generally accepted as an appropriate method for researching real-world phenomena and ambiguities (Yin, 2014), this approach also has associated limitations. At a high-level, this includes:

1. Complexities and confounding variables associated with such a nuanced and complex area of research, leading to difficulties delineating scope and determining relevancies.
2. Over-determinacy and maintaining objectivity during the conceptualization process.
3. Data quality, type, and source associated with newer areas of research.
4. The risk of redundancy associated with such a rapidly evolving topic.
5. Temporal / contextual constraints (such as access restrictions and logistics-related challenges during the COVID-19 pandemic).

Unfortunately points one to three represent a natural consequence of this area of study (Yin, 2014). Macro-level social science research is often afflicted by the challenges associated with complex, multiple determinants of social phenomena and the associated risks of inaccurate / incomplete inferences being drawn from a few cases in which there are likely a number of factors as play (George, 2003; George & Bennett, 2005; Long, 2011). The nature of this subject matter involves numerous variables and interacting phenomena, which makes it challenging to draw conclusions with a high degree of certainty.

In order to mitigate the impact of these limitations on research conclusions, this report draws on a variety of different data types and sources. Multiple data sources and an iterative / transparent analysis process are used throughout this report to increase the construct validity and reduce the risk of over-determinacy. In addition, careful case study selection was used in order to understand and conceptualize the dynamics of health, wealth, and technology in different contexts. For controlled comparison and reduction of selection bias, case studies with significant and quantifiable variance (namely economic, health, and technology criteria) were selected. Furthermore, mitigation of these limitations is seen through scope-related transparency and clarity on what this paper is and what this paper is not. Namely this paper represents an additional meta-level perspective based on systematic research methods in an exploratory and rapidly evolving field of research, rather than a comprehensive and stagnant understanding of ethical AI policy.

The newness of this field implies that early real-world implementations are imperfect, messy, and experimental in nature as affirmed by industry experts listed in Appendix C and from secondary research involving global experts (Thevapalan, 2021). With statistics suggesting

that the vast majority of implementations are not just imperfect, they fail altogether (Forth et al., 2020; McKinsey Global Institute, 2018b; Landay, 2023; Rogers 2016; Venture Beat, 2019). In order to draw meaningful conclusions from messy data, researchers have opted for a meta-level research approach to better understand widespread implementation challenges in order to suggest policy improvements to mitigate this trend.

Furthermore, research topics characterized by rapid change face additional data challenges, such as a lack of standardized data and research studies (Castellacci et al., 2005). Currently, the private sector has been leading ANI implementations as compared to academia or the public sector (Thevapalan, 2021; Vardi, 2023). As such, a significant amount of data sources used in this report are from digital experts / project observations derived from the private sector as these offer the most current real-world reflections of ANI use. With this, there is a potential risk of poor or biased data quality for two key reasons:

1. any outcomes or observations provided by SMEs have been derived by real-world experience as opposed to controlled academic experiments and;
2. potential bias via conscious / subconscious over or under emphasis of key phenomenon (e.g. inauthentic accounts of past projects to emphasize project successes or minimize project failures, exaggerating shortcomings of other stakeholders or competitors, etc.).

To mitigate the aforementioned risks, this report considers reflections from a wide variety of actors with varying backgrounds and levels of experience. Furthermore, this report seeks to provide clarity on its inherent positionality. Using real-world data can lead to weaknesses such as lower internal validity, lack of quality control surrounding data collection, and susceptibility to multiple sources of bias for comparing outcomes (Camm & Fox, 2018). However it offers the potential for greater external validity (Bhattacherjee, 2012); which is the admitted core priority for this research given the accelerating pace of AI usage globally and the need for greater AI ethics insights.

Although the enormous potential of AI likely increases the relevance and external appetite for this type of research, it may also contribute to a more expeditious risk of redundancy. In the time of developing this report, the global technology and health landscapes have evolved at an extreme pace bringing with it unprecedented risks, opportunities, and social implications[21].

[21] Including technologies such as OpenAI's ChatGPT, Google's Bard conversational AI service, broader ANI-enabled search features, etc. and associated discourse regarding the policy

To ensure the prolonged relevance of this report, the research questions and approach evolved throughout the research process out of pertinence and necessity in order to capture research outcomes that would still be insightful to the academic and commercial communities on a longer term basis. This can be observed within the high-level research outcomes that capture broader trends and are agnostic of specific instances (solutions, projects, companies, etc.) of ANI in healthcare.

Lastly, it is productive to consider the global health context in which this report was written. The research proposal for this report was submitted in November 2019, shortly before the onset of the COVID-19 pandemic. The original approach which can be seen in Appendix B, included in-person semi-structured interviews with healthcare workers, patients, digital experts, and policy makers with an intended data collection period of January 2021 to September 2021. However, the actual research approach (also shown in Appendix B) was adapted in response to the pandemic and the associated lockdown(s), border restrictions, quarantine periods, and additional considerations for the aforementioned groups. As such, in-person semi-structured interviews were regrettably removed from the research plan for three key reasons:

- **To protect the physical safety of researchers and participants -** it was determined that unnecessary physical exposure to interviewees violated the strict ethical standards at the Vienna University of Technology (Technische Universität Wien, 2007); particularly the obligation of researchers to select research approaches that minimizes harm to participants (World Economic Forum, 2018a). The original research approach included in-person visits to health centers (which represented "hotspots" during the pandemic) in the three cases study locations. With varied vaccination rates both within and between countries, the likelihood that researchers would become a "super spreader" offered an intolerable risk. Additionally, many health facilities implemented emergency policies restricting physical access to their facilities (Mathieu et al., 2020).
- **A focus shift of health and digital health workers -** although access to interview groups was confirmed in November 2019, all parties retracted and / or delayed their participation due to significant stressors on the healthcare system caused by the pandemic. The rapid need for new and redesigned processes to treat COVID-19

implications of these technologies and their expected impact to fundamental societal constructs such as employment, trust, and democracy (Byrne, 2023; del Castillo et al., 2021; Manheim & Kaplan, 2019; McCallum, 2023; OpenAI, 2022; Pichai, 2023).

patients, supply tests and vaccinations, monitor the ever-evolving crisis, manage the high turnover of health personnel, etc. resulted in the original approach no longer being a viable research plan.

- **Fallout after the pandemic -** the pandemic applied stressors on global health systems, which exacerbated pre-existing issues resulting in wide-spread stress and burnout amongst HHR and higher rates of leaving the industry even in high-resource locations (Lyon et al., 2020; Maunder et al., 2021).

Although consideration was given to delaying this research project until after the pandemic, this was deemed an unfavorable option as the critical need for this type of research seemed to outweigh the value of the original approach in comparison to the adjusted approach.

Susan Horton, Professor of Global Health Economics at the University of Waterloo, Canada stated that "*people worldwide are now more aware of the importance of testing, as a result of the pandemic*" and "*that advances such as point-of-care tests and digitalisation provide opportunities to bring diagnostics to currently underserved populations*" (Bagcchi, 2021, para. 17). So sardonically, the pandemic presented significant research challenges, but it also increased the global cognizance and inclination for this type of research. Furthermore, there was significant appetite for the outcomes of this research with requests made by PricewaterhouserCoopers (PwC), the United Nations Industrial Development Organization (UNIDO), and Microsoft to receive an overview of research conclusions with presentation(s) / workshop(s) related to key actionable outcomes to follow.

To minimize the impact of the above-mentioned access issues on research conclusions, researchers 1) pivoted the research questions 2) redesigned the research approach to include a systematic analysis of secondary data 3) added 30% more touchpoints with SMEs through the data collection, review, and analysis stages of research to validate the analysis logic and 4) added an additional research step that involved conducting SME interviews to provide a final sense check to ensure research conclusions were reasonable and valid.

These strategies endeavored to add sufficient triangulation and robustness to the research design based on best practice academic standards (Denzin, 2012). Of which, the research results indicate data saturation whereby recurring themes became increasingly present and repetitive throughout the data analysis process as described in Appendix D: Thematic Analysis. Key themes and research outcomes were then reviewed by SMEs to provide a sense check, which indicated general consensus and agreement amongst the experts. This,

combined with a robust research approach and transparent case study selection, suggests a high likelihood of replicability.

Despite potential criticism due to the aforementioned research limitations, this report offers an additional perspective on areas for further optimization in ANI policy. Looking forward, greater penetration of ANI will present more extensive opportunities for data observation and collection, which will likely improve the academic and commercial understandings of this topic. Therefore the outcomes of this research should be treated as a foundation for academic discourse, whereby any associated policy recommendations are continually revised as more data / examples of diagnostic ANI in low-resource locations are implemented in the (hopefully not so distant) future.

2 Literature Review

2.1 Conceptual Overview

When examining the relationship between social inequality and public health, prevailing research predominantly describes a causal association, with the former being posited as the independent variable and the latter as the dependent variable. This is seen in such research excerpts as "*most diseases in lower-income countries are caused by poverty*" (Stevens, 2004, p. 4), "*higher income was associated with greater longevity throughout the income distribution*" (Chetty et al., 2016, para. 5), "*the evidence for the effect of social inequality on population health and mortality is compelling*" (Moss, 1995, para. 1), and so on. Prior research tends to focus on looking at social inequality as the cause rather than the symptom of dichotomous public health. However based on real-world observations on modern digitally-enabled healthcare, this relationship may be more symbiotic than prior research suggests.

ANI has the potential to impact the power dynamic of this causal relationship due to its scalable nature and ability to offer more standardized, intelligent, and cost-effective solutions that increase accessibility to a larger group of patients and healthcare workers. Therefore, it is hypothesized that if properly implemented, managed, and governed, ANI use in diagnostics can potentially help counter the growing health gap between high-resource regions and

low-resource regions. However in order to achieve this, there are many challenges that need to be overcome.

Currently, the majority of ANI applications are being developed and implemented in high-resource contexts; typically developed, western countries (Chatterjee & Dethlefs, 2022; Wahl et al., 2018). Three key reasons for this include 1) access to funding 2) the ability to prioritize innovation and 3) generally less barriers to implement digitally-enabled healthcare processes (e.g. through adequate infrastructure, available workforce, etc.)[22] (Chatterjee & Dethlefs, 2022).

Although major international organizations such as the WHO, UNESCO, UNIDO, The Lancet, etc. have provided recommendations on safe, effective, and ethical strategies to implement AI, there are potential policy gaps and missed opportunities that should be addressed in order to manage and implement ANI projects in a safe and successful manner (Hallaert, 2020; Hunt, 1996; Lancet, 2021; United Nations Educational, Scientific and Cultural Organization, 2022; United Nations Industrial Development Organization, 2021). To analyze these gaps, this report considers real-world macro-trends and example projects within the selected case study locations in order to better understand the dynamics of implementing ANI projects in these regions. This "real-world" aspect is highly notable. Due to their nature, ethics policy recommendations tend to follow an idealistic point of view. However the essence of this research topic suggests that it is paramount that any research outcomes be applicable to real-world settings and all of the *messiness* that entails.

The rate of failure amongst digital transformation projects is unfortunately high in both high-resource and low-resource regions (Rogers, 2016; Venture Beat, 2019; Thevapalan, 2021). The situation is further complicated in low-resource settings whereby there are significant barriers and cost considerations impacting project success for ANI and other complementary technologies (Jawhari et al., 2016; Khan et al., 2022). Furthermore, the "cost" of failure is often higher in low-resource regions as these contexts typically have less disposable resources (e.g. financing, human resources, etc.) and that the potential health outcomes associated with ANI-enabled diagnostics are often much higher.

Research has shown that equal access to basic healthcare services, such as diagnostic care can help to reduce social inequality in a region (Buzeti et al., 2019; Ford et al., 2021). With ANI

[22] Although the combination and severity of each of these three items varies significantly depending on the location / specific context.

having tremendous potential to improve the quantity and quality of healthcare services offered (Davenport & Kalakota, 2019); thus making this a key priority for global policy makers and healthcare leaders.

2.2 Benefits of ANI in Healthcare

There are numerous potential benefits of emergent technologies including ANI, such as improved efficiency, productivity, communication, connectivity, transparency, and greater cost advantages (Makridakis, 2017). Many industries are anticipated to be impacted by ANI, however healthcare is particularly poised for disruption (Davenport & Kalakota, 2019).

Due to advances in computing power, learning algorithms, and the availability of large data sets (big data) sourced from medical records and wearable health monitors, ANI has increasing relevance in the major areas of healthcare (Ahuja, 2019; Collier et al., 2020; Healthcare Excellence Canada, 2020). The list below indicates examples of ANI used in healthcare, which are becoming increasingly integrated into healthcare processes:

- virtual health assistants;
- customer service chatbots;
- robot-assisted surgery;
- automated image diagnosis;
- automation of redundant healthcare tasks;

Along with systems designed to provide the following health processes / outcomes:

- targeted treatment;
- reduction of dosage errors;
- management of medical records;
- treatments of rare diseases;
- fraud detection (Bush, 2018; Davenport & Kalakota, 2019; Insider Intelligence, 2022).

Each of the aforementioned use cases for ANI in healthcare are either directly or indirectly involved in supporting medical diagnostics and are highly complementary in nature. Despite strong potential for process improvements, ANI systems can also directly improve patient health outcomes. ANI systems typically use deep learning technologies and programs that offer a more rapid reading and analysis of complex images, including those from CT scans

and MRIs (Davenport & Kalakota, 2019; Insider Intelligence, 2022; Schmidt-Erfurth et al., 2018a). These automated image diagnosis systems can offer improved performance to doctors, resulting in better diagnoses of diseases (Richens et al., 2020).

In addition, ANI can be used as a valuable tool in increasing the productivity of an individual health worker, which can help combat the shortage of radiologists and other medical professionals in hospitals (Ahuja, 2019). An example of this is the time savings and additional data generated during robot-assisted surgery. These technology-enabled solutions can help liberate the time, attention, and energy of specialized surgeons and the associated data and images generated from these surgeries can be used in future training and diagnostics[23] (Ahuja, 2019).

Another relevant example is AI-enabled diagnostics and its use in preventative healthcare. This involves predictive models that analyze patient data and activities and allow clinicians to intervene before medical crises occur. To facilitate this, Microsoft and PwC have collaborated with Open Source Imaging Consortium (OSIC) to create a shareable data repository with anonymous imaging data (Ramraj, 2022). Ultimately enabling medical professionals to make quicker, more accurate diagnoses[24].

The rise in available healthcare data and computing power has helped drive the development of new ANI applications that improve the efficiency and effectiveness of patient care, allowing medical professions to deliver higher quality services more rapidly and at a lower cost[25] (World Economic Forum, 2018b). So in addition to patient benefits such as reduced wait times, improved accuracy of diagnoses, more efficient healthcare processes, and improved communication and coordination between patients and healthcare providers, there are also substantial potential cost savings.

[23] To further expand on robot-assisted surgery, some hospitals use these tools during tasks such as open-heart surgery, that exceed human capabilities. In these cases, the surgeries that were assisted by AI-implemented robots resulted in lesser complications, comparatively lesser pain for the patients, and a faster recovery rate (Insider Intelligence, 2022; Humanitas University, 2022).

[24] Although the aforementioned project focuses on a rare lung disease, it is expected that the applications will broaden in the future. Numerous studies have predicted ANI to have a significant impact across many streams of patient care such as chronic disease management and clinical decision making, while including specialized fields such as radiology, pathology, ophthalmology, and cardiology (Bresnick, 2016; Hsieh, 2017; PricewaterhouseCoopers, 2017b). With greater penetration, the scale of impacts becomes self-reinforcing as more data is then integrated into new ANI tools.

[25] Yet despite the previously mentioned projected growth rate (37.5% CAGR) of AI use in healthcare, as a whole the healthcare industry has been historically slow to capitalize on the value of emerging technologies (Landi, 2018).

To give perspective on the scale of potential cost savings it is pertinent to understand that healthcare is consistently a significant area of spend for most governments (Organisation for Economic Co-operation and Development, 2019b). In recent years, the cost of healthcare has been rapidly outpacing economic growth for almost every country within the Organisation for Economic Co-operation and Development (OECD) and is expected to continue (Organisation for Economic Co-operation and Development, 2019b). Based on the latest data sets, the OECD stated that "*preliminary estimates for 2020 for a number of OECD countries all point to a significant increase in the ratio of health spending to GDP. This reflects both the extra health spending needed to combat COVID-19 and reductions in GDP caused by restrictions on economic activity. Based on the initial data, the average share of GDP allocated to health is estimated to have jumped from 8.8% in 2019 to 9.7% in 2020*" (Organisation for Economic Co-operation and Development, 2021b, p. 188).

Beyond the pandemic, healthcare costs are expected to continue to rise in many countries due to improved service price and intensity, population growth, population aging, disease prevalence / incidence, and other factors (World Health Organization, 2022b). ANI in particular, offers significant possible benefits in terms of providing more cost-effective medical services. Whereby, the use of ANI applications is projected to result in approximately $150 billion in saved healthcare costs annually by 2026 in the USA alone (Collier et al., 2020).

To dissect healthcare costs further, administrative tasks generally account for approximately 30% of overall healthcare costs (Insider Intelligence, 2022). Therefore, a relatively straight-forward automation-focused Machine Learning (ML) system could result in millions of dollars of cost savings over time. Yet, the potential benefits of ANI systems are not restricted to cost management; the potential for economic growth and competitive advantage are also significant points of consideration.

A global study by PwC indicates that AI has a $15.7 trillion potential contribution to the global economy by 2030 (PricewaterhouseCoopers, 2017a). However, the economic gains are expected to be severely unevenly distributed. The study suggested that the greatest economic gains from AI will be in China and North America with a 26% and 14.5% boost to GDP respectively (PricewaterhouseCoopers, 2017a). This is equivalent to a total of $10.7 trillion and accounts for almost 70% of the global economic impact (PricewaterhouseCoopers, 2017a). Furthermore, the potential value of ANI applications is even more significant when

you combine it with other complementary technologies such as EMRs and mobile health devices (Wahl et al., 2018).

Although generally positive, these benefits paint a problematic picture if they are severely unevenly distributed globally. When considering these benefits from a macro-perspective, high-resource contexts predominantly reap the benefits of AI whereas low-resource contexts disproportionately bear the risks (Chatterjee & Dethlefs, 2022; Eliaçık, 2022; Makridakis, 2017); whereby this asymmetry becomes a glaring threat to modern equality. Currently 83% of the world's population (approximately 6.74 billion people) live in developing countries with this number expected to grow over the next three decades (United Nations Conference on Trade and Development, 2022). Therefore any competitive advantages derived from increased process efficiencies, improved health outcomes, and cost savings are primarily benefiting those already in positions of relative health, wealth, and access to technology.

2.3 Bias in Application

This research topic was selected in order to offset the academic and commercial bias that has been observed in ANI literature and real-world ANI applications thus far. Despite the potential benefits of emerging technologies such as AI, the emergence of these scalable technologies have further complicated pervasive health and diagnostic disparities and emphasized the growing role of public health within international cooperation and national security (Feldbaum et al., 2006; Fidler, 2007; Lee, 2001; Price-Smith, 2002).

There has been long-standing prejudice in global health as indicated by the well-documented yet poorly solutioned concept of health disparities, which refers to differences and / or gaps in the quality of health and healthcare across racial, ethnic, and socio-economic groups (Riley, 2012; World Health Organization, 2003; World Health Organization, 2016b). This relates to population-specific differences in the presence of disease, health outcomes, and / or access to healthcare (Riley, 2012; World Health Organization. 2016b).

The cost of this bias in healthcare is severe. Racial health disparities are associated with an estimated $35 billion in excess healthcare expenditures annually, $10 billion in illness-related lost productivity, and nearly $200 billion in premature deaths (Ayanian, 2015). Conversely, the economic case for investment is strong. Investing in diagnostics (and healthcare in general) is a relatively efficient way to reduce social inequality as it impacts many other aspects of what makes a society unequal (such as education, infrastructure, etc.). The median

Benefit-Cost[26] exceeds one for five of the six priority conditions[27] in middle-income countries, and exceeds one for four of the six priority conditions in low-income countries (Lancet, 2021).

Yet despite diagnostics being a key component of quality healthcare, it is often under-recognised, leading to systemic underfunding and inadequate resourcing (Boehme & Pai, 2020). In general, people who are poor, marginalized, young, or less educated have the least access to diagnostics (Stevens, 2004). 47% of the global population has little to no access to diagnostics and only 19% of the population in developing countries have access to basic diagnostic tests for some of the most common diseases[28], which is exacerbated by a lack of trained staff and inequitable access to equipment (Lancet, 2021; World Bank, 2021e; World Health Organization, 2016a).

A reduction in the *Diagnostic Gap*[29] from between 35 and 62% to 10% for diabetes, hypertension, HIV, tuberculosis, and both syphilis and hepatitis B infection in pregnancy, could reduce premature deaths by 1.1 million each year in low- to middle-income countries (Lancet, 2021). Yet, despite recent digital innovations in diagnostics, investment in this area of medicine is lacking and new technologies are beyond reach for many countries (Bagcchi, 2021).

In July 2018 Brian Wahl from Johns Hopkins University published an article titled "*Artificial intelligence (AI) and global health: how can AI contribute to health in resource-poor settings?*" in which he discussed AI's ability to deliver a broad range of critical public services and its potential contributions to achieving SDGs through enhanced healthcare, decreased mortality rates, etc. As described by Wahl: "*little has been documented in the academic literature on AI applications for health in resource-poor settings*" (Wahl et al., 2018, p. 3). *"While there are now many AI applications that have been deployed in high-income country contexts, use in low-resource settings remains relatively nascent. With a*

[26] A Benefit-Cost (otherwise commonly referred to as a 'cost-benefit') analysis is a commonly used method to compare the costs and benefits of an intervention, with both figures being expressed in monetary units (Centers for Disease Control and Prevention, 2021b). A score greater than 1.0 indicates that a project is expected to deliver a positive net value.
[27] Priority conditions include: Diabetes, Hypertension, Human Immunodeficiency Virus (HIV), and Tuberculosis in the overall population, and Hepatitis B virus infection and Syphilis for pregnant women (Lancet, 2021).
[28] With the exception of HIV and malaria.
[29] The Diagnostic Gap refers to the proportion of the population with an undiagnosed disease or condition (Kale, 2002).

few notable exceptions, there are limited examples of AI being used in such settings" (Wahl et al., 2018, para. 1). Although the COVID-19 pandemic prompted a significant increase in digital health projects globally, these projects were not equally distributed across different health / economic contexts and many projects are still in their infancy, of which the long term outcomes have yet to be fully observed (Meskó, 2022).

The concentration of technology-enabled diagnostic tools and innovation is extreme. Just four companies (in North America and Europe) account for half of the global supply of in vitro diagnostics and a comparable number from North America, Europe, and Japan account for 75% of the global supply of imaging equipment (Fortune Business Insights, 2022; Grand View Research, 2020; Lancet, 2021; Statista, 2019).

During the empirical research review, researchers identified existing applications of ANI use (in diagnostics or supporting processes) of which, the vast majority of these exist in high-resource countries / environments. To give an indication of this, please see Figure 2 for a closer look at the market depth in one of the case study locations (Canada); of which the rationale for the case study selection will be discussed in section 3.3 Case Study Rationalization.

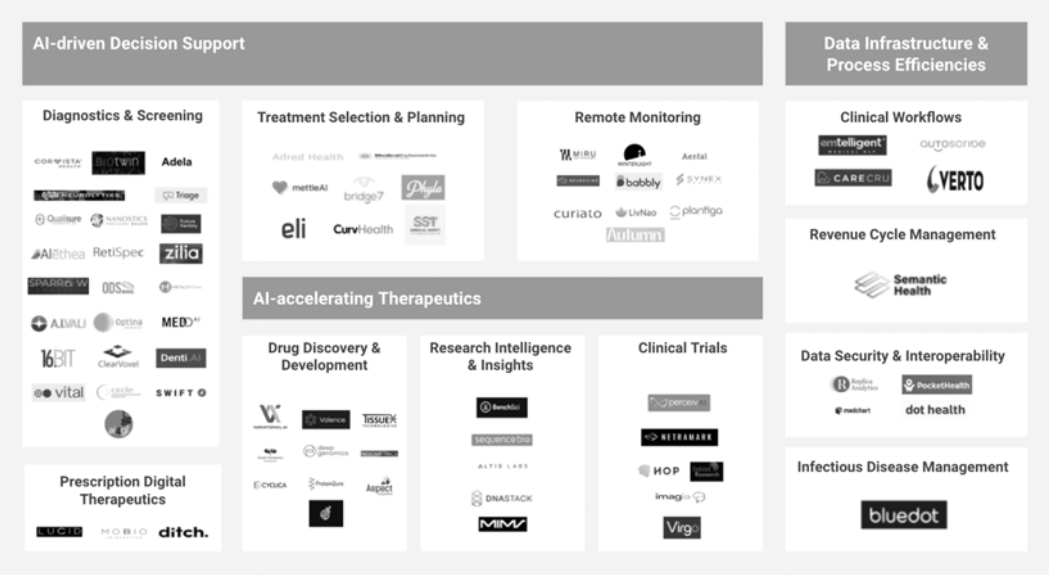

Figure 2. Canada's AI and Healthcare Market Map (Basu, 2022)[30].

Despite early applications of ANI in low-resource settings, there is still a great deal to be understood as transitioning from pilot to scalable solutions will require overcoming several

[30] Note: (1) This infographic is not exhaustive (2) Companies could belong to more than one category and in different categories (3) The map covers a combination of AI first and Applied AI companies.

challenges. The current bias in academic and commercial settings has been heavily influenced by the broader policy environment in which these technologies operate; thus providing the case for further academic study.

2.4 The Current Policy Environment

Now that the general context of ANI-enabled diagnostics in global health has been established, let us consider the policy context and associated gaps[31]. At a high-level, this includes a review of traditional public health policy and industrial policy (specifically digital industrial policy[32]) as it relates to the health sector for each of the case study locations (Columbia University, 2021; Dadush, 2016). To establish a comprehensive picture of the current policy environment, this section is divided into two parts:

- a review of the current state of global diagnostic policy trends not necessarily exclusively related to AI and;
- AI specific policy recommendations not necessarily exclusively related to diagnostics.

The former considers broad industry analysis from health-focused IGOs (e.g. WHO) and international research organizations, whereas the latter focuses on AI recommendations from other IGOs without an exclusively healthcare-focused mandate (e.g. UNESCO)[33].

Globally, an increasing number of national governments have developed policies and recommendations related to ANI-enabled diagnostics and the broader concept of digital health (Digital Health Canada, 2023; Lancet, 2021; Malachie, 2020; National Department of

[31] These gaps are pervasive in many areas of Computer-Supported Cooperative-Work (CSCW). Professor of Technology Design and Assessment and head of the Human Computer Interaction Group at the Vienna University of Technology, Geraldine Fitzpatrick, found that progress has been made in terms of understanding concepts related to CSCW solutions in healthcare, however research on the broader policy levels is incomplete (Fitzpatrick & Ellingsen, 2013). The study indicated that "*this presents a number of challenges for CSCW research moving forward: in having a greater impact on larger-scale health IT projects; broadening the scope of settings and perspectives that are studied; and reflecting on the relevance of the traditional methods in this field - namely workplace studies - to meet these challenges*" (Fitzpatrick & Ellingsen, 2013, p. 609).

[32] Historically, the broader area of industrial policy development was primarily focused on strengthening market competitiveness. However, modern interpretations have evolved to be more multi-purpose and mission-oriented and include a strong focus on innovation and technology dynamics; making it increasingly relevant to this topic of study (Aiginger & Rodrik, 2020; Mazzucato & Kattel, 2020; Coyle & Muhtar, 2021; Timmers, 2022).

[33] Each of these organizations has developed a series of recommendations, which represented a crucial point of analysis in this report. Depending on the source, this includes 10-138 recommendations, principles, and / or suggested laws and policies (Lancet, 2021; United Nations Educational, Scientific and Cultural Organization, 2022; World Health Organization, 2021d).

Health, 2020; United Nations Educational, Scientific and Cultural Organization, 2022; United Nations Industrial Development Organization, 2021; World Health Organization, 2021a; World Health Organization, 2021d). However, these policies are often inconsistent with a glaring under-representation of low-resource contexts (many in the Global South, including entire continents such as Africa) regarding AI ethics guidelines and recommendations (Casilli, 2022; Jobin et al., 2019).

Temporally, the implementation of national and local policies / regulations related to ANI-enabled healthcare continues to lag technology-related changes (Taylor et al., 2018). As such, many of the policy suggestions thus far have been reactionary in nature to what is being developed in the market (Singh, 2019; Taylor et al., 2018). This can lead to increased risk due to the sensitive nature of healthcare and health data whereby "*stringent technical safeguards and a strong regulatory and legal base to support enforcement of rules*" are critical in order to protect patients (Singh, 2020, p. 7).

This lack of proactivity and risk aversion to "getting it wrong" is then coupled with inconsistent definitions on what constitutes as an emerging technology; resulting in policies that despite being increasingly of interest, are "*set against a literature where no consensus has emerged as to what qualifies a technology to be emergent*" (Rotolo et al., 2016, p. 1827). This then significantly limits the utility of research and impairs strategic policy development and its ability to manage the directionality and outcomes of the technology (Rotolo et al., 2016).

Relating to macro-diagnostic trends, there is varied availability and accessibility globally (Lancet, 2021; Shiffman & Smith, 2007). This has resulted from a policy environment that that is heavily impacted by the "*power of the actors involved, the absence of diagnostics from national health strategy plans, the detrimental effect of under-regulation and over-regulation, the disadvantageous structure of the global diagnostics market (especially for [low and middle income countries]) and the effect of corruption*" (Lancet, 2021, p. 2011).

The Lancet's commission on diagnostics was conducted in the wake of the diagnostic crisis that was the COVID-19 pandemic. This study included an analysis on the current status of global diagnostics via six factors outlined by the WHO, including an analysis of health systems, the health workforce, health information systems, access to diagnostics, financing, and leadership / governance. Through this analysis of the policy environment, it was determined that the fundamental cause for the current situation is the low visibility and

prioritization of diagnostics, which is generally true on both national and international levels (Lancet, 2021). The commission states that "*diagnostics are not explicitly mentioned in proposals for universal health coverage and are largely missing from national strategic plans for health*" (Lancet, 2021, p. 1998). In cases where diagnostics is mentioned, such as in the National Action Plans for Health Security (NAPHS), it focuses specifically on epidemic infectious diseases rather than the broader category of diagnostics (Lancet, 2021; World Health Organization, 2022a). The lack of comprehensive policies in diagnostics represents a significant gap, which has the potential to exacerbate existing inequalities[34].

In response to these broader trends, IGOs such as UNESCO and the WHO developed a series of recommendations on the ethics of AI (among other recommendations that are outside the scope of this research). Of which, the WHO recommendations are specific to healthcare, with the UNESCO recommendations being more industry agnostic in nature. To get a sense of the nature of these recommendations, an excerpt from UNESCO's recommendations[35] on the ethics of AI is indicated below.

- Regarding fairness and non-discrimination: "*AI actors should promote social justice and safeguard fairness and non-discrimination of any kind in compliance with international law. This implies an inclusive approach to ensuring that the benefits of AI technologies are available and accessible to all, taking into consideration the specific needs of different age groups, cultural systems, different language groups, persons with disabilities, girls and women, and disadvantaged, marginalized and*

[34] Additionally, there are other key issues that are heavily related to the specific context, namely: corruption, data availability, and the presence of suitable infrastructure. Corruption tends to heavily impact health systems because resources tend to be inefficiently allocated; although it has a particularly strong impact on diagnostics due to the need for expensive equipment and supplies (Bruckner, 2019; Killelea, 2021). Data is typically scarce and incomplete, particularly in low- to middle-income countries (Lancet, 2021; World Health Organization, 2021b). Additionally physical infrastructure is insufficient or non-existent in these environments, resulting in weak services with variable / inadequate quality (Lancet, 2021).

Sequential to barriers such as corruption and poor technical and physical infrastructure are issues such as widely insufficient support capabilities (e.g. management and procurement systems, technical support, information technology, and supply chains) (Lancet, 2021; World Health Organization, 2021a). There is a global crisis of HHR, with an estimated shortfall of around 840,000 diagnostics staff, whereby the existing levels of education and training are so insufficient they cannot even maintain current levels (Lancet, 2021). Additionally, quality and safety mechanisms for standards are often scarce for low- to middle-income countries.

[35] Please note that these recommendations only pertain to UNESCO member-states and do not extend to countries not within the UN, despite excluded countries still contributing to global health gaps.

vulnerable people or people in vulnerable situations" (United Nations Educational, Scientific and Cultural Organization, 2022, p. 20).

- Additionally, the report includes international recommendations stating that "*the most technologically advanced countries have a responsibility of solidarity with the least advanced to ensure that the benefits of AI technologies are shared such that access to and participation in the AI system life cycle for the latter contributes to a fairer world order with regard to information, communication, culture, education, research and socio-economic and political stability*" (United Nations Educational, Scientific and Cultural Organization, 2022, p. 20)

Although the rationale for current policy and ethics recommendations is generally sound, it should be noted that the majority of ethical recommendations outlined in this report are self-reportedly idealistic and cannibalistic in nature (Munn & Prem, 2022; United Nations Educational, Scientific and Cultural Organization, 2022). This is represented in the quote "*while all the values and principles outlined below are desirable per se, in any practical contexts, there may be tensions between these values and principles. In any given situation, a contextual assessment will be necessary to manage potential tensions, taking into account the principle of proportionality and in compliance with human rights and fundamental freedoms*" (United Nations Educational, Scientific and Cultural Organization, 2022, p. 18).

Based on this, some global experts have called into question the effectiveness of IGOs in suggesting and enforcing policies, especially during periods of significant change (Hallaert, 2020). As indicated by the global data sources referenced throughout this report, IGOs and national governments have had limited and / or inconsistent success in reducing the growth of health gaps over the past decades. The explosion of scalable technologies provides a further strain on these systems. Thus, potentially offering new opportunities to rethink international policy to increase its efficacy in a rapidly changing world. Accordingly, this asymmetry in digital application / adoption and mixed historical response to diagnostic biases undermines the concept of modern equality, which suggests the need for further research in order to capitalize on the benefits of AI as a society in a fair and safe manner.

2.5 Literature Gap

"There clearly is a massive gap between the real-world impacts of computing research and the positivity with which we in the computing community tend to view our work.

We believe that this gap represents a serious and embarrassing intellectual lapse. The scale of this lapse is truly tremendous: it is analogous to the medical community only writing about the benefits of a given treatment and completely ignoring the side effects, no matter how serious they are" (Hecht et al., 2018, para. 5).

The aforementioned lack of studies on ANI-enabled diagnostic projects, particularly in low-resource locations represents a significant need for further research. Conjointly underexplored is an understanding of how ANI projects manifest in real-world settings compared to current policy recommendations on ANI and any gaps or under optimizations this may produce.

This unmet need for non-partisan research results in significant underutilization of emerging technologies and heightened risks for vulnerable populations. "*Many health system hurdles in such [resource-poor] settings could be overcome with the use of AI and other complementary emerging technologies. Further research and investments in the development of AI tools tailored to resource-poor settings will accelerate realizing of the full potential of AI for improving global health"* (Wahl et al., 2018, p. 1). If properly implemented, ANI could be a tool used to decrease the healthcare component of social inequality, due to reinforcing concepts such as greater accessibility of services and transparency of data (Davenport & Kalakota, 2019).

However, for ANI to be successfully implemented in low-resource settings, it is important to consider and address the many nuances associated with these contexts, such as relative digital immaturity, limited access to reliable data sets, and / or the relatively low priority of innovation in favor of more immediate concerns. Without sufficient academic research on this topic, there is a substantial risk for 1) further growth of health disparities and / or 2) significant damage to low-resource populations through exploitation of resources (e.g. data, cobalt, etc.), privacy breaches, mass job loss through automation, or nefarious use of AI by other countries (e.g. through biowarfare or autonomous weapons and a potential AI arms race) (Franco, 2020; Lee, 2020).

Prominent political scientist Geraldine de Bastion stated "*there is widespread concern that data exploitation is the next wave of exploitation in Africa*" (de Bastion, 2022). Yet, although data exploitation in itself is a major threat, it is only one component of the broader notion of

Data Colonialism[36] in Africa (Elmi, 2020). Although data colonialism is a threat in most emerging markets, it is particularly prevalent in Africa due to its diverse cultural, racial, and linguistic diversity making Africa in essence "ground zero" for this threat (Elmi, 2020).

These literature gaps partially exist due to early technology innovations having historically been initiated by the private sector and then subsequently pervaded into academia and the public sector. This can be problematic as the unique and individual objectives of the private sector, public sector, and academia are somewhat at odds. Industry best practices such as *Lean Methodologies*[37] (leveraging sprints and scrum meetings) are the gold standard for many technology professionals (Lagas, 2020). Many of these specialists have been trained via the mantra "progress over perfection" whereby perfection is theorized as a moving target of which technology is meant to be continually iterative (Casey, 2021; Eyet, 2023; Gibbon, 2022; Lagas, 2020). Additionally, there are clear business objectives that result in corporations conducting or funding their own research (that is naturally prejudiced) or engaging in business practices to maximize revenue and minimize operational and financial waste. Yet, this can be highly problematic in vulnerable critical sectors such as healthcare.

Therefore when considering gaps in understanding, it is productive to consider commercial gaps in addition to literature gaps within academia. These gaps exist both through the relative lack of projects in low-resource environments but also with the lack of robust understanding for the broader implications of the projects that do currently exist.

Studies suggest that early implementations of AI (and other emerging technologies) have been arduous and venturesome in both high- and low-resource contexts. Experts estimate that as high as 87% of AI projects fail and never make it to production (Thevapalan, 2021). There are a variety of issues that contribute to this, such as leadership issues, data constraints, and a lack of defined scope (Venture Beat, 2019). Of the projects that make it to production, many still fail due to lack of adoption of digital tools, lack of engagement, poor onboarding processes, miscommunication, user and employee resistance to change, etc. (Bucy et al., 2016; Forbes Technology Council, 2021; Forth et al., 2020; Khairat et al., 2018; Kohli & Jha, 2018; Musen et al., 2014; Rogers, 2016; Wears & Berg, 2005; Yang et al., 2019).

[36] Data Colonialism refers to the control of data as a proxy for the control of people, of which 1) data extraction 2) monopolization and 3) monetization are the key components (Elmi, 2020).
[37] Lean Methodologies refers to continuous experimentation to achieve optimum value with lesser resources and less waste (Daniel, 2023).

As such, this increases the difficulty of conceptualization of this subject matter: attempting to capture real-world messiness of ANI-enabled healthcare implementations (that are currently sub-idealistic) into policy recommendations (which are currently idealistic in nature). "*What makes this worse is that we can't learn such frameworks through online courses or masters degrees. We can only learn these through experiences in the industry*" (Thevapalan, 2021, para. 28). Thus emphasizing the need for industry input and reduction of information silos between sectors.

Current international policy recommendations are in the process of being implemented by various countries and international organizations, with each recommendation having a unique timeline and road to fruition (United Nations Educational, Scientific and Cultural Organization, 2022; World Health Organization, 2021a; World Health Organization, 2021d; World Health Organization, 2023b). Yet, the highly interdependent nature of these policy recommendations creates concerns over the short-term implications and potential gaps which will be experienced in the meantime. Whereby the associated impacts of this have not been sufficiently studied, reported, and elucidated.

The macro-perspective provided in this report seeks to address the need for a better coordinated approach between academia, the public sector, and the private sector. Thus offering an additional cross-sectional perspective on this subject matter: robust academic research grounded in strong public sector industry experience via the use of private sector digital tools.

The specificities of this academic approach will be further elaborated on in the following section.

3 Methodology

3.1 Methods Overview

"*If the world is complex and messy, then at least some of the time we're going to have to give up on the simplicities. But one thing is sure: if we want to think about the messes of reality at all, then we're going to have to teach ourselves to think, to practice, to relate and to know in new ways*" (Law, 2004, p. 2).

When studying global challenges such as health disparities, it is prudent to follow a multifaceted approach in order to develop a strong understanding of the broader health, economic, and technological contexts between countries. A multi-case study approach with thematic analysis was selected in order to enable this breadth of understanding. Although there is a need to consider a localized perspective (via concepts such as *Appropriate Technology*[38] and *Culturally-Adapted Healthcare*[39]) when implementing digital health tools, specifics on these localizations vary across different regions and are beyond the scope of this research paper.

Before discussing the detailed approach, let us first consider the academic perspective embedded in this report as this perspective will help rationalize and contextualize the selected approach. In order to select an appropriate research approach, researchers first considered various ethical schools of thought in which to consider, specifically the spectrum between *Absolutism*[40] and *Relativism*[41]. This was done in an effort to understand the interactions between patient and public health goals and to rationalize the analysis criteria used in this report.

This ethical exercise comes with challenges due to a lack of a universal truth. For instance, those who prioritize population health goals over the health goals of the individual would typically lean towards an absolutist perspective. With the increasing interconnectedness of the world, the international community has many shared health goals and challenges, particularly in the case of diagnosing and managing the spread of communicable diseases (Decker et al., 2009). Naturally, this debate intensified during the recent COVID-19 pandemic when policy makers from around the world were challenged with developing and enforcing mandates related to vaccinations, masks, and restrictions of physical / geographic movements and if so, to what degree.

Those who strongly believe in an individual or culture's unique right to choose their health goals, treatments, etc., would likely opt for a relativist point of view. This school of thought suggests that standards of truth, rationability, and the ethics of "right" and "wrong" vary

[38] Appropriate Technology refers to the notion that modes of care should be appropriately adapted to a community's social, economic, and cultural development (World Health Organization, 1997).
[39] Culturally-Adapted Healthcare refers to the notion that care should be tailored to patients' norms, beliefs, values, language, and literacy skills (Hodge et al., 2010; Pottie et al., 2013).
[40] Absolutism describes the theory that ethical rules are the same everywhere (Rozuel, 2013).
[41] Relativism describes the theory that ethical rules are relative to the norms of one's culture (Rozuel, 2013).

substantially between cultures and historical time periods and that there are no universal criteria to adjudicate these differences (McDonald, 2010). Healthcare is highly personal: what is the appropriate course of treatment for Patient A may not be the same for Patient B and is highly dependent on the patient's perspective, demographic, cultural context, and overall health goals. To ignore this individual autonomy when conducting macro-level research would be ill-advised. Due to the omnipresence of both of these schools of thoughts when analyzing global health, the perspective of this research sits somewhere in the middle with a slight leaning towards absolutism as denoted in Figure 3.

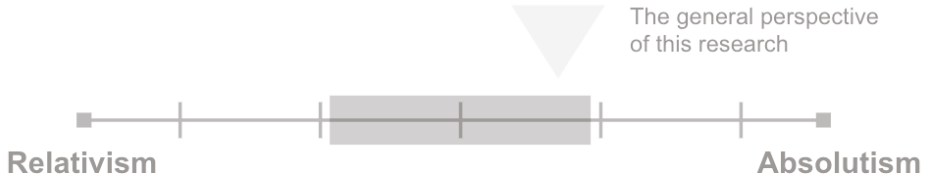

Figure 3. Relativism Versus Absolutism as it Applies to this Research Topic.

Therefore, a mixed methods approach was deemed appropriate to consider the unique health systems in the three case study locations, while also considering macro-level data such as social, economic, and health statistics. Although there may be criticism of this approach by groups or cultures which opt for a more extreme perspective (on either end of the spectrum), the selected research approach represents a genuine intention to balance shared global health goals, challenges, and trends with those that are unique within a region. Any data or expert opinions that fall outside of this range are considered outside of the scope of this report[42].

Accordingly this research falls under a *Constructionism Epistemology*[43], which enables it to accept the value of multiple data sources (McDonald, 2010). Typically, constructionists anchor their research with the assumption that there is no absolute truth and that the researcher's key role is to consider various claims of truth and understand how these manifest in everyday life (McDonald, 2010). More specifically, the research adheres to a subgroup of constructionism: social constructionism, which aims to conceptualize the social world and

[42] The inclusion criteria for this is based on data sources and SMEs that do not indicate extreme leanings (e.g. partisan research, reporting, or affiliations) and indicate general agreeance with the previously mentioned criteria and definitions.

[43] Constructionism Epistemology is an epistemological perspective commonly used in sociology studies and business research methods, which suggests that reality is a product of human intelligence interacting with experience in the real-world, thus making it socially and culturally constructed and somewhat subjective (Business Research Methodology, 2022).

views society as simultaneously existing as both a subjective and an objective reality[44] (Andrews, 2012). Therefore, the notion of "making sense of the social world" has been embedded into the research design by considering real-world data and observations as opposed to data derived from highly-controlled and sanitized academic observations / experiments. This is further bolstered through using thematic analysis, which although systematic, is semi-subjective in nature.

Using this lens, researchers began the *Conceptualization Process*[45]. Proper conceptualization was of significant importance to this subject matter due to the imprecision and ambiguity of many constructs in the social sciences (Bhattacherjee, 2012). This stage of research included specification of the key multidimensional constructs involved in this research topic on social inequality and the interaction with ANI-enabled diagnostics.

As a result of the conceptualization process, a case study design was selected as it is well-suited to understanding complex organizational processes that involve multiple participants and interacting sequences of events. There are two key strengths of case study research that are particularly relevant to this research topic:

1. its ability to derive richer, more contextualized, and more authentic interpretation of the phenomenon of interest than most other research methods by virtue of its ability to capture a wide array of contextual data and;

2. the phenomenon of interest can be studied from the perspectives of multiple participants and using multiple levels of analysis (Bhattacherjee, 2012).

Each of the above points are critical to this research topic as one could argue that the research questions may not be addressed in a holistic manner by using alternative research methods, such as experimental research designs, survey methodology, etc. (Stake, 2005).

Although there are numerous notable scholars within social science case study research, this report predominately aligns with Robert K. Yin due to his emphasis on theoretical development and the ability to derive inferences beyond the specific cases studied (Yin, 1989;

[44] Although it may be logical to consider other epistemological theories in different contexts, they are out of scope for this research paper.
[45] Conceptualization Process describes the intellectual process of developing a research idea into a realistic and appropriate research design so that it is researchable and defensible (Aurini et al., 2016).

Yin, 2002; Yin, 2014). Within this methodology, Yin suggests three possible types of case studies (Yin, 2014):

1. **Exploratory Case Studies -** which aim to explore situations in which the case(s) being evaluated have no clear or single set of outcomes.
2. **Descriptive Case Studies -** aims to describe the phenomenon within the context it occurred.
3. **Explanatory Case Studies -** used when seeking to explore causal links that are too complex for other research methodologies, such as survey or experimental strategies.

This report subscribes to the former: an exploratory case study approach. Furthermore, the aforementioned types of case studies can be considered within a single case study research design or multiple case study research design (also referred to as a comparative case study design). This report follows a multiple case study design due to its advantages in replication and to better understand the factors that allow for successful outcomes in one case, but potentially less successful outcomes in another (Yin, 2014). Thus highlighting differences, commonalities, and areas of potential synergy between samples.

Multi-case design also offers the benefit of the *"ability to discover a wide variety of social, cultural and political factors potentially related to the phenomenon of interest that may not be known in advance"* which is essential when looking at an exploratory field of research such as this (Bhattacherjee, 2012, p. 40). This methodology allows researchers to follow replication logic (as seen in Figure 4) and typical rules of scientific rigor similar to those used in *Positivist Research*[46] to enhance research conclusions (Yin, 2002).

[46] Positivist Research is an approach in sociology research that relies on empirical evidence (e.g. experiments and statistics) to indicate information about how society functions. Positivists believe researchers should approach research in an objective and logical way (similar to studies in the natural sciences) (Nickerson, 2022).

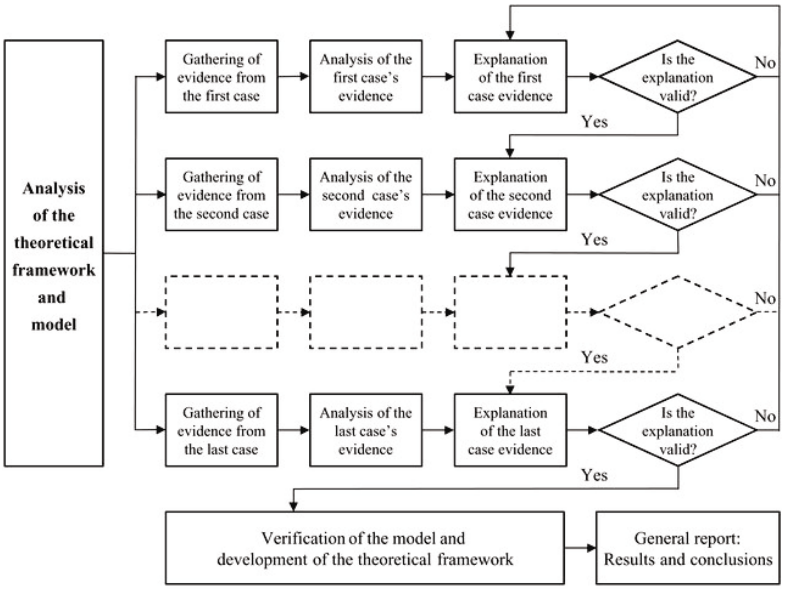

Figure 4. The Process of Replication Logic Used in this Report (Yin, 1989; Nieto & Pérez-Aguiar, 2000).

The use cases were strategically selected to offer a wide variety of subsets of stakeholders within a use case in order to increase the external validity of results. Additionally, each use case includes real-world examples of digital health implementations in various environments, which aims to broaden the generalizability of research outcomes[47].

Using a multiple case study approach allowed research outcomes to be reasonably academically robust yet still commercially relevant, while maintaining an acceptable degree of internal and external validity as seen in Figure 5.

[47] As compared to clinical laboratory experiments for instance, where "*artificially contrived treatments and strong control over extraneous variables render the findings less generalizable to real-world settings*" (Bhattacherjee, 2012, p. 36).

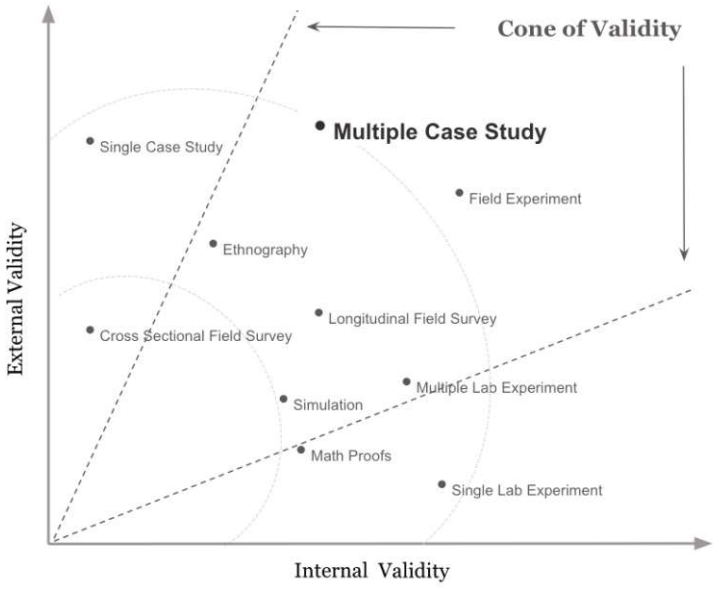

Figure 5. Internal and External Validity (Bhattacherjee, 2012).

Based on the scope of this research paper, the data points associated with each case study (approximately 110-140 data sources per use case[48]) were deemed sufficient to reach suggested levels of *Theoretical Sampling*[49] associated with qualitative research studies (Eisenhardt, 1989; Glaser & Strauss, 1967). However, there is tremendous potential to expand the case study list in the future to include other relevant countries in order to chase absolute degrees of *Theoretical Saturation*[50] within a rapidly evolving field of study.

[48] Please note, that a "data source" may contain information on one or more case studies. For instance, an in-depth report on country comparisons completed by a large data and research organization such as the World Intellectual Property Organization, World Population Review, World Bank, International Data Corporation, etc. would count as one "unique" data source that contributes data to all three case studies. These data sources vary in scope, depth, and specificity so the quantity of sources recorded for each case study country is not necessarily indicative of the depth of research for each location. Additionally, although a data source may include information on one or more case studies, the information may not be equally weighted (e.g. it may include a study conducted in Cameroon which is discussed in the context of other African countries, such as South Africa. Within the context of counting data sources per use case, this scenario would count as a data source for both Cameroon and South Africa, despite its focus on Cameroon). Overall, approximately 175 *unique* data sources were used in the systematic analysis phase of research, which resulted in 110-140 data sources per use case.

[49] Theoretical Sampling refers to the process of data collection for generating theory whereby the analyst jointly collects, codes, and analyzes his / her data, and decides what data to collect next and where to find them in order to develop his / her theory as it emerges (Glaser & Strauss, 1967).

[50] Theoretical Saturation refers to the point in data collection when no additional issues or insights emerge from data and all relevant conceptual categories have been identified, explored, and exhausted (Glaser & Strauss, 1967).

Inline with best practices in social studies research, this research approach was designed to be highly iterative and collaborative with multiple rounds of collecting, consolidating, and analyzing data, which was then stress-tested by industry experts (the interview transcripts of which can be found in Appendix E) and then further iterated. For due diligence purposes, researchers complied with best practices in data collection and analysis techniques, such as providing transparency on data sources, data analysis, and clarity on shifts in approach / research focus[51] (Aguinis et al., 2019). To reduce potential ambiguity, a high-level overview of the research process can be seen in Figure 6.

Figure 6. Overview of the Research Approach.

Furthermore, it is pertinent to consider the role of the researcher in the data collection, analysis, and dissemination of research outcomes. In the social sciences, it is typically much more difficult to maintain total distance and objectivity from the object of study (Easterby-Smith et al., 2021). Although this level of closeness with a research problem can help enhance research conclusions, it is critical that it is managed in such a way that it does not impact the robustness of research conclusions. Therefore, researchers have attempted to strike a balance between a highly involved and a highly detached research design, as seen in Figure 7.

[51] Explanations on these topics are covered in sections 3.2 Data Sources, 3.3 Case Study Rationalization, 3.5 Data Analysis Overview, and 1.9 Limitations. Details on the case study selection and analysis process can be viewed in Appendix A: Case Study Selection - Percentile Calculation and Analysis and Appendix D: Thematic Analysis, respectively. Research results were sense checked by SMEs, a full list of which can be viewed in Appendix C: Overview of Subject Matter Experts with the interview transcripts captured in Appendix E: Subject Matter Expert Feedback and Framework Refinement. For further questions, please reach out to the lead researcher at leslie.walker@student.tuwien.ac.at.

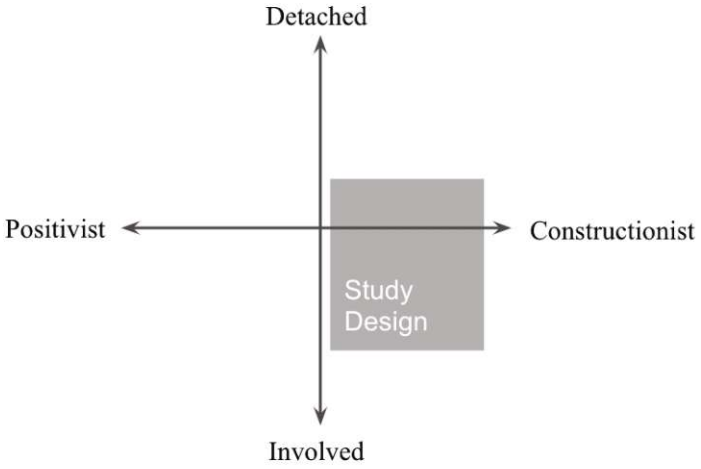

Figure 7. Epistemology and Research Style (Easterby-Smith et al., 2021).

However despite this attempted balance, it is important to clarify that research topics of this nature tend to lean towards an involved approach because of its connection to *Action Research*[52]. Action research is a research methodology that is particularly well-suited to researching the systems and phenomena associated with innovation and change as it assumes that social phenomena are continually changing rather than static and that researchers are often part of this change process itself (Easterby-Smith et al., 2021; Somekh, 2006). There are two key beliefs associated with action research that are particularly relevant to this research topic (Easterby-Smith et al., 2021):

1. The best way of learning about an organization or social system is through attempting to change it, and this therefore should be an objective of the action research.
2. The people most likely to be affected by, or involved in implementing, these changes should as far as possible become involved in the research process itself.

Due to the origins of the inspiration for this research project: years of observed patterns and biases of digital transformation projects globally, there is an inescapable degree of involvement between the lead researcher and the research process. This involvement offers both opportunities and challenges. Total detachment often presents challenges when implementing research conclusions, yet total involvement threatens objectivity of research conclusions. The latter has been mitigated by using multiple data sources and a collaborative

[52] Action Research describes a research methodology commonly applied in the social sciences with the aim of transformative change via the simultaneous process of taking action and conducting research, which are connected through critical reflection (McCormack & Dewing, 2012).

analytical approach. Additionally the desired outcomes of this research paper necessitate a slightly greater degree of involvement, that is: actionable insights that can be implemented on real-world projects within different policy contexts. Therefore, purely observational analysis would not be prudent to the research topic and the desired outcomes.

Lastly, for the sake of robust academic transparency (especially given the proximity and interest of this research topic in sectors outside of academia, namely the private sector), additional context on the funding of this research is required. Over the course of the approximately 3.5 years of research, this study was primarily self-funded by the lead researcher. The exception was during year two of the research process, where the lead researcher was successful in attaining Rotary International's Global Grant Scholarship valued at $30, 000 USD. This scholarship was aimed at fostering international cooperation related to disease prevention and treatment, of which this research was well-aligned. Although other potential sources of funding were made available, these were ultimately declined due to potential risk of biasing results.

3.2 Data Sources

Further expanding on the previously described research approach, this report follows a balanced perspective that includes both qualitative and quantitative types of data. The nature of this subject matter infers the value of considering both types of data, whereby using only one type would result in an elevated risk of failing to properly rationalize, conceptualize, and ultimately answer the research questions. Predominantly, phase 1 (case study selection) included quantitative data such as coefficients and indices (e.g. GINI coefficient, Health Index Score (HIS), etc.[53]), phase 2 (case study analysis) included qualitative data (e.g. data collection and thematic analysis), and phase 3 (validation of the research outcomes) also uses qualitative analysis through codified input from SMEs as seen in Figure 8.

[53] With these coefficients and indices, researchers performed a comparative analysis to 1) determine similarities and differences and 2) determine the variance between each category of data points. This was done in an effort to ensure that the case studies reasonably represented a broader generalizable context. The calculation of this percentile analysis can be viewed in Appendix A.

Figure 8. High-Level Research Analysis Approach.

This overall research approach was selected to satisfy the requirements of a compensatory research design, which aims to combine both qualitative and quantitative research to mitigate the weaknesses of each approach. A common criticism of qualitative studies is that they can be weak on generalization, whereas quantitative studies may be weak at explaining why the observed results have been obtained (Easterby-Smith et al., 2021). In terms of the research outcomes, quantitative research tends to generate "*factual, reliable outcome data that are usually generalizable to some larger populations, and qualitative research produces rich, detailed and valid process data based on the participant's, rather than the investigator's, perspectives and interpretations*" (Steckler et al., 1992, p. 1).

In order to strengthen research conclusions, triangulation was used to derive insights from different data sources to enhance construct validity (Denzin, 2012; Gibbert et al., 2008). These data sources[54] include:

- A robust and systematic review of secondary data sources:
    - Reports and data sets by IGOs, national, and regional governments;
    - Publicly available data published by relevant companies (e.g. large technology companies, local startups and accelerators, healthcare facilities, etc.) including blogs, newsletters, articles, etc.;
    - News articles by reputable[55] third parties regarding example projects and broader industry trends;
    - Relevant academic and peer-reviewed literature;
    - Video and written testimonials from applicable stakeholders;

[54] To clarify, the selected sample of literature is separate from chapter 2 Literature Review. The purpose of the literature review was to give an overview of the current context, whereas the goal of the data source selection is to better understand the interrelated concepts and uncover any related policy gaps and / or opportunities for improvement related to the research questions.
[55] In this case, "reputable" refers to recognized news agencies such as Harvard Business Review, BBC News, Scientific American, WIRED, etc. that have a history of standards, transparency, and reasonable news coverage.

    - Conferences (e.g. The International Technology Summit 2020 / 2021 / 2022, Ethics of AI in Africa hosted by UNESCO, etc.) and;
    - Workshop and lecture series content (e.g. The Digital Humanism Initiative by TU Wien Informatics, Gateway Centre of Excellence in Rural Health Research (Canada), etc.);
- Primary data derived from interviews, written, and oral inputs from SMEs[56].

In total, the sample of literature involved over 175 unique sources of data from the above-mentioned sources. The systematic review of secondary research within each of the selected case studies included a thorough analysis of archival research and existing literature on global reports from organizations such as UNIDO, WHO, World Economic Forum (WEF), etc. as well as publicly available secondary data from relevant technology and health services facilities. In addition to the main academic institutions on social inequality, healthcare, and AI, this study also considered insights (research, thought leadership, data sets, etc.) from leading innovation firms and accelerators, such as Google, Microsoft, PwC, and Creative Destruction Lab (CDL).

Regarding nuances related to data quality and quantity, the newness of this field implies that researchers cannot yet draw on mass amounts of previous data as compared to more idealistic research scenarios where extensive data sets are readily available. In the case of low data quantity (primarily related to ANI-enabled diagnostic implementations in low-resource environments), researchers studied prior technologies that share similarities to ANI. To ensure the comparisons made are appropriate, researchers considered comparative technologies based on two different types of factors: factors intrinsically related to the technology and extrinsic factors that either helped or hindered the implementation and / or adoption of the technology. The recency of the comparative technology was also considered to reduce the risk of temporal changes in the environments (political, social, economic, etc.) in each of the case studies. This was done so that any comparison made was as similar as possible to the environment in which ANI operates today.

To determine reasonable comparative technologies, intrinsic factors related to ANI were considered to deduce prior technology(ies) that share similar characteristics. As ANI has not yet reached full expected market penetration, researchers considered the *potential* innovation

[56] An overview of the SMEs can be found in Appendix C: Overview of Subject Matter Experts, with additional interview transcript materials in Appendix E: Subject Matter Expert Feedback and Framework Refinement.

of different technologies, rather than how much innovation has already occurred. In general, there are two key determinants to consider in order to evaluate a technology's potential; that is, how far and how fast a technology can advance over time. This includes:

1) the barrier to entry for a single developer to create something useful and;
2) whether development on the core platform is centralized or decentralized (Allen, 2017).

Typically, technologies that have 1) a low barrier of entry for single developers and 2) decentralized development are the most likely to permeate the market relatively quickly and have the greatest potential for future impact, whether that be in the form of opportunities or risk (Allen, 2017; Berrio et al., 2020; Rip, 2015). Conversely, technologies that have a high barrier of entry for individual developers and a centralized core platform are most likely to have slower dispersion of the technology and potentially slower market penetration. Technologies that have a low barrier of entry for single developers, such as mobile apps, may have a high potential scale of impact but a restricted likelihood of potential impact because this impact is highly dependent on the decisions made by the company(ies) that own this development and may be at the mercy of market consolidations, regulations, and (in)conducive business decision making. For an overview of the four possible quadrants please see Figure 9 below.

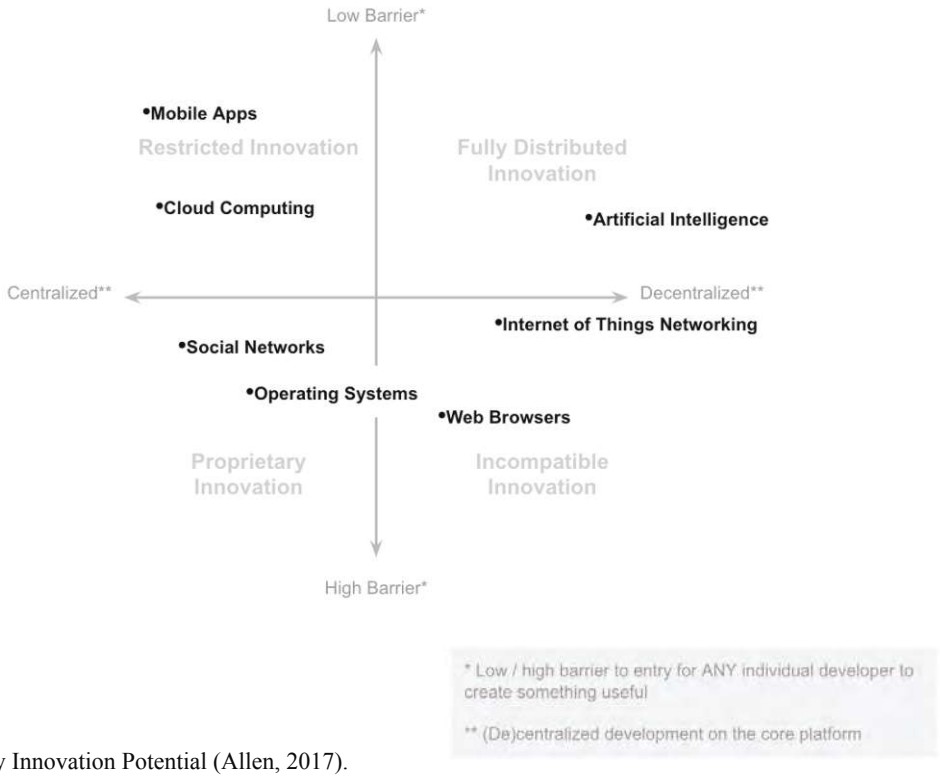

Figure 9. Technology Innovation Potential (Allen, 2017).

As indicated by the diagram, AI is well poised for potential innovation and technological advancement. However, we can also make inferences from lessons learned from IoT implementations for example. IoT and ANI are complementary systems in a sequential process, where IoT generates mass amounts of Patient-Generated Data (PGD) and ANI systems can help analyze the data. As such, many ANI-enabled digital health projects include some type of IoT data (e.g. wearables, patient monitoring, patient-reported outcomes, etc.) (Thakare et al., 2022). Additionally, they have comparable and sometimes overlapping requirements (e.g. connectivity, data quality, governance requirements, etc.). Most importantly, they can be used together for a shared intended outcome: improving the quality of service through improved diagnostic improvements, process efficiencies, enhancements in patient experience, etc. at a very low cost compared to traditional resource models (Pattanayak, 2020). As such, in situations where there is limited data on ANI-enabled diagnostic projects, researchers also consider the use, impact, and implications of IoT in the various case study environments in order to bolster the data set and derive valuable conclusions relevant to the research questions.

Although the above constitutes the actual approach and corresponding data sources used in this report, it is meaningful to note that this represents a deviation from the original research approach and associated data sources. The original research approach was to equally use two methods of data collection: in person semi-structured interviews and document review in order to satisfy triangulation and robustness requirements of the research design (Denzin, 2012). Interviewees were to include special interest groups, ANI project teams, end users (such as healthcare patients and recipients of ANI health services), industry experts, government officials, and policy makers. As mentioned, this process redesign was required as the intended logistics and access to interview groups were no longer feasible during the COVID-19 pandemic.

3.3 Case Study Rationalization

In order to address the research questions and test theories / examine generalizability of inferences between ANI-enabled diagnostics in low-resource regions compared to high-resource settings, this report follows generally accepted criteria for case study selection. This asserts that each case study must be 1) appropriate and 2) adequate (Gentles et al., 2015; Kuzel, 1992). Whereby appropriateness relates to whether each case study is a strong fit to the purpose of research and the phenomenon of inquiry and adequacy focuses on the quantity

(e.g. the number of selected case studies, the quantity of data associated with each case study, etc.) (Kuzel, 1999; Miles & Huberman, 1994; Patton, 1990). Although there may be other relevant countries of interest, researchers ultimately selected and eliminated countries based on alignment with this criteria. This process was conducted in multiple rounds using generally accepted purposeful sampling strategies. Ultimately, a combination strategy was selected with leanings towards intensity, maximum variation, critical, and opportunistic sampling approaches as indicated in Table 1.

Table 1. Purposeful Sampling Strategies and Their Operational Definitions (Patton, 1990, pp. 182-183).

Types of purposeful sampling strategies	Definition of the sampling strategy
Extreme case	The case demonstrates unusual manifestation of the phenomenon, such as outstanding success and notable failures.
Intensity case	The case is information rich but not an extreme case.
Maximum variation	Cases, despite having diverse variations, exhibit important common patterns that cut across variations.
Homogeneous	Variation between cases is minimized, analysis is simplified and study is focused.
Typical case	Case illustrates what is typical, normal or average.
Stratified purposeful case	Case illustrates characteristics of a particular subgroup to facilitate comparison and not for generalization or representation.
Critical case	Case that permits logical generalization to other cases because if it is true to this one case, it's likely to be true to all other cases.
Snowball	Cases of interest from people who know people who know people who know cases, rich information rich, good examples for study, etc.
Criterion	Cases picked because they meet some predetermined criterion.
Theoretical	The cases are manifestation of a theoretical construct and are used to examine and elaborate on it.
Confirming and disconfirming	Cases that elaborate on initial analysis to seek exceptions or test variations.
Opportunistic	Cases that emerge from following leads during field work.
Random purposeful	Cases are randomly selected from a large sample for the purpose of increasing credibility and not for generalization or representation.
Politically important case	Cases are selected or eliminated because they are politically sensitive cases.
Convenience	Cases are selected on the basis of minimum effort, time and money. They are candidate examples of low credibility, information rich cases.
Combination	**Cases are flexible and meet different interests and needs.**

Case studies were selected in order to test the early hypothesis: that there are common opportunities and challenges associated with ANI implementation across different contexts, however low-resource regions are at greater risk of not being able to capitalize on the opportunities and also face greater challenges in terms of barriers and risks, but that these can be mitigated through thoughtful regulation and implementation strategies. To test this hypothesis, researchers selected dissimilar case studies to increase variance in observations (Yin, 2009). The case studies were identified using *Theoretical Sampling*[57] as opposed to *Random Sampling*[58] and include:

- **Case Study 1 - (High-Resource) Canada -** (Relative) Social Equality and Robust Health Systems
- **Case Study 2 - (Low-Resource) Cameroon -** (Relative) Social Inequality and Weak Health Systems
- **Case Study 3 - (Dichotomous) South Africa -** Significant National Inequality and Dichotomous Health Systems

From each of the case studies, three key subject areas were considered: health system indicators, economic indicators, technology / innovation indicators, and the combination thereof due to their interrelatedness. These categorizations are discussed in further detail below.

1. ***Health System***[59] **Indicators** – this research included a high-level overview of the current state and trends of the health systems in the three selected case study locations, including a broad understanding of available health facilities, HHR, and the overall ability to serve patients. The assessment of the healthcare sector in each country was based on generally accepted criteria for evaluating health systems such as: access to care, care processes, administrative efficiency, equity, and patient outcomes (Papanicolas & Smith, 2013). This review primarily involved quantitative data via global indices such as the HIS and Healthcare Access and Quality Index

[57] Theoretical Sampling describes the process of data collection that is dynamic in nature, whereby the researcher seeks additional data based on concepts developed from initial data analysis. This method involves following early insights to expand and refine the evolving theory as it emerges (Glaser & Strauss, 2012).
[58] Random Sampling refers to a probability sample where every possibility has an equal and independent probability of being selected in the sample (Setia, 2016).
[59] Health System(s) are the organization of people, institutions, and resources designed to deliver healthcare services to meet the needs of target populations (Wickramasinghe, 2016).

(HAQI)[60]. These indices consider data points such as the number of trained workers per 1000 citizens, available Personal Protective Equipment (PPE), and public health indicators (e.g. crude death rate, life expectancy, infant mortality, maternal mortality, etc.) (Our World in Data, 2015; World Bank, 2019; World Population Review, 2023a)[61].

2. **Economic Indicators** – this perspective provides insight on inequality from an income standpoint, primarily focusing on the economic size / income of a country (e.g. GDP and the percentage of GDP spent on healthcare) and the associated distribution of this income (e.g. GINI coefficient). It is important to note that although income inequality is a major component of social inequality, it is not the only component. Therefore, when discussing social inequality, factors such as access to basic health services are also considered; which represents an overlap with the former point. Additionally, governance plays a major role in the fair and efficient allocation of healthcare dollars and the enforcement of policies.
3. **Technology / Innovation Indicators** – this category considers the prevalence of adequate technology and innovation enablers required to successfully implement ANI-enabled diagnostic processes, including the presence of complementary technologies and necessary health equipment / infrastructure. It also considers broader measures such as National Innovation Strategies (NIS) / systems and AI strategies, as well as the state of infrastructure that is required to deliver ANI-enabled health services (e.g. connectivity).

Even though this report focuses specifically on ANI-enabled diagnostics, a high-level understanding of the various country contexts was critical in order to understand the broader health and social contexts of the case study locations. Additionally, because healthcare facilities operate under a limited-resource model, shortages in one department often have direct impacts on other departments. Topically, this notion became increasingly relevant during the COVID-19 pandemic and the associated shortages of health resources such as

[60] Please note, that although this research focuses specifically on diagnostics, it is important to get a broader understanding of the health system in which the diagnostic systems operate due to the limited-resource model associated with most healthcare facilities. The ability to provide diagnostic services is systemic in nature, requiring significant upstream, downstream, and supporting processes to facilitate this.

[61] The basis for these measurements is further elaborated on in section 3.4 Detailed Case Study Review.

HHR and PPE, resulting in severe increases in hospital and diagnostic wait times (Fraser Institute, 2022; Organisation for Economic Cooperation and Development, 2022).

In order to account for the different types of comparative data from these three categories (e.g. index scores versus total GDP dollar amounts versus inverse[62] metrics, etc.), this analysis used percentile calculations to compare the respective data points of the three case study locations across seven key categories[63]. Each metric was strategically chosen based on 1) relevance to the subject matter and 2) availability / sufficiency of comparative data points (e.g. countries). The acceptance criteria used to determine the sufficiency of data points for use in the percentile calculations was that each data set was to a) include a minimum of 100 data points from b) at least five continents in order to enhance the external validity of research results.

The intention of this process is to use percentiles to help contextualize the three case studies in order to rationalize the case study selection and indicate a sufficient variance between case studies. Figure 10 demonstrates an overview of the percentile comparisons for each of the three case study locations under the respective categories.

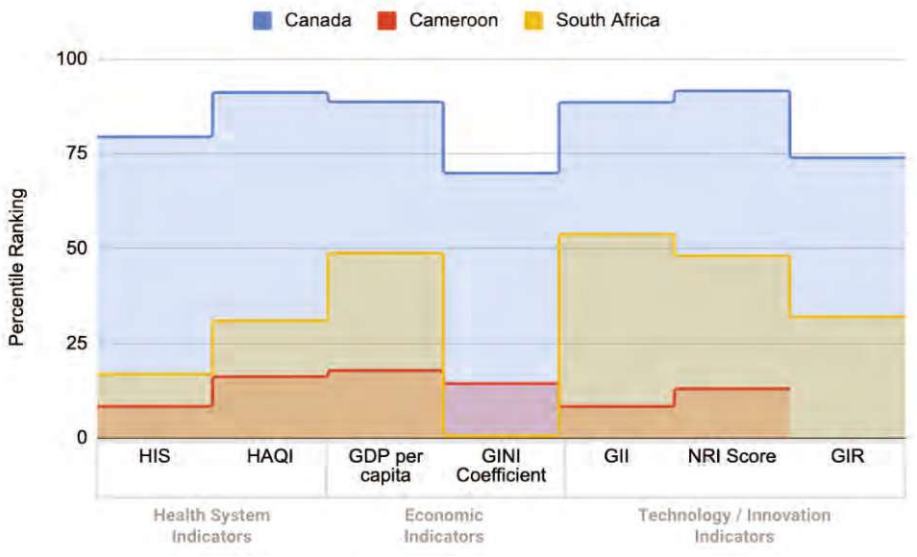

Figure 10. Case Study Selection: Percentile Comparison Across Relevant Metrics (Our World in Data, 2015; Statista, 2022a; Statista, 2022b; World Bank, 2021b; World Bank, 2021c; World Economic Forum, 2021; World Intellectual Property Organization, 2022; World Population Review, 2023b)[64].

[62] When analyzing multi-country indices, a higher score typically denotes a more positive scenario (e.g. HIS, HAQI, NIS, etc.). However the GINI coefficient represents the reverse, whereby a highly equal country has a low score and a highly unequal country has a high score.

[63] The seven categories are: Health System Indicators (HIS, HAQI), Economic Indicators (GDP per capita, GINI Coefficient), and Technology Indicators (Global Innovation Index (GII), Network Readiness Index (NRI) Score, and Global Infrastructure Ranking (GIR)).

[64] Overview of the metrics used in Figure 10:

As indicated by the above graphic, Canada typically sits in a relatively favorable position across all three categories. Conversely, Cameroon sits in the lower percentiles for the three categories. The South African data generally trends in between Canada and Cameroon, with the exception of measures of inequality[65]. For further details on this analysis, please see Appendix A for the percentile calculation of each relevant comparison category.

To further illustrate the case study rationalization, a heat map was used to visualize the relative performance of each case study country via quartiles to indicate distribution as seen in Figure 11.

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1. HIS - a statistical analysis of the overall quality of the healthcare system, including healthcare infrastructure, healthcare professionals (doctors, nursing staff, and other health workers), competencies, cost, quality medicine availability, and government readiness (Statista, 2022a).

2. HAQI - this measure considers 32 causes from which death should not occur in the presence of effective care to approximate personal healthcare access and quality by location and over time. Specifically, this index considers: Tuberculosis, Diarrhoeal diseases, Lower Respiratory Infections (LRIs), Upper Respiratory Infections (URIs), Diphtheria, Whooping cough, Tetanus, Measles, Maternal disorders, Neonatal disorders, NM skin cancer, Breast cancer, Cervical cancer, Uterine cancer, Colon cancer, Testicular cancer, Hodgkin's lymphoma, Leukemia, Rheumatic Heart Disease (HD), Ischaemic HD, Stroke, Hypertensive HD, Chronic respiratory, Peptic ulcer, Appendicitis, Hernia, Gallbladder, Epilepsy, Diabetes, Chronic kidney, Congenital heart, etc. (Our World in Data, 2015). Please note for the purposes of this data, 194 countries / archipelagic states were considered. All subregions / categorizations (e.g. Eurasia, sub-Saharan Africa, world, etc.) were excluded.

3. GDP per capita - a snapshot of a country's economy that indicates the monetary market value of all final goods and services made within a country during 2023 divided by the number of citizens (World Population Review, 2023b).

4. GINI Coefficient - a statistical measure of the inequality among values of a frequency distribution, like levels of income, for a country (World Bank, 2021c).

5. GII - provides a ranking of countries by their capacity for, and success in, innovation (World Intellectual Property Organization, 2022).

6. NRI Score - considers the propensity for countries to capitalize the opportunities offered by information and communications technology based on a composite of three components: 1) the environment for Informations and Communications Technology (ICT) offered by a given country or community 2) the readiness of the community's key stakeholders (individuals, businesses, and governments) to use ICT and 3) the usage of ICT amongst these stakeholders (World Economic Forum, 2021).

7. GIR - this infrastructure score is calculated based on the following factors: road connectivity index, quality of roads, railroad density, efficiency of train services, airport connectivity, efficiency of air transport services, linear shipping connectivity index, efficiency of seaport services, electrification rate, electric power transmission and distribution losses, exposure to unsafe drinking water, and reliability of water supply (Statista, 2022b).

[65] For readability, the percentile of the GINI coefficient was inverted so that it matched the logic of other indices (i.e. a high percentile ranking is favorable and a low percentile ranking is less favorable. So for instance, South Africa's GINI coefficient rank of 1 put it in the 99.4 percentile of most unequal countries or alternatively the 0.6 percentile of equal countries).

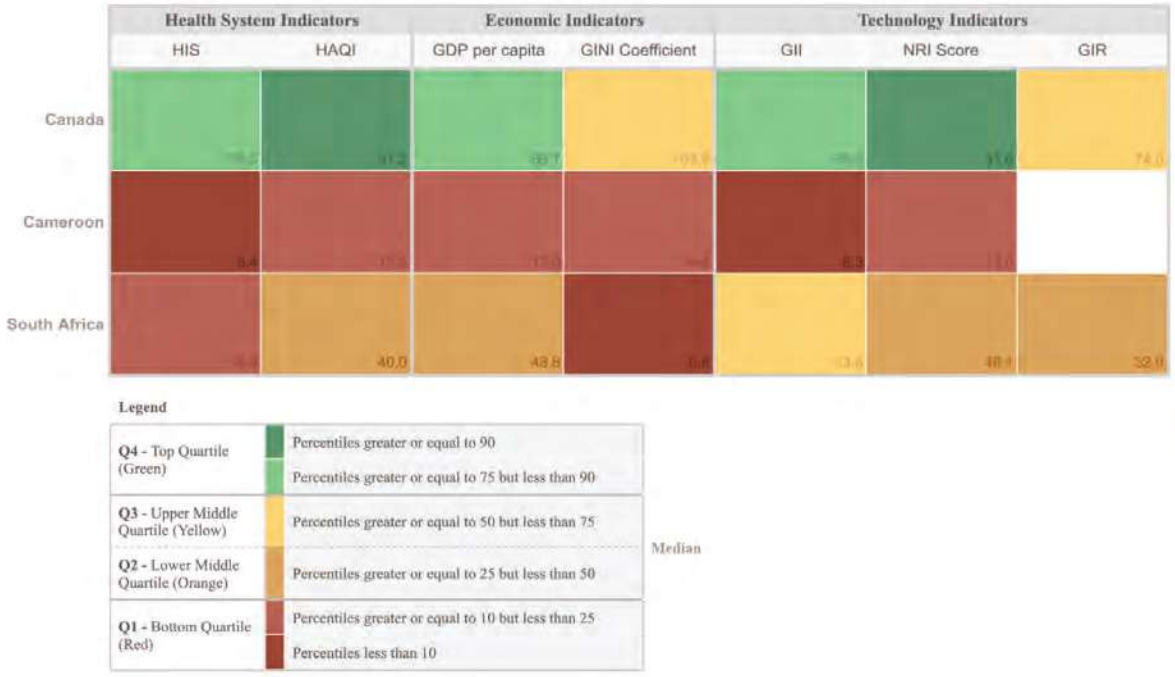

Figure 11. Heat Map of Relative Case Study Rankings Amongst a Variety of Factors[66].

This analysis suggests the following relative positions of the three case study locations as related to the research questions (Figure 12) (Central Intelligence Agency, 2019; Fullman et al., 2018).

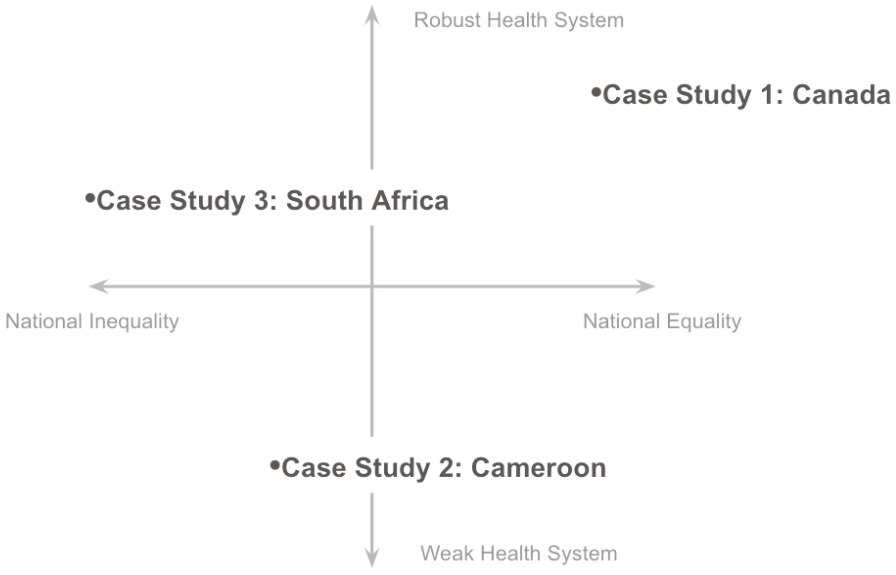

Figure 12. Illustrative Cross-sectional View of Case Studies.

[66] Although Cameroon was not included in the GIR ranking, other sources suggest it is also relatively less advanced in this category compared to the other two case studies (World Bank Group, 2013).

To further clarify these relative placements, please note that this analysis is done on a country-level[67]. This is not to say that there are no areas in Canada or Cameroon that can be considered low- and high-resource, respectively. The intention of this research is to find pervasive macro-level gaps and under optimizations in international AI policy. Any substantial outliers (e.g. remote Indigenous and / or underprivileged populations in Canada living in low-resource environments) require their own area of focus and as such are outside of the scope of this report. For the sake of data consistency, the dichotomous case study of South Africa was categorized on a national level using averages within the indices to capture the broad variance in the above categorizations.

Finally, for policy development to be successful regarding this subject matter it has to be feasible, realistic, and suitable in these contexts. Therefore, a closer look at the NRI is well-justified in order to better understand how well poised each country is to implement ANI-enabled health services in the future. This composite index considers technology, people, governance, and impact data points, which culminates in an overall country score[68].

[67] In terms of the depth of data, Figures 10 and 11 represent a high-level overview of the relative position of each country. This is informed by over 75 individual metrics embedded within these data points and indices (Our World in Data, 2015; Statista, 2022a; Statista, 2022b; World Bank, 2021b; World Bank, 2021c; World Economic Forum, 2021; World Intellectual Property Organization, 2022; World Population Review, 2023b).

[68] **Category Definitions (World Economic Forum, 2021):**

- **Overall Score 2021:** the equally weighted average score for the below categories for each country in the year 2021.
- **Technology:** assesses the level of technology that is essential for a country's participation in the global economy.
- **People:** assesses the access, resources, and skills required by the people and organizations within each country to use technology productively.
- **Governance:** assesses how safe individuals and firms are regarding the network economy, regulation, and digital inclusion.
- **Impact:** assesses the ability of technology to improve the growth and well-being in society and the economy.

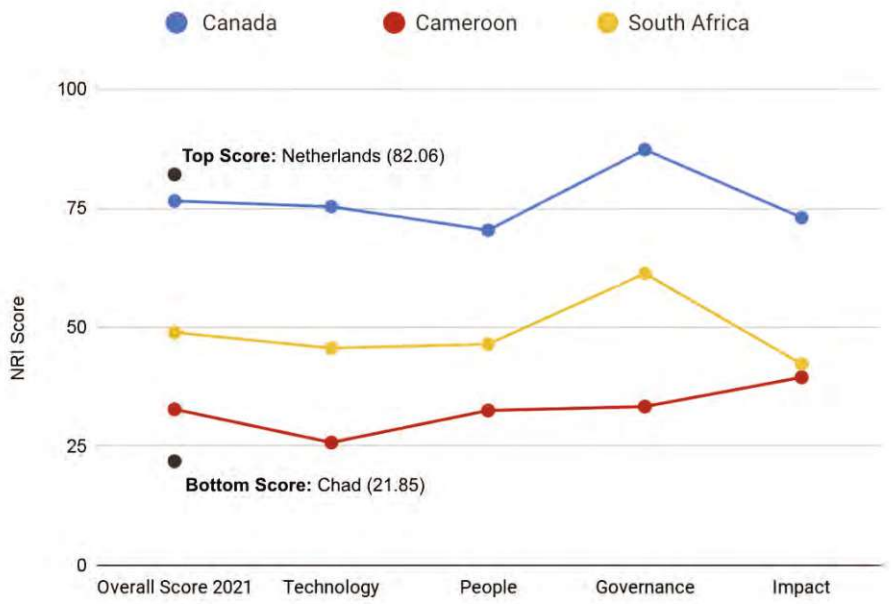

Figure 13. Comparison of NRI Score (Overall and By Category) of the Case Study Locations (World Economic Forum, 2021).

As seen in Figure 13, the case studies are relatively evenly distributed across this index. Canada has a NRI score of 76.48, which places it in 11th out of 130 economies with its main strength being its governance (World Economic Forum, 2021). Conversely, governance was the lowest category for Cameroon, which had an NRI score of 32.76 placing it 114th out of 130 economies (World Economic Forum, 2021). South Africa sits close to the center rank at 70th with an NRI of 48.88 (World Economic Forum, 2021). The highest and lowest overall ranking countries have also been highlighted to show the distribution of the case studies amongst the ranking. This relatively evenly distributed variance between the case studies was also an important point of consideration in the case study selection. The nuances of which are discussed further in the following subsection.

3.4 Detailed Case Study Review

Case study 1 considers examples from the digital health landscape in Canada, a comparatively high-resource context (World Bank, 2021a). This case study was selected to demonstrate health, economic, and technology / innovation enablers that have contributed to successful ANI implementation (in diagnostics and the larger health system) with projects demonstrating clear positive Key Performance Indicators (KPIs) (Vector Institute, 2022). In

addition, it offers insights on the challenges and lessons learned with early ANI implementations, of which the vast majority are in high-resource regions[69].

Canada's relative prosperity exists on a national economic level, but also relates to its healthcare context. Many major health facilities in Canada receive funds from government funding and taxation, private sector firms, educational institutions, and private donations (Sutherland, 2011; Sutherland et al., 2013; University Health Network, 2010). Many major hospitals regularly report sizable annual revenues and funding reserves (Central Intelligence Agency, 2017; Charity Intelligence Canada, 2018; World Bank, 2021b).

Although the Canadian healthcare system is imperfect, the country regularly ranks in the top 10% out of 195 countries listed on the HAQI (McAlister et al., 2018; Valle, 2016). Additionally, it is relatively well resourced by international standards. For instance, there was an average of 2.77 doctors per 1,000 people in 2021, which was comparatively higher than both Cameroon and South Africa (Perkel, 2020; World Bank, 2019).

Furthermore, the country has a generally strong culture of innovation and social entrepreneurship within medicine (PricewaterhouseCoopers, n.d.). The digital health landscape in Canada is quite active with numerous startups of significant valuation (> $30M) advertising the use of ANI technologies[70] (Tracxn, 2023).

In contrast, case study 2 was selected to demonstrate health, economic, and technology constraints that lead to underutilization of ANI in diagnostics in low-resource regions.

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[69] Another key reason to compare a higher-resource use case to a lower-resource use case is the phenomenon of leapfrogging of development. This describes a process whereby a nation "*bypasses traditional stages of development to either jump directly to the latest technologies (stage-skipping) or explore an alternative path of technological development involving emerging technologies with new benefits and new opportunities (path-creating)*" (Center for Strategic and International Studies, 2020, para. 2). Globalization has increased the ability for nations to collaborate and cross-share information to better understand lessons learned from different technology implementations. This can potentially allow developing countries to more rapidly make progress as opposed to the trial and error required of early adopters. South Africa has already indicated leapfrogging related to AI (Government of South Africa, 2021). Additionally, developed countries can have legacy systems, processes, and policies that are highly embedded and difficult to disrupt; thus providing an opportunity for more dynamic contexts to leapfrog ahead. That being said, it is important to note that despite potential lessons learned from technology implementations in other countries, there are still significant cultural differences to consider when implementing a technology in one context versus another and further studies and customized approaches will be required to successfully implement digital healthcare in new environments.

[70] Although please note, the distribution of these startups is uneven with the majority being concentrated in urban centers, most notably Toronto, Ontario.

Cameroon is characterized by many social and economic challenges often associated with underdeveloped countries, including low / stagnant per capita income, substantial income inequality, widespread corruption (which contributes to a top-heavy civil service), continuing inefficiencies in key sectors, and a generally unfavorable climate for business enterprise (Central Intelligence Agency, 2019). Contrary to the previous case study, this can be considered a low-resource scenario (Bang & Balgah, 2022; Bang et al., 2021). Not only does Cameroon have a comparatively low GDP per capita (USD $1,666.9 compared to Canada's USD $51,987.9) (World Bank, 2021b), according to reports from the WHO Cameroon ranks amongst the countries with the lowest overall life expectancy (World Health Organization, 2020b).

Health services are provided by public and private institutions, however most citizens receive basic healthcare services via government-funded schemes (World Health Organization, 2017). Primary healthcare funding sources include the state, households, the private sector, and donors (Ojong et al., 2022); albeit to a significantly lesser overall funding amount than the previously mentioned case study.

Further to these inauspicious economic and health outcomes, Cameroon is experiencing a crisis in HHR (Kingue et al., 2013). Although different sources report slightly varied figures depending on the year and research method used, there is a strong general consensus amongst experts that the HHR crisis exists. The WHO reports that there are approximately 1.1 physicians and 7.8 nurses and midwives per 10,000 population (World Health Organization, 2010). Other studies have indicated that there are only 1,555 physicians in Cameroon, representing 0.8 physicians per 10,000 inhabitants (Tantchou Tchoumi & Butera, 2013). Regardless, this ratio is one of the lowest in the world (World Bank, 2019).

Some of the additional challenges faced by Cameroon in the past decade include:

- Inequitable geographic distribution of health workers (Ministry of Public Health (Cameroon), 2010). Approximately 60% of doctors are located in the Centre and Littoral regions and many people living in rural communities do not have access to a physician (World Health Organization, 2016a).
- An aging public sector health workforce with 53% of health workers aged 40-51 and 31% over age 51 in a sector where the retirement age is between 50 and 55 (World Health Organization, 2011).

- Lack of regulations and absence of an ongoing accreditation system for human resources for health education and training (World Health Organization, 2020a).
- Limited human resource production planning and recruitment, including problems resulting from the centralization of recruitment and posting, lack of task planning, poor organization of duty, evaluation, incentive, and lack of project management (Ministry of Public Health Directorate of Health Resources, 2012).

Financially, healthcare cost inefficiencies are also notable. Cameroon spends more money on healthcare services than any other sub-Saharan African country (except South Africa), yet the burden of communicable and non-communicable disease has still doubled (Marquez & Farrington, 2013); leading to systemic financial inefficiencies as well. The presence of endemic / communicable diseases also skews funding as it applies a constant and significant burden on the healthcare system (Helen Keller International, 2022; World Health Organization, 2018b).

Cultural values and perspectives also limit the adoption and implementation of digitally-enabled health services. Although there are examples of digitally-enabled health projects within the country, there is a measured lack of proactiveness regarding innovation (Bonaventure, 2019; Bonny, 2019; StartupList Africa, 2019; World Intellectual Property Organization, 2021). Thus, limiting the appetite for digital transformations and increasing the risk of inadequate adoption of these projects. Of the digital healthcare startups in Cameroon, the funding is markedly smaller than the previously mentioned Canadian examples (StartupList Africa, 2019).

Although this comparison to case study 1 indicates variance, it is not too extreme as to negate research conclusions as Cameroon is characterized by relative stability compared to other low-income countries (Central Intelligence Agency, 2019); whereby an extremely idiosyncratic use case would diminish research conclusions. Furthermore, Cameroon is a good candidate for this research topic due to its reasonable development potential based on a diversified economy but still high poverty due to weak institutional development (International Cooperation & Development, 2019). Suggesting that the research conclusions may be applicable to other developing country contexts. Additionally, it has been referred to as "*Africa in miniature*" due to its geographical and cultural diversity (BBC, 2018, para. 1). Therefore, this use case suggests reasonable external validity to other low-resource contexts / developing countries (United Nations, 2018a; United Nations, 2019).

Lastly, South Africa was selected as the cross-section of the above case studies due to its history of dichotomous health, economic, and technology indicators yet notable progress and sophistication in digital health (World Bank, 2021d). Although it has examples of high-resource health centers, it also has significant inequality related to healthcare (Singh, 2020). As described by Singh (Adjunct Professor in the division of Clinical Public Health, University of Toronto, Canada and WHO's Ad Hoc Research Ethics Review Committee for COVID-19) "*there is a substantial body of research and several global, multilateral and national policy frameworks that engage with critical policy issues in this field. In South Africa, the nature of these issues is complicated by high levels of poverty, a large disease burden and highly unequal resourcing and access to health services*" (Singh, 2020, p. 2).

South Africa can be described as a dual economy with one of the highest and most enduring inequality rates in the world with a Gini coefficient of 0.63 in 2022 (Organisation for Economic Co-operation and Development, 2021a; World Bank, 2021c). This dichotomy exists within its healthcare context as well. South Africa has a two-tiered health system, which provides care to different groups based on socioeconomic status and causes significant disparities in access to health services (Health Policy Project, 2016).

The country uses a private and public healthcare system, of which the majority of the health services (approximately 86%) are conducted through the public healthcare system (Columbia University Mailman School of Public Health, 2016; Health Policy Project, 2016). This system receives its funding primarily from a National Revenue Fund (Health Policy Project, 2016). The private health sector is funded primarily through out-of-pocket payments and medical schemes (Columbia University Mailman School of Public Health, 2016). In comparing the two systems, the per capita health expenditure is observed to be significantly skewed. Although only 18% of the population regularly use private providers, it accounts for approximately half of health expenditures (Columbia University Mailman School of Public Health, 2016).

Furthermore, this case study is also characterized by social and health factors that are shared by other countries with substantial medical inequality (Wagstaff et al., 2014); thus indicating potential generalizability of research conclusions. At a high level, relevant factors include:

- Regions within the country that can be considered both high- and low-resource from both an economic and medical perspective (e.g. including but not limited to urban

versus rural areas) (Mayosi & Benatar, 2014; Organisation for Economic Co-operation and Development, 2021c).

- Shortages and / or unequal distributions of HHR throughout the country (approximately 79% of doctors work privately, leaving only 21% of doctors for the public sector) (Expatica, 2022).
- Significant upskilling requirements to produce a digitally- and data-literate workforce (Accenture and Gordon Institute of Business Science, 2018; Singh, 2020).
- Regional customizations, such as the presence of 11 national languages spoken throughout South Africa (Singh, 2020).
- Infrastructure constraints, such as unequal access to electricity and internet (Singh, 2020).
- Challenges with data quality, including the common constraints associated with ANI-enabled systems such as racial and gender biases (Baeza-Yates, 2021; Singh, 2020).
- Lack (or inconsistency) of complementary technologies, such as EMRs (Singh, 2020).
- A history of medical tourism from neighbouring countries (Crush & Chikanda, 2015).

The challenges associated with democratic and effective implementation of AI in healthcare are compounded in South Africa due to the severity of socioeconomic and infrastructural conditions, which includes high levels of inequality in access to and funding of healthcare (University of Pretoria and Access Partnership, 2018). For instance, the vast majority of households in rural areas are without access to electricity and only 9.1% of South African households have access to the internet at home (Statistics South Africa, 2019).

Despite these challenges, South Africa has seen sustained progress in its healthcare systems and infrastructure with many of its research and treatment facilities being considered world-class (such as Discovery Health, BroadReach Healthcare, etc.) (Nwaka et al., 2012). Additionally, it is one of the countries with the best documented successful implementations of ANI in healthcare, public health research, and drug development (Singh, 2020). There are numerous examples of local innovation of ANI regarding medical risk prediction and personalized medical diagnostics (Cortex Logic, 2019).

There are also opportunities related to improved ANI-enabled diagnostics in the country. Although current implementations have been unequal, there are many possible benefits of ANI in South Africa (Accenture and Gordon Institute of Business Sciences, 2018). With this,

ANI may help address issues facing South Africa's healthcare system, such as a shortage of qualified healthcare professionals and supplies, accessibility barriers, and rural / urban disparities in healthcare services (University of Pretoria and Access Partnership, 2018).

Due to the above factors, it is logical to presume that these three case studies should give a reasonably generalizable overview of different health contexts to better understand the dynamics of ANI implementations and the social / economic implications of these implementations. The process by which the case studies were analyzed and the research outcomes derived via this analysis are described below.

3.5 Data Analysis Overview

A multiple case study approach with thematic analysis was selected due to its wide range of research interests and theoretical perspectives as it:

a) works well with a wide range of research questions;
b) can be used to analyze different types of data;
c) allows for large or small data-sets and;
d) can be applied to produce data-driven or theory-driven analyses (Clarke & Braun, 2013).

The role of the thematic analysis was to identify key / reoccuring themes, such as notable patterns or relationships in the data in order to use these themes to address the research questions (Maguire & Delahunt, 2017). To do this, researchers followed the widely accepted approach of Braun & Clarke's 6-Step Framework in order to conduct the thematic analysis. This process is described below (Braun & Clarke, 2006):

1. **Familiarization with the data:** including review and re-review of qualitative and quantitative data with an iterative feedback-loop with industry experts throughout the analysis process.
2. **Coding:** involves generating labels for key features of the data. This goes beyond data reduction and is inherently analytical in nature through capturing both semantic and latent / conceptual codes.
    a. **Semantic Coding:** exclusively considers the explicit / surface meanings of the data whereby researchers do not look for anything beyond what is said or what has been written (Braun & Clark, 2006).

b. **Latent / Conceptual Coding:** goes beyond the surface meaning and attempts to "*identify or examine the underlying ideas, assumptions, and conceptualizations - and ideologies - that are theorized as shaping or informing the semantic content of the data*" (Braun & Clark, 2006, p. 84).

3. **Searching for themes:** identifying patterns related to the research question and collating all the coded data relevant to each theme.
4. **Reviewing themes:** reflecting on the coded themes to determine whether they reflect the full data set. If so, then mapping the relationships between the themes, which may include splicing or consolidating like-themes.
5. **Defining and naming themes:** writing the overview and analysis of each theme, through asking key questions such as "what story does this theme tell?" and "how does it fit into the overall data picture?".
6. **Writing up:** the final stage, which focuses on contextualizing the data and relating it back to the existing literature.

In line with academic recommendations for thematic analysis, this process was not treated as a linear model (i.e. where one cannot correctly proceed to the next phase without completing the prior phase) (Clarke & Braun, 2013). Instead the analysis process was highly recursive. The analysis included multiple rounds of thematic frameworking, coding, charting, mapping, and interpretation over a period of approximately 19 months. As expected, each iteration uncovered further insights to better form the understanding of this research topic. Each of these iterative stages of analysis can be viewed in Appendix D.

This analysis process was conducted in a manner closely abiding by the scientific method to ensure the research and conclusions are maximally logical, confirmable, repeatable, and scrutinizable. This was done by systematically selecting a wide range of data types, sources, and strategies to determine the key themes (Bhattacherjee, 2012). Once the key themes were established, researchers then cross-referenced them with current policy recommendations to highlight any gaps, incongruencies, or potential opportunities for increased effectiveness. Outcomes of this research were then sense checked and refined with industry experts as seen in Appendix E.

Due to the cross-functional nature of this subject area, threat of subjectivity, and possible criticism of constructivism associated with this research topic, researchers evaluated the validity of the approach and corresponding results via three criteria:

1) **Authenticity** - demonstrating a deep and accurate understanding of the phenomena (Clarke & Braun, 2013). The evaluation of authenticity considers the degree to which researchers have captured the "*multiple perspectives and values of participants in their study and foster change across participants and systems during their analysis*" (Mauldin, 2020, p. 327). This was addressed through strategically selecting diverse data sources and SMEs with a broad range of experience related to the scope of this report (e.g. professional area of expertise, specific role, geographic areas of focus, years of experience, etc.). Each of these experts possess in-depth insights in high-resource contexts, low-resource contexts, or both; whereby these insights were then used to refine the research outcomes based on their written and oral feedback.
2) **Plausibility** - demonstrating an alignment to similar research in this field (Clarke & Braun, 2013). Testing for plausibility involves determining the degree to which the research results are congruent and reflective of real-world patterns. This was addressed through a consistent emphasis on real-world findings and observations throughout this research (which was particularly pertinent due to the relatively exiguous degree of academic research on ANI in low-resource settings). The selected data sources used in this report include numerous non-academic sources, such as company reports, news articles, workshop and lectures series content, etc.

   This was done out of a cognisance of the inherent misalignment between academia and real-world implementations of ANI. Typically academics specialize in rigorous and systematic inquiry. As such, academic ethicists are prone to asking different questions compared to the businesses implementing ANI systems (Blackman, 2020). This results in academic treatments that "*do not speak to the highly particular, concrete uses of data and AI. This translates to the absence of clear directives to the developers on the ground and the senior leaders who need to identify and choose among a set of risk mitigation strategies*" (Blackman, 2020, para. 8).

   To account for this, researchers used repeated sense checking with private sector SMEs (over 20 separate touch points throughout the research process) in order to minimize the risks of poor plausibility. Additionally, research results were sense checked in four in-depth SME interviews 60-120 minutes in length. Each of these interviewees indicated strong agreeance on the key themes, implications, and associated recommendations, which will be discussed further in chapter 4 Results and Discussion.

3) **Criticality** - demonstrating the ability to question assumptions to provide rigorous research results (Clarke & Braun, 2013). Testing for criticality involves considering how well the qualitative method of study fits with the research questions. Although there are many potential ways to investigate the research questions, there was strong evidence to suggest that a balanced perspective that considers multiple different types of data was most appropriate when considering the complex interactions between ANI and its societal impact (Crossman, 2020; Yin, 2002).

Based on this criteria, the results indicate a high likelihood of replicability of this study. However as with any research approach, there are limitations which suggest that further research is required to deepen the academic understanding of this subject matter. Yet, although there is still much to be learned in this quickly evolving area of study, this research offers an additional breadcrumb on the path to a more nuanced understanding of the societal implications of ANI. Although our collective understanding of this subject matter is not yet comprehensive, the research results indicate that we know enough to reasonably suggest modifications to current policies in order to improve the equality associated with ANI use, particularly in key public good industries such as healthcare.

4 Results and Discussion

4.1 Emerging Themes from this Research

Before discussing the key themes in detail, it is useful to first consider the more abstract high-level research observations in order to provide additional context on the research outcomes. Evidenced by a growing body of literature, an increasing number of scholars and experts have directed their attention toward the broader discussion of ethical AI, even during the relatively short time frame of writing this report (2019-2023). This topic was heavily featured at UNESCO's conference on the Ethics of AI in Africa (03.11.2022) whereby several industry experts including Gabriela Ramos (Assistant Director-General for the Social and Human Sciences of UNESCO), Dr. Rachel Adams (Research ICT Africa), and many others indicated the need for further research in this field. In addition, the comparative case study approach was observed to be reasonably justified as indicated through quotes from industry experts such as Professor Emma Ruttkamp-Bloem (University of Pretoria, UNESCO

Ad Hoc Expert Group on the Ethics of AI and COMEST) who stated "*I don't think the discourse is different. The context is different. So we can use lessons learned from other locations when implementing AI in Africa*" (Ruttkamp-Bloem, 2022).

These empirical observations were noted within the primary and secondary data, of which the thematic analysis indicated sufficient data saturation to satisfy generally accepted scientific requirements, including redundancy of data, repetitive themes, and a sharp diminishing of new themes, opinions, and patterns in the data set (Fusch & Ness, 2015). The emerging themes were sense checked by industry experts, whereby quotes such as "*that makes sense*", "*that's spot on*", and "*yes, I'm in alignment*" were regularly captured in the interview transcripts, suggesting convergence between the analytical findings and the expert opinions. None of the SME interviews involved any point of significant disagreement or opposition that would lead to substantial changes in content or restructuring of the closing framework. All suggested updates by the SMEs were related to semantics in order to improve the clarity of the closing framework rather than fundamental criticisms of the themes, subthemes, implications, or recommendations.

Broadly, the data indicated that ANI use has increased substantially in recent years and that this has been disproportionately in high-resource contexts due to the lesser degree of barriers and greater available resources (e.g. personnel and funding) as compared to low-resource contexts (Eliaçık, 2022; Neurons Lab, 2022; Qiu & Liu, 2023). Additionally, there are many risks associated with ANI, such as job loss, data and environmental exploitation, etc. of which low-resource contexts tend to disproportionately bear the burden of this (Allen, 2021; Chatterjee & Dethlefs, 2022; Eliaçık, 2022; Makridakis, 2017). Therefore, although there may be examples of successful project outcomes on a micro-level in low-resource contexts (e.g. instances of ANI increasing accessibility of health services, etc.), macro-level trends tend to be less favorable.

Specifically relating to the key themes, each of the themes was observed to varying degrees across the three case studies. However, the impact and severity of each key theme varied significantly between the three case studies. Yet in general, the more low-resource a region is, the more it was observed to be impacted by the challenges outlined (Eliaçık, 2022; Neurons Lab, 2022; Qiu & Liu, 2023). Therefore, although it would be beneficial to integrate each of the key themes into international and national digital health strategies in a broader context, it is particularly critical to do so when considering low-resource situations.

Furthermore, the data indicated that general guidelines (under five main domains: transparency, justice and fairness, non-maleficence, legal responsibility, and privacy) tend to be consensual across a variety of different contexts, yet localized contexts may differ when it comes to the actual manifestation of these guidelines (Casilli, 2022; Jobin et al., 2019). So although these notable recommendations may not be relevant in all contexts, the broader themes and subthemes outlined in this report indicate strong generalizability across different contexts.

Although critics may point out the numerous challenges associated with adjusting for cultural differences / complexities when conducting macro-level research, these do not inherently mean that this type of research is invalid, that broader universal values do not exist, or that certain initiatives are not globally beneficial or applicable (Killelea, 2021). Inherent to the nature of macro-level research, this report makes no claims at being comprehensive. This is a highly complex and rapidly evolving field of study with many unknowns still outstanding. Of which, incremental improvements to understanding are required in order to improve real-world outcomes (Killelea, 2021). Even with the inability to guarantee comprehensivity, researchers would point out that critical policy gaps were observed across the three levels of policy (society, community, and individual) in three dissimilar case studies, indicating reasonable opportunities for policy improvement.

Each research theme represents a gap or under optimization in the current policy environment, whereby the essence of each theme is either:

1. left out of policy recommendations completely;
2. insufficiently included in policy recommendations;
3. inconsistently applied in policy recommendations;
4. misattributed (in terms of the end goal, responsible stakeholder, etc.) in policy recommendations, and / or;
5. lacking efficacy in real-world settings.

Thus indicating a significant gap between AI ethics recommendations and real-world implementations. Furthermore, it is argued that current policy recommendations are often worse than ineffective and may go so far as being counter effective as they divert resources away from more effective avenues (Munn & Prem, 2022). Although these gaps exist due to a variety of reasons, they all represent the broader nature of current AI ethics policy recommendations being:

a) meaningless ideals that are difficult to conceptualize and implement in a productive way;
b) isolated principles in which the broader industries in which they are expected to be implemented have a culture that often celebrates deviation from inclusion and ethical ideals and;
c) are "toothless" in nature whereby these principles are not accompanied with any type of enforcement suggestions, recommendations, guidelines, rewards, and / or repercussions for violating these principles (Munn & Prem, 2022).

In order to address these policy gaps, key themes and their associated implications and recommendations were documented[71]. At a high-level, the data indicated alignment with *Systems Theory*[72] principles, whereby many of the themes are interdependent as well as mutually-reinforcing in nature. Thus, improvements made under one theme are likely to have positive impacts on other themes due to the larger system in which they co-operate. Therefore logically, the more themes considered, the greater the likelihood of enabling impactful, sustainable, and ethical improvements in ANI-enabled global health.

Furthermore, although researchers focused on data related to ANI-enabled diagnostics, many of the observed themes can be attributed to other public good industries beyond healthcare. Arguably one of the most tangible examples of this is poor data quality whereby errors are compounded across computational workflows. This is relevant in many industries, yet medical data is particularly characterized by inaccurate, incomplete, or missing information (Holzinger et al., 2019). Whereby low-resource contexts tend to have exceptionally weak data sets and as such, these populations are either mis- or under-represented in ANI-enabled diagnostic tools.

As such, many of the challenges associated with implementing ANI in low-resource contexts transcend a particular project or sector and are systemic in nature. This implies that making

[71] Summarized in Table 2: Closing Framework Summarizing Themes, Implications and Suggested Recommendations (section 4.2 Closing Framework).
[72] Systems Theory refers to an interdisciplinary field of study that describes the many interacting elements of society and aims to understand societal problems holistically (Killelea, 2021). Within this scope, the themes described in this report are highly interrelated and mutually affective as opposed to being characterized by overly-simplified and incomplete casual relationships. Another key element of systems theory is the forward looking nature of solutioning to emphasize collective problem solving. This is in contrast to commonly used reflective methods, whereby experts look backwards to understand the cause of a problem which can lead to defensiveness and further division and ignores looming future challenges (Killelea, 2021).

ANI use more equitable starts far before a project begins and relates to the social, economic, and political contexts in which it is derived. ANI is a product of the collective "us". Therefore, it will likely exacerbate trends that are already occurring in society. If a society is highly fair and democratic, ANI will likely make it more fair and democratic. Yet if a society is highly unequal and non democratic, ANI will likely intensify these trends. Despite methods to increase the fairness of a particular AI system (e.g. higher quality data sets, improved algorithms to reduce bias, etc.), broader principles of fairness will likely not be improved without broader societal change. These observations infer further external applicability of results to other public good sectors that were not necessarily intended at the outset of this research.

Inline with this, the data indicated a broader need for much stronger collaboration between the private sector, public sector, and academia. Of which, historical ways of thinking and working are unlikely to be effective in addressing societal challenges such as growing health inequalities (Carbonnier & Sumner, 2012). Although there are many opportunities for synergies between these three groups, pervasive silos present a significant threat to future collaborations. In order for the suggested recommendations listed in this research paper to be effective, it is imperative that all three of these groups have a willingness to reflect and acknowledge their own strengths, weaknesses, and prejudices. Within academia this includes adjusting incentives and policies to negate unintentional and / or unfavorable societal outcomes that result from technological innovation. One clear recommendation is an adjustment to the peer review process whereby reviewers should require that papers / proposals rigorously consider all reasonable broader impacts, both positive and negative (Hecht et al., 2018).

Finally, researchers would like to clarify that although recommendations have been suggested for each theme, these suggestions alone do not guarantee success as they rely heavily on effective implementation to be successful. In order to increase the likelihood of adoption and future efficacy, any interventions and / or policy improvements should generally be substantial, acceptable under the current political / policy environment, and result in a relatively quick impact (Killelea, 2021). Failure to meet these criteria will likely result in insignificant improvements or alternatively, overly radical improvements that may upset current systems without adequate systems to take their place (Killelea, 2021).

With that context in mind, the researchers present the following distinct yet interdependent themes and associated policy considerations meant to improve the dialogue on the responsible use of ANI-enabled diagnostics[73]. To improve the readability hindered by overlapping themes, they have been listed in order based on their closest inter-relatedness, whereby they generally follow the pattern of moving from "what" to "how".

Theme 1: Power imbalances amongst stakeholders create substantial challenges and threaten ANI project success and ethical implementation.

The research indicated that power dynamics play a significant role in this subject matter, and the numerous key stakeholders, each with significantly varying objectives, makes equality and ethical enforcement exceedingly difficult. Although these power imbalances can be observed on many levels from macro (i.e. systemic imbalances) to micro (i.e. patient / provider interactions), the former will be the focus of discussion based on the scope of this research.

Glaringly, the research indicated that corporations are currently heavily under-engaged regarding conversations and policies on ANI in low-resource locations in public good sectors such as healthcare. Thus far, recommendations for engaging with corporations are widely ignored in international policy but their size and impact on economic, social, and research factors necessitates that they are better engaged. This power imbalance is highly problematic as many low-resource governments have to balance economic benefits with public health and ethics goals (e.g. new facilities and job creation in impoverished regions at the expense of possible data exploitation) (Basheer, et al., 2022). This means that there is rarely a clear, obvious answer on what is ethical and the situation often necessitates difficult tradeoffs.

Additionally, low-resource regions are at a significant disadvantage regarding implementing ANI. Quality ANI systems are heavily dependent on large quantities of high quality data. Therefore these systems require more sophisticated infrastructure for data storage and current processing technology. Low-resource contexts such as developing countries, typically cannot afford the expensive large-scale computing infrastructure required by these systems (Eliaçık, 2022).

[73] Please note, that although other insights were discovered during the data collection and analysis phase of this research, they represent insights outside of the scope of this research and as such, have been captured in section 4.3 Suggestions for Further Research.

This suggests two possible ways forward in addressing this skewed power dynamic: a significant increase in external funding from high-resource regions to strengthen the competitiveness of these regions and / or engaging larger companies and developing partnerships[74] in order to help offset this power imbalance. There has been mixed success[75] associated with the former, so although a case can be made for continued (or increased) economic aid from high-resource countries, growing inequalities suggest that this alone is insufficient (Hamza, 2018; OXFAM International, 2020; Pearse, 2021). Accordingly, the latter will be discussed in greater detail in the following subtheme.

Subtheme 1a: Corporations are currently heavily under engaged and mutual private / public sector objectives are severely underrepresented in ANI policy.

"*The locus of [control] - the center of gravity of AI has been moved to industry, not academia. [...] You'd like to see AI developed to solve the world's problems, but I hate to tell you that is not in their interest. Their interest is to make money*" - Moshe Vardi[76] (Vardi, 2023, 30:40).

Arguably the most impactful stakeholder is simultaneously the most notable gap in international ANI policy recommendations. This lack of sufficient engagement with *Big Tech*[77] represents a glaring point of under optimization in current ANI policy. Of which, the omission of this critical stakeholder calls into question the objective ability of IGOs in developing effective international ANI policy recommendations in a modern digital context. Yet, this leads us to the question: how can we leverage the strengths of Big Tech while also developing policies that protect the patient from harm or exploitation?

[74] Although some critics may point out that corporations are by nature illegitimate in public policy making and therefore that the delegation of decision making to a national or transnational public-private entity is a poor form of democratic legitimacy, researchers would like to point out that by this standard, few national governments would qualify as democratically accountable either (Long, 2011). Additionally due to their economic size, one could reasonably make the argument that these entities currently have substantial decision making capabilities whether implicitly or explicitly stated in legislation.

[75] This mixed success is often as a result of the many stakeholders and pressures for budget allocations as well as poor political decision making, the existence of complicated legal structures, etc. (Acemoglu & Robinson, 2012).

[76] Moshe Vardi is a prominent mathematician and computer scientist and holds many notable roles including his position as Professor at Rice University.

[77] Otherwise known by the abbreviation GAMAM and refers to tech giants including Google, Amazon, Meta, Apple, and Microsoft.

First let us consider the immense relevance of Big Tech in this area of research. Despite many of the Big Tech companies having revenues larger than entire economies, international ANI policy heavily focuses on what national governments can do to challenge inequality (Dughi, 2021). However, this approach is severely limited as these organizations are multinational (or more fittingly, global) organizations that are increasingly growing separate from their roots in an individual country as physical space matters less and less (Stanger, 2021).

As Big Tech continues to permeate African markets there are concerns over this looming power dynamic. Not only do the Big Tech players dwarf the economies of Cameroon and South Africa, ironically some have a net worth larger than the GDP of Canada, the "high-resource" case study country used in this research (Dughi, 2021). Once the net worths of multiple or all of the tech giants are combined, this represents a massive force that needs to be better engaged, especially regarding conversations around technology use in public good sectors such as healthcare. Ideally there should be a balance between protecting public interest while cultivating a positive business environment to encourage the ethical implementation of ANI in low-resource contexts.

The harm associated with this pervasive power imbalance can be reduced through a variety of methods, including specifically referencing large corporations in IGO policies rather than placing the responsibility solely on low-resource governments[78] (Marcus, 2023). Although engagement with industry and Non-Governmental Organizations (NGOs) has been historically out of scope for some IGOs such as the United Nations, this approach is increasingly impacting these organizations' ability to achieve their objectives (Long, 2011).

Moreover, humanity faces a growing number of shared global challenges beyond healthcare. Much of which was highlighted during the height and fallout of the COVID-19 pandemic, which contributed to growing alienation and erosion of trust in many political systems (Killelea, 2021). More broadly, structural re-evaluation is necessitated by the growing degree of species-level challenges (e.g. pandemics, AI, climate change, etc.), which require a greater degree of leadership, coordination, and collaboration than national governments and traditional IGO structures have historically provided. Structural changes are likely required in order to meet these global challenges and systems will need to self-modify in order to become more adaptable and resilient to these challenges. As such, the ability of IGOs to strategically and critically reassess their objectives, operations, and project outcomes will

[78] In addition to charities, NGOs, and other foundations.

have a tremendous impact on whether they are able to maintain their relevance in our modern society.

Although there may be critics who suggest that private sector engagement has a deleterious effect on the provision of public goods and limits IGO resources and authority, this report would argue that IGOs cannot reasonably expect to effectively address modern global health challenges with outdated scopes and recommendations that follow an incomplete understanding of key actors. In fact, well-documented worsening health inequalities during the course of these IGOs' existence would suggest that there is further room for optimization via new approaches that are better grounded in the evolving realities of modern global health dynamics.

When analyzing the research results through the lens of systems theory, it becomes clear that policy makers must consider businesses as a partner rather than an obstacle or bystander in sustainable / ethical digital health policy. Failing to address these growing power imbalances associated with digital health does not simply limit policy effectiveness, it can go so far as creating counterproductive policies that fail to capitalize on clear synergies between sectors and do not address the actual causes of health inequalities. This is captured in the following quote by Senior Consultant Paul Jakubowski who specializes in digital operations: "*there's no way to do [socially beneficial digital initiatives] without the resources of Big Tech because they are the ones that have the technology that you need. If you don't involve them you're working with twigs and mud while they're building ChatGPT. The divide is too huge*" (P. Jakubowski, personal communication, May 28, 2023).

With this, the potential of public-private sector synergies has become increasingly relevant in recent years, particularly in the case of low-resource contexts. Generally, good quality infrastructure is a prerequisite for economic and social development, whereby it is a key precondition for enabling developing countries to accelerate / sustain the pace of their development in key sectors such as healthcare (Miroux, 2008). The challenge is that many low-resource countries face huge infrastructure investment needs but lack the necessary capacity domestically to meet them (Miroux, 2008). These gaps can be bridged through a sharing of development costs or through leveraging economies of scale and scope; two areas in which the tech giants are particularly adept.

These challenges have contributed to a changing role of the state in many low-resource economies whereby it plays a lesser role as investor but often greater role as regulator /

mediator. Additionally, transnational public-private networks are undeniably more numerous and increasingly influential in raising and solving health challenges at regional and global levels (Long, 2011). Therefore, the exclusion of Big Tech in IGO policy recommendations is not sufficiently enabling and supporting these realities in many low-resource contexts.

There are a variety of possible solutions to enable greater global health equalities. As a starting point, it is important to encourage self-regulation with Big Tech companies while also recognizing the limits of this approach. Although ethics has not been entirely embedded or embraced in the corporate sector in the past, ethical AI requires shared responsibility between actors moving forward. Encouraging companies to follow procedures on evaluating potential risk or harms of AI projects can be a useful step forward (Horvitz, 2022). Examples of such recommendations include the clear articulation of the need and system requirements for explainability[79] (Longo et al., 2020).

A strong degree of transparency and scrutinizability is important whereby concrete standards, procedures, and associated limitations should be available to external groups and the general public to be open for feedback (Horvitz, 2022). Moreover, it is encouraged to have multiple versions of these reports in order to increase readability. Often external corporate policies are not written for the purpose of informing the user, but rather they are created (by either marketing or legal teams) to either improve a company's brand image or protect the company from litigation (Landay, 2023). This results in a communication style that is either vague and potentially misleading to end consumers or alternatively is long-winded and full of jargon making it difficult to read and comprehend for those outside the legal community (Landay, 2023). The idea being that ethical transparency is only legitimate if it is communicated in an understandable manner. Therefore companies should be highly encouraged to communicate

[79] More broadly, there should also be strong promotion of how corporations can systematically integrate generally accepted ethics frameworks into their projects and decision making criteria. Examples of this include Porter and Kramer's Creating Shared Value (CSV) framework and more specifically its derivatives including CSV+ which augments traditional CSV frameworks with ethical considerations (de los Reyes et al., 2017; Porter & Kramer, 2019). With this, there should be a degree of proportionality on how to safely move forward (or not) with a project (i.e. whether a project is a) allowed to proceed as described b) is allowed to proceed with guidance and / or constraints and if so, a clear definition of the constraints and c) whether the project is not allowed to proceed and for what reasons) (Horvitz, 2022). Through this, policy makers may find value in highlighting examples of enduring and sustainable ethical projects to market this as the industry standard for large players (Huxham & Vangen, 2000; Klijn & Teisman, 2000; Malik et al., 2018).

their procedures in a human-centered manner that includes plain language, images, and graphics[80] meant to communicate to large public audiences.

Although these corporate procedures are not a comprehensive solution, it is still valuable to encourage the discussion of ethics in corporate spaces and also provide a helpful foundation in which more neutral organizations can review ethical compliance. Based on this, it is also recommended to create organizations with the specific purpose of:

- evaluating and publicizing private sector ethical performance so that patients and consumers can make informed decisions (Horvitz, 2022) and;
- encouraging and managing public-private sector cooperation (e.g. Pan-Canadian AI Strategy) to foster a more coordinated ethical approach between the sectors (Brandusescu, 2021).

Further related to the limitations of this approach, it is important that policy makers consider the natural market forces that are often working against ethical ideals of equality and public good[81]. From a business and financial perspective there is an incentive for companies to maximize revenue and minimize waste which often results in "cutting corners" or exploiting growth opportunities. As such, any policy recommendations that do not integrate business objectives into their policy recommendations, will likely have limited real-world success.

Ethicists have stated that "*the only sustainable AI is ethical AI*" (Ruttkamp-Bloem, 2022) and although this is generally accepted as true, the definition and responsibility of these standards are ill-defined making it ineffectual in real-world settings (Russell, 2022). Competitive market forces create a sort of *Prisoner's Dilemma*[82] for companies, whereby executives and shareholders want the industry to be sustainable (have end user trust, heavily engaged users, etc.) so that they can continue to participate in this industry and generate income. However, there is little incentive for individual companies to bear the responsibility and additional

[80] An example of this is embedding a product's ethical implication directly into its design in order to communicate the extent of the risk in a more human manner. E.g. when a smart phone is recording, it is typically denoted by a small dot in the upper right hand corner (depending on the model of the phone) however this is subtle, abstract, and ambiguous and does not necessarily capture the extent of the threat. A more clear and ethical mode of communication would be to denote this with an eye symbol so that its intention and implication is more readily understood by a broader number of humans (Landay, 2023).

[81] Such as the duty to shareholders rather than the public (as in the case with governmental agencies).

[82] The Prisoner's Dilemma describes a paradox in decision analysis in which two individuals making decisions based on their own self-interests does not produce the optimal outcome for the group. This phenomenon occurs in many aspects of the economy (Investopedia, 2022).

resource costs associated with initiating these objectives in a pervasive and meaningful way. Therefore they are unlikely to spontaneously commit to and sustain idealistic ethical standards unless it is mandated and enforced as the industry standard (Stanger, 2021).

In many cases, large companies are motivated to give the impression of high ethical standards to project a positive brand image (Dhillon, 2013). Yet, this is an important distinction: giving the impression of high ethical standards (e.g. through branding and marketing campaigns, spotlight projects, etc.) is not synonymous with committing to these ideals on a systematic / business-wide level (Moss & Metcalf, 2019). Related to this, there has been a large uptick of projects observed in what researchers refer to as "*Novelty Ethics Projects*[83]", under the larger umbrella of *Ethics Washing*[84] (Buedo & Waligora, 2022). These are projects intended to be highly marketable and bolster a company's image of Corporate Social Responsibility (CSR). Yet, in reality these projects have limited substance or sustainability and represent a lame effort to offset the negative social / systemic outcomes a company may contribute to. Other ethics washing strategies include hiring world-renowned AI ethicists in order to neutralize critics of AI ethics in order to avoid stringent regulation (Casilli, 2022).

Therefore, the most palpable recommendation under this theme is for policy makers to focus on aligning recommendations and partnerships to business / financial goals for corporations; both positively and negatively. Providing clear financial incentives such as tax advantages, access to new markets, opportunities for partnership, etc. are likely to more authentically engage private sector corporations in this discussion. Policy makers should amplify communications on the potential value of CSR and public / private sector cooperation in the public health space. Large public sector accounts are generally quite appealing to a corporation as they offer one huge account as opposed to having to convince an entire market of consumers to use their product. This can result in significant cost savings (such as marketing and customer acquisition costs), with the trade off being a higher regulatory

[83] A proposed new term to describe specific projects within the broader concept of ethics washing. These projects are designed to be 'feel-good', attention grabbing, and brand enhancing but generally contribute little to no long term systemic improvements.
[84] Ethics Washing refers to situations whereby actions are widely announced and are intended to reflect on ethical aspects of research and business practices but do not necessarily result in meaningful change (Buedo & Waligora, 2022).

burden imposed by the public sector client. Thus offering mutual benefits through partnership that can benefit the patient (and taxpayer)[85].

Furthermore, studies have indicated that companies that heavily engage in CSR have a sizable advantage when it comes to developing innovative technologies (American Accounting Association, 2022; Huang et al., 2020; Moser & Martin, 2012). This provides opportunities for a company to develop a competitive advantage over competitors, which is a top priority for Big Tech players in the innovation race (Rikap & Lundvall, 2021).

In addition to financial incentives, governments should have clear and consistent financial punishments (e.g. proportionate financial penalties such as fines, compensation orders, payments of surcharges, criminal court charges, etc.) for significant ethical violations[86] (Organisation for Economic Co-operation and Development et al., 2013). Finally, regulations regarding mergers, acquisitions, and size caps will become increasingly critical in addressing power dynamics. When a company is "too big to fail", it is de facto ungovernable and threatens stable / inclusive democracies (Lowery-Kingston et al., 2021; Stanger, 2021). Any policy recommendations that do not include this notion of financial alignment, are likely insufficient to offset growing inequality trends, particularly in industries of high public interest such as healthcare.

Subtheme 1b: Current sources of funding skew digital priorities and risk equitable access to ANI-enabled services.

Despite the growing recognition of the importance of taking current societal trends into account during ANI system design, this represents a radical change from current trends and the attainment of this goal faces tremendous barriers by way of natural market forces (Röcker et al., 2014; Ziefle, 2010). The data indicated predominate sources of research funding for ANI-enabled projects, whereby the majority of research centers are funded by Big Tech, leading to *Lobbying*[87] and policy impacts (Birhane et al., 2022; Brandusescu, 2021; Halminen et al., 2018; Knight, 2020; Ruttkamp-Bloem, 2022; Simonite, 2020). The severity of this has

[85] The concepts of partnerships with clearly defined and measured mutual benefits extends to academic research as well, particularly in the case of community-based research projects (Cooper et al., 2022). This will be discussed in further detail in subtheme 3b.

[86] Please note, the study of legal systems, court battles, potential bribery, and enforcing penalties in specific contexts is outside the scope of this research report.

[87] Lobbying describes a mechanism for powerful companies or organizations to influence laws and regulations. This may result in substantial and / or undue influence, unfair competition, and policy capture, which can be detrimental to the process of policy making and to the overall public interest (Organisation for Economic Co-operation and Development, 2022).

increased substantially in recent years with record rates of lobbying in many countries (including but not limited to the scope of this research) (Banga & Saha, 2021; Bank et al., 2021; Birnbaum, 2022; Dittoh et al., 2021; Metakides, 2020). The number of scientific authors with corporate ties increased from 43% to 79% over the last decade and publications by Alphabet and Microsoft increased more than fivefold during this period (Birhane et al., 2022; Casilli, 2022). With this, research and funding tends to focus on markets and diseases characterized by favorable expected profitability and often these priorities do not align to global health goals.

To address this, IGOs should further engage academia to help moderate the ANI research environment, particularly related to diagnostic research. This includes clear direction and insights on the opportunities and challenges of private-public sector partnerships, and methods in which real and perceived risks can be mitigated (e.g. through improved explainability, transparency, reporting standards, internal trust and organizational consistency, etc.) (Longo et al., 2020; Rowe et al., 2013; Yassanye et al., 2021). A clear distance exists in the technological skills possessed by private sector employees and those in the public sector who are entrusted to develop and enforce regulations to manage these innovators; of which academia can play a critical role in mitigating these gaps.

An example of this is Venture Capital (VC) funding. VC investment in global AI firms has increased dramatically, whereby many recent mainstream ANI diagnostic innovations have had a significant degree of VC funding (Parekh & Baker, 2023; Park, 2023; Tricot, 2021; Wiggers, 2019). Although there is a case to be made that venture capitalism positively contributes to societal advancement by fueling disruptive innovation and helping young companies grow, studies have shown this does not manifest equally across geographies, demographics, industries, or companies (Edwards, 2021; Kassan, 2022; Parekh & Baker, 2023; RateMyInvestor, 2018; Tricot, 2021). In addition, it tends to create a market of monoculture business models that prioritizes rapid growth and a timely exit. Paradoxically, this results in the failure of most businesses that opt for this funding model and as such, destroys vast amounts of economic value (Kassan, 2022); a result that is particularly problematic in low-resource regions which often struggle with the retention of economic advantages.

In Africa, the majority of VC funding goes towards *Fintech*[88] (Adams, 2022). Although Fintech in itself is not a problem and there may be auxiliary benefits (i.e. a spill-over effect) to other sectors, disproportionate funding and development opportunities related to banking and financial services creates a lack of attention and funding in public good sectors, including healthcare. This then greatly impacts what projects are implemented, who are on the project teams, who are the stakeholders and profiters, etc. thus preserving or worsening health and technology gaps in public good sectors.

Partial solutions to manage these broader systemic concerns include reducing top-heaviness in funding schemes, providing greater accountability and regulation of VC initiatives, and an increase in the quantity and effectiveness of independent, non-VC (e.g. incubator, corporate VC funding, microloans, peer-to-peer lending, purchase-order financing, etc.), and / or public funding models. In particular, IGOs should seek to develop frameworks that balance innovation and safety and provide greater structure to the accountability and transparency of venture capitalism.

Although local and public funding is somewhat captured in national and IGO recommendations, it is not fully optimized as the funding structure of these entities often results in projects that are ad hoc in nature, creating barriers to developing consistent *Performance-Informed Budget Processes*[89] (Curristine, et al., 2007; Farazmand et al., 2022; Herrera & Pang, 2005; R. Koria, personal communication, June 22, 2023). This hinders an ability to plan and leads to chronic inefficient use of financial resources, which is particularly constricting in low-resource contexts and their limited disposable incomes (Wikler, 2003). Where additional public funding is not possible, tax credits and accelerated depreciation can also be used to support local organizations and independent research (e.g. academia or startups) to encourage unbiased data and research related to ANI in these regions (International Monetary Fund et al., 2015). Despite this, there needs to be a recognition that it will be very difficult (and impossible for most national governments) to go dollar-for-dollar with large corporations and investment firms on research funding. Therefore, this bias needs

[88] Fintech describes the use of technology to modify, enhance, or automate financial services either for businesses or consumers (e.g. mobile banking, peer-to-peer payment services, automated portfolio managers, trading platforms, and also the development / trading of cryptocurrencies) (Columbia University, n.d.).

[89] Performance-Informed Budget Processes describe the use of performance information (e.g. decreases in mortality or morbidity rates of a health program) when making funding decisions to provide a framework for more informed resource allocation and management (Organisation for Economic Co-operation and Development, 2018).

to be mitigated through other means, such as the encouragement of creative funding strategies, stronger investment regulations, and the empowering of competitors which will be discussed further below.

Subtheme 1c: Current systems and policies do not sufficiently foster local competition, such as startups, accelerators, and local companies.

Related to the power imbalances discussed in earlier subthemes, the data also indicated a need to encourage more local competition in order to reduce the dependence on large foreign corporations for ANI innovation (Kritikos, 2014; Naudé et al., 2011; United Nations, 2018b). "*There's a colonial implication of only working with big international companies, which inevitably are always from the western world. And by failing to encourage local startups and local capacity building, you're definitely perpetuating those systems*" (G. Neal, personal communication, March 25, 2023). Furthermore, encouraging local innovation can have significant positive impacts[90] in terms of increasing a country's competitiveness and standards of living (Fu & Shi, 2022; Hoffecker, 2018; Naudé et al., 2011). In order to facilitate this, national governments and IGOs should seek to offer a more conducive business environment (e.g. accessible funding, competitive advantages, openness to innovation, etc.) to startups, accelerators, and local privately-owned firms[91] (Fu & Shi, 2022).

With this, let us first consider the role of greater local funding. Although the concept of local funding is partially captured in current national and IGO policies and recommendations, these recommendations were observed to be insufficient and / or ineffectual in real-world settings; specifically with many funding options in low-resource countries being unreasonably restrictive and / or time and energy intensive to achieve (Digital Health Canada, 2023; Kumbol, 2022; Lancet, 2021; Lubalo, 2022; Malachie, 2020; National Department of Health, 2020; United Nations Educational, Scientific and Cultural Organization, 2022; United Nations Industrial Development Organization, 2021; World Health Organization 2021a). The implication of this is that these funding options are not realistically accessible to local

[90] However, the scale of this impact varies on the stage of development of a country and the degree to which the business environment is receptive to innovation (Kritikos, 2014; Naudé et al., 2011).

[91] Although it is not uncommon for large corporations to 'buy up' certain startups, this pattern has been decreasing in recent years (Glasner, 2022; Snobar, 2022). However, regardless of whether startups are bought by large companies, bought by other startups, or remain independent companies, it is important that governments engage with local entrepreneurs and qualified workers in order to 1) emphasize shared goals and 2) strengthen relationships to local talent.

businesses, especially startups which are often characterized by resource scarce positions. This is problematic as it results in many local startups being forced to go without external funding as they do not have the disposable resources available in order to successfully apply for these grants / programs.

As such, it is prudent for IGOs to encourage national governments to conduct a robust review of their funding policies in order to deduce what restrictions are practical / impactful and which ones are arbitrarily prohibitive / restrictive[92]. A funding organization should design their application processes by considering not only the people receiving the grant, but also the people not receiving the grant (as this group typically makes up the majority of applicants). This involves a sensitivity towards the latter group in reducing the burden and / or providing alternative benefits. An example of this is a grant process which includes multiple rounds whereby only successful applicants are invited to submit subsequent rounds as opposed to grants that require a single submission in its entirety (which has the same resource burden whether the recipient is successful or not). A multi-stage application process ensures that people / projects which do not fulfill the grant criteria waste fewer resources if they are already sorted out at an earlier stage. Resources of which, they can then utilize in more fruitful areas; which is particularly relevant in low-resource contexts.

In addition to a lack of accessible funds, there are also access issues related to exposure and contact with government officials (Kumbol, 2022). The data indicated that many startup founders and personnel feel they have inadequate access to government officials, particularly compared to the access, opportunities, and advantages received by large corporations (Doruk & Söylemezoğlu, 2014; Kumbol, 2022; Lubalo, 2022). This added barrier then further exacerbates pervasive biases and inequality issues of ANI implementations in these regions.

One potential solution that policy makers may consider is developing standardized forms of recognition for startups (such as IGO "seals of approval" for passing defined ethical criteria) in order to capitalize on their brand position to provide international clout, exposure, and accreditation to these local companies[93]. In addition, governance bodies should consider partnering with academia to offer programs / resources to help local startups scale in order to

[92] Even going so far as to provide examples of historic highly restrictive funding criteria and possible suggestions for improvement.
[93] Although some IGOs already have programs similar to that described above (e.g. UNIDO), these programs tend to be ad hoc, relatively small in nature, and lack sufficient exposure to be highly impactful.

challenge the overwhelming power dynamics in low-resource regions (Doruk & Söylemezoğlu, 2014).

Although this complex subtheme involves the need for greater competitive advantages for local companies such as greater funding and improved political access, the issue is much broader. "*If you're in a place that doesn't have a good innovation ecosystem then even if you create a good technology and you get some grants from your government you'll still take it elsewhere. Or it just won't thrive because there's a lack of knowledge / enterprise*" (G. Neal, personal communication, March 25, 2023). As such, other elements related to this subtheme will be discussed in later themes / subthemes, including the need for strong government accountability and conducive business environments to encourage local expertise.

Theme 2: Insular decision making and stunted collaboration significantly jeopardizes systemic improvements to delivering ethical ANI-enabled health services.

In order to maximize public good and avoid big players from entrenching and becoming indispensable, public institutions (both cross-cultural and cross-industry) should attempt to outpace these players in establishing set norms and governance structures around new technology (Lowery-Kingston et al., 2021). Although early attempts at regulating transnational organizations have yielded mixed results, the increasing interconnectedness of the world and consequentiality of modern challenges suggests the need to better manage these beasts (Mares, 2022). This growing interconnectedness also offers substantial opportunities for knowledge sharing and greater access to positive examples of digital policy (e.g. Freeman, 1987). Whereas the contrary, insular decision making, offers the risk of episodic technology challenges globally.

As previously discussed, the efficient use of resources during ANI implementations is particularly difficult, which is further complicated by the barriers associated with low-resource contexts (Thomford et al., 2020). This creates an impasse, whereby emerging technologies can help automate mundane tasks and improve the efficient use of human resources, however their implementation requires a significant degree of financial and human input, which low-resource regions often do not have. These trends are not likely to be upset without substantial international collaboration and the sharing of the AI ethics burden.

Furthermore, a self-reinforcing cycle was observed in the data. Shortages of human resources are exacerbated by mass migration patterns (predominantly from the Global South

northward)[94] (Macaulay, 2022). These mass migration patterns are driven by quality of life indicators within a country, such as weak income opportunities and poor access to healthcare services (Eurostat, 2022). This then creates challenges for remaining health and technology workers, which are experiencing high levels of burnout, turnover, and pervasive retention issues (especially amongst healthcare workers, policy makers, and ethicist in Africa) (Macaulay, 2022; Maunder et al., 2021; Michel et al., 2019). This in turn reduces the likelihood of success for ANI-enabled healthcare projects and creates other competitive disadvantages, which further perpetuates health disparities (Mariani, 2008).

The following subthemes outline the potential value of greater international collaboration and methods in which we can look for inspiration from the private sector to increase the efficient use of limited resources to minimize waste and maximize project impact (Gupta, 2023; Madhani, 2020; van Assen, 2021). The goals of which are to bring knowledge closer to the decision maker and to follow general principles of enlightened self interest.

Subtheme 2a: The importance of greater cross-sectional collaboration cannot be overstated.

The growing interconnectedness of the world and shared global challenges, require a degree of cooperativeness on a scale unprecedented in human history (Killelea, 2021). AI ethics challenges were observed to be both structural and global, which suggests that many of the ethics challenges associated with ANI are shared across many different contexts (Johnson et al., 2020). Prominent global leader on AI Gary Marcus[95] stated "*it takes a village to raise an AI*" whereby proper cooperation and collaboration has a significant impact on the effectiveness and ethicality of ANI solutions (Marcus, 2023, 15:08). Accordingly, the need for greater international, inter-industry, and inter-disciplinary collaboration was abundantly represented in the data set (Ebadi, 2018; Holzinger et al., 2022; Jain, 2022; Landay, 2023; Meltzer & Kerry, 2021; Morley & Cashell, 2017; United Nations Educational, Scientific and Cultural Organization, 2022; Zwarenstein & Bryant, 2000). This notion demonstrated legitimacy across macro and micro levels of cooperation: from international collaboration to interdisciplinary project delivery teams.

[94] Unfortunately human resourcing constraints and skill gaps are highly complex issues that are not likely to be immediately solved; of which, the localized solutions are outside the scope of this report. Only broader themes relevant to this research topic will be discussed.

[95] Gary Marcus is a leading scientist, best-selling author, and entrepreneur (Founder of Robust.AI and Geometric.AI, acquired by Uber) who specializes on the topic of AI and the associated societal gaps and repercussions.

Relating to social inequalities, strong coordination helps to make more efficient use of scarce resources by avoiding duplication and gaps in healthcare services and reduces the burden on low-resource countries that occurs when multiple programmes, processes, and systems are imposed on them by global health actors (Long, 2011; Spicer et al., 2020). More broadly, ethical decision making has been a complicated process in many low-resource contexts as these regions often have to deprioritize ethical ideals in favor of more immediate concerns, such as economic growth or the development of critical infrastructure within a country (Baltussen, 2006). This has significant implications as low-resource countries are on the frontlines of enforcing ethical standards and preventing outcomes such as data exploitation, as in the case with many African countries (Peters, 2017).

To address this, researchers wish to emphasize the value of a coordinated approach between countries with shared values related to AI[96] to help offset the power imbalance between stakeholders to offer greater protection from exploitation (Formanek, 2021; Jain, 2022; Stanger, 2021; Ramos, 2022). Developing shared pan-regional laws and standards (e.g. African Peace and Security Architecture (APSA), African Continental Free Trade Area (AfCFTA), Mekong Basin Disease Surveillance network (MBDS), Middle East Consortium on Infectious Disease Surveillance (MECIDS), etc.) that are multilateral in nature regarding topics such as data ownership, privacy and surveillance, bias and discrimination, etc. allows countries to cooperate towards shared goals with a bigger market weight and associated bargaining power (Banga & Saha, 2021; Gnanguênon, 2020; Long, 2011; Swedish International Development Cooperation Agency, 2022). Thus creating a collaborative advantage spawned from mutual need: "*the vicious threat posed by diseases and pathogenic microbes […] is predicated on […] the mutuality of vulnerability*" (Aginam, 2005, p. 3).

Coordinated laws suggest that if a corporation wants to access or conduct business in a market (such as North America, Europe, or smaller sub regions such as West Africa, East Africa, sub-Saharan Africa, etc.) it will have to accommodate these standards of practice into their operations. This coordination offers a more effective method of policy enforcement by a *bloc* of countries rather than leaving individual countries to attempt to protect themselves from exploitative powers and represents a critical step in removing the burden of care related to the 10 / 90 Health Gap faced by developing countries (Formanek, 2021).

[96] And other potential commonalities such as geographic proximity, sociodemographic likeness, knowledge / technology / economic synergies, etc.

Although this approach has been successfully utilized in smaller sub-regions, arguably the most poignant global example is the European Union and the far-reaching impacts of its technology policy. This has been coined the "Brussels Effect" by Anu Bradford of Columbia University and describes the regulatory phenomenon whereby coordinated regulation(s) are passed by numerous countries within a region that leads to externalizing of these regulations to other countries outside of this region (Bradford, 2020). As regulations are passed (regarding data protection for instance) Big Tech companies must accommodate these requirements due to the combined market size of these countries[97] (Metakides, 2020). However due to the global nature of their technology products, it is not easy to significantly differentiate their products and processes in other markets (Bradford, 2020; Metakides, 2020). Therefore, these natural market forces then lead to improved protections in regions beyond the country borders specified in the regulations. Thus offering a method in which high-resource countries can help nudge the burden of care and digital health protection off of low-resource countries.

This subtheme offers an opportunity for countries to share the burden of cost, which can help provide reprieve from the rising cost of healthcare in many countries by taking advantage of the large amount of shared health challenges between countries. In this case, a country or a neutral third party organization can lead a large digital health project or develop a tool, solution, etc. and receive funding or additional resources from other countries that may benefit from this product. When implemented properly, this funding model has strong economic rationale as it reduces redundancy and the need for each country to separately have to "reinvent the wheel".

To enable this collaboration (within democratic and meritocratic contexts), it is critical to elect leaders using modern criteria, such as competence, cooperation, compassion, conflict resolution, strong understanding of global priorities, etc. Yet many political ideologies, including many of which have been observed within this research context, are still characterized by outdated notions of national self-interest and competition between states (Killelea, 2021).

Fostering genuine and enduring collaborations is not always straight-forward especially given the large number of stakeholders, varying objectives, and skewed power dynamics associated with this area of study. Although there are many factors that are required for successful

[97] I.e. the European market accounts for approximately 1/3 of their business (Metakides, 2020).

collaborations[98], the data indicated a gap that is regularly missing from these partnerships: clearly defined goals and objectives to achieve through the collaboration for each of the stakeholders (Hückstädt, 2023; von Richthofen et al., 2022). And with this, strategies to alter the partnership if / when these objectives are not met. These objectives should be measurable in order to continuously assess whether the collaboration is a productive one or merely superficial / perfunctory[99]. If a collaboration is not productive, researchers suggest 1) reframing the partnership to increase its benefits or 2) reassessing the relationship altogether to redirect resources to focus on projects with more compelling outcomes.

The data also indicated a stronger need to improve collaboration on a micro-level throughout the AI development pipeline. This collaboration involves stronger coordination between different disciplines within the same context / system or between similar contexts / systems in different countries[100]. Heavily specialized homogenous teams create potential risk and a lack of awareness of broader project implications when implementing ANI in low-resource contexts (Apfelbaum, 2017; Wang et al., 2022). Although there is a case to be made for broader collaboration in various industries, this notion is particularly pertinent in healthcare due to its direct and profound human impact and the low / mixed data quality it is generally characterized by. This consequentiality and potential variance of system outputs suggests that the legitimacy of a system can be highly influenced by the codesign of ANI systems between medical (e.g. neurologists, pathologists, family medicine, etc.), technology (e.g. human computer interaction, knowledge discovery and data mining, etc.), and relevant cultural specialists (Holzinger, 2021).

In situations where interdisciplinary teams may not be available (e.g. regions characterized by 1) homogenous groups[101] or 2) human resourcing capacity constraints), it is productive to encourage interdisciplinary training and knowledge sharing as these contexts necessitate that

[98] Such as a high level of shared interest, trust, and joint problem solving in addition to institutionalized decision making, transparency, and accountability mechanisms to reinforce these aims (Cronin, 1999; Long, 2011).

[99] Ideally these should be facilitated and assessed by neutral third parties, which depending on the context may include IGOs. In cases where this is not possible / applicable, self-management is possible although more complicated by potential conflicts of interest.

[100] E.g. one could argue that modern day Indigenous groups living in remote Canada share more in common with remote Indigenous groups in other countries such as Australia than they do with the general Canadian population living in downtown Toronto.

[101] In this case, "homogenous groups" goes beyond the demographic characteristics of a person and considers their prior education, training, years of experience, area of expertise, etc.

one person may need to 'wear many hats'[102] (Macaulay, 2022). A better understanding of the other skill sets and experiences required to deliver ANI-enabled health services can help reduce silos, productivity losses, and misunderstandings; while increasing health and operational outcomes through enabling a shared common goal for projects and teams (Kulkarni & Engineers, 2016; Sandow & Allen, 2005).

However the manifestation of these recommendations associated with diverse and collaborative teams may be challenging in real-world settings due to certain macro-trends that will be discussed further below.

Subtheme 2b: Human resourcing constraints present a major threat to successful ANI projects, particularly in low-resource locations.

In order to better collaborate and take advantage of diverse skills and perspectives, these characteristics must be readily available. Yet unfortunately, this is not necessarily the case in many contexts. Although the lack of available skilled workers is represented throughout the case studies, the effects tend to be more impactful the more low-resource a context is (Dodani & LaPorte, 2005; Mariani, 2008). This trend generally holds true when comparing differences between and within countries (e.g. developing versus developed countries and rural versus urban contexts, respectively) (Docquier, 2006; Dodani & LaPorte, 2005; Mohammadiaghdam et al., 2020; Yuksekdag, 2018). As such, this presents a significant threat to efficient and ethical digital implementations as the skills and capabilities of those 'on the ground' conducting the work is a critical determinant of project success (or lack thereof) (Killelea, 2021). Furthermore, experts state that a crucial component to promoting inclusive and responsible digital health technology development is through working closely with communities on practically-oriented, community-based problem solving (Dittoh et al., 2021). Thus making the implications of personnel shortages particularly noteworthy.

In particular the "Brain Drain" of African talent has had severe consequences which are expected to continue in the future[103] (Macaulay, 2022). A survey of more than 4,500 18-24

[102] Ideally this training will be across all levels of an organization: from entry level to senior executive. Within the context of this research, example training sessions include: defining, assessing and measuring the ethics of projects, quantifying project KPIs, understanding power dynamics and their implications, basic understandings of ANI, as well as healthcare-based skills (such as understanding patient goals and objectives of care, etc.). Also in high-resource locations, training on power structures is suggested so that when multinational groups do collaborate they can 'speak on eye level' (von Richthofen et al., 2022).

[103] Low-resource regions in Canada also experience significant personnel shortages through urbanization and Brain Drain of qualified workers (Bergen, 2021; Government of Canada, 2023;

year olds in Africa found that 52% are likely to consider emigrating in the next few years, citing economic hardship and education opportunities as the key reasons (Macaulay, 2022). This is expected to further perpetuate already disproportionate levels of ANI implementations in high-resource regions as many skilled African workers are choosing to immigrate to these regions; which in turn relates to differences in innovation costs (Mariani, 2008).

Although conceptualizing and addressing the entirety of the Brain Drain crisis in Africa is outside the scope of this research, this report will discuss some of the in-scope factors that contribute to this crisis and proposed solutions to these contributors. For instance, some African countries have enacted emigration restrictions in order to curb these migration patterns in critical industries, such as healthcare (British Council, 2016; Yuksekdag, 2018). However, this report proposes alternative methods to limiting the impact of human capacity shortages. Namely, 1) enabling favorable working conditions to influence natural market forces to reduce mass emigration patterns of skilled workers and 2) increasing the efficient use of current resources in the meantime.

First, let us consider enabling favorable working conditions for health and technology workers in low-resource contexts. The previously mentioned study on young African adults cited two key reasons for the migration of qualified workers to other countries: 1) economic hardship and 2) lack of local education opportunities. The alleviation of economic hardship can be improved through stronger engagement with the private sector and the more competitive salaries associated with this (ECIKS, 2019). Furthermore, the creation of centers of excellence can help attract key workers, which then attracts technology companies, which then attracts more skilled workers; thus creating a self-reinforcing system and further indicates the value of private / public / academic sector collaboration (P. Jakubowski, personal communication, May 28, 2023).

Specifically relating to the lack of educational opportunities, the data indicated two key areas of potential improvement: 1) a stronger understanding of the changing role of traditional academic institutions in fostering a skilled and digitally-literate workforce and 2) regarding financial and auxiliary support for local researchers. Although career movements between industry and academia have become increasingly common, there is a trend of growing competition from corporations in the educational / training space via the development of

House of Commons Canada, 2012). Although the Canadian context is less extreme than the migration patterns observed in the other two cases studies, there are many similarities on the causes and implications of these shortages of skilled workers.

accreditation systems (e.g. Google Career Certificates) (Bauer & Cohen, 2012; Pichai, 2021). These systems have natural competitive advantages as they are 1) often closely tied to job opportunities as opposed to traditional academic institutions whereby this tends to be less coupled 2) are agile in nature and can be quickly adapted to changing talent / skill demands for large organizations and 3) are scalable and relatively-cost effective in nature (Coursera, 2023; Pichai, 2021). This and the growth of remote work creates more cost-effective options for students and skilled workers that were not necessarily available a few decades ago.

Regarding financial and auxiliary support for researchers, the data indicated that the amount of funding tends to be insufficient and the criteria by which funding recipients are selected is suboptimal. Researchers observed a greater need for independently funded research for not only local PhD students but also younger scholars at local universities. It was stated that fostering this knowledge and human capital earlier in an academic career is highly critical, despite most current funding focusing exclusively on the upper levels of education (Kumbol, 2022; Organisation for Economic Co-operation and Development, 2019a). Delaying funding support until so late in an academic career risks premature disengagement from academia by promising scholars or alternatively, may cause them to seek out educational opportunities elsewhere. Both of which contribute to knowledge gaps and emigration of skilled workers.

Due to the systematic nature of these recommendations and the need for strong coordination from different sectors, these recommendations may take years or decades to yield positive results. Therefore, in the meantime it is important to increase the efficient use of resources in order to maximize health outcomes with limited resources. This provides an opportunity for high-resource contexts to provide knowledge-based support to low-resource contexts that are grappling with widespread trends such as resource shortages and the Brain Drain.

The data indicated that there is exceptional value to better capturing the lessons learned from early ANI-implementations (even so far as the creation of a central database of ANI projects and outcomes), whereby opportunities for knowledge sharing are currently heavily underutilized between stakeholders (e.g. partnerships between public sector groups and academic institutions, partnerships with international academic institutions, and broader open and sovereign resources between stakeholders) (Lowery-Kingston et al., 2021; van der Hijden & van der Wende, 2020). A tremendous amount of insights can be derived from early ANI projects, which can enable low-resource regions to minimize unnecessary resource

waste[104] (Pettey, 2019). In order to do this in a culturally relevant and sensitive manner, frameworks such as the Plug-In Principle can be used (Dittoh et al., 2021). This framework involves processes and strategies for merging different knowledge systems and reengineering systems to produce an appropriate amalgam technology. This process begins with a strong understanding of the patient / user and has been developed and implemented in low-resource contexts including many in Africa (Dittoh et al., 2021).

In order to effectively enable this, IGOs and academic institutions are encouraged to alter their dialogue surrounding ANI implementation to better normalize the concept of project failure. Historically, governments and other organizations have perceived failure to be unfavorable and a reflection of incompetence on the part of the project team (Farson & Keyes, 2002; Townsend, 2010). However, the concept and overall value of failure has changed significantly in recent years, particularly with the "fail fast" notion associated with innovation in the private sector (Ferreira et al., 2020; Rhaiem & Amara, 2021; Townsend, 2010). Strong reflection skills and an understanding of 'what went well' and 'what didn't go well' via a project debrief can greatly improve the quality of ANI system moving forward.

Insights from early implementations can be hugely beneficial to those implementing similar projects and can help others avoid making the same mistakes and the unnecessary / wasted use of resources[105]. As such, it is recommended that the international policy community encourage more open and honest conversations regarding ANI implementations globally. It is clear that the innovation process is challenging; accepting and embracing this can help improve international communication and genuine collaboration.

Theme 3: Current ANI-related ethics recommendations do not adequately capture the scale and impact of industry disruptions and what this means to the healthcare system and the patient.

"*In the coming decades it is likely that we will see more internet-like revolutions, in which technology steals a march on politics. Artificial intelligence and biotechnology might soon overhaul our societies and economies - and our bodies and minds too - but they are hardly a blip on the current political radar. Hence traditional democratic politics is losing control of*

[104] Incidentally inline with theme 1, this is also an excellent way to engage corporations who have often been the early implementers of these systems.
[105] As ANI projects further permeate low-resource regions, it is important that these lessons learned are also captured. For example, a low-resource context (e.g. underserviced, rural, etc.) in a developed country may share similarities with an ANI-enabled project in a developing country.

events, and is failing to present us with meaningful visions of the future" (Harari, 2015, p. 437).

The global rate of change is increasing at a rapid pace, spurred by technological advances, new challenges, and shifting global / cultural priorities (Global Priorities Institute, n.d.). However, short election cycles and a complex yet ambiguous socio-political environment makes attributing responsibility / accountability on policy leaders difficult. This results in many health policies being relatively short-sighted in nature, focusing on short-term risks and how ANI will be integrated into current processes. It is far more onerous, yet arguably more important, to conceptualize broader challenges such as the implications of new ways of working (i.e. evolving workforce needs and dramatic changes to the patient experience) and the broader impacts of AGI and ANI on democracy, trust, and civil liberties (Dutton, 2018; Greenhill, 2020; Lee, 2020; Stanger, 2021).

Currently it is unclear exactly how penetration of ANI into health systems will manifest (from a tsunami of point solutions to larger systemic disruptions) and what this means for high- and low-resource contexts. Large, systemic disruptions have the potential to upset more established industries and supply chains, which may lead to prolonged bureaucratic or lobbying-related delays. Whereas there is an argument to be made that this creates an opportunity for some developing countries as the infrastructure that currently exists is potentially weak. Alternatively, these same rapid disruptions can increase the risk of systemic failure, particularly in societies with low levels of social, political, and economic resilience (Killelea, 2021).

When looking at early ANI implementations, an incompatibility is often observed when attempting to fit these disruptive transformational technologies into traditional processes. Studies suggest that current resource allocation in healthcare systems are largely carried out based on historical patterns and through ad hoc decisions (Seixas et al., 2021). This in turn biases the type of projects being implemented, the teams delivering the projects, and the impacts to the patient. Additionally, financial incentives often dictate the areas of focus for research, drug development, etc. (Formanek, 2021). Of which, this has significant societal implications on inequality as "*medicine becomes increasingly focused on upgrading the healthy rather than healing the sick*" (Harari, 2015, p. 419).

With this, it is clear that the digital disruption of the healthcare industry offers both opportunities and also stressors, implying a clear need for policy makers to better support

relevant stakeholders through this turbulent process. Such a fundamental shift will be a 'marathon, not a sprint' requiring prolonged participation and engagement from all relevant parties; whereby the risk of disengagement and change fatigue is substantial. Building motivation and trust with patients and HHR takes time but losing it can happen quickly, so adaptability, patience, and transparency are critical in enabling systemic ethical ANI.

Subtheme 3a: Many early ANI implementations are integrated into (or directly replace) current processes, rather than be used as a catalyst to reimagine health systems and patient-provider interactions entirely.

The intense rate of change globally, particularly in cultural expectations and technological capability will disrupt societal opinions of what matters most[106] (Harari, 2015; Szlezák et al., 2010). As this process occurs, shared human decisions will likely create a world that is 1) difficult to predict and 2) radically different from its current state (Harari, 2015). Although experts attempt to make predictions in order to understand how technology will disrupt critical industries, the reality is that most of these predictions, in the long term, will not be correct (Harari, 2015; Salganik, 2023). However, the true value in expert predictions is that they help us acknowledge that change is likely to occur and that we need to prepare to adapt.

This need to adapt in a safe and agile way is the crux of ethical and efficient ANI use in healthcare. Yet, many early implementations of ANI in healthcare are unimaginative with ANI tools being integrated into current processes rather than being used as a catalyst to reimagine healthcare entirely (Greenhill, 2020). One example is using paper forms as the base design for EMRs and electronic health forms. Yet the user requirements and experience vary substantially depending on the medium of data input. This can lead to the fragmentation of data entry of vital signs, respiratory parameters, and administered medications being distributed across multiple screens, leading to challenges in both recording and interpreting the data (Collins et al., 2012). This is highly problematic as historical medical data is already characterized by inaccurate, incomplete, or missing data and further poor workflows / process designs can perpetuate or exacerbate these issues especially when this data is used for diagnostic ANI algorithms.

This results in missed opportunities for system improvements, inefficient upgrades and investments, and perpetuates outdated, biased, and potentially harmful processes (many of

[106] For instance, as seen in shifts from religious to humanists movements, and the associated impacts on ethical definitions and understandings, and goals for both societies and individuals.

which have foundations in ubiquitous gender and racial biases) (FitzGerald & Hurst, 2017; Marcelin et al., 2019; Parikh et al., 2019). This is particularly harmful to resource-poor contexts, whereby the development of appropriate technologies should follow a "bettering process" rather than a replacement, transfer, or change process in order for it to be successful in a sustainable manner (Dittoh et al., 2021).

The move to more digitized public services, including that of which is occurring in the health sector, requires a significant degree of collaboration between patient and provider. This represents radically new ways of working for both parties and requires patient enablement, upskilling, autonomy, and ownership (e.g. as in the case with medical data). Developing ANI-enabled diagnostic systems is one matter, but actually driving adoption by patients and HHR is often exceptionally challenging and time intensive.

Although sporadically referenced in policy recommendations, stakeholder engagement, upskilling, system and process acceptance, and sustained adoption are critical determinants of ANI project success. Yet the high rate of project failure suggests limited success in these areas. As such, change management plans should be developed that borrow frameworks commonly-used in the private sector such as personas, associated journey maps, goals, methods of assessment, etc. for each set of stakeholders (Weiner, 2009). The purpose of which is not to be an absolute path forward but rather an opportunity to imagine, discuss, and reassess future adaptations and ANI implementations.

Although IGOs may not necessarily be the actors implementing these change management plans, there is an opportunity for greater big picture messaging within health policy. ANI implementation and adoption is a long and complicated process requiring significant patient engagement, upskilling, and trust. Failure to provide this big picture perspective risks eroding patient trust in health systems with every bump in the AI road (of which there are likely to be many). In fact, one could argue that the need for a comprehensive and articulate change management strategy was one of the major insights from the COVID-19 pandemic (Gallegos et al., 2023). Without this approach you risk alienating patients who then reject health systems entirely and have the communication tools (e.g. social media) to influence others (Khadafi et al., 2022). #ANTIVAX anyone?

This unique bird's eye view on global health allows IGOs the perspective to highlight potential shortcomings or fallacies in national strategies. For instance, in many countries (including the three case studies discussed in this report), a disproportionate amount of study

and discourse is focused on the deployment phase of a product rather than the production phase (Casilli, 2022). As a result, the vast majority of the AI ethical guidelines tend to focus on how to manage products once these products are already available (Casilli, 2022). However, a more responsible approach is to also focus on the production phase of an ANI product and to follow a more end-to-end approach to AI ethics[107]. This would better consider the geographies of resource / data extraction and exploitation required for AI systems, of which many low-resource countries are the victims (Casilli, 2022; de Bastion, 2022). Additionally, this strategy can be used to increase transparency[108] and accountability with algorithms and help reduce bias associated with data that often excludes or further victimizes marginalized populations (Baeza-Yates, 2021).

Ultimately, the aim of this recommendation is to develop stringent standards along the AI supply chain in order to protect those who both develop and use these emerging technologies. This then brings us to subtheme 3b and a further look into how the patient fits into these new ways of working.

Subtheme 3b: A patient-centered perspective is not wholly embedded throughout policy, governance, and healthcare processes resulting in misalignment of resources to patient outcomes.

The complexity of this subject matter, buzz surrounding ANI innovation, and pressure to digitize makes it easy to misappropriate time and energy to initiatives that are innocuous but not optimally productive. Although this research has previously discussed major stakeholders and their associated power dynamics, it is important that we dedicate significant thought to arguably the most nuanced and relevant stakeholder: the patient. Ultimately, all international

[107] This end-to-end approach can be observed regarding policies in other industries such as food production and consumer goods. As an example, why may a certain coffee be considered ethical? Generally it is considered ethical if it was both produced and marketed in an ethical manner (e.g. workers were not exploited, any pollutants were mitigated or offset, etc.). The entire end-to-end process is considered and not just the deployment phase. Whereas currently, many governments focus on how to regulate technology products after they are already produced (an obvious example is self-driving cars although this also applies to many ANI products as well).

[108] To clarify, an increase in transparency is not synonymous with full transparency or transparency to the point where the cybersecurity or gaming risk is harmful or intolerable.

and national health policy recommendations should be conceived in such a way that they are human- / user- / patient-centered[109] (Russell, 2020).

However, the challenge is that this is often difficult to implement and evaluate. Consider the following interview excerpt with a senior IGO professional in policy development, regarding whether a patient-centered perspective is wholly embedded within IGO policy and governance.

> **Interviewee:** *"I think it is."*
>
> **Interviewer:** *"Do you?"*
>
> **Interviewee:** *"There is this cognisance that - ..."*
>
> **Interviewer:** *"- I agree there is a cognisance. But is it embedded into regular day-to-day procedures and decision making? I would argue that it's not."*
>
> **Interviewee:** *"That's where you've got to separate it out. Policy, governance, and healthcare processes - that's very different levels of interaction."*
>
> **Interviewer:** *"...But do you believe it's fully embedded in any of them?"*
>
> **Interviewee:** *"No, but there's a cognisance."*
>
> **Interviewer:** *"I agree that there's cognisance, but is cognisance sufficient?"*
>
> **Interviewee:** *"...no, it's not."*

Although there may be an intention to embrace a patient / user perspective in policy development[110], this does not always manifest in an actionable manner; resulting in suboptimal strategic and resourcing decisions. Furthermore, this lack of engagement and co-development can exacerbate challenges associated with transitioning from ANI development to implementation (Osman Andersen et al., 2021), which can lead to substandard project outcomes such as the low adoption rates previously discussed.

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[109] The distinction between human, user, and patient has been emphasized in this case because although all digital health processes should have some direct or indirect benefit to the patient, some of these processes will be back-office (as opposed to front-office processes that are patient facing). Therefore these systems should be conceived in such a way that they are also conducive to the agents interacting with them, such as HHR for instance.

[110] The comparison is particularly stark when compared to the customer "obsession" characterized by the private sector.

The data indicated numerous projects that were time, energy, and financially intensive that did not result in the desired project outcomes, at least from the perspective of the patient (Forth et al., 2020; McKinsey Global Institute, 2018b; Rogers 2016; Venture Beat, 2019). To capture this, please consider the following real-world example provided by a SME involving their work with a client organization[111].

Scenario 1: *While completing digital transformation initiatives, a healthcare facility in Canada spent an undisclosed but "significant" amount of time and money digitizing parking services for patients to use in-hospital diagnostic tools / services. When receiving patient feedback, it became clear that the majority of patients would have preferred alternate solutions such as non-traditional service hours and / or digital health services that they could access remotely[112].*

This suggests a misalignment of project spending to patient impact / satisfaction and developing "technology for technology's sake"[113] (ETCIO, 2023). These misalignments tend to have disproportionately negative consequences in low-resource regions. For instance, the above scenario may result in a less efficient use of funds leading to disgruntled Canadian taxpayers. However this same scenario may have been devastating in a low-resource context where these funds are much more limited and thus each precious dollar becomes more vital.

The high rate of ANI project failure, particularly related to the challenges associated with moving from development to implementation suggest a critical bottleneck in the need to develop stronger insights, concepts, and methods for gathering patient / user input to drive more favorable project outcomes such as buy-in, trust, sustained adoption, etc. (Dietvorst et al., 2015; Keeffe et al., 2005; Maddox et al., 2019; Ribeiro et al., 2016; Vayena et al., 2019; Verghese et al., 2018).

Scenario 2: *Several studies report that clinicians spend up to 30% of their work-day performing documentation tasks yet the quality of EMR data is often substandard, inefficient for information retrieval, and can lead to information overload (Ammenwerth & Spötl, 2009;*

[111] The name of the client was redacted from this report for privacy purposes.
[112] E.g. The use of video conferencing, robotic, and ANI-enabled diagnostic tools can reduce the requirements of in-person specialized staff and support personnel; enabling some healthcare facilities to offer hours of operation outside of traditional working hours (Spatharou et al., 2020).
[113] Which refers to digitizing because you can and not necessarily because you should (or not digitizing in the way you should).

Collins et al., 2010; Collins et al., 2012; Cottrell, 2000; Fontaine et al., 2000; National Research Council, 2009); thus creating substantial challenges for data-hungry ANI systems.

This suggests that poor system / process design may not only create a larger burden for the user, but can result in substandard medical care for the patient. This malalignment of resources (time, energy, financial, etc.) to patient and operational outcomes is unfortunately pervasive in health and medical systems in various contexts.

Further exacerbating these consequences is the fact that resource alignment is often more difficult to achieve in low-resource regions due to funding and personnel constraints. Limited project resources may result in reducing all non-essential project teams / initiatives, such as the personnel and analysis required to conduct robust patient interviews, focus groups, etc. in order to optimally align projects with patient goals. To avoid this, it is prudent for IGOs to communicate strategies for obtaining accurate patient input during codesign, the risks of failed alignment to patient goals, and possible solutions to mitigate these risks[114]. This includes leveraging strategies from the private sector, such as following a lean *User-Centered Approach*[115] in order to design healthcare processes that are optimally beneficial to the patient group (Landay, 2023).

These strategies should be flexible and conducive to a wide range of contexts. For example, high-resource contexts may have available prototypes to test with potential patients to generate early feedback. However, low-resource contexts may follow other feedback strategies such as the use of product narratives, which have been shown to be comparably as valuable as prototypes in generating accurate input, yet have significantly fewer resource requirements (Hende & Schoormans, 2012).

The use of such strategies can improve the likelihood for project success through a targeted and iterative design process (Murphy et al., 2022; Nijhuis et al., 2018); that can productively engage underrepresented groups (Harrington et al., 2018). Additionally, the increasingly collaborative nature of the healthcare system indicates the need for patient / user input in building the levels of trust and understanding required for sustained engagement (Cai et al., 2019; Maddox et al., 2019; Vayena et al., 2018). The result of which is not only improved healthcare processes, but health outcomes as well (Chalfen & Rich, 2012; Dang et al., 2017).

[114] This includes encouraging national governments to embed these practices within their own operations, as well as making this content readily available to health facilities within the country.
[115] A User-Centered Approach is an iterative design process in which designers focus on the users and their needs in each phase of the design process (Chammas et al., 2015).

From a change management perspective, engaging with patients can increase buy-in, digital adoption, and the overall championing of new health solutions, resulting in better project outcomes with lower costs (Krist et al., 2017; Phillips & Klein, 2023).

Furthermore, in recognition of the very diverse healthcare contexts covered in this report, there is compelling evidence on the value of addressing the patient directly (i.e. a bottom-up approach as opposed to the top-down policy approach previously discussed). "*People to people. Not country to country. As we saw with the COVID-19 pandemic, a passport doesn't protect you*" (R. Maharajh, personal communication, August 8, 2023). Encouraging patient empowerment can offer an additional layer of protection in maintaining high ethical standards of digital health services (Rimondini et al., 2019). Patient and community empowerment, such as an awareness of individual rights, autonomy over treatment options, data ownership and transparency, etc. is particularly important in regions with governments of varying human rights standards (World Health Organization, 2006).

The specific approach and method / style of communication will vary significantly depending on the cultural context and should involve a strong understanding of local customs, norms, and accepted behaviors. Although these specifications are outside the scope of this report, there are still broader trends worth acknowledging, such as the value of local buy-in and incremental system improvements[116] (Killelea, 2021). A key broader trend is the implication of power imbalances in community-based research and technological empowerment (Cooper et al., 2022). This can result in outside (often Western) perspectives and expertise dominating community-based technological discussions and research, whereby involvement of community stakeholders is highly encouraged at all stages of a project, but is of particular importance when conceptualizing a research problem prior to solutions development and when analyzing data (Cooper et al., 2022).

Thus suggesting that the more that IGOs and other policy groups advocate, articulate, and disseminate the value of individual / community rights, the more likely patients are to avoid

[116] Additionally, there are shared human challenges that exist cross-culturally, such as balancing the role of "citizen" and "consumer" and how policy can protect users / patients while also allowing for autonomy and personal choice in an increasingly technology-enabled world (Stanger, 2021). As consumers, humans are not always adept at making decisions that are "good for us", so it is important that individuals are empowered and supported so that they can be better equipped (in the case of healthcare and other key sectors) to be citizens first and consumers second (Stanger, 2021).

exploitation whether by their government, a corporation, or an illegal organization (MacLean, 2021; Rimondini et al., 2019; World Health Organization, 2006).

Theme 4: Commonly-used methods of ideation, communication, and implementation of ANI-related ethics policies limit the impact in real-world settings.

There is strong evidence to suggest that broader elements (such as a well-functioning government, low levels of corruption, high levels of human capital, a sound business environment, etc.) generally have positive impacts on economic and societal measures, including access to healthcare services (Killelea, 2021). Although the impact of these elements will likely vary depending on the specific national context, shared policy gaps were observed across the three case study countries.

AI ethics policy recommendations by IGOs and most national governments tend to be idealistic by nature (Casas-Roma, 2022; United Nations Educational, Scientific and Cultural Organization, 2022); yet this can severely limit their practical viability, particularly in low-resource settings. As such, these policies and policy recommendations do not always manifest as intended despite sounding reasonable, beneficial, and gainful on paper. Without effective policy in this regard, there is a risk of harmful systemic impacts at the individual, community, and societal levels (Landay, 2023).

This suggests a need for IGOs to elevate their strategic thinking on how they develop and communicate their policy recommendations associated with ANI implementation in diagnostics. Greater intentionality in policy development is particularly important given growing customer expectations and greater emphasis on transparency, accountability, and strategic decision making in the health sector (Daniels & Sabin, 1997; Deloitte, 2014; Douglas & Meijer, 2016; Lateef, 2011; Sampson et al., 2019).

Ever expanding global health disparities that have been further agitated by the disproportionate use of emerging technologies imply that past policies have had limited efficacy in offsetting these broader patterns. As such, researchers are urging policy makers to consider new ways of problem solving if they are serious about addressing pervasive systemic trends.

Subtheme 4a: *Eating Your Own Dog Food*[117] - in order to drive meaningful change, IGOs should embrace their own recommendations on ethical AI and digital policy internally.

Many countries, including the case studies discussed throughout this report, have either developed or are in the process of developing a NIS[118] (Information Technology & Innovation Foundation, 2019; Organisation of African, Caribbean and Pacific States, 2022). Yet, there was sufficient evidence to indicate that this has not been fully embraced within internal processes.

Throughout the data collection process researchers heard numerous quotes such as "regulation stifles innovation" and "the business model is against you[119]". This negative perception of the public sector is particularly concerning when coming from leading AI juggernauts and digital specialists, most of which come from the private sector. Although the objectives of the private and public sectors are somewhat at odds, this recurring point of view is problematic at a time when collaboration between the public and private sector is increasingly potentially productive. Therefore in order to increase the effectiveness of policy recommendations (through decreasing silos between industries and improving the ease of inter-industry collaboration), IGOs and national governments need to "walk the walk" rather than just "talk the talk" in terms of embracing change, managing risk, and capturing lessons learned along the way.

For a number of reasons, governance teams have been generally more risk averse and hesitant to embrace change as compared to their counterparts in the private sector, resulting in slow approval processes and conservative projects (Borins, 2001; Burall & Neligan, 2005; Cebon, n.d.; Cerna, 2013; Curristine et al., 2007; Van de Sijpe & Rayp, 2005). Furthermore, traditional mindsets and ways of working are heavily entrenched within global health systems, which is further spurred by heavily siloed vertical health organizations (Gostin & Mok, 2009). Yet, this is invariably at odds with driving innovation and collaborating with technology companies (Cebon, n.d). Conversely, the private sector has had to develop robust

[117] "Eating your own dog food" or otherwise known as "dogfooding" is a well-known concept in the private sector that describes the practice of using one's own products or services for testing, quality control, and testimonial purposes in order to continually improve the product or service (Kenton, 2023).

[118] Cameroon is currently in the process of developing a NIS (Organisation of African, Caribbean and Pacific States, 2022).

[119] In the context of this quote, "you" refers to policy makers and ethicists.

strategies to manage cost and operational risks as this has been key to the survival of private sector firms (Beckers & Stegemann, 2021).

Although many public sector organizations have sought to improve this, there is still often a bias in the types of risks that governments tend to focus on (i.e. transparency and compliance with procurement laws) (Beckers & Stegemann, 2021l; Greenhill, 2020). Furthermore, there are not only distinctions in the types of risks public sector organizations focus on as described above, but there are often differences in the nature of these risks. This is characterized by what researchers have coined "active" versus "passive" ethical considerations / violations. Active ethical violations are clear point-in-time decisions (e.g. the decision on whether or not to construct (potentially financially lucrative) facilities on protected land). Passive ethical considerations are more related to cumulative systemic implications whereby a single conscious decision is not necessarily made (as in the case with growing global health gaps related to ANI). Neither one is necessarily more important, however the former tends to receive a disproportionate amount of bandwidth in policy discussions presumably because it is easier to measure, conceptualize, and attribute accountability. This tends to ignore the broader picture within a country and the notion that inaction (or slow / insufficient action) is also a decision[120]; thus systematically biasing decision making. In a rapidly changing world, the consequences of this indecision / inaction become increasingly severe.

Therefore it is recommended that IGOs integrate broad multi-level strategy discussions on the different types of ethical risks at all levels of the organization[121]. This may be facilitated via the use of frameworks and tools commonly used in strategic decision making and risk mitigation within the private sector such as a SWOT[122] analysis, issue-based strategic

[120] To play out the scenario, we understand that there are current well-documented inequalities that have been perpetuated by unequal systems. If governments and IGOs do too little (or nothing), there will also be significant risk that these issues will continue / grow. Indecision is also a decision whether it has been conscious or not.

[121] Although it is a commonly cited practice for policy makers and government officials to habitually ask themselves 'what is the risk of moving forward with project x / partnering with a company y / etc.?' it is equally as prudent to habitually ask the antithesis of the above question (e.g. 'what is the risk of **NOT** moving forward with project x / partnering with a company y / etc.?') and then balancing, articulating, and mitigating potential negative outcomes (Bellante & Link, 1981; Harris, 2014; Khan, 2017; McConnell & Hart, 2019; Office of the Auditor General of Canada, 1998).

[122] An acronym for strengths, weaknesses, opportunities and threats. This tool helps business leaders determine the factors that are both within and outside of their control (e.g. businesses versus industry forces) in order to develop strategies to maximize an organization's competitive advantages and capitalize on positive industry trends while mitigating the threat of external risks.

planning, balanced scorecard, strategic mapping, Objectives and Key Results (OKRs), and Porter's five forces. The use of these tools can be an effective method for conceptualizing broader industry forces and how they relate to a health organization in order to challenge the natural human bias we have towards "business as usual".

Additionally, there is potential for improvement related to innovation and creating room for safe experimentation in government. IGOs and government bodies should encourage a culture shift to embrace more open and innovative business models supplemented by risk management strategies (Beckers & Stegemann, 2021). This can foster a more cooperative relationship with private sector organizations. Particularly within public good industries such as healthcare of which there is a natural level of responsibility sharing between sectors.

Risk mitigation and protection of the public good is a key objective of most democratic governments. Yet as previously discussed, the majority of current ANI implementations result in suboptimal project outcomes or fail altogether to achieve the desired objectives, which can be costly and put patients or end users at risk. Although these growing pains can be expected due to the complexity associated with implementing transformative technologies, it is prudent to recognize the changing needs within the health policy landscape. Adaptability within policy will become increasingly critical as the understanding of the opportunities, risks, and implications of ANI-enabled healthcare evolve.

In order to limit the negative impacts of digital disruptions to the patient, IGOs and national governments should look to create safe spaces for experimentation and robust risk management strategies to account for the messiness of digital transformations. This should be led by patient input in terms of what risks are tolerable and which are not, as well as transferring specific risks and responsibilities of a project to private sector investors / lenders to help mitigate the risk to the patient and tax payer (Beckers & Stegemann, 2021).

Subtheme 4b: There is a need for greater enforcement consistency, accessibility, and reduced fragmentation within health governance processes.

Without fair, consistent, and viable processes to communicate and implement ANI policy recommendations, the development of such policy recommendations is an exercise in futility. With this, the data indicated numerous challenges related to inconsistent enforcement of laws / policies and palpable favoritism, particularly in low-resource contexts (Kumbol, 2022). This spawned calls for more clear and consistent laws for both corporations and startups in terms

of providing them with support yet also holding them accountable (Bischof, 2021). Without consistent enforcement of digital policies, the entire system is undermined and individual organizations may not be sufficiently motivated to adhere to the policies. In fact, adhering to policies when your competitors are not creates a competitive disadvantage; often resulting in a self-perpetuating cycle of bad behavior (Crossman, 2020). Although IGOs are not directly responsible for developing and enforcing national laws, that does not suggest that there are no methods in which they can better contextualize and support the need for consistency and reduced fragmentation on an international level (Crossley, 2020).

To better conceptualize this issue, let us consider two distinct causes for inconsistency in policy enforcement: 1) accidental and 2) intentional. The former is generally characterized by disorganization within government and lack of coordination between different government bodies whereas the latter is due to calculated actions as in the case with corruption (Bang, 2021; Central Intelligence Agency, 2019; World Health Organization, 2020a). Both significantly limit the real-world efficacy of ANI-related policies, yet the low-resource contexts studied were much more likely to be impacted by both types as opposed to the high-resource contexts which primarily experience the former (Central Intelligence Agency, 2019; Bang & Balgah, 2022; Bang et al., 2021; Transparency International, 2021).

Fragmentation and / or poor coordination within and between different levels of government / health systems represents a significant threat to the efficient use of health resources in many contexts, including contexts that are otherwise stable (Spicer et al., 2020). When asked about the challenges related to achieving health-related SDGs, Director General of the WHO Dr. Tedros Adhannom Ghebreyesus stated that fragmentation is a fundamental underlying problem. "*The reality is, we're off track to achieve these ambitious [SDGs] by 2030. Fragmentation, duplication and inefficiency are undermining progress*" (World Health Organization, 2018a, p. 1). Globally, much of this fragmentation is caused by issues such as the proliferation of global health actors, problems of global leadership, divergent interests, problems of accountability, and problems of power relations (Spicer et al., 2020). This chaotic and complicated landscape can produce challenges for both private and public health organizations, along with auxiliary organizations (e.g. medical device suppliers, software providers, etc.), whereby the expectations of them are unclear, ill-defined, or difficult to navigate.

Despite numerous diverse efforts to reduce fragmentation, there has been limited success to date (Buse & Walt, 1996; Evans & Kieny, 2015; International Health Partnership, 2017; Gostin & Mok, 2009; Shorten et al., 2012; Spicer et al., 2010; Walt et al., 2009). Therefore substantial changes are required in the ways IGOs, national and local governments communicate and provide development assistance for health (Spicer et al., 2020). Systemic inequality thrives in ambiguity. To reduce this, a broad mapping of actors and a structural review of international health governance systems is recommended that involves classifying responsibility by 1) accountability 2) liability and 3) culpability in order to clarify ownership, promote actionability, and protect those most vulnerable to digitally-enabled health solutions (O'Sullivan et al., 2019). In addition, there are further opportunities to clarify the legal liability of ANI systems in international law and in the case of violations, what tools and processes are available to alleged victims[123] (Schneeberger et al., 2020). Co-collaboration of ANI legislation with key stakeholders (e.g. government bodies, health organizations, Big Tech, local startups / accelerators / privately-owned businesses, etc.) can improve the clarity and intentionality of regulations and reduce the technical knowledge gap between digital experts and policy makers.

Conversely, the case of intentionally inconsistent policy enforcement is a difficult topic for policy recommendations to tackle as this often occurs in regions characterized by high levels of political corruption, disruption, and lack of accountability. Although the origins of corruption and the systematic reduction of corruption within a country is outside of the scope of this report, researchers will discuss this topic within the context of the research questions. To this end, researchers acknowledge that there are encoded societal norms associated with corruption (both overt and covert) within the three case studies and it is unproductive to consider the causes of corruption from a western moralistic point of view. However, it is within the scope of this research to consider the impact of corruption as it relates to the case studies in a logical and systematic way. Due to its nature, corruption tends to lead to a lack of efficiency and an unfair distribution of resources that can perpetuate social and economic inequality (Killelea, 2021).

[123] Although the specificities of this approach are out of scope for this research paper, key components of this will involve the use of integrated solutions and a workplace culture shift towards fostering stronger interpersonal networks, open communication between different government / health bodies, greater transparency, and better assimilating the strengths of the private and public sectors (Jaén, 2011; Stange, 2009). In the meantime, strong co-collaboration between stakeholders (e.g. government bodies, health organizations, Big Tech, local startups / accelerators / privately-owned businesses, etc.) can help increase the relevance and shared understandings of new policies and legislation (Kumbol, 2022).

Of the three case study locations, Cameroon was reported to have the highest levels of corruption with a score of 27 on the Corruption Perceptions Index ranking it 144 out of 180 countries (bottom fifth percentile) (Central Intelligence Agency, 2019; Transparency International, 2021)[124]. Knowing this, it is important for IGOs to develop policy recommendations and support strategies in such a manner that they can still provide value despite potential bad actors within a country's government. For instance, suggesting recommendations that are not dependent on widespread government / legislative cooperation and can be implemented by smaller groups, teams, or departments (i.e. *Civil Society*[125]) (Transparency International, 2017; World Health Organization et al., 2017). Additionally, Encouraging direct financing to vetted and approved local startups, accelerators, and / or volunteer organizations can help circumvent unintended or unethical uses of funds by higher levels of governments. To do this, it is pragmatic to leverage the private sector (such as VCs, accelerators, incubators, etc.) and neutral third party organizations in the vetting process.

Subtheme 4c: The methods of communicating AI ethics recommendations by IGOs oversimplifies priority, relative impact, and prerequisites, which can perpetuate systemic biases.

"*We know the direction we should be heading in, but there are lots of problems to solve and we're working with too few resources*" (Adams, 2022).

Thus far we have discussed limitations related to the content of current IGO recommendations, however limitations related to the structure and formatting of policy recommendations were also observed. Currently, AI ethics recommendations by IGOs are communicated via a list of broad and vaguely-defined policy suggestions (generally around ~40-80 recommendations depending on the IGO), whereby it is the responsibility of member countries to prioritize which recommendations to focus on (Ramos, 2022; United Nations Educational, Scientific and Cultural Organization, 2022).

However, presenting an extensive list of idealized recommendations represents an oversimplification of AI recommendations and their relative priority / impact and ultimately

[124] The topic of overt corruption (as defined by the Corruptions Perceptions Index) is comparably less relevant to Canada and South Africa, which fall in the 93rd and 61st percentile respectively (Transparency International, 2021).

[125] Civil Society refers to a wide array of organizations, such as community groups, non-governmental organizations, etc. that is often referred to as the third sector of society that is neither state nor market (World Health Organization et al., 2017).

represents a serious source of under optimization in IGO policy development. Furthermore, it can be argued that this format goes beyond under optimization and is rather a deoptimization. Despite the well-intentioned nature behind this format structure, it ignores the practicalities and severe scarcity of resources in many locations[126]. A *laundry list*[127] format is typically more conducive to high-resource contexts which are able to select multiple priorities simultaneously; whereas when resources are scarce, strategic prioritization becomes exceedingly important (DeBoer et al., 2020; Wikler, 2003). Thus representing a subtle way that policy recommendations can be unintentionally contributing to the biases they are attempting to reduce (Baltussen & Niessen, 2006). Neither priority nor actionability are captured in this format, of which other more streamlined and pragmatic checklists are arguably more productive[128].

Although there may be criticism of highlighting certain recommendations based on (general) priority / impact / effort, etc., this sentiment is contrarian in nature. Efficient resource allocation represents a reverence for funding and is a key component of evidence-informed policy making and the competent management of health systems (Mitchell et al., 2023). Yet, this nuanced perspective is not currently captured in IGO policy recommendations whereby there is insufficient acknowledgement of 1) the relationships between recommendations (e.g. whether recommendations are hierarchical versus linear, dependent versus independent, etc.) 2) the scope of effort / resources required to implement the recommendation 3) the scale of impacts associated with the recommendations and 4) a mapping of the impacted stakeholders. Although the exact answers to these questions may vary based on the localized setting, sufficient data exists to provide more intelligent frameworks and insights than are currently being offered[129].

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[126] Although this report subscribes to a somewhat balanced perspective of relativism versus absolutism and as such, member states are still encouraged to have autonomy over prioritization in order to ensure relevance to the localized context, there is still a severe need for elevated strategic framing on the part of IGOs in terms of highlighting common priorities.

[127] Although this term was originally used in the 19th century to describe an actual list of clothing for laundry services, the term has remained in colloquial language (despite its original meaning becoming less relevant in modern life) and describes a list of heterogeneous items that is typically a long list of wants / demands; of which, the term is often used in negotiations or conversations between stakeholders (e.g. the union came with a laundry list of demands) (Merriam-Webster, n.d.).

[128] Such as "The Ten Commandments of Ethical Medical AI" for example (Muller et al., 2021).

[129] For instance, the ability to indicate high priority recommendations and the degree to which each is evidence-informed, deliberative, participatory, and action-oriented (Mitchell et al., 2023).

Strategic prioritization with incomplete or ever-evolving data is a common exercise conducted in the private sector that contributes to project leanness and competitive advantages over other companies / sectors. This exercise is often conducted via tools and decision making frameworks such as the Action Priority Matrix (APM) that plots the effort versus impact of different initiatives. APMs are used to inform the order and priority of key initiatives to optimize project outcomes and increase the likelihood of success (i.e. start with the 'quick wins': high impact / low effort and end with the last quadrant: low impact, high effort)[130]. This strategic planning can create self reinforcing project cycles where the quick wins result in timely operational / financial improvements. Of which the savings can then be reinvested to internally fund the program and carry on momentum, which provides a mechanism to develop structured evidence-based roadmaps[131].

In line with this logic, researchers would like to highlight four key recommendations that were indicated as key choke points for ethical ANI implementation during the review of secondary research and in the SME interviews. That is to say, failure to address these recommendations will significantly limit the efficacy of other IGO recommendations:

1. Better alignment of AI policy to financial / operational goals for Big Tech, both positively and negatively (e.g. access to new markets, strategic partnerships, taxes, penalties for AI ethics violations, blocked mergers and acquisitions to limit size, etc.).
2. Developing a strong coordinated approach between countries with shared AI values to increase bargaining power and through this, prioritize the implementation of AI and data security policies to prevent further exploitation.
3. Designing decision making criteria (on an individual and organizational level) and related processes whereby the patient is at the forefront; which includes increasing the

[130] Please note, all data points should be plotted in a RELATIVE fashion. Possible factors informing impact include: % of population helped, cost / time / resources savings, equitable and / or wider distribution, increased accuracy, better patient experience, etc. Possible factors informing effort include: financial (e.g. funding required), social (e.g. amount of stakeholder engagement, coordination required etc.), political (e.g. similar to above, but related specifically to political organizations), geographical (e.g. close proximity versus widespread coordination over various cultures, languages, etc.), and temporal (e.g. the predicted amount of time required).

[131] The combination and priority of KPIs will vary depending on the goals / scope of a healthcare facility, yet a hierarchy of KPIs is recommended based on impact to human (e.g. clinical errors, infection rate, and medication errors) and technology factors (e.g. laboratory test time, location of the facility, etc.) (Burlea-Schiopoiu & Ferhati, 2020). Possible de / centralization of spending and operational processes may be required to increase transparency and efficiency of decision making, although the specificities of this will vary depending on the context (Burlea-Schiopoiu & Ferhati, 2020; Curristine, et al., 2007).

degree of patient input and collaboration and then legitimately integrating this patient feedback into laws and processes.

4. Further advocating, articulating, and disseminating the value of patient and community empowerment / involvement throughout the project cycle.

When researching factors that have limited the effectiveness of IGOs in the past, power dynamics represents a strong emerging theme. "*International relations are driven much more by raw power dynamics. That is because there are laws and standards of behavior within countries, whereas between them raw power matters most, and laws, rules, and even mutually agreed-upon treaties and organizations for arbitration (such as the League of Nations, the United Nations, and the World Trade Organization) don't matter much*" (Dalio, 2021, p. 340). As such, failure to address these imbalances is analogous to throwing a bucket of water on a wildfire; well-intentioned but insufficient to upset the pervasive forces at play.

As the locus of control of AI sits well within the realm of the private sector, it is necessary that this group be better acknowledged in policy recommendations. Moreover, it is critical to consider the genuine goals and motivations for these private sector corporations in order to foster sufficient and genuine engagement[132] (point 1). Any policy recommendations that fail to include the notion of business / financial motivation are likely to be ineffectual in addressing systemic biases. Additionally, failure to develop coordinated laws and strategies between countries (point 2) will likely perpetuate the burden of care and policy enforcement on low-resource countries. If policy makers fail to effectively address pervasive power imbalances, the impact of the other recommendations is limited or threatened altogether.

To further increase the likelihood of reducing systemic digital health biases, improved operational efficiency needs to be elevated within policy development, particularly due to its pertinence in low-resource contexts. Accurate patient input can enable the efficient use of resources by ensuring resource allocation is strongly aligned to patient goals and outcomes (point 3). Therefore given the focus on low-resource contexts discussed in this report, this is a particularly valuable policy recommendation from an resource efficiency standpoint (both operationally and financially).

[132] Examples of poor engagement include corporations continuing current practices focusing on lucrative rather than public good sectors, doing the bare minimum to comply with lax legislation, cutting corners in the case of ill-defined or inconsistently enforced legislation, or developing novelty projects that have marginal societal impacts.

Finally, encouraging patient and community empowerment through advocating, articulating and disseminating information related to this topic (point 4) offers a direct line of communication with patients. The data indicated that individual and community empowerment was a particularly productive method to protect patients and improve health outcomes especially in low-resource contexts where hospitals and other health facilities may be a rare point of contact between patient and health provider[133] (Abrahams et al., 2019; Kamadjeu et al., 2005; Lambrinou et al., 2019; Náfrádi et al., 2017; Raina & Thawani, 2016; Rissel, 1994).

Future ways of working and receiving healthcare services will exist in a multi-agent system that includes many (potentially billions) of AI systems interacting among themselves, across industries, and interacting with humans (Sierra, 2022). This requires significant upskilling, trust, and change on the part of the patient (or end user) of which individual and community[134] support will be required to facilitate this in a supportive and productive manner[135] (Geis et al., 2019; Sierra, 2022). Self governance and an empowered patient helps protect the patient from ethical concerns pertaining to patient autonomy, safety, and justice and reducing reliance on national policies (albeit not completely) particularly in corrupt or low-resource settings (Ali et al., 2021; Laflamme et al., 2019; Rissel, 1994).

These notable recommendations and a broader understanding of shared AI challenges can provide valuable strategies and frameworks to both high- and low-resource countries. In order to facilitate this and improve the actionability of AI recommendations, IGOs are encouraged to consider new ways of conceptualizing their recommendations. For instance, consider "zooming out" to recognize broader views, societal values, and systemic issues; followed by "zooming in" to contextualize a particular type of AI technology within a particular type of domain with a set of trackable problems and solutions in order to make

[133] Although this issue is still quite prevalent, there are an increasing number of examples of reduced barriers to access of health services in low-resource contexts (Dittoh et al., 2021). Primarily this includes an increase in available digital health services in rural regions, which offer an increasingly cost effective means to circumvent widespread transportation challenges in Africa (Dittoh et al., 2021).

[134] Here the term "community" refers to a group of people that share similar goals, traits or values. This can include a group of people living in close geographic proximity or it can also include a group of specialists, such as radiologists, etc.

[135] These socio-technical communities need shared political, economic and behavioral structures (e.g. norms, standards, incentives, punishments, etc.) and the flexibility in which they can evolve overtime to capture the notion that values and ethics are non-universal, contextually dependent social constructs (Schwartz, 2012; Sierra, 2022).

these recommendations actionable and more effective in real-world contexts (Munn & Prem, 2022).

4.2 Closing Framework

The research indicated that current policy recommendations from major IGOs were not wholly ill-conceived. However gaps and under optimizations were observed whereby policies and critical nuances were 1) absent 2) insufficient 3) inconsistently-applied 4) misattributed and / or 5) lacking efficacy in real-world settings. For the purpose of readability, accessibility, and actionability of research outcomes, the culmination of the emerging themes and associated recommendations have been summarized in the chart below, which follows the articulation formatting of prominent IGO internal policy recommendations.

Table 2. Closing Framework Summarizing Themes, Implications and Suggested Recommendations.

Theme	Implication	Suggested Recommendations
Theme 1: Power imbalances amongst stakeholders create substantial challenges and threaten ANI project success and ethical implementation.		
Subtheme 1a: Corporations are currently heavily under engaged and mutual private / public sector objectives are severely underrepresented in ANI policy.	Lack of adequate corporate engagement results in uneven distributions of ANI-enabled solutions across industries and inconsistent applications of ethics standards within a region.	• Address all relevant stakeholders, such as Big Tech within policy dialogue. For IGOs where private sector actors are out of scope, highly consider adjusting this scope or reevaluate the organization's ability to meet its objectives with the exclusion of these large actors. • Better align AI policy to financial / operational goals for Big Tech (both positively and negatively e.g. access to new markets / strategic partnerships, taxes, penalties for AI ethics violations, blocked mergers and acquisitions to limit size, etc.).* • Encourage good behavior from Big Tech through the clear articulation of system requirements for explainability and transparent processes that are communicated in a human-centered and accessible manner and have an openness to feedback / scrutiny. • Heavily promote the requirement to embed a product's ethical implication directly into its design. • Create organizations with the specific purpose of 1) evaluating and publicizing private sector ethical performance so that patients and consumers can make informed decisions and 2) encouraging and managing public-private sector cooperation to facilitate a more coordinated ethical approach between the sectors.
Subtheme 1b: Current sources of funding skew digital priorities and risk equitable access to ANI-enabled services.	This leads to systematically biased research, projects, and teams which fosters further inequalities in digitally-enabled healthcare processes.	• Further engage academia to help moderate public-private sector interactions, including clear direction and insights on the opportunities and challenges of private-public sector partnerships, and methods in which real and perceived risks can be mitigated. • Providing greater accountability and regulation of VC initiatives and an increase in the quantity and effectiveness of independent, non-VC, and / or public funding models. • Develop frameworks that balance innovation and safety and provide greater structure to the

		accountability and transparency of venture capitalism.
Subtheme 1c: Current systems and policies do not sufficiently foster local competition, such as startups, accelerators, and local companies.	Without local competition, the majority of innovation, processes, policies, etc. are from developed countries which are not entirely well-suited for low-resource regions. This also perpetuates power imbalances where these regions become increasingly reliant on external entities.	• Encourage national governments to conduct a robust review of their funding policies in order to deduce what restrictions are practical / impactful and which ones are unnecessarily prohibitive / restrictive, including providing examples and outcomes. • Suggest tangible steps in order to provide equal access to government officials (at every level) for local health and technology startups compared to big players. • Offer alternative forms of support (beyond funding), such as standardized forms of recognition for local startups (such as IGO 'seals of approval') that are scalable in order to provide international clout, exposure, and accreditation. • Explore partnerships with other sectors such as academia to offer programs and resources to help local startups scale.
Theme 2: Insular decision making and stunted collaboration significantly jeopardizes systemic improvements to delivering ethical ANI-enabled health services.		
Subtheme 2a: The importance of greater cross-sectional collaboration cannot be overstated.	Current weak levels of collaboration perpetuate research, process, and innovation-related silos, limiting the practical effectiveness of ANI implementations.	• Develop a coordinated approach between countries with shared AI values to increase bargaining power against large corporations and through this, prioritize the implementation of AI and data security policies to prevent further exploitation.* • Elect (or encourage the election of) leaders using an updated modern criteria rather than those with outdated notions of national self-interest and competition between states. • During collaborations, ensure that each stakeholder has clearly defined goal(s) to achieve via the collaboration. In instances, where there are no goals / goals have not been met, restructure or reassess the collaboration in order to optimize the allocation of resources. • Suggest collective contribution funding models to address shared health challenges between countries. • Provide / encourage opportunities for greater interdisciplinary training at all levels; the role of the

		generalist is particularly important in low-resource contexts.
Subtheme 2b: Human resourcing constraints present a major threat to successful ANI projects, particularly in low-resource locations.	Without sufficient local human capital, low-resource locations are at risk of failing to provide adequate social services as well as further losing financial, technological, and social competitiveness compared to higher resource locations.	• Address the critical need for capacity building by 1) encouraging centers of excellence 2) partnering with local and international academic institutions to expand opportunities for knowledge sharing (e.g. open and sovereign resources) to develop / attract more local talent and 3) partner with corporations to offer more attractive positions to better engage the local workforce. • Greater funding, of which, the characteristics of the recipient and not just the project are considered to champion local talent and skill development. • Assert that wealthy and / or technologically advanced groups need to lead by example when developing and communicating ANI projects and their ethical implications. • Encourage early implementers to actively communicate the lessons learned from ANI projects in an open and honest way to reduce risk and avoid inefficient use of resources in low-resource regions. • When integrating systems or processes, use frameworks such as the Plug-In Principle to enable more culturally sensitive / appropriate technologies.
Theme 3: Current ANI-related ethics recommendations do not adequately capture the scale and impact of industry disruptions and what this means to the healthcare system and the patient.		
Subtheme 3a: Many early ANI implementations are integrated into (or directly replace) current processes, rather than be used as a catalyst to reimagine health systems and patient-provider interactions entirely.	Without adequately conceptualizing the predicted degree of change in the healthcare industry, governments and health institutions have fallacious context for strategic decision making.	• Encourage the development of robust change management plans for the multitude of stakeholders involved, including example plans and strategies to adjust these plans in a safe and agile manner. • Broaden policies to reflect an end-to-end approach to AI ethics, including pre- and post- deployment activities.

Subtheme 3b: A patient-centered perspective is not wholly embedded throughout policy, governance, and healthcare processes resulting in misalignment of resources to patient outcomes.	Lack of a patient-centered "North Star" leads to projects and processes that are an inefficient (or misuse) of resources that do not result in strategic improvements to the patient experience.	• Leverage strategies used in the private sector for obtaining accurate human / user / patient input, while communicating the risks of failed alignment to patient goals and possible solutions to mitigate these risks. • Design decision making criteria (on an individual and organizational level) and related processes whereby the patient is at the forefront, which includes increasing the degree of patient input and collaboration and then actually integrating this patient feedback into laws and processes.* • Advocate, articulate, and disseminate the value of patient and community empowerment / involvement at all stages of a project (research, design, implementation, and sustainment).*
Theme 4: Commonly-used methods of ideation, communication, and implementation of ANI-related ethics policies limit the impact in real-world settings.		
Subtheme 4a: In order to drive meaningful change, IGOs should embrace their own recommendations on ethical AI and digital policy internally.	Without following your own advice, IGOs and national governments are more prone to making impractical, overly simplified, and / or incomplete policy recommendations and risk failing to capitalize on future opportunities.	• Actively encourage a culture shift in the public sector to embrace more open and innovative business models supplemented by risk assessment / mitigation strategies. • Continually integrate conversations on the different types of ethical risks and the associated consequences into everyday work processes via the use of established tools and frameworks already embedded in the private sector. • Create a safe space for experimentation within policy and governance to protect patients given the high consequence of health outcomes and the messiness associated with real-world digital transformations. This includes a more personalized understanding of risk tolerance for patients and an openness to transferring specific risks and responsibilities of a project to private sector investors / lenders to help mitigate the risk to the patient and tax payer.
Subtheme 4b: There is a need for greater enforcement consistency, accessibility, and reduced fragmentation within	Unclear and inconsistently enforced policies are essentially ineffectual at encouraging desired behaviors from	• Conduct a broad mapping of actors and a structural review of international health governance systems that involves classifying responsibility by 1) accountability 2) liability and 3) culpability. • Where possible, improve the clarity and intentionality of legislation through the co-collaboration of policy development with key stakeholders (e.g. government bodies, health organizations, Big Tech,

health governance processes.	organizations, often leading to perpetuating and reinforcing bad behaviors between stakeholders.	local startups / accelerators / privately-owned businesses, etc.). • Encourage direct financing to vetted and approved startups, accelerators, and / or volunteer organizations to prevent unintended or unethical uses of funds by known corrupted entities. Leverage the private sector (such as VCs, accelerators, incubators, etc.) and neutral third party organizations during this vetting process.
Subtheme 4c: The methods of communicating AI ethics recommendations by IGOs oversimplifies priority, relative impact, and prerequisites, which can perpetuate systemic biases.	Without elevating conversations on priority and relative impact, organizations, teams, and individuals particularly in low-resource contexts are ill-equipped to make strategic decisions due to a lack of broader context.	• Apply elevated strategic thinking to AI ethics recommendations based on relative priority / impact / effort, etc. to develop structured evidence-based roadmaps; while being transparent on the data and rationale used to develop these insights. • Reframe how policy recommendations are conceptualized to broaden the scope of consideration: from societal views and systemic considerations to specifics on ANI problems and solutions.

Notes:

- * Identified through primary and secondary data sources as particularly notable recommendations.
- To indicate the mapping and breadth of recommendations, each has been broadly categorized based on the level of its intended beneficiary: society (orange), community (blue), and user / individual (purple) with those that are structurally transcendent (e.g. reasonably attributed to all levels) in black[136].

[136] Naturally, these recommendations are interrelated and subject to change depending on the specific context (i.e. regulations developed and enforced by national versus local governments). However, at a meta-level this exercise serves to indicate the distribution of gaps and associated recommendations to mitigate these gaps across the different levels of policy.

Through the course of this research process, an abundance of related research questions were noted beyond the scope of this report. The most evident examples will be discussed in further detail in the following section.

4.3 Suggestions for Further Research

Due to its relevance and complexity, this area of study offers a plethora of associated research topics to consider. Although the data in this report indicated authenticity, plausibility, and criticality of research conclusions based on Braun and Clarke's generally accepted criteria, researchers acknowledge that there is still a tremendous amount of insights to be gained in this subject matter. This dissertation is meant to provide an impetus for discourse within academia and the private sector. Whereby the following represents a list of potential follow-up areas of research to consider:

- **A longitudinal study of digital implementations in a low-resource setting -** a long term study of a low-resource location, which includes detailed research on sustained project outcomes in order to validate and refine the research findings associated with this report in a micro-context[137].
- **Replication studies comparing high- and low-resource contexts within the case study locations -** although this report classified "high-" and "low-" resource regions on a national level, it would be insightful to systematically compare high- and low-resource contexts within a country (such as comparing urban and rural populations, mainstream populations compared to marginalized populations, etc.) in order to expand on the research understandings derived from this study.
- **Replication studies using the same case study selection criteria but different case study country selections -** these studies should follow the same case study selection criteria (e.g. high- versus low-resource contexts as defined in this report) with countries other than Canada, Cameroon, and South Africa in order to test the strength of generalizability of this research and to further validate / challenge the research design and outcomes of this report.
- **Replication studies in both healthcare and other public goods sectors -** this includes studies to confirm / challenge whether the emerging themes outlined in this

[137] Ideally this would be expanded to other locations as well to test the degree of generalizability of this research.

report are consistent in other public good sectors (e.g. education, transportation, etc.) or whether there is weak overlap in key themes.

- **The dynamics of sector competition versus collaboration -** studies involving primary or secondary research to contribute to a greater understanding of the dynamics of competition versus collaboration (e.g. knowledge protection versus knowledge sharing) within (or between) different sectors. High-level frameworks and market forces would be especially interesting in contexts that have a joint private and public healthcare system.
- **Analyzing the implications of burnout and high turnover on HHR upskilling -** this should involve primary research to develop a better understanding of the dynamics of burnout of HHR in low-resource locations and the associated implications of rapidly evolving roles and workplace characteristics. Notably, this should include an understanding of the strains of upskilling and potential re-training on HHR and supporting personnel during digital transformations.
- **Furthering the understanding of how individual patient preference should impact health processes and interventions -** this subject matter would heavily benefit from a better understanding of how to balance patient preference and autonomy related to risk tolerance. From an ANI perspective, this involves a stronger meta-level understanding of who should own patient data (e.g. patient, government, hybrid model) and how this might change depending on the cultural context. Yet more broadly, this research should focus on how unique patient health (and life) goals impact the delivery of health services and how emerging technologies can facilitate this personalisation.
- **Quantifying the impacts of medical data bias and developing a robust set of suggestions for improvement -** due to ANI's logic-based nature and dependence on historical data, there is legitimate concern that ANI algorithms may increase inequalities related to ethnicity, socioeconomic status, and gender (Manyika et al., 2019). Particularly, a comparative study between human versus ANI bias in low-resource locations, the efficacy of built-in safeguards to minimize these biases, and the societal implications thereof.

Practically speaking, academic PhD research has inherent constraints such as time and resource limitations. Although significant effort was taken to mitigate the impacts of these constraints on research conclusions, these limitations offer potential opportunities for future

researchers with different resource models. Therefore large organizations, such as private sector companies, IGOs, academic institutions, think tanks, etc. are highly encouraged to replicate this study with multi-person teams, substantial budgets, and extended project cycles in order to further refine and / or challenge the research findings and our collective understanding of this area of study.

5 Conclusion

Presently, a conspicuous disparity exists in the utilization of ANI-enabled diagnostics in high-resource contexts compared to low-resource regions. This disjuncture coincides with growing global health disparities as groups with little access to digital technologies are left further behind. This consequential societal juxtaposition is both ironic and unfortunate as low-resource regions could arguably reap the most significant benefits from the associated systemic enhancements.

In studying the impact of emergent scalable technologies such as ANI, it is reasonable to conclude that these technologies will likely exacerbate current societal trends. ANI will likely amplify highly fair and democratic societies, whereas the reverse is also true in less fair / robust societies. Therefore, with an increasingly digitized society it is critical to better understand the complicated relationship between digitally-enabled healthcare and social inequality. Significant disparities have been observed whereby developed, high-resource regions have disproportionately experienced the economic and social benefits associated with ANI in diagnostics compared to developing, low-resource contexts. Whereas these low-resource contexts often experience a disproportionate share of the risk of ANI. Thus prompting significant opportunities for collaboration between key stakeholders in the public, private, and academic sectors to limit these growing global health gaps.

To address this, this research considered over 175 sources of secondary research, conference materials, and inputs from SMEs in order to highlight current IGO policy gaps. High-level themes include:

- **Theme 1:** Power imbalances amongst stakeholders create substantial challenges and threaten ANI project success and ethical implementation.
    - **Subtheme 1a:** Corporations are currently heavily under engaged and mutual

private / public sector objectives are severely underrepresented in ANI policy.
    - **Subtheme 1b:** Current sources of funding skew digital priorities and risk equitable access to ANI-enabled services.
    - **Subtheme 1c:** Current systems and policies do not sufficiently foster local competition, such as startups, accelerators, and local companies.
- **Theme 2:** Insular decision making and stunted collaboration significantly jeopardizes systemic improvements to delivering ethical ANI-enabled health services.
    - **Subtheme 2a:** The importance of greater cross-sectional collaboration cannot be overstated.
    - **Subtheme 2b:** Human resourcing constraints present a major threat to successful ANI projects, particularly in low-resource locations.
- **Theme 3:** Current ANI-related ethics recommendations do not adequately capture the scale and impact of industry disruptions and what this means to the healthcare system and the patient.
    - **Subtheme 3a:** Many early ANI implementations are integrated into (or directly replace) current processes, rather than be used as a catalyst to reimagine health systems and patient-provider interactions entirely.
    - **Subtheme 3b:** A patient-centered perspective is not wholly embedded throughout policy, governance, and healthcare processes resulting in misalignment of resources to patient outcomes.
- **Theme 4:** Commonly-used methods of ideation, communication, and implementation of ANI-related ethics policies limit the impact in real-world settings.
    - **Subtheme 4a:** Eating Your Own Dog Food - in order to drive meaningful change, IGOs should embrace their own recommendations on ethical AI and digital policy internally.
    - **Subtheme 4b:** There is a need for greater enforcement consistency, accessibility, and reduced fragmentation within health governance processes.
    - **Subtheme 4c:** The methods of communicating AI ethics recommendations by IGOs oversimplifies priority, relative impact, and prerequisites, which can perpetuate systemic biases.

Data saturation was observed for each of the above points across the data set. Thus indicating that there are currently under optimizations in IGO policy recommendations which should be actively addressed in order to elevate the strategic impact of these organizations.

In contexts where a region lacks resources, decision makers fundamentally have to make development tradeoffs; thus strategic decision making and effective prioritization of resources becomes increasingly important. Accordingly, one could argue that focusing on well-intentioned but less impactful policy recommendations is an inefficient, even so far as counterproductive, use of resources. Until IGOs fully embrace this, ANI recommendations will lack pragmatism and will have limited value for many of its members. Therefore, the use of tools such as APMs is recommended in order to increase the practicalness of policy recommendation in real-world settings. As such, researchers would like to highlight the following notable recommendations:

- Better alignment of AI policy to financial / operational goals for Big Tech, both positively and negatively (e.g. access to new markets, strategic partnerships, taxes, penalties for AI ethics violations, blocked mergers and acquisitions to limit size, etc.).
- Developing a strong coordinated approach between countries with shared AI values to increase bargaining power and through this, prioritize the implementation of AI and data security policies to prevent further exploitation.
- Designing decision making criteria (on an individual and organizational level) and related processes whereby the patient is at the forefront; which includes increasing the degree of patient input and collaboration and then legitimately integrating this patient feedback into laws and processes.
- Further advocating, articulating, and disseminating the value of patient and community empowerment / involvement throughout the project cycle.

ANI is expected to increasingly permeate many aspects of society and it is our responsibility as academics to better understand the social implications of this; particularly how these technologies can be used to improve the human experience rather than reduce it. ANI's vast potential and scalability has caused it to become a central point of strategic discussions for many governments, academic institutions, and private sector firms. Of which, IGOs are uniquely positioned to facilitate this collaboration. The immense potential of AI suggests the need for species-level conversations on how to manage the associated threats and opportunities. More broadly as humanity faces growing shared global challenges, species-level cooperation will likely become increasingly essential. Therefore, IGOs are highly encouraged to reflect on their objectives, scopes, and overall ability to meet modern global challenges.

Although there is still much to be understood on this rapidly evolving topic, this report seeks to provide a foundation for productive discourse and potential reassessments of current models. This marks the key pursuit of this research, of which it has been a pleasure to study this topic at the Vienna University of Technology with Univ.-Prof.in Mag.a Dr.in Sabine Köszegi.

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Abrahams, N., Gilson, L., Levitt, N.S., et al. (2019). Factors that influence patient empowerment in inpatient chronic care: early thoughts on a diabetes care intervention in South Africa. BMC Endocr Disord 19, 133. DOI: 10.1186/s12902-019-0465-1

Accenture and Gordon Institute of Business Sciences. (2018). Artificial Intelligence: is South Africa ready? https://www.accenture.com/_acnmedia/pdf-107/accenture-ai-south-africa-ready.pdf

Acemoglu, D., & Robinson, J. A. (2012). Why nations fail. Profile Books LTD. Great Britain.

Adams, R. (2022, November 3). Regional and ethical AI development in Africa - practical examples. Ethics of AI in Africa: What Role can German Development and Research Policy Play? [Conference Presentation]. German UNESCO Commission, Bonn, Germany.

Aginam, O. (2005). Global health governance: international law and public health in a divided world. University of Toronto Press. DOI: 10.3138/9781442675377

Aguinis, H., Hill, N. S., & Bailey, J. R. (2019). Best practices in data collection and preparation: recommendations for reviewers, editors, and authors. Organizational Research Methods. DOI: 10.1177/1094428119836485

Ahuja, A. S. (2019) The impact of artificial intelligence in medicine on the future role of the physician. PeerJ 7:e7702.

Aiginger, K., & Rodrik, D. (2020). Rebirth of industrial policy and an agenda for the twenty-first century. Journal of Industry, Competition and Trade, 20(2), 189-207. DOI: 10.1007/s10842-019-00322-3

Ali, A., Dindoust, D., Grant, J., & Clarke, D. (2021) Delivering epilepsy care in low-resource settings: the role of technology, Expert Review of Medical Devices, 18:sup1, 13-23. DOI: 10.1080/17434440.2021.2013198

Allen, N. (2021, March 11). The promises and perils of Africa's digital revolution. The Brookings Institution. https://www.brookings.edu/articles/the-promises-and-perils-of-africas-digital-revolution/

Allen, R. (2017, June 12). Why artificial intelligence is different from previous technology waves. Medium. Machine Learning in Practice. https://medium.com/machine-learning-in-practice/why-artificial-intelligence-is-different-from-previous-technology-waves-764d7710df8b

Alonso, C., Kothari S., & Rehman, S. (2020, December 2). How artificial intelligence could widen the gap between rich and poor nations. International Money Fund. IMF Blog. https://www.imf.org/en/Blogs/Articles/2020/12/02/blog-how-artificial-intelligence-could-widen-the-gap-between-rich-and-poor-nations

Alvaredo, F., Chancel, L., Piketty, T., Saez, E., & Zucman G. (2018). World inequality report. World Inequality Lab, 4-11. https://wid.world/document/world-inequality-report-2018-english/

American Accounting Association. (2022, April 26). Study finds corporate social responsibility boosts tech innovation. https://www.prnewswire.com/news-releases/study-finds-corporate-social-responsibility-boosts-tech-innovation-301532873.html

Ammenwerth, E., & Spötl, H. P. (2009). The time needed for clinical documentation versus direct patient care. Methods of information in medicine, 48(01), 84-91.

Andrews, T. (2012). What is social constructionism?. Grounded Theory Review, 11, 39-46.

Apfelbaum, E. (2017, December 11). The trouble with homogeneous teams. MIT Sloan Management Review. https://sloanreview.mit.edu/article/the-trouble-with-homogeneous-teams/

Aurini, J., Heath, M., & Howells, S. (2016). The how to of qualitative research. SAGE.

Avidon, E. (2020, March 27). SAS analytics platform benefiting from AI investment. Tech Target. https://www.techtarget.com/searchbusinessanalytics/news/252480784/SAS-analytics-platform-benefiting-from-AI-investment

Ayanian, J. Z. (2015, October 1). The cost of racial disparities in health care. Harvard Business Review. https://hbr.org/2015/10/the-costs-of-racial-disparities-in-health-care

Baeza-Yates, R. (2021, May 24). Ethics in AI: a challenging task [Online Lecture]. Digital Humanism Series. TU Wien Informatics. https://dighum.ec.tuwien.ac.at/dighum-lectures/

Bagcchi, S. (2021, October 15). Diagnostic tech ‘out of reach’ as rich few dominate market. SciDev.Net. https://www.scidev.net/asia-pacific/news/diagnostic-tech-out-of-reach-as-rich-few-dominate-market/

Balogh, E. P., Miller, B. T., Ball, J. R., et al. (2015). Improving diagnosis in health care. National Academies Press (US). DOI: 10.17226/21794

Baltussen, R. (2006). Priority setting of public spending in developing countries: do not try to do everything for everybody. Health policy (Amsterdam, Netherlands), 78 (2-3), 149-156. DOI: 10.1016/j.healthpol.2005.10.006

Baltussen, R., & Niessen, L. (2006). Priority setting of health interventions: the need for multi-criteria decision analysis. Cost effectiveness and resource allocation: C/E, 4 (14). DOI: 10.1186/1478-7547-4-14

Bang, H. N. (2021). A gap analysis of the legislative, policy, institutional and crises management frameworks for disaster risk management in Cameroon. Progress in Disaster Science, 11.

Bang, H. N., & Balgah, R. A. (2022). The ramification of Cameroon's Anglophone crisis: conceptual analysis of a looming "complex disaster emergency". Int J Humanitarian Action 7, 6. DOI: 10.1186/s41018-022-00114-1

Bang, H. N., Mbah, M. F., Ndi, H. N., & Ndzo, J. A. (2021). Gauging Cameroon's resilience to the COVID-19 pandemic: implications for enduring a novel health crisis. Transforming Government: People, Process and Policy, 15, 4, 658-674. DOI: 10.1108/TG-08-2020-0196

Banga, K., & Saha, A. (2021, April 15). Lobbying for digital dominance in Africa. Institute of Development Studies. https://www.ids.ac.uk/opinions/lobbying-for-digital-dominance- in-africa/

Bank, M., Duffy, F., Leyendecker, V., & Silva, M. (2021, August 31). The lobby network: big tech's web of influence in the EU. Corporate Europe Observatory. https://corporateeurope.org/en/2021/08/lobby-network-big-techs-web-influence-eu

Basheer, M., Nechifor, V., Calzadilla, A., et al. (2022). Balancing national economic policy outcomes for sustainable development. Nat Commun 13, 5041. DOI: 10.1038/s41467-022-32415-9

Basu, S. (2022). Radical Reads: The first Canadian AI and healthcare market map. Radical Ventures. https://radical.vc/radical-reads-ai-and-healthcare-map-canada/

Bauer, E. A., & Cohen, D. E. (2012). The changing roles of industry and academia. The Journal of investigative dermatology, 132(3 Pt 2), 1033–1036. DOI: 10.1038/jid.2011.368

BBC. (2018, October 22). Cameroon country profile. https://www.bbc.com/news/world-africa-13146029

Beckers, F., & Stegemann, U. (2021, September 10). A smarter way to think about public-private partnerships. Mckinsey & Company. https://www.mckinsey.com/capabilities/risk-and-resilience/our-insights/a-smarter-way-to-think-about-public-private-partnerships

Bellante, D., & Link, A. N. (1981). Are public sector workers more risk averse than private sector workers?. Industrial and Labor Relations Review, 34(3), 408–412. DOI: 10.2307/2522787

Bergen, B. (2021, June 28). Canada's new brain drain problem. Council of Canadian Innovators. Medium. https://canadianinnovators.medium.com/canadas-new-brain-drain-problem-edc58bfedbc7

Berlinguer, G. (1999). Health and equity as a primary global goal. Development 42, 17–21. DOI: 10.1057/palgrave.development.1110076

Berrio, P., Ibarra, A. G., & Galeano, B. (2020). Chapter 30 - healthcare strategic planning using technology assessment. Clinical Engineering Handbook (Second Edition), Academic Press, 181-185. ISBN: 9780128134672

Bhattacherjee, A. (2012). Social sciences research: principles, methods, and practices. Textbooks Collection 3. Global Text Project. https://digitalcommons.usf.edu/oa_textbooks/3

Bianchi, P., & Labory, S. (2020). European industrial policy: a comparative perspective. The Oxford Handbook of Industrial Policy, 593-620. DOI: 10.1093/oxfordhb/9780198862420.013.22

Binellia, C., Loveless, M., & Whitefield, S. (2015). What is social inequality and why does it matter? evidence from central and eastern europe. World Development, 70, 239-248. DOI: 10.1016/j.worlddev.2015.02.007

Birhane, A., Kalluri, P., Card, D., Agnew, W., Dotan, R., & Bao, M. (2022, June). The values encoded in machine learning research. 2022 ACM Conference on Fairness, Accountability, and Transparency, 173-184.

Birnbaum, E. (2022, January 24). Tech spent big on lobbying last year. Politico. https://www.politico.com/newsletters/morning-tech/2022/01/24/tech-spent-big-on-lobbying-last-year-00001144

Bischof, J. (2021, June 6). Why African startups are lobbying governments for more regulation. Quartz. https://qz.com/africa/2016932/african-startup-acts-have-pros-and-cons

Blackman, R. (2020, October 15). A practical guide to building ethical AI. Harvard Business Review. https://hbr.org/2020/10/a-practical-guide-to-building-ethical-ai

Boehme, C., & Pai, M. (2020, February 1). Diagnostic gaps in global health. Think Global Health.

Bonaventure, D. (2019, May 26). Digital health in Cameroon. Keafon Health. https://keafon.com/digital-health-in-cameroon/

Bonny, A. (2019, December 21). Cameroon invents smart incubators for babies. https://www.aa.com.tr/en/health/cameroon-invents-smart-incubators-for-babies/1680338#

Borins, S. (2001). The challenge of innovating in government. IBM Center for The Business of Government.

Bradford, A. (2020). The Brussels effect: how the European Union rules the world. Faculty Books. New York.

Brandusescu, A. (2021, March 1). Artificial intelligence policy and funding in Canada: public investments, private interests. DOI: 10.2139/ssrn.4089932

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. Qualitative Research in Psychology, 3 (2). DOI: 77-101.10.1191/1478088706qp063oa

Bresnick, J. (2016, September 21). Big data, artificial intelligence, IoT may change healthcare in 2017. https://healthitanalytics.com/news/big-data-artificial-intelligence-iot-may-change-healthcare-in-2017

Bresnick, J. (2018, April 30). Top 12 ways artificial intelligence will impact healthcare. https://healthitanalytics.com/news/top-12-ways-artificial-intelligence-will-impact-healthcare

British Council. (2016, May 4). Investment in higher education can stem brain drain. https://www.britishcouncil.org/contact/press/investment-higher-education-can-stem-brain-drain

Bruckner, T. (2019). The ignored pandemic: how corruption in healthcare service delivery threatens universal health coverage. Transparency International UK.

Bucy M., Finlayson A., Kelly, G., & Moye, C. (2016, May 9). The 'how' of transformation. McKinsey & Company.

Buedo, P., & Waligora, M. (2022, June 16). We need to eliminate ethics-washing. British Medical Journal (BMJ).

Burall, S., & Neligan, C. (2005). The accountability of international organizations. Global Public Policy Institute. GPPi Research Paper Series No. 2.

Burlea-Schiopoiu, A., & Ferhati, K. (2020). The managerial implications of the key performance indicators in healthcare sector: a cluster analysis. Healthcare (Basel, Switzerland), 9(1), 19. DOI: 10.3390/healthcare9010019

Buse, K., & Walt, G. (1996). Aid coordination for health sector reform: a conceptual framework for analysis and assessment. Health Policy, 38 (3), 173–87.

Bush, J. (2018). How AI is taking the scut work out of health care. Harvard Business Review. https://hbr.org/2018/03/how-ai-is-taking-the-scut-work-out-of-health-care

Bushwick, S. (2023, August 1). Unregulated AI will worsen inequality, warns nobel-winning economist Joseph Stiglitz. Scientific American. https://www.scientificamerican.com/article/unregulated-ai-will-worsen-inequality-warns-nobel-winning-economist-joseph-stiglitz/

Business Research Methodology. (2022). Constructivism research philosophy. Research Philosophy. https://research-methodology.net/research-philosophy/epistomology/constructivism/

Buzeti, T., Brown, C., Yang L., & Madureira-Lima, J. (2019). Health and reduced inequalities. World Health Organization. European Office for Investment for Health and Development, WHO Regional Office for Europe.

Byrne, D. (2023, March 20). Does your company need a policy for AI like ChatGPT?. Corporate Governance Institute. https://www.thecorporategovernanceinstitute.com/insights/news-analysis/policy-for-chatgpt-may-be-crucial-as-ai-surges-in-popularity/

Cai, C., Winter, S., Steiner, D., Wilcox, L., & Terry, M. (2019). "Hello AI": uncovering the onboarding needs of medical practitioners for human-AI collaborative decision-making. Proceedings of the ACM on Human-Computer Interaction. 3. 1-24. DOI: 10.1145/3359206.

Calero Valdez, A., Ziefle, M., Verbert, K., Felfernig, A., & Holzinger, A. (2016). Recommender systems for health informatics: state-of-the-art and future perspectives. Machine Learning for Health Informatics: State-of-the-Art and Future Challenges, 391-414.

Camm, A. J., & Fox, K. A. A. (2018). Strengths and weaknesses of 'real-world' studies involving non-vitamin K antagonist oral anticoagulants. Open Heart 2018;5:e000788. DOI: 10.1136/openhrt-2018-000788

Carbonnier, G., & Sumner, A. (2012). Reframing aid in a world where the poor live in emerging economies. International Development Policy | Revue internationale de politique de développement. 3. DOI: 10.4000/poldev.977

Casas-Roma, J. (2022). Ethical idealism, technology and practice: a manifesto. Philos. Technol. 35, 86. DOI: 10.1007/s13347-022-00575-7

Casey, K. (2021, May 11). 'Progress over perfection': a mantra for HR and leadership. Forbes Human Resources Council. https://www.forbes.com/sites/forbeshumanresources

council/2021/05/11/progress-over-perfection-a-mantra-for-hr-and-leadership/?sh=190eaf8979e7

Casilli, A. (2022, January 25). What is 'truly ethical' artificial intelligence? An end-to-end approach to responsible and humane technological systems [Online Lecture]. Digital Humanism Series. TU Wien Informatics. https://dighum.ec.tuwien.ac.at/dighum-lectures/

Castellacci, F., Grodal, S., Mendonça, S., & Wibe, M. (2005). Advances and challenges in innovation studies. Journal of Economic Issues. 39. DOI: 10.1080/00213624.2005.11506782.

Cebon, P. (n.d.). Risk aversion or poor governance?. Hargreaves Institute. https://www.hargraves.com.au/risk-aversion-or-poor-governance/

Center for Strategic and International Studies. (2020, April 10). The need for a leapfrog strategy. https://www.csis.org/analysis/need-leapfrog-strategy

Centers for Disease Control and Prevention. (2021a, March 5). Strategy and policy development. Office of the Associate Director for Policy and Strategy. https://www.cdc.gov/policy/polaris/policyprocess/strategy-development/index.html

Centers for Disease Control and Prevention. (2021b, October 20). Cost-benefit analysis.

Central Intelligence Agency. (2019). The CIA world factbook 2020-2021. Skyhorse Publishing.

Cerna, L. (2013). The nature of policy change and implementation: a review of different theoretical approaches. Organisation for Economic Co-operation and Development.

Chalfen, R. & Rich, M. (2012). Sharing information about the pain: patient-doctor collaboration in therapy and research. In I. Management Association (Ed.), Regional Development: Concepts, Methodologies, Tools, and Applications, 897-913. DOI: 10.4018/978-1-4666-0882-5.ch504

Chammas, A., Quaresma, M., & Mont'Alvão, C. (2015). A closer look on [sic] the user centred design. Procedia Manufacturing. 3, 5397-5404. DOI: 10.1016/j.promfg.2015.07.656

Chancel, L., Piketty, T., Saez, E., Zucman, G., et al. (2022). World inequality report 2022. World Inequality Lab. https://wir2022.wid.world/

Charity Intelligence Canada. (2020). Princess Margaret Cancer Foundation. https://www.charityintelligence.ca/charity-details/55-princess-margaret-cancer-foundation

Chatterjee, J., & Dethlefs, N. (2022, April 13). Developing countries are being left behind in the AI race – and that's a problem for all of us. The Conversation Media Group Ltd.

https:// theconversation.com/developing-countries-are-being-left-behind-in-the-ai-race-and- thats-a-problem-for-all-of-us-180218

Chetty, R., Stepner, M., Abraham, S., Lin, S., Scuderi, B., Turner, N., Bergeron, A., & Cutler, D. (2016). The association between income and life expectancy in the United States, 2001-2014. DOI: 10.1001/jama.2016.4226

Clarke, V., & Braun, V. (2013). Teaching thematic analysis: overcoming challenges and developing strategies for effective learning. The Psychologist, 26, 120-123.

Collier, M., Fu, R., & Yin, L. (2020, July 30). Artificial Intelligence: healthcare's new nervous system. Accenture. https://www.accenture.com/au-en/insights/health/artificial-intelligence-healthcare

Collins, S. A., Fred, M., Wilcox, L., & Vawdrey, D. K. (2012). Workarounds used by nurses to overcome design constraints of electronic health records. NI 2012 : 11th International Congress on Nursing Informatics, June 23-27, 2012, Montreal, Canada. International Congress in Nursing Informatics (11th : 2012 : Montreal, Quebec), 2012, 93.

Collins, S., Bakken, S., Vawdrey, D., Coiera, E., & Currie, L. M. (2010). Discuss now, document later: CIS/CPOE perceived to be a 'shift behind'in the ICU. Studies in health technology and informatics, 160(Pt 1), 178.

Columbia University. (n.d.). What is financial technology (FinTech)? a beginner's guide. https://bootcamp.cvn.columbia.edu/blog/what-is-fintech/

Columbia University. (2021, May 6). Public health policy: definition, examples, and more. Columbia University Irving Medical Center. https://www.publichealth.columbia.edu/public-health-now/news/public-health-policy-definition-examples-and-more

Columbia University Mailman School of Public Health. (2019). South Africa summary. https://www.publichealth.columbia.edu/research/comparative-health-policy-library/south-africa-summary

Cooper, N., Horne, T., Hayes, G., Heldreth, C., Lahav, M., Holbrook, J., & Wilcox, L. (2022). A systematic review and thematic analysis of community-collaborative approaches to computing research.

Cortex Logic. (2019). Cortex logic: the AI engine for business. http://cortexlogic.com/

Cottrell, C. (2000). Medicare data study spotlights coding errors. Journal of AHIMA, 71(8), 58-59.

Coursera. (2023). Google professional certificates. https://www.coursera.org/google-career-certificates

Coyle, D., & Muhtar, A. (2021). Industrial policy: learning from the past. University of Cambridge. https://www.bennettinstitute.cam.ac.uk/publications/industrial-policy-learning-past/

Cronin, B. (1999). Community under anarchy: transnational identity and the evolution of cooperation. Columbia University Press. New York.

Crossley, N. (2020). Consistency, protection, responsibility, global governance: a review of multilateralism and international organizations. 26 (3), 473-499. DOI: 10.1163/19426720-02603001

Crossman, A. (2020). An overview of qualitative research methods. ThoughtCo. https://www.thoughtco.com/qualitative-research-methods-3026555

Crush, J., & Chikanda, A. (2015). South-South medical tourism and the quest for health in Southern Africa. Social science & medicine (1982), 124, 313-320. DOI: 10.1016/j.socscimed.2014.06.025

Curristine, T., Lonti, Z., & Joumard, I. (2007). Improving public sector efficiency: challenges and opportunities. OECD Journal on Budgeting, 7, 1.

Dadush, U. (2016, February 1). Industrial policy: a guide for the perplexed. Policy Center for the New South (formerly 'OCP Policy Center').

Dalio, R. (2021). Principles for dealing with the changing world order: why nations succeed and fail. Avid Reader Press, 193-340. ISBN: 978-1-4711-9669-0

Dang, B. N., Westbrook, R. A., Njue, S. M., et al. (2017). Building trust and rapport early in the new doctor-patient relationship: a longitudinal qualitative study. BMC Med Educ 17, 32. DOI: 10.1186/s12909-017-0868-5

Daniel, D. (2023, January). Lean manufacturing (lean production). TechTarget. https://www.techtarget.com/searcherp/definition/lean-production

Daniels, N., & Sabin, J. (1997). Limits to health care: fair procedures, democratic deliberation, and the legitimacy problem for insurers. Philosophy & public affairs, 26(4), 303-350. DOI: 10.1111/j.1088-4963.1997.tb00082.x

Das, S., & Dunbar, S. (2022). The COVID-19 pandemic - a diagnostic industry perspective. Frontiers in cellular and infection microbiology, 12, 862440. DOI: 10.3389/fcimb.2022.862440

Dataconomy. (2022, June 17). Weak AI is a building block to its sophisticated successors. https://dataconomy.com/2022/06/artificial-narrow-intelligence/

Davenport, T., & Kalakota, R. (2019). The potential for artificial intelligence in healthcare. Future healthcare journal, 6(2), 94–98. DOI: 10.7861/futurehosp.6-2-94

de Bastion[138], G. (2022, November 3). Ethics of AI in Africa - perspectives, challenges and discourse. Ethics of AI in Africa: What Role can German Development and Research Policy Play? [Panel Discussion]. German UNESCO Commission, Bonn, Germany.

DeBoer, R. J., Fadelu, T. A., Shulman, L. N., & Van Loon, K. (2020). Applying lessons learned from low-resource settings to prioritize cancer care in a pandemic. JAMA Oncol. 2020; 6 (9), 1429-1433. DOI: 10.1001/jamaoncol.2020.2976

Decker, K. C., & Holtermann, K. (2009). The role for exercises in senior policy pandemic influenza preparedness. Journal of Homeland Security and Emergency Management, 6 (1), 2009. DOI: 10.2202/1547-7355.1521

del Castillo, P., Moerel, L., & Volman, Y. (2021, February 23). Preventing data colonialism without resorting to protectionism - the European strategy [Online Lecture]. Digital Humanism Series. TU Wien Informatics. https://dighum.ec.tuwien.ac.at/dighum-lectures/

Deloitte. (2014, May 18). The Deloitte consumer review: the growing power of consumers. https://www2.deloitte.com/content/dam/Deloitte/uk/Documents/consumer-business/consumer-review-8-the-growing-power-of-consumers.pdf

de los Reyes, G., Scholz, M., & Smith, N. C. (2017). Beyond the "win-win": creating shared value requires ethical frameworks. California Management Review, 59(2), 142-167. DOI: 10.1177/0008125617695286

Denzin, N. K. (2012). Triangulation 2.0. Journal of Mixed Methods Research. 6 (2), 80-88.

Dhillon, J. S. (2013). Ethical brand image & corporate goodwill: issues & challenges. International Journal of Management & Information Technology. 3, 46-53. DOI: 10.24297/ijmit.v3i1.4639

Dietvorst, B. J., Simmons, J. P., & Massey, C. (2015). Algorithm aversion: people erroneously avoid algorithms after seeing them err. Journal of experimental psychology. General, 144(1), 114–126. DOI: 10.1037/xge0000033

Digital Health Canada. (2023). Strategic plan: digital health canada strategic plan.

Dittoh, S., Kulathuramaiyer, N., & Bon, A. (2021, March 23). Digital society, social justice and academic education [Online Lecture]. Digital Humanism Series. TU Wien Informatics. https://dighum.ec.tuwien.ac.at/dighum-lectures/

Docquier, F. (2006). Brain drain and inequality across nations. Revue d'Economie du Développement. 21. DOI: 10.2139/ssrn.947463

[138] Please note, any discrepancies in name capitalization throughout the reference list are intentional and are based on the exact published name of the individual.

Dodani, S., & LaPorte, R. E. (2005). Brain drain from developing countries: how can brain drain be converted into wisdom gain?. Journal of the Royal Society of Medicine, 98 (11), 487-491. DOI: 10.1177/014107680509801107

Doruk, O. T., & Söylemezoğlu, E. (2014). The constraints of innovation in developing countries: too many barriers to start ups?. Procedia - Social and Behavioral Sciences. 150, 944-949.

Douglas, S., & Meijer, A. (2016) Transparency and public value-analyzing the transparency practices and value creation of public utilities. International Journal of Public Administration, 39:12, 940-951. DOI: 10.1080/01900692.2015.1064133

Dughi, P. (2021, March 29). Apple, Amazon wealthier than more than 90% of the world's countries. Medium. https://medium.com/stronger-content/apple-amazon-wealthier-than-more-than-90-of-the-worlds-countries-17dbae8b98fe

Dutton, T. (2018, July 5). AI policy 101: an introduction to the 10 key aspects of AI policy. Medium. https://medium.com/politics-ai/ai-policy-101-what-you-need-to-know-about- ai-policy-163a2bd68d65

Easterby-Smith, M., Thorpe, R., & Jackson, P. (2012) Management research (4th ed.). Sage Publications LTD.

Ebadi, B. (2018, August 20). Collaboration is necessary for ethical artificial intelligence. Centre for International Governance Innovation. https://www.cigionline.org/articles/collaboration-necessary-ethical-artificial-intelligence/

ECIKS. (2019, December 2). Stopping the brain drain: is it possible?. ECIKS Management Consulting LLP. https://eciks.com/stopping-the-brain-drain-is-it-possible/

Edwards, E. (2021, February 24). Check your stats: the lack of diversity in venture capital is worse than it looks. Forbes.

Eisenhardt, K. M. (1989). Building theories from case study research. Academy of Management Review, 14 (4).

Eliaçık, E. (2022, August 15). How could AI transform developing countries?. Artificial Intelligence. Dataconomy. https://dataconomy.com/2022/06/artificial-intelligence-in-developing-countries/

Elmi, N. (2020, November 11). Is big tech setting Africa back?. Foreign Policy. https://foreignpolicy.com/2020/11/11/is-big-tech-setting-africa-back/

Encyclopaedia Britannica. (2016, September 6). List of medical tests and diagnostic procedures. https://www.britannica.com/topic/list-of-medical-tests-and-diagnostic-procedures-2074273

ETCIO. (2023, January 5). “The age of celebration of technology for technology’s sake is over”: Satya Nadel. Economic Times.

European Parliament. (2023, March 23). What think tanks are thinking: artificial intelligence. Briefing. https://www.europarl.europa.eu/thinktank/en/document/EPRS_BRI(2023)745695

Eurostat. (2022, October 21). Quality of life indicators - measuring quality of life. European Union.

Evans, T., & Kieny, M. (2015). The international health partnership+. In OECD Development Co-operation Report 2015: Making Partnerships Effective Coalitions for Action. 99-103.

Expatica. (2022, October 3). The healthcare system in South Africa. https://www.expatica.com/za/healthcare/healthcare-basics/healthcare-in-south-africa-105896/

Eyet, J. (2023, April 19). The perfectionism paradox. Medium. https://jeffeyet.medium.com/the-perfectionism-paradox-bb0e0998bb1e

Farazmand, A., De Simone, E., Gaeta, G.L., et al. (2022). Corruption, lack of transparency and the misuse of public funds in times of crisis: an introduction. Public Organiz Rev 22, 497-503. DOI: 10.1007/s11115-022-00651-8

Farson, R., & Keyes, R. (2002, August). The failure-tolerant leader. Harvard Business Review. https://hbr.org/2002/08/the-failure-tolerant-leader

Feldbaum, H., Patel, P., Sondorp, E., & Lee K. (2006). Global health and national security: the need for critical engagement. Med Confl Surviv. 2006 Jul-Sep; 22(3):192-8. DOI: 10.1080/13623690600772501

Ferreira, J. J. M., Fernandes, C. I., & Ferreira, F. A. F. (2020). Wearing failure as a path to innovation. Journal of business research, 120, 195-202. DOI: 10.1016/j.jbusres.2020.08.006

Fidler, D. P. (2007). Reflections on the revolution in health and foreign policy. Bulletin of the World Health Organization, 85 (3), 243-44.

FitzGerald, C., & Hurst, S. (2017). Implicit bias in healthcare professionals: a systematic review. BMC Med Ethics 18, 19. DOI: 10.1186/s12910-017-0179-8

Fitzpatrick, G., Ellingsen, G. (2013). A review of 25 years of CSCW research in healthcare: contributions, challenges and future agendas. Comput Supported Coop Work, 22, 609-665. DOI: 10.1007/s10606-012-9168-0

Fontaine, B. R., Speedie, S., Abelson, D., & Wold, C. (2000). A work-sampling tool to measure the effect of electronic medical record implementation on health care workers. The Journal of Ambulatory Care Management, 23(1), 71-85.

Forbes Technology Council. (2019, July 11). How will AI impact society in the next decade? 11 Tech Pros Weigh In. Forbes. https://www.forbes.com/sites/forbestechcouncil/2019/06/11/ how-will-ai-impact-society-in-the-next-decade-11-tech-pros-weigh-in

Forbes Technology Council. (2021, June 15). 13 industry experts share reasons companies fail at digital transformation.

Ford, J., Sowden, S., Olivera, J., Bambra, C., Gimson, A., Aldridge, R., & Brayne, C. (2021). Transforming health systems to reduce health inequalities. Future Healthcare Journal, 8 (2), e204–e209. DOI: 10.7861/fhj.2021-0018

Formanek, C. (2021, October 12). AI risk in Africa. Effective Altruism Forum. https://forum.effectivealtruism.org/posts/wLQkTBHcPKtoku8Js/ai-risk-in-africa

Forth, P., Reichert, T., de Laubier, R., & Chakraborty, S. (2020, October 29). Flipping the odds of digital transformation success. Boston Consulting Group. https://www.bcg.com/publications/2020/increasing-odds-of-success-in-digital-transformation

Fortune Business Insights. (2022, June). In vitro diagnostics market size, share & industry analysis. https://www.fortunebusinessinsights.com/industry-reports/in-vitro-diagnostics-ivd-market-101443

Franco, J. (2020, May 14). Human rights online: where are we and where will pandemic response take us?. Digital Humanism: Informatics in Times of COVID-19 [Workshop]. Digital Humanism Series. TU Wien Informatics. https://dighum.ec.tuwien.ac.at/ws-dighum-covid-19/

Fraser Institute. (2022, April 27). Long wait times for health care predated pandemic. Toronto Sun. https://www.fraserinstitute.org/article/long-wait-times-for-health-care-predated-pandemic

Freeman, C. (1987). Technology policy and economic performance: lessons from Japan. UNKNO Publishing. ISBN: 0861879287

Fu, X., & Shi, L. (2022). Direction of innovation in developing countries and its driving forces. Economic Research Working Paper No. 69. World Intellectual Property Organization.

Fullman, N., et al. (2018, May 23). Measuring performance on the healthcare access and quality index for 195 countries and territories and selected subnational locations: a

systematic analysis from the global burden of disease study 2016. The Lancet, 391 (10136), 2236-2271. DOI: 10.1016/S0140-6736 (18)30994-2

Fusch, P. I., & Ness, L. R. (2015). Are we there yet? data saturation in qualitative research. The Qualitative Report, 20 (9), 1408-1416. http://www.nova.edu/ssss/QR/QR20/9/fusch1.pdf

Gallegos, M., et al. (2023). Anti-vax: the history of a scientific problem. Journal of Public Health, 45, 1, 140-141. DOI: 10.1093/pubmed/fdac048

Geis, J. R., et al. (2019). Ethics of artificial intelligence in radiology: summary of the joint European and North American multisociety statement. Radiology, 293(2), 436-440.

Gentles, S. J., Charles, C., Ploeg, J., & McKibbon, K. A. (2015). Sampling in qualitative research: insights from an overview of the methods literature. The Qualitative Report. 20. 1772-1789. DOI: 10.46743/2160-3715/2015.2373

George, A. L. (2003). Bridging the gap: theory and practice in foreign policy. Washington, DC: U.S. Institute of Peace.

George, A. L., & Bennett, A. (2005). Case studies and theory development in the social sciences. Cambridge, MA: Massachusetts Institute of Technology.

George Washington University. (2021, August 17). What is preventive healthcare?. https://healthcaremba.gwu.edu/blog/what-is-preventive-healthcare/

Gibbon, C. (2022, September 22). Big execution: focus on progress over perfection to make innovation happen. Forbes Technology Council. https://www.forbes.com/sites/forbestechcouncil/2022/09/22/big-execution-focus-on-progress-over-perfection-to-make-innovation-happen/?sh=522fadb76904

Glaser, B. G., & Strauss, A. L. (1967). The discovery of grounded theory: strategies for qualitative research. AldineTransaction, 1-45.

Glaser, B. G., & Strauss, A. L. (2012). The discovery of grounded theory: strategies for qualitative research. Aldine Transaction, New Brunswick.

Glasner, J. (2022, August 30). They're just not into it: the biggest US tech companies aren't buying startups. Crunchbase News. https://news.crunchbase.com/public/tech-companies-startups-aapl-amzn-goog-msft/

Global Priorities Institute. (n.d.). Foundational academic research on how to do the most good. University of Oxford. https://globalprioritiesinstitute.org/

Gnanguênon, A. (2020, October 29). Mapping African regional cooperation: how to navigate Africa's institutional landscape. https://ecfr.eu/publication/mapping-african-regional-cooperation-how-to-navigate-africas-institutional-landscape/

Gostin, L., & Mok, E. (2009). Grand challenges in global health governance. Br Med Bull. 90: 7-18.

Government of Canada. (2023, May 29). Rural economic development. https://ised-isde.canada.ca/site/rural/en/skills-and-labour

Government of South Africa. (2021, November 4). Minister Khumbudzo Ntshavheni: artificial intelligence regulation while encouraging innovation. https://www.gov.za/speeches/minister-khumbudzo-ntshavheni-remarks-artificial-intelligence-ai-regulation-while

Grand View Research. (2020). In vitro diagnostics market size, share & trends analysis. https://www.grandviewresearch.com/industry-analysis/in-vitro-diagnostics-ivd-market

Grand View Research. (2022, January). Artificial intelligence in healthcare market size, share, and trends analysis report by component (software solutions, hardware, services), by application (virtual assistants, connected machines), by region, and segment forecasts, 2023 - 2030. California, United States.

Greenhill, A. (2020, November 30). Stakeholders' perspectives: how artificial intelligence (AI) can and should be used in healthcare. Healthcare Excellence Canada[139]. https://www.cfhi-fcass.ca/opportunities/webinars/artificial-intelligence-in-healthcare/webinar-summary-stakeholders-perspectives

Gupta, C. (2023, January 12). Ultimate guide to building a customer-focused culture. Zendesk Blog. https://www.zendesk.com/blog/what-is-customer-focus/

Hagerty, M. R. (1999). Testing Maslow's Hierarchy of Needs: national quality-of-life across time. Social Indicators Research 46, 249-271.

Hallaert, J. J. (2020, November 5). The tragedy of international organizations in a world order in turmoil. https://ecipe.org/wp-content/uploads/2020/07/ECI_20_PolicyBrief_05_2020_ LY08.pdf

Halminen, O., Tenhunen, H., Heliste, A., & Seppälä, T. (2019, July). Factors affecting venture funding of healthcare AI companies. In ICIMTH. 268-271.

Hamza, I. (2018, March 30). Foreign aid vs. self-help in low- and middle-income countries. University of Buffalo. Global Health Equity.

Harari, Y. N. (2015). Homo Deus: A Brief History of Tomorrow. Penguin Random House UK.

[139] Formerly known as the Canadian Foundation for Healthcare Improvement

Harrington, C., Wilcox, L., Connelly, K., Rogers, W., & Sanford, J. (2018). Designing health and fitness apps with older adults: examining the value of experience-based co-design. 15-24. DOI: 10.1145/3240925.3240929

Harris, P. (2014). Risk-averse governments. Nature Clim Change 4, 245-246. DOI: 10.1038/nclimate2176

Healthcare Excellence Canada. (2020). Artificial intelligence (AI) in healthcare.

Healthcare Excellence Canada. (2021, January 22). Implementing artificial intelligence (AI) in healthcare: lessons learned from innovators and early adopters [Webinar].

Health Policy Project. (2016, May). Health financing profile: South Africa. https://www.healthpolicyproject.com/pubs/7887/SouthAfrica_HFP.pdf

Hecht, B., Wilcox, L., Bigham, J.P., Schöning, J. et al. (2018). It's time to do something: mitigating the negative impacts of computing through a change to the peer review process.

Helen Keller International. (2022, May 24). Looking bravely: treating and eliminating diseases of poverty in Cameroon. https://reliefweb.int/report/cameroon/looking-bravely-treating-and-eliminating-diseases-poverty-cameroon

Hende, E.A., & Schoormans, J. (2012). The story is as good as the real thing: early customer input on product applications of radically new technologies. Journal of Product Innovation Management. 29. DOI: 10.1111/j.1540-5885.2012.00931.x.

Herrera, S., & Pang, G. (2005). Efficiency of public spending in developing countries : an efficiency frontier approach. Policy Research Working Paper; No. 3645. World Bank, Washington, DC.

Hirst, R. (2003). Scientific jargon, good and bad. Journal of Technical Writing and Communication, 33(3), 201-229. DOI: 10.2190/J8JJ-4YD0-4R00-G5N0

Hodge, D. R., Jackson K.F., & Vaughn M.G. (2010). Culturally sensitive interventions and health and behavioral health youth outcomes: a meta-analytic review. Social Work in Health Care 2010, 49 (5), 401-23.

Hoffecker, E. (2018, May 31). Local innovation: what it is and why it matters for developing economies. MIT D-Lab. Local Innovation Group.

Holzinger, A. (2021, September). The next frontier: AI we can really trust. In Joint European conference on machine learning and knowledge discovery in databases (pp. 427-440). Cham: Springer International Publishing.

Holzinger, A., et al. (2022). Information fusion as an integrative cross-cutting enabler to achieve robust, explainable, and trustworthy medical artificial intelligence. Information Fusion, 79, 263-278.

Holzinger, A., Haibe-Kains, B., & Jurisica, I. (2019). Why imaging data alone is not enough: AI-based integration of imaging, omics, and clinical data. European Journal of Nuclear Medicine and Molecular Imaging, 46, 2722-2730.

Horvitz, E. (2022, June 28). AI advances, responsibilities, and governance [Online Lecture]. Digital Humanism Series. TU Wien Informatics. https://dighum.ec.tuwien.ac.at/dighum-lectures/

House of Commons Canada. (2012, December). Labour and skills shortages in Canada: addressing current and future challenges. Standing Committee on Human Resources, Skills and Social Development and the Status of Persons with Disabilities.

Hsieh, P. (2017, April 30). AI in medicine: rise of the machines. https://www.forbes.com/sites/paulhsieh/2017/04/30/ai-in-medicine-rise-of-the-machines/

Huang, J., Xie, P., Zeng, Y., & Li, Y. (2021). The effect of corporate social responsibility on the technology innovation of high-growth business organizations. Sustainability. DOI: 10.3390/su13137286

Hückstädt, M. (2023). Ten reasons why research collaborations succeed-a random forest approach. Scientometrics. DOI: 10.1007/s11192-022-04629-7

Humanitas University. (2022, February 3). Don’t expect robot surgeons, expect a surgeon-AI partnership. Medical Sciences. Milan.

Hunt, S. (1996). The success and failure of international organizations. Proceedings of the ASIL Annual Meeting, 90, 596-598. DOI: 10.1017/S0272503700087243

Huxham, C., & Vangen, S. (2000). What makes partnerships work?. Public-Private Partnerships: Theory and Practice in International Perspective, Routledge, London, 293-310.

Information Technology & Innovation Foundation. (2019, June 13). National innovation policies: what countries do best and how they can improve. Global Trade & Innovation Policy Alliance. https://www2.itif.org/2019-national-innovation-policies.pdf

Insider Intelligence. (2022, April 15). Use of AI in healthcare & medicine is booming - here’s how the medical field is benefiting from AI in 2022 and beyond. Business Insider Intelligence.

Insider Intelligence. (2023, January 11). Use of AI in healthcare & medicine is booming - here's how the medical field is benefiting from AI in 2023 and beyond[140]. Business Insider Intelligence. https://www.insiderintelligence.com/insights/artificial-intelligence-healthcare/

Institute of Medicine. (2011). For the public's health: revitalizing law and policy to meet new challenges. Committee on Public Health Strategies to Improve Health. Washington, DC: The National Academies Press. DOI: 10.17226/13093.

International Data Corporation. (2022). Worldwide semiannual artificial intelligence tracker.

International Health Partnership. (2017). IHP+Results: 2016 Performance Report.

International Monetary Fund, Organisation for Economic Co-operation and Development, United Nations, & World Bank. (2015, October 15). Options for low income countries' effective and efficient use of tax incentives for investment. https://www.oecd.org/tax/options-for-low-income-countries-effective-and-efficient-use-of-tax-incentives-for-investment.pdf

Investopedia. (2022, August 4). What is the prisoner's dilemma and how does it work?.

Jaén, C. R. (2011). Successful health information technology implementation requires practice and health care system transformation. Annals of family medicine, 9(5), 388 - 389. DOI: 10.1370/afm.1307

Jain, P. (2022, August 10). The importance of international norms in artificial intelligence ethics. Council on Foreign Relations. https://www.cfr.org/blog/importance-international-norms-artificial-intelligence-ethics

Jawhari, B., Ludwick, D., Keenan, L., et al. (2016). Benefits and challenges of EMR implementations in low resource settings: a state-of-the-art review. BMC Med Inform Decis Mak 16, 116 (2016). DOI: 10.1186/s12911-016-0354-8

Jobin, A., Ienca, M., & Vayena, E. (2019). The global landscape of AI ethics guidelines. Nature Machine Intelligence, 1(9), 389-399.

Johnson, D. G., Tamburrini, G., & Zeng, Y. (2020, November 3). Ethics and IT: how AI is reshaping our world [Online Lecture]. Digital Humanism Series. TU Wien Informatics. https://dighum.ec.tuwien.ac.at/dighum-lectures/

Kaikkonen, A. (2021, December 2). Health Solutions: caught out by a pandemic. European Investment Bank. https://www.eib.org/en/essays/covid-19-pandemic-diagnostics

Kale, R. (2002). The treatment gap. Epilepsia, 43, 31-33.

[140] Note, this represents an updated source from the original that was published listed previously.

Kamadjeu, R. M., Tapang, E. M., & Moluh, R. N. (2005). Designing and implementing an electronic health record system in primary care practice in sub-Saharan Africa: a case study from Cameroon. Inform Prim Care. 2005; 13(3): 179-86. DOI: 10.14236/jhi.v13i3.595

Kassan, J. (2022, November 17). We can't rely on venture capital funding to build a just and thriving entrepreneurial economy: here's what to do instead. Entrepreneur. https://www.entrepreneur.com/leadership/venture-capital-funding-no-longer-provides-a-just-and/438356

Keeffe, B., Subramanian, U., Tierney, W. M., Udris, E., Willems, J., McDonell, M., & Fihn, S. D. (2005). Provider response to computer-based care suggestions for chronic heart failure. Medical care, 43(5), 461–465. DOI: 10.1097/01.mlr.0000160378.53326.f3

Kennett, P. (2008). Governance, globalization and public policy. Edward Elgar Publishing. ISBN: 978 1 84542 436 7

Kenton, W. (2023, January 31). 'Eat your own dog food'. Investopedia. https://www.investopedia.com/terms/e/eatyourowndogfood.asp

Khadafi, R., Nurmandi, A., Qodir, Z., & Misran. (2022). Hashtag as a new weapon to resist the COVID-19 vaccination policy: a qualitative study of the anti-vaccine movement in Brazil, USA, and Indonesia. Human vaccines & immunotherapeutics, 18(1), 2042135. DOI: 10.1080/21645515.2022.2042135

Khairat, S., Marc, D., Crosby, W., & Al Sanousi, A. (2018). Reasons for physicians not adopting clinical decision support systems: critical analysis. JMIR medical informatics, 6(2), e24. DOI: 10.2196/medinform.8912

Khan, G. (2017, August 28). Balancing on the tightrope: how government can embrace innovation in a high-risk world. PricewaterhouseCoopers LLP. https://www.pwc.com.au/digitalpulse/government-innovation-embrace-fail-risk.html

Khan, M., Khurshid, M., Vatsa, M., Singh, R., Duggal, M., & Singh, K. (2022). On AI approaches for promoting maternal and neonatal health in low resource settings: a review. Front. Public Health 10:880034. DOI: 10.3389/fpubh.2022.880034

Killelea, S. (2021). Peace in the age of chaos: the best solution for a sustainable future. Hardie Grant Books. London. UK.

Kingue, S., Rosskam, E., Bela, A. C., Adjidja, A., & Codjia, L. (2013). Strengthening human resources for health through multisectoral approaches and leadership: the case of Cameroon. Bulletin of the World Health Organization, 91 (11), 864-867. World Health Organization. DOI: 10.2471/BLT.13.127829

Klijn, E. H., Teisman, G. R. (2000). Governing public-private partnerships. Public-Private Partnerships: Theory and Practice in International Perspective, Routledge, London. 84-102.

Knight, W. (2020, October 4). Many top AI researchers get financial backing from big tech. https://www.wired.com/story/top-ai-researchers-financial-backing-big-tech/

Kohli, A., & Jha, S. (2018). Why CAD failed in mammography. Journal of the American College of Radiology : JACR, 15(3 Pt B), 535–537. DOI: 10.1016/j.jacr.2017.12.029

Krist, A. H., Tong, S. T., Aycock, R. A., & Longo, D. R. (2017). Engaging patients in decision-making and behavior change to promote prevention. Studies in health technology and informatics, 240, 284-302.

Kritikos, A. (2014). Entrepreneurs and their impact on jobs and economic growth. IZA World of Labor. 8. DOI: 10.15185/izawol.8

Kulkarni, N., & Engineers, C. C. (2016). Collaboration improves productivity, but how to improve collaboration?. In Proceedings of 2016 Industrial and Systems Engineering Research Conference, Anaheim, CA, 21-24.

Kumar, Y., Koul, A., Singla, R., & Ijaz, M. F. (2023). Artificial intelligence in disease diagnosis: a systematic literature review, synthesizing framework and future research agenda. Journal of ambient intelligence and humanized computing, 14 (7), 8459-8486. DOI: 10.1007/s12652-021-03612-z

Kumbol, V. (2022, November 3). Regional and ethical AI development in Africa - practical examples. Ethics of AI in Africa: What Role can German Development and Research Policy Play? [Conference Presentation]. German UNESCO Commission, Bonn, Germany.

Kuzel, A. J. (1992). Sampling in qualitative inquiry. B. F. Crabtree & W. L. Miller (Eds.), Doing qualitative research, 31-44. Sage Publications, Inc.

Laflamme, L., Chipps, J., Fangerau, H., Juth, N., Légaré, F., Sawe, H. R., & Wallis, L. (2019) Targeting ethical considerations tied to image-based mobile health diagnostic support specific to clinicians in low-resource settings: the Brocher proposition. Global Health Action, 12:1. DOI: 10.1080/16549716.2019.1666695

Lambrinou, E., Hansen, T. B., Beulens, J. (2019). Lifestyle factors, self-management and patient empowerment in diabetes care. European Journal of Preventive Cardiology, 26, 2_suppl, 55-63. DOI: 10.1177/2047487319885455

Lancet. (2021, November 27). The Lancet Commission on diagnostics: transforming access to diagnostics, 398.

Landay, J. A. (2023, January 24). “AI for good” isn’t good enough: a call for human-centered AI [Online Lecture]. Digital Humanism Series. TU Wien Informatics. https://dighum.ec.tuwien.ac.at/dighum- lectures/

Landi, H. (2018). Study: healthcare lags other industries in digital transformation, customer engagement tech. Healthcare Innovation. Population Health Management.

Lagas, B. (2020, April 30). Lean innovation: what manufacturers can learn from the tech sector’s appropriation of lean thinking. National Institute of Standards and Technology. U.S. Department of Commerce. https://www.nist.gov/blogs/manufacturing-innovation-blog/lean-innovation-what-manufacturers-can-learn-tech-sectors

Lateef, F. (2011). Patient expectations and the paradigm shift of care in emergency medicine. Journal of emergencies, trauma, and shock, 4(2), 163-167. DOI: 10.4103/0974-2700.82199

Law, J. (2004). After method: mess in social science research. Routledge. ISBN: 0-203-48114-3

Lee, E. A. (2020, May 14). The new urgency of digital humanism as we become digital humans. Digital Humanism: Informatics in Times of COVID-19 [Workshop]. Digital Humanism Series. TU Wien Informatics. https://dighum.ec.tuwien.ac.at/ws-dighum-covid-19/

Lee, K. (2001). Globalisation - a new agenda for health?. https://www.semanticscholar.org/paper/Globalisation-a-new-agenda-for-health-Lee/01a6609083129819619343993330d78c44d92dfbf

Little, W. (2022). Introduction to sociology : 2nd Canadian edition. Open Textbook Library.

Long, W. J. (2011). Pandemics and peace: public health cooperation in zones of conflict. United States Institute of Peace. Washington, DC.

Longo, L., Goebel, R., Lecue, F., Kieseberg, P., & Holzinger, A. (2020, August). Explainable artificial intelligence: concepts, applications, research challenges and visions. In International cross-domain conference for machine learning and knowledge extraction (pp. 1-16). Cham: Springer International Publishing.

Lowery-Kingston, J., Passoth, J. H., & Veale, M. (2021, January 26). Digital superpowers and geopolitics [Online Lecture]. Digital Humanism Series. TU Wien Informatics. https://dighum.ec.tuwien.ac.at/dighum-lectures/

Lubalo, N. (2022, November 3). Regional and ethical AI development in Africa - practical examples. Ethics of AI in Africa: What Role can German Development and Research Policy Play? [Panel Discussion]. German UNESCO Commission, Bonn, Germany.

Lyons, D., Frampton, M., Naqvi, S., Donohoe, D., Adams, G., & Glynn, K. (2020). Fallout from the COVID-19 pandemic - should we prepare for a tsunami of post viral depression?. Irish journal of psychological medicine, 37(4), 295-300. DOI: 10.1017/ipm.2020.40

Macaulay, C. (2022, June 18). African brain drain: '90% of my friends want to leave.' BBC News. https://www.bbc.com/news/world-africa-61795026

MacLean, S. T. (2021, September 8). Ensuring security and privacy in an age of patient empowerment. Future of Personal Health. Media Planet.

Maddox, T. M., Rumsfeld, J. S., & Payne, P. R. O. (2019). Questions for artificial intelligence in health care. JAMA, 321(1), 31–32. DOI: 10.1001/jama.2018.18932

Madhani, P. (2020). Building a customer focused strategy: conceptual frameworks and research propositions. SSRN Electronic Journal. DOI: 10.2139/ssrn.3717410

Maguire, M., & Delahunt, B. (2017). Doing a thematic analysis: a practical, step-by-Step guide for learning and teaching scholars. All Ireland Journal of Higher Education, 9 (3).

Makridakis, S. (2017). The forthcoming Artificial Intelligence (AI) revolution: its impact on society and firms. Futures, 90, 46-60.

Malachie, M. (2020). The 2020 - 2024 national digital health strategic plan. Ministry of Public Health. Republic of Cameroon.

Malik, M., Mamun, M. A., & Amin, A. (2018). Peer pressure, CSR spending, and long-term financial performance. Asia-Pacific Journal of Accounting & Economics, 26, 1-20. DOI: 10.1080/16081625.2018.1493933

Manheim, K., & Kaplan, L. (2019). Artificial intelligence: risks to privacy and democracy. Yale JL & Tech., 21, 106.

Manyika, J., Silberg, J., & Presten, B. (2019). What do we do about the biases in AI?. Harvard Business Review.

Marcelin, J. R., Siraj, D. S., Victor, R., Kotadia, S., & Maldonado, Y. A. (2019). The impact of unconscious bias in healthcare: how to recognize and mitigate it. The Journal of Infectious Diseases, 220, 2, S62-S73. DOI: 10.1093/infdis/jiz214

Marchildon, G. (2018, September 25). Comparative healthcare systems: similarities and differences in Canada, USA and Europe. https://www.researchgate.net/publication/

332686917_Comparative_Healthcare_Systems_Similarities_and_Differences_in_Canada_USA_and_Europe

Marcus, G. (2023, March 9). Gary Marcus: on ChatGPT [Online Lecture]. Digital Humanism Series. TU Wien Informatics. https://informatics.tuwien.ac.at/news/2374#online-event

Mares, R. (2022, February 11). Regulating transnational corporations at the UN - the negotiations of a treaty on business and human rights. DOI: 10.2139/ssrn.4032615

Mariani, F. (2008). Brain drain, R&D-cost differentials and the innovation gap. Recherches économiques de Louvain, 74, 251-272. DOI: 10.3917/rel.743.0251

Marks, L., Hunter, D. J., & Alderslade, R. (2011). Strengthening public health capacity and services in Europe. World Health Organization.

Marquez, P. V., & Farrington, J. L. (2013). The challenge of non-communicable diseases and road traffic injuries in sub-Saharan Africa. An Overview. Washington, DC.: The World Bank.

Mathieu, E., Ritchie, H., Rodés-Guirao, L., Appel, C., Giattino, C., Hasell, J., Macdonald, B., Dattani, S., Beltekian, D., Ortiz-Ospina, E., & Roser, M. (2020). COVID-19: stringency index. Our World in Data. https://ourworldindata.org/covid-stringency-index

Mauldin, R. L. (2020). Foundations of social work research. Mavs Open Press. Arlington.

Maunder, R. G., et al. (2021). Burnout in hospital-based healthcare workers during COVID-19. Science Briefs of the Ontario COVID-19 Science Advisory Table. 2021; 2 (46). DOI: 10.47326/ocsat.2021.02.46.1.0

Mayosi, B. M., & Benatar, S. R. (2014). Health and health care in South Africa - 20 years after Mandela. The New England journal of medicine, 371(14), 1344–1353. DOI: 10.1056/NEJMsr1405012

Mayrhofer, P. H. (2021). Unit 4: how to write a scientific paper: an introduction to the art of scientific writing [PowerPoint Slides]. Technische Universität Wien.

Mazzucato, M., & Kattel, R. (2020). Grand challenges, industrial policy, and public value. Oxford University Press. DOI: 10.1093/oxfordhb/9780198862420.013.12

McAlister, F. A., Cram, P., & Bell, C. M. (2018). Comparing Canadian health care to that in other countries: looking beyond the headlines. CMAJ : Canadian Medical Association journal = journal de l'Association medicale canadienne, 190 (8), E207–E208. DOI: 10.1503/cmaj.171527

McCallum, S. (2023, April 1). ChatGPT banned in Italy over privacy concerns. BBC. https://www.bbc.com/news/technology-65139406

McConnell, A., & Hart, P. (2019). Inaction and public policy: understanding why policymakers ‘do nothing’. Policy Sci 52, 645–661. DOI: 10.1007/s11077-019-09362-2

McCormack, B. & Dewing, J. (2012). Action research: working with transformational intent. Klinisk Sygepleje, 26 (3), 4-14.

McDonald, G. (2010). Ethical relativism vs absolutism: research implications. European Business Review, 22 (4), 446-464.

McHugh, M. L. (2012). Interrater reliability: the kappa statistic. Biochemia medica, 22(3), 276–282.

McKinsey Global Institute. (2018a, September 4). Notes from the AI frontier: modeling the impact of AI on the world economy. McKinsey & Company. Discussion Paper. https://www.mckinsey.com/featured-insights/artificial-intelligence/notes-from-the-ai-frontier-modeling-the-impact-of-ai-on-the-world-economy

McKinsey Global Institute. (2018b, October 29). Unlocking success in digital transformations. McKinsey & Company. Survey. https://www.mckinsey.com/capabilities/people-and-organizational-performance/our-insights/unlocking-success-in-digital-transformations

Medical Futurist. (2023, January 19). Top artificial intelligence companies in healthcare to keep an eye on. https://medicalfuturist.com/top-artificial-intelligence-companies-in-healthcare/

Meltzer, J. P., & Kerry, C. F. (2021, February 17). Strengthening international cooperation on artificial intelligence. Brookings. https://www.brookings.edu/research/strengthening-international-cooperation-on-artificial-intelligence/

Merriam-Webster. (n.d). The history of ‘laundry list’. https://www.merriam-webster.com/words-at-play/the-history-of-laundry-list

Meskó, B. (2022). COVID-19's impact on digital health adoption: the growing gap between a technological and a cultural transformation. JMIR human factors, 9(3), e38926. DOI: 10.2196/38926

Metakides, G. (2020, May 14). New policy directions for European digital sovereignty. Digital Humanism: Informatics in Times of COVID-19 [Workshop]. Digital Humanism Series. TU Wien Informatics. https://dighum.ec.tuwien.ac.at/ws-dighum-covid-19/

Michel J., et al. (2019). How and why policy-practice gaps come about: a South African universal health coverage context. Journal of Global Health Reports. 3:e2019069. DOI:10.29392/joghr.3.e2019069

Microsoft. (2023, January 23). Microsoft and OpenAI extend partnership. Microsoft Corporate Blogs. https://blogs.microsoft.com/blog/2023/01/23/microsoftandopenai extend partnership/

Miles, M. B., & Huberman, A. M. (1994). Qualitative data analysis: an expanded sourcebook. Sage Publications, Thousand Oaks, CA.

Ministry of Public Health (Cameroon). (2010). Cameroon analysis of the human resources for health situation 2010. Yaoundé, Cameroon: Ministry of Public Health (Cameroon).

Ministry of Public Health Directorate of Health Resources. (2012). Cameroun: analyse de la situation des ressources humaines pour la santé, 2010.

Miroux, A. (2008, December). Transnational corporations and the infrastructure challenge: an African perspective. NEPAD-OECD Africa Investment Initiative. https://www.oecd.org/development/investmentfordevelopment/41881230.pdf

Mitchell, P., Reinap, M., Moat, K., & Kuchenmüller, T. (2023). An ethical analysis of policy dialogues. Health research policy and systems, 21(1), 13. DOI: 10.1186/s12961-023-00962-2

Mohammadiaghdam, N., Doshmangir, L., Babaie, J., et al. (2020). Determining factors in the retention of physicians in rural and underdeveloped areas: a systematic review. BMC Fam Pract 21, 216. DOI: 10.1186/s12875-020-01279-7

Moltzau, A. (2019, August 7). Artificial Intelligence and recent billion dollar investments 2019. Medium. https://medium.com/dataseries/artificial-intelligence-and-recent-billion-dollar-investments-2019-759e78b042ad

Morley, L., & Cashell, A. (2017). Collaboration in health care. Journal of medical imaging and radiation sciences, 48 (2), 207–216. DOI: 10.1016/j.jmir.2017.02.071

Moser, D. V., & Martin, P. R. (2012). A broader perspective on corporate social responsibility research in accounting. The Accounting Review, 87(3), 797-806.

Moss, E., & Metcalf, J. (2019, November 14). The ethical dilemma at the heart of big tech companies. Harvard Business Review. https://hbr.org/2019/11/the-ethical-dilemma-at-the-heart-of-big-tech-companies

Moss, N. E. (1995). Social inequalities and health. Health Affairs, 14 (2).

Muller, H., Mayrhofer, M. T., Van Veen, E. B., & Holzinger, A. (2021). The ten commandments of ethical medical AI. Computer, 54(07), 119-123.

Munn, L., & Prem, E. (2022, December 6). The uselessness of AI ethics [Online Lecture]. Digital Humanism Series. TU Wien Informatics. https://dighum.ec.tuwien.ac.at/dighum-lectures/

Murphy, A., Bere, N., Vamvakas, S., & Mavris, M. (2022). The added value of patient engagement in early dialogue at EMA: scientific advice as a case study. Frontiers in medicine, 8, 811855. DOI: 10.3389/fmed.2021.811855

Musen, M. A., Middleton, B., & Greenes, R. (2014). Clinical decision-support systems. In Biomedical Informatics: Computer Applications in Health Care and Biomedicine: Fourth Edition (pp. 643-674). Springer London. DOI: 10.1007/978-1-4471-4474-8_22

Náfrádi, L., Nakamoto, K., & Schulz, P. J. (2017). Is patient empowerment the key to promote adherence? a systematic review of the relationship between self-efficacy, health locus of control and medication adherence. PloS one, 12 (10), e0186458. DOI: 10.1371/journal.pone.0186458

National Department of Health. (2020). National digital health strategy for South Africa 2019 - 2024. Republic of South Africa.

National Research Council. (2009). Computational technology for effective health care: immediate steps and strategic directions.

National Research Council (US), Institute of Medicine (US), Woolf, S.H., & Aron, L. (2013). U.S. health in international perspective: shorter lives, poorer health. Washington (DC): National Academies Press (US), 4, Public Health and Medical Care Systems.

Naudé, W., Szirmai, A., & Goedhuys, M. (2011). Innovation and entrepreneurship in developing countries. United Nations University. http://collections.unu.edu/eserv/UNU:858/A2011916102624_20.pdf

Neurons Lab. (2022, August 23). Explaining why you would fail at 98% of chances in AI project creation. https://neurons-lab.com/blog/managed-capacity-model/

Nickerson, C. (2022, January 6). Positivism in sociology: definition, theory & examples. Simply Psychology. www.simplypsychology.org/positivism-in-sociology-definition-theory-examples.html

Nieto, M., & Pérez, W. (2000), The development of theories from the analysis of the organisation: case studies by the patterns of behaviour, Management Decision, 38 (10), 723-734. DOI: 10.1108/00251740010360588

Nijhuis, T., Guan, Q., & Tewary, V. (2018). Assessing person-centered therapeutic innovations. IQVIA. White Paper.

Nojszewska, E., & Sielska, A. (2022). Chapter 5: value based healthcare (VBHC) as a tool for achieving clinical effectiveness. In Economics and Mathematical Modeling in Health-Related Research. Leiden, The Netherlands: Brill. DOI: 10.1163/9789004517295_007

Nwaka, S., Ochem, A., Besson, D., et al. (2012). Analysis of pan-African centres of excellence in health innovation highlights opportunities and challenges for local innovation and financing in the continent. BMC Int Health Hum Rights 12, 11. DOI: 10.1186/1472-698X-12-11

Office of the Auditor General of Canada. (1998, August). Innovation in the federal government: the risk not taken. Government of Canada. https://www.oag-bvg.gc.ca/internet/english/meth_gde_e_10193.html

Ojong, N., Zakariaou, N., Martin, N. C., & Kum, V. (2022, June 15). Health care financing in Cameroon: challenges and opportunities [Webinar]. Nkafu Policy Institute.

OpenAI. (2022, November 30). Introducing ChatGPT. Product Announcements. https://openai.com/blog/chatgpt#OpenAI

Organisation for Economic Co-operation and Development. (2018, November 23). OECD best practices for performance budgeting. Public Governance Committee. https://one.oecd.org/document/GOV/PGC/SBO(2018)7/en/pdf

Organisation for Economic Co-operation and Development. (2019a). Benchmarking higher education system performance. Higher Education. OECD Publishing. Paris. DOI: 10.1787/be5514d7-en

Organisation for Economic Co-operation and Development. (2019b). Health at a glance 2019: OECD indicators (summary). OECD Publishing. Paris. DOI: 10.1787/e88a7402-en

Organisation for Economic Co-operation and Development. (2021a). Economic policy reforms 2021: going for growth: South Africa. https://www.oecd.org/economy/growth/South-Africa-country-note-going-for-growth-2021.pdf

Organisation for Economic Co-operation and Development. (2021b). Health at a glance 2021: OECD indicators. OECD Publishing. Paris. DOI: 10.1787/ae3016b9-en

Organisation for Economic Co-operation and Development. (2021c). OECD data: South Africa. https://data.oecd.org/south-africa.htm

Organisation for Economic Co-operation and Development. (2022). Lobbying. https://www.oecd.org/corruption/ethics/lobbying/

Organisation for Economic Co-operation and Development, United Nations Office on Drugs and Crime, & World Bank. (2013). Anti-corruption ethics and compliance handbook for business. https://www.oecd.org/corruption/Anti-CorruptionEthicsCompliance Handbook.pdf

Organisation of African, Caribbean and Pacific States. (2022). Development of a first national research and innovation strategy in Cameroon. OACPS Research and Innovation.

Osman Andersen, T., Nunes, F., Wilcox, L., Kaziunas, E., Matthiesen, S., & Magrabi, F. (2021, May). Realizing AI in healthcare: challenges appearing in the wild. In Extended Abstracts of the 2021 CHI Conference on Human Factors in Computing Systems (pp. 1-5).

O'Sullivan, S., et al. (2019). Legal, regulatory, and ethical frameworks for development of standards in artificial intelligence (AI) and autonomous robotic surgery. The international journal of medical robotics and computer assisted surgery, 15(1), e1968.

Our World in Data. (2015). Healthcare access and quality index, 2015. https://ourworldindata.org/grapher/healthcare-access-and-quality-index

OXFAM International. (2020, October 23). Poor countries denied $5.7 trillion in aid because of rich countries' 50-year failure to deliver on aid promises. https://www.oxfam.org/en/press-releases/poor-countries-denied-57-trillion-aid-because-rich-countries-50-year-failure-deliver

Oxford Languages. (2022a). Diagnose. In Oxford Dictionary. Oxford University Press.

Oxford Languages. (2022b). Treatment. In Oxford Dictionary. Oxford University Press.

Papanicolas, I., & Smith, P. C. (2013). Health system performance comparison: an agenda for policy, information, and research. Maidenhead: Open University Press, McGraw-Hill Education.

Parekh, S., Baker, E. (2023, May 15). Investment in medical imaging AI tops $5B. Report: VC Funding for Medical Imaging AI Companies. Signify Research.

Parikh, R. B., Teeple, S., & Navathe, A. S. (2019). Addressing bias in artificial intelligence in health care. JAMA, 322 (24), 2377–2378. DOI: 10.1001/jama.2019.18058

Park, A. (2023, September 8). Ibex gallops to $55M VC round for cancer-catching AI diagnostics. Fierce Biotech. https://www.fiercebiotech.com/medtech/ibex-doubles-lifetime-funding-55m-cancer-catching-ai

Pattanayak, D. (2020, April 4). Scope of internet of things (IoT) in healthcare system. Proceedings of the International Conference on Innovative Computing & Communications (ICICC) 2020. DOI: 10.2139/ssrn.3568540

Patton, M. Q. (1990). Qualitative evaluation and research methods. Sage Publications. Newbury Park, California, 1990.

Pearse, W. (2021, April 7). A flawed system: the problems with development aid. Inomics. https://inomics.com/blog/the-problems-with-development-aid-1388062

Perkel, C. (2020, January 21). Canada lags behind peers in doctors per capita, but average in physician visits. National Post. The Canadian Press. https://nationalpost.com/pmn/news-pmn/canada-news-pmn/canada-lags-behind-peers-in-doctors-per-capita-but-average-in-physician-visits

Peters, D. (2017, November 21). Africa must keep its rich, valuable data safe from exploitation. The Conversation. https://theconversation.com/africa-must-keep-its-rich-valuable-data-safe-from-exploitation-87535

Pettey, C. (2019, November 5). Lessons from artificial intelligence pioneers. Gartner. https://www.gartner.com/smarterwithgartner/lessons-from-artificial-intelligence-pioneers

Phillips, J., & Klein, J. D. (2023). Change management: from theory to practice. TechTrends 67, 189-197. DOI: 10.1007/s11528-022-00775-0

Pichai, S. (2021, March 11). Career certificates and more ways we're helping job seekers. Official Blog (Grow with Google). https://blog.google/outreach-initiatives/grow-with-google/career-certificates/

Pichai, S. (2023, February 6). An important next step on our AI journey. Google Blog. https://blog.google/technology/ai/bard-google-ai-search-updates/

Plavén-Sigray, P., Matheson, G. J., Schiffler, B. C., & Thompson, W. H. (2017). The readability of scientific texts is decreasing over time. eLife, 6, e27725. DOI: 10.7554/eLife.27725

Porter, M. E., & Kramer, M. R. (2019). Creating shared value. In: Lenssen, G.G., Smith, N.C. (eds) Managing Sustainable Business. Springer, Dordrecht. DOI: 10.1007/978-94-024-1144-7_16

Pottie, K., Hadi, A., Chen, J., Welch, V., & Hawthorne, K. (2013). Realist review to understand the efficacy of culturally appropriate diabetes education programmes. Diabetic medicine : a journal of the British Diabetic Association, 30 (9), 1017-1025. DOI: 10.1111/dme.12188

Pratt, M. K. (2018, August 1). Artificial intelligence in primary care. Medical economics. https:// www.medicaleconomics.com/business/artificial-intelligence-primary-care

Price-Smith, A. T. (2002). The health of nations: infectious diseases, environmental change, and their effects on national security. Cambridge, MA: MIT Press.

PricewaterhouseCoopers. (n.d). The digital disruptors changing health care in Canada. https://www.pwc.com/ca/en/industries/technology/digital-disruptors-changing-health-care-in-canada.html

PricewaterhouseCoopers. (2017a). Sizing the prize: what's the real value of AI for your business and how can you capitalise?. https://www.pwc.com/gx/en/issues/analytics/assets/pwc-ai-analysis-sizing-the-prize-report.pdf

PricewaterhouseCoopers. (2017b). What doctor? Why AI and robotics will define new health. https://www.pwc.at/de/publikationen/branchen-und-wirtschaftsstudien/healthcare-ai-new-health.pdf

Qiu, R., & Liu, Z. (2023). AI widens the gap between the rich and the poor. SHS Web Conf, 152. DOI: 10.1051/shsconf/202315205004

Raina, R. S., & Thawani, V. (2016). The zest for patient empowerment. Journal of clinical and diagnostic research : JCDR, 10(6), FE01–FE3. DOI: 10.7860/JCDR/2016/16816.7902

Ramos, G. (2022, November 3). UNESCO recommendation on the ethics of AI - implementation in Africa. Ethics of AI in Africa: What Role can German Development and Research Policy Play? [Conference Presentation]. German UNESCO Commission, Bonn, Germany.

Ramraj, A. (2022, December 12). Reimagining healthcare with AI: three key areas for transformation. Forbes Technology Council. https://www.forbes.com/sites/forbestechcouncil/2022/12/12/reimagining-healthcare-with-ai-three-key-areas-for-transformation/?sh=68af99155b5c

RateMyInvestor. (2018). Diversity in U.S. startups. https://ratemyinvestor.com/DiversityVC Report_Final.pdf

Reich, M. R. (2002). Introduction: public-private partnerships for public health. Public-Private Partnerships for Public Health. Cambridge, MA: Harvard Series on Population and International Health. Harvard Center for Population and Development Studies, 1-18.

Rhaiem, K., & Amara, N. (2021). Learning from innovation failures: a systematic review of the literature and research agenda. Rev Manag Sci 15, 189–234. DOI: 10.1007/s11846-019-00339-2

Ribeiro, M. T., Singh, S., & Guestrin, C. (2016, August). "Why should I trust you?" explaining the predictions of any classifier. In Proceedings of the 22nd ACM SIGKDD international conference on knowledge discovery and data mining (pp. 1135-1144).

Richens, J. G., Lee, C. M., & Johri, S. (2020). Improving the accuracy of medical diagnosis with causal machine learning. Nat Commun 11, 3923. DOI: 10.1038/s41467-020-17419-7

Rikap, C., & Lundvall, B. A. (2021). The digital innovation race: conceptualizing the emerging new world order. DOI: 10.1007/978-3-030-89443-6

Riley, W. J. (2012). Health disparities: gaps in access, quality and affordability of medical care. Transactions of the American Clinical and Climatological Association, 123.

Rimondini, M., Busch, I. M., Mazzi, M. A., et al. (2019). Patient empowerment in risk management: a mixed-method study to explore mental health professionals' perspective. BMC Health Serv Res 19, 382. DOI: 10.1186/s12913-019-4215-x

Rip, A. (2015). Technology assessment. International Encyclopedia of the Social & Behavioral Sciences (Second Edition), Elsevier, 125-128. ISBN: 9780080970875

Rissel, C. (1994). Empowerment: the holy grail of health promotion?. Health Promotion International, 9, 1, 39–47. DOI: 10.1093/heapro/9.1.39

Röcker, C., Ziefle, M., & Holzinger, A. (2014). From Computer Innovation to Human Integration: Current Trends and Challenges for Pervasive HealthTechnologies. In: Holzinger, A., Ziefle, M., Röcker, C. (eds) Pervasive Health. Human–Computer Interaction Series. Springer, London. DOI: 10.1007/978-1-4471-6413-5_1

Rogers, B. (2016, January 7). Why 84% of companies fail at digital transformation. Forbes. https://www.forbes.com/sites/brucerogers/2016/01/07/why-84-of-companies-fail-at-digital-transformation/#f4aa842397bd

Roser, R. (2019). Global Economic Inequality. Our World In Data Org. https://ourworldindata.org/global-economic-inequality

Rotolo, D., Hicks, D., & Martin, B. R. (2016). What is an emerging technology?. Cornell University, 1, 6-8.

Rouganne, M. (2018, February 9). How mobile phones are shaping the future of Africa. Digital Corner. https://www.digitalcorner-wavestone.com/2018/02/how-mobile-phones-are-shaping-the-future-of-africa/

Rowe, S., Alexander, N., Kretser, A., et al. (2013). Principles for building public-private partnerships to benefit food safety, nutrition, and health research. Nutr Rev. 71 (10): 682-691.

Rozuel, C. (2013). Ethical absolutism versus ethical relativism. In: Idowu, S.O., Capaldi, N., Zu, L., Gupta, A.D. (eds) Encyclopedia of Corporate Social Responsibility. Springer, Berlin, Heidelberg. DOI: 10.1007/978-3-642-28036-8_494

Russell, S. (2020, September 8). How not to destroy the world with artificial intelligence [Online Lecture]. Digital Humanism Series. TU Wien Informatics. https://dighum.ec.tuwien.ac.at/dighum-lectures/

Russell, S. (2022, March). Provably beneficial artificial intelligence. In 27th International Conference on Intelligent User Interfaces, 3-3.

Russell, S., et al. (2015). Research priorities for robust and beneficial artificial intelligence: an open letter. AI Magazine, 36 (4), 3-4.

Ruttkamp-Bloem, E. (2022, November 3). Perspectives, challenges and discourses. Ethics of AI in Africa: What Role can German Development and Research Policy Play? [Conference Presentation]. German UNESCO Commission, Bonn, Germany.

Salganik, M. J. (2023). Predicting the future of society. Nat Hum Behav. DOI: 10.1038/s41562-023-01535-7

Sampson, C. J., et al. (2019). Transparency in decision modelling: what, why, who and how?. PharmacoEconomics, 37(11), 1355–1369. DOI: 10.1007/s40273-019-00819-z

Sandow, D., & Allen, A. M. (2005). The nature of social collaboration: how work really gets done. Reflections: The SoL Journal, 6(2-3), 2-3.

Schmidt-Erfurth, U., Bogunovic, H., Sadeghipour, A., et al. (2018a). Machine learning to analyze the prognostic value of current imaging biomarkers in neovascular age-related macular degeneration. Opthamology Retina; 2:24-30.

Schmidt-Erfurth, U., Sadeghipour, A., Gerendas, B. S., Waldstein, S. M., & Bogunović, H. (2018b). Artificial Intelligence in retina. Progress in Retinal and Eye Research.

Schneeberger, D., Stöger, K., & Holzinger, A. (2020, August). The European legal framework for medical AI. In International Cross-Domain Conference for Machine Learning and Knowledge Extraction (pp. 209-226). Cham: Springer International Publishing.

Schwartz, S. H. (2012). An overview of the Schwartz theory of basic values. Online Readings in Psychology and Culture, 2, 1. DOI: 10.9707/2307-0919.1116

Seixas, B. V., Regier, D. A., Bryan, S. et al. (2021). Describing practices of priority setting and resource allocation in publicly funded health care systems of high-income countries. BMC Health Serv Res 21, 90. DOI: 10.1186/s12913-021-06078-z

Setia, M. S. (2016). Methodology Series Module 5: Sampling Strategies. Indian journal of dermatology, 61(5), 505–509. DOI: 10.4103/0019-5154.190118

Shiffman, J., & Smith, S. (2007). Generation of political priority for global health initiatives: a framework and case study of maternal mortality. The lancet, 370(9595), 1370-1379.

Shorten, T., Taylor, M., Spicer, N., Mounier-Jack, S., & McCoy, D. (2012). The international health partnership plus: rhetoric or real change? results of a self-reported survey in the context of the 4th high level forum on aid effectiveness in Busan. Globalization and Health. 8:13.

Sierra, C. (2022, April 26). Responsible artificial intelligence [Online Lecture]. Digital Humanism Series. TU Wien Informatics. https://dighum.ec.tuwien.ac.at/dighum-lectures/

Simonite, T. (2020, December 10). The dark side of big tech's funding for AI research. Wired. https://www.wired.com/story/dark-side-big-tech-funding-ai-research/

Singh, V. (2020). AI & data in South Africa's health sector. Policy Action Network. AI & Data Series 6.

Singh, J. A. (2019). Artificial Intelligence and global health: opportunities and challenges. Emerging Topics in Life Sciences. 3 (6). 741-746. DOI: 10.1042/ ETLS20190106

Snobar, A. (2022, January 14). Why M&As between startups will catalyze tech growth in 2022. Forbes Technology Council. https://www.forbes.com/sites/forbestechcouncil/2022/01/14/why-mas-between-startups-will-catalyze-tech-growth-in-2022/?sh=246fc8dc77ac

Somekh, B. (2006). Action research: a methodology for change and development. Open University Press. The McGraw-Hill companies.

Spatharou, A., Hieronimus, S., & Jenkins, J. (2020, March 10). Transforming healthcare with AI: the impact on the workforce and organizations. McKinsey & Company. https://www.mckinsey.com/industries/healthcare/our-insights/transforming-healthcare-with-ai

Spicer, N., Agyepong, I., Ottersen, T., et al. (2020). 'It's far too complicated': why fragmentation persists in global health. Global Health 16, 60. DOI: 10.1186/s12992-020-00592-1

Spicer, N., Aleshkina, J., Biesma, R., et al. (2010). National and sub-national HIV/AIDS coordination: are global health initiatives closing the gap between intent and practice? Glob Health. 6:3.

Stake, R. E. (2005). Qualitative case studies. Sage Handbook of Qualitative Research, 3rd edn. Thousand Oaks, CA: Sage, 443-466.

Stange, K. C. (2009). The problem of fragmentation and the need for integrative solutions. Annals of family medicine, 7(2), 100-103. DOI: 10.1370/afm.971

Stanger, A. (2021, June 15). Digital humanism and democracy in geopolitical context [Online Lecture]. Digital Humanism Series. TU Wien Informatics. https://dighum.ec.tuwien.ac.at/dighum-lectures/

StartupList Africa. (2019). Top startups in Cameroon. https://startuplist.africa/location/cameroon

Statista. (2019, April 30). Size of the global point of care diagnostics market from 2015 to 2022. https://www.statista.com/statistics/726116/world-point-of-care-diagnostics-market-size/

Statista. (2022a, December 1). Health and health systems ranking of countries worldwide in 2021, by health index score. https://www.statista.com/statistics/1290168/health-index-of-countries-worldwide-by-health-index-score/

Statista. (2022b, August 5). Top 100: ranking of countries according to their quality of infrastructure in 2019. https://www.statista.com/statistics/264753/ranking-of-countries-according-to-the-general-quality-of-infrastructure/

Statistics South Africa. (2019). General household survey. P0318. https://www.statssa.gov.za/publications/P0318/P03182019.pdf

Steckler, A. B., Mcleroy, K., Goodman, R., Bird, S. T., & Mccormick, L. (1992). Toward integrating qualitative and quantitative methods: an introduction. Health education quarterly, 19, 1-8. DOI: 10.1177/109019819201900101

Stevens, P. (2004). Diseases of poverty and the 10/90 gap. International Policy Network. London, UK.

Sutherland, J. M. (2011). Hospital payment policy in Canada: options for the future. Canadian Health Services Research Foundation. https://healthcarefunding.ca/key-issues/current-funding/

Sutherland J. M., Repin N., Crump R. T., & Hellsten E. (2013). Paying for hospital services: a hard look at the options. CD Howe Institute.

Swedish International Development Cooperation Agency. (2022, October 4). Regional cooperation in Africa. https://www.sida.se/en/sidas-international-work/countries-and-regions/regional-cooperation-in-africa

Szlezák, N. A., Bloom, B. R., Jamison, D. T., Keusch, G. T., Michaud, C. M., Moon, S., et al. (2010) The global health system: actors, norms, and expectations in transition. PLoS Med 7(1): e1000183. DOI: 10.1371/journal.pmed.1000183

Tantchou Tchoumi, J. C., & Butera, G. (2013). Profile of cardiac disease in Cameroon and impact on health care services. Cardiovascular Diagnosis and Therapy, 3 (4), 236-243. DOI: 10.3978/j.issn.2223-3652.2013.12.05

Taylor, S., et al. (2018). Responsible AI – key themes, concerns & recommendations for European research and innovation: summary of consultation with multidisciplinary experts. Hub4NGI.

Technische Universität Wien. (2007, January 17). Code of ethics. TU Wien Informatics. https://informatics.tuwien.ac.at/code-of-ethics/

Thakare, V., Khire G., & Kumbhar, M. (2022). Artificial intelligence (AI) and internet of things (IoT) in healthcare: opportunities and challenges. DOI: 10.1149/10701.7941ecst

Thamm, A. (2021, July 20). Artificial general intelligence (AGI). Data & AI Glossary. https://www.alexanderthamm.com/en/data-science-glossary/artificial-general-intelligence-agi/

Thevapalan, A. (2021, March 5). Andrew Ng's 5 step framework to plan AI projects effectively. Towards Data Science. https://towardsdatascience.com/5-step-framework-to-plan-ai-projects-effectively-de1a1bc958c

Thomford, N. E., Bope, C. D., Agamah, F. E., Dzobo, K., Owusu Ateko, R., Chimusa, E., Mazandu, G. K., Ntumba, S. B., Dandara, C., & Wonkam, A. (2020). Implementing artificial intelligence and digital health in resource-limited settings? Top 10 lessons we learned in congenital heart defects and cardiology. Omics : a journal of integrative biology, 24 (5), 264–277. DOI: 10.1089/omi.2019.0142

Timmers, P. (2022). Digital industrial policy for Europe. Centre on Regulation in Europe. Brussels, Belgium. https://cerre.eu/wp-content/uploads/2022/12/Digital-Industrial-Policy-for-Europe.pdf

Townsend, W. (2010). Innovation and the value of failure. International Journal of Management and Marketing Research, 3, 1.

Tracxn. (2023, March 17). AI in healthcare startups in Canada. https://tracxn.com/explore/AI-in-Healthcare-Startups-in-Canada

Transparency International. (2017, September 25). Persistent corruption in low-income countries requires global action. https://www.transparency.org/en/press/20070925-persistent-corruption-in-low-income-countries-requires-global-acti

Transparency International. (2021). Corruption perceptions index - 2021. https://www.transparency.org/en/cpi/2021

Tran, T. N. T., Felfernig, A., Trattner, C., & Holzinger, A. (2021). Recommender systems in the healthcare domain: state-of-the-art and research issues. Journal of Intelligent Information Systems, 57, 171-201.

Tricot, R. (2021). Venture capital investments in artificial intelligence: analysing trends in VC in AI companies from 2012 through 2020. OECD Digital Economy Papers, 319, OECD Publishing, Paris. DOI: 10.1787/f97beae7-en

United Nations. (2018a). Cameroon. Human Development Indices and Indicators: 2018 Statistical Update. United Nations Development Report. 1-3, 5-6.

United Nations. (2018b, November 20). The least developed countries report 2018: overview. United Nations Conference on Trade and Development. https://unctad.org/system/files/official-document/ldcr2018overview_en.pdf

United Nations. (2019). World economic situation and prospects. 169-170.

United Nations Conference on Trade and Development. 2022 (November 15). Now 8 billion and counting: where the world's population has grown most and why that matters.

United Nations Educational, Scientific and Cultural Organization. (2022). Recommendations on the ethics of artificial intelligence. United Nations Educational, Scientific and Cultural Organization. 7, place de Fontenoy, 75352 Paris 07 SP, France.

United Nations Industrial Development Organization. 2021 (December 9). UNIDO's groundbreaking publication on the adoption of AI by SMEs. https://www.unido.org/news/unidos-groundbreaking-publication-adoption-ai-smes

University of Pretoria and Access Partnership. (2018). Artificial intelligence for Africa: an opportunity for growth, development, and democratisation. https://www.up.ac.za/media/shared/7/ZP_Files/ai-for-africa.zp165664.pdf

University of Washington. (2014). Design for high-and low-resource settings. https://courses.washington.edu/bioeteam/400_DesignHighLowResource 2014.pdf

Valle, V. M. (2016). An assessment of Canada's healthcare system weighing achievements and challenges. Norteamérica. 11. 193-220. DOI: 10.20999/nam.2016.b008.

van Assen, M. F. (2021) Lean, process improvement and customer-focused performance. The moderating effect of perceived organisational context, Total Quality Management & Business Excellence, 32:1-2, 57-75. DOI: 10.1080/14783363.2018.1530591

van der Hijden, P., & van der Wende, M. (2020, October 3). Mitigating brain drain by connecting universities. University World News. https://www.universityworldnews.com/post.php?story=20200929134323744

Van de Sijpe, N., & Rayp, G. (2005). Measuring and explaining government inefficiency in developing countries. The Journal of Development Studies, 43:2, 360-381. DOI: 10.1080/00220380601125230

Vardi, M. (2023, March 9). Gary Marcus: on ChatGPT [Online Lecture - Discussion Portion]. Digital Humanism Series. TU Wien Informatics. https://informatics.tuwien.ac.at/news/2374#online-event

Vayena, E., Blasimme, A., & Cohen, I. G. (2018). Machine learning in medicine: addressing ethical challenges. PLoS medicine, 15(11), e1002689. DOI: 10.1371/journal.pmed.1002689

Vector Institute. (2022). Health at Vector. https://vectorinstitute.ai/health-research/

Venture Beat. (2019, July 19). Why do 87% of data science projects never make it into production?. https://venturebeat.com/ai/why-do-87-of-data-science-projects-never-make-it-into-production/

Verghese, A., Shah, N. H., & Harrington, R. A. (2018). What this computer needs is a physician: humanism and artificial intelligence. JAMA, 319(1), 19–20. DOI: 10.1001/jama.2017.19198

von Richthofen, G., Corrigan, C., & Volker, L. (2022, November 3). Scientific cooperation for ethical AI development in Africa. Ethics of AI in Africa: What Role can German Development and Research Policy Play? [Conference Presentation and Panel Discussion]. German UNESCO Commission, Bonn, Germany.

Wagstaff, A., Bredenkamp, C., & Buisman, L. R. (2014). Progress on global health goals: are the poor being left behind?. The World Bank Research Observer, 29, 2, 137–162. DOI: 10.1093/wbro/lku008

Wahl, B., Cossy-Gantner, A., Germann, S., & Schwalbe, N. (2018). Artificial Intelligence (AI) and global health: how can AI contribute to health in resource-poor settings?. BMJ Global Health. 3. e000798.

Walt, G., Spicer, N., & Buse, K. (2009). Mapping the global health architecture. In: Buse K, Hein W, Drager N, editors. Making sense of Global Health governance: the policy perspective. London: Palgrave Macmillan.

Wang, H., He, W., & Yang, Y. (2022). Is heterogeneity better? The impact of top management team characteristics on enterprise innovation Performance. Behavioral sciences (Basel, Switzerland), 12(6), 164. DOI: 10.3390/bs12060164

Wears, R. L., & Berg, M. (2005). Computer technology and clinical work: still waiting for Godot. JAMA, 293(10), 1261–1263. DOI: 10.1001/jama.293.10.1261

Weiner, B. J. (2009). A theory of organizational readiness for change. Implementation Sci 4, 67. DOI: 10.1186/1748-5908-4-67

Wickramasinghe, N. (2016). Handbook of research on healthcare administration and management. IGI Global. DOI: 10.4018/978-1-5225-0920-2

Wiggers, K. (2019, April 17). PathAI raises $60 million for AI pathology and diagnostic tools. VentureBeat. https://venturebeat.com/ai/pathai-raises-60-million-for-ai-pathology-and-diagnostic-tools/

Wikler, D. (2003). Why prioritize when there isn't enough money?. Cost Eff Resour Alloc 1, 5. DOI: 10.1186/1478-7547-1-5

World Bank. (2019), Physicians (per 1,000 people). https://data.worldbank.org/indicator/SH.MED.PHYS.ZS?end=2019&start=2009

World Bank. (2021a). GDP (current US$). https://data.worldbank.org/indicator/NY.GDP.MKTP.CD

World Bank. (2021b). GDP per capita (current US$). https://data.worldbank.org/indicator/NY.GDP.PCAP.CD

World Bank. (2021c). GINI Coefficient by country. https://data.worldbank.org/indicator/SI.POV. GINI

World Bank. (2021d). The World Bank in South Africa. https://www.worldbank.org/en/country/southafrica/overview#1

World Bank. (2021e). Population, total. https://data.worldbank.org/indicator/sp.pop.totl

World Bank Group. (2013). Cameroon's infrastructure: a continental perspective. World Bank Group eLibrary. DOI: 10.1596/1813-9450-5822

World Economic Forum. (2018a). Code of ethics for researchers. https://widgets.weforum.org/coe/index.html#code

World Economic Forum. (2018b, May 31). Four ways AI can make healthcare more efficient and affordable. Health and Healthcare. https://www.weforum.org/agenda/2018/05/four-ways-ai-is-bringing-down-the-cost-of-healthcare/

World Economic Forum. (2021). Network readiness index. http://reports.weforum.org/global-information-technology-report-2015/network-readiness-index/

World Health Organization. (1997, August). Technical discussions: appropriate health technology. EMlRC44/Tech.Disc'/l.

World Health Organization. (2003). Investing in health. Commission on Macroeconomics and Health. Geneva, Switzerland.

World Health Organization. (2006, February). What is the evidence on effectiveness of empowerment to improve health?. https://www.euro.who.int/__data/assets/pdf_file/0010/ 74656/E88086.pdf

World Health Organization. (2010). WHO AHWO Cameroon fact sheet.

World Health Organization. (2011). Human resources for health census, Cameroon.

World Health Organization. (2016a). Health analytical profile 2016 Cameroon. World Health Organization: African Health Observatory. Ministry of Public Health. https://www.afro.who.int/sites/default/files/2017-07/Health_Profile_Cameroon_2016_ENG.pdf

World Health Organization. (2016b). Life expectancy increased by 5 Years since 2000, but health inequalities persist. News Release. Geneva, Switzerland.

World Health Organization. (2017). Primary health care systems (PRIMASYS): case study from Cameroon. https://apps.who.int/iris/rest/bitstreams/1346254/retrieve

World Health Organization, Regional Office for Europe, European Observatory on Health Systems and Policies, et al. (2017). Civil society and health: contributions and potential. World Health Organization. Regional Office for Europe. https://apps.who.int/iris/handle/10665/ 326290

World Health Organization. (2018a). Towards a global action plan for healthy lives and well-being for all. Geneva: WHO.

World Health Organization. (2018b, May 1). Country cooperation strategy at a glance - Cameroon. https://www.who.int/publications/i/item/WHO-CCU-18.02-Cameroon

World Health Organization. (2020a). Global health workforce alliance: Cameroon.

World Health Organization. (2020b). Life expectancy and healthy life expectancy data by country. Global Health Observatory data repository. https://apps.who.int/gho/data/node.main.688

World Health Organization. (2021a). Global strategy on digital health 2020-2025. Geneva: World Health Organization. Licence: CC BY-NC-SA 3.0 IGO.

World Health Organization. (2021b). SCORE for health data technical package: global report on health data systems and capacity, 2020. Geneva. Licence: CC BY-NC-SA 3.0 IGO.

World Health Organization. (2021c, January 29). WHO publishes new essential diagnostics list and urges countries to prioritize investments in testing. Geneva, Switzerland. https://www.who.int/news/item/29-01-2021-who-publishes-new-essential-diagnostics-list-and-urges-countries-to-prioritize-investments-in-testing

World Health Organization. (2021d, June 28). Ethics and governance of artificial intelligence for health. https://www.who.int/publications/i/item/9789240029200

World Health Organization. (2022a, December 1). World Health Organization strategy (2022-2026) for the National Action Plan for Health Security. https://www.who.int/publications/i/item/9789240061545

World Health Organization. (2022b, December 8). Global spending on health: rising to the pandemic's challenges. ISBN: 978 92 4004121 9

World Health Organization. (2023a). WHO guidelines. https://www.who.int/publications/who-guidelines

World Health Organization. (2023b, May 16). WHO calls for safe and ethical AI for health.

World Health Organization. (2023c, May 19). World health statistics 2023: monitoring health for the SDGs, sustainable development goals. World Report. ISBN: 978-92-4-007432-3

World Intellectual Property Organization. (2021). Global innovation index 2021 - Cameroon. https://www.wipo.int/edocs/pubdocs/en/wipo_pub_gii_2021/cm.pdf

World Intellectual Property Organization. (2022). GII 2022 at a glance. https://www.wipo.int/edocs/pubdocs/en/wipo-pub-2000-2022-section1-en-gii-2022-at-a-glance-global-innovation-index-2022-15th-edition.pdf

World Population Review. (2023a). Best healthcare in the world 2023. https://worldpopulationreview.com/country-rankings/best-healthcare-in-the-world

World Population Review. (2023b). GDP ranked by country 2023. https://worldpopulationreview.com/countries/by-gdp

Yang, Q., Steinfeld, A., & Zimmerman, J. (2019). Unremarkable AI: fitting intelligent decision support into critical, clinical decision-making processes. DOI: 10.1145/3290605.3300468.

Yassanye, D. M., Anason, A. P., & Barrett, D. H. (2021). Mitigating ethical risks in public-private partnerships in public health. Journal of public health management and practice : JPHMP, 27(4), E177-E182. DOI: 10.1097/PHH.0000000000001031

Yin, R. K. (1989). Case study research: design and methods (1st ed.). London: Sage Publications.

Yin, R. K. (2002). Case study research: design and methods (3rd ed.). Thousand Oaks, CA: Sage Publications.

Yin, R. K. (2014). Case study research: design and methods (5th ed.). Thousand Oaks, CA: Sage Publications.

Yuksekdag, Y. (2018). Health without care? Vulnerability, medical brain drain, and health worker responsibilities in underserved contexts. Health Care Anal 26, 17-32.

Ziefle, M. (2010). Human-centered design of e-health technologies: concepts, methods and applications: concepts, methods and applications. IGI Global.

Zwarenstein, M., & Bryant, W. (2000). Interventions to promote collaboration between nurses and doctors. The Cochrane database of systematic reviews, (2), CD000072. DOI: 10.1002/14651858.CD000072

7 Appendix

Appendix A: Case Study Selection - Percentile Calculation and Analysis

This appendix comprises an overview of the statistical analysis completed during the case study selection phase of research. In this analysis, researchers consider key metrics in three categories pertinent to the case study locations: health systems, economics, and technology context. The outputs of this analysis were used to inform Figure 11. Heat Map of Relative Case Study Rankings Amongst a Variety of Factors. The weighted average percentile calculation is as follows:

$$\text{Percentile (P)} = \left(\frac{\text{Number of Values Below "x"}}{\text{Total Number of Values}} \right) \times 100$$

Health System Indicators:

1) HIS

Total Data Points: 166 MAX: 86.8 MIN: 32.8 Median: 72.3 Range: 54.0

	HIS	Rank	Percentile
Canada	78.4	34	79.5
Cameroon	50.7	152	8.4
South Africa	56.6	138	16.9

2) HAQI

Total Data Points: 194 MAX: 94.6 MIN: 32.5 Median: 63.7 Range: 62.1

	HAQI	Rank	Percentile
Canada	87.6	17	91.2

Cameroon	44.4	164	15.5
South Africa	52.0	132	40.0

Economic Indicators:

3a) GDP

Total Data Points:	MAX: USD	MIN: USD	Median: USD	Range: USD$26 T
212	$26.7 T	$93.27 B	$29.56 B	(or 2.660673e+13)

	GDP	Rank	Percentile
Canada	2.36 T	8	96.2
Cameroon	49.52 B	90	57.5
South Africa	447.72 B	38	82.1

3b) GDP per capita

Total Data Points: 213	MAX: USD	MIN: USD	Median: USD	Range: USD
	$234,315.5	$221.5	$7,302.3	$234,094

	GDP per capita	Rank	Percentile
Canada	51987.9	24	88.7
Cameroon	1666.9	175	17.8
South Africa	7055.0	109	48.8

4) GINI Coefficient

Total Data Points: 163	MAX: 63.0	MIN: 24.6	Median: 37.0	Range: 38.4

	GINI (%)	Rank	Percentile
Canada	33.3	114	30.1

Cameroon	46.6	23	85.6
South Africa	63.0	1	99.4

Technology Indicators:

5) GII

Total Data Points: 132 MAX: 64.6 MIN: 11.6 Median: 28.8 Range: 53.0

	GII	Rank	Percentile
Canada	50.8	15	88.6
Cameroon	15.1	121	8.3
South Africa	29.8	61	53.8

6) NRI Score

Total Data Points: 131 MAX: 80.3 MIN: 20.12 Median: 50.38 Range: 60.18

	Overall NRI	Rank	Percentile
Canada	74.2	11	91.6
Cameroon	33.7	114	13.0
South Africa	48.9	68	48.1

7) GIR

Total Data Points: 100 MAX: 95.4 MIN: 57.1 Median: 73.8 Range: 38.3

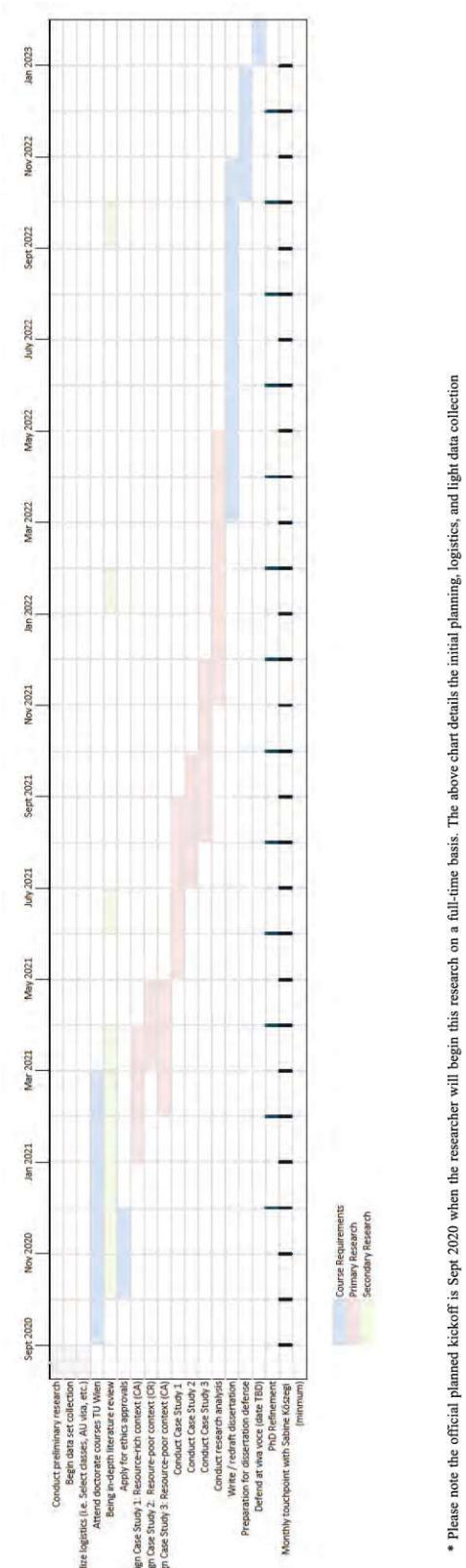
	GII	Rank	Percentile
Canada	80.8	26	74.0

Cameroon[141]	-	-	-
South Africa	68.1	68	32.0

[141] Cameroon was not included in this data set.

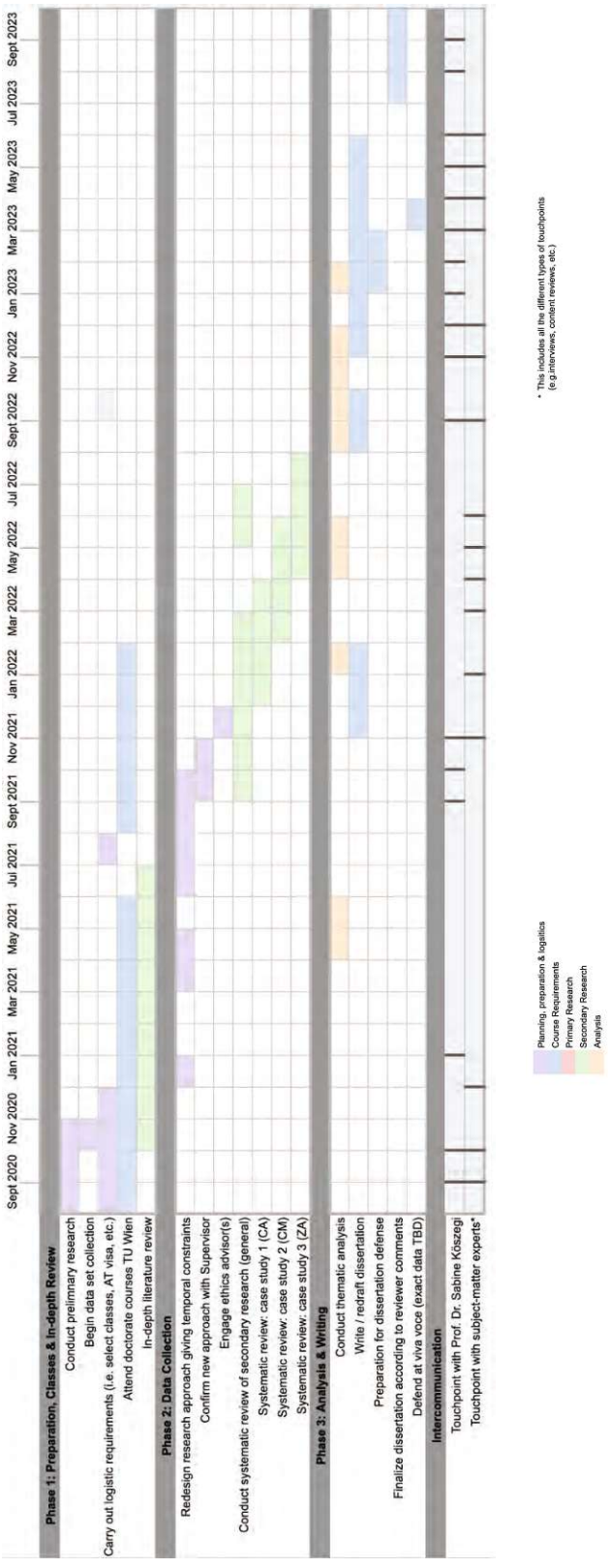
Appendix B: Original Vs. Actual Research Plan

Original Research Plan (conceptualized November 2019 - January 2020)



* Please note the official planned kickoff is Sept 2020 when the researcher will begin this research on a full-time basis. The above chart details the initial planning, logistics, and light data collection phases which will be conducted in the meantime and is not included in the 30-month estimate.

Actual Research Plan (confirmed October 2021)



Appendix C: Overview of Subject Matter Experts[142]

Experts across multiple levels (executive level to manager) were consulted in order to develop a wide range of insights. In order to encourage breadth of feedback, researchers provided different formats for possible feedback including written (email, text, whiteboarding, etc.) or verbal (video and / or audio call in a semi-structured interview format). The specific questions were adjusted based on 1) the stage of the iterative research process (early consultations were much more exploratory in nature whereas this became more structured in the later stages of the research process) and 2) the expertise of the participant. For the list of experts please see the chart below. The names have been redacted for privacy purposes.

Table 3a. List of Subject Matter Experts Consulted During the Course of This Research Project.

Role	Area of Expertise	Phase(s) of Research Involved In
Head of Global Strategy & Operations, Customer Transformation at Microsoft	Management consultant specializing in digital transformations and project implementation in various global contexts	• Data collection • Early stages of iterative analysis
Head of Front Office Transformation, PwC Global	Executive level strategist specializing in digital transformations and project implementation in various global contexts	• Data collection • Early stages of iterative analysis
Research Associate, University of Oxford	Industrial digital policy research and development in various global contexts	• Early stages of iterative analysis
Associate Professor of Regional Economic Development, University of Guelph	Regional development with a focus on rural regions and associated policy / governance structures.	• Data collection • Iterative analysis
Chief Director, Institute for Economic Research on	Science policy, technology, and innovation policy globally and within	• Iterative analysis • Outcome validation

[142] This list only includes the SMEs directly consulted (e.g. beyond secondary data collection). All inputs from secondary sources have been attributed respectively throughout the report.

Innovation at Tshwane University of Technology	South Africa	
Project Specialist - Industrial Development, UNIDO	Policy and industrial development, project implementation in various global contexts	• Data collection • Iterative analysis • Outcome validation • Sense check
Global Commercial Programs Director, Digital Data at Sanofi	Digital healthcare expert and senior management consultant with strong experience in project implementation	• Data collection • Outcome validation • Sense check
Manager - Digital Operations PwC Canada	Project management and implementation of digital solutions	• Data collection • Iterative analysis • Outcome validation • Sense check
Senior Data Analyst, Creative Destruction Lab (University of Toronto)	Computer scientist working for a prominent nonprofit organization which helps scale science and technology-based companies globally	• Data collection • Iterative analysis • Outcome validation • Sense check

Additional input was received from the following through privately hosted events through organizations such as UNESCO, TU Wien, and Queen's University. The names have been redacted for privacy purposes.

Table 3b. List of Subject Matter Experts Consulted During the Course of This Research Project (Cont'd).

Role	**Area of Expertise**	**Phase(s) of Research Involved In**
Executive Director, Institute for Ethics in Artificial Intelligence (Technical University of Munich)	Public and international affairs, CSR, research development and coordination particularly in developing country settings	• Data collection • Early stages of iterative analysis
Principal Researcher, Research ICT Africa	AI and society, gender and AI, transparency, open data, and data protection	• Data collection
Founder, SuaCode.ai	Pharmacist, entrepreneurship, coding, remote learning,	• Data collection

University of Pretoria, UNESCO Ad Hoc Expert Group on the Ethics of AI and COMEST	AI ethics, philosopher of science and technology, and machine ethics researcher	• Data collection
Data scientist, Tabiri Analytics	AI and machine learning, data driven and customer centered software applications	• Data collection

Appendix D: Thematic Analysis

The details of Braun and Clarke's (2006) widely accepted stages of thematic analysis are discussed below as they relate to this research topic and process. There are multiple rounds of thematic analysis due to the iterative nature of this research project. For readability, each individual section follows the chronological order of iterative rounds. There is a cumulative nature to this research as each stage includes new information as well as content from previous stages. Therefore, please note that the chronological order is the reverse order of importance and comprehensiveness as the earlier rounds are the most simplistic as these represent the earliest stages of research. Therefore, this section should be treated as an aid to better understand the research process, whereas the body of this report should be the main focus for research outcomes as it captures the cumulation of these processes and data inputs.

Step One: Familiarization with the Data

"*At this stage, it is useful to make notes and jot down early impressions*" (Maguire & Delahunt, 2017, p. 3355). Please see below for rough notes and initial impressions of the data. This text was transcribed from handwriting from the lead researcher.

"There is general acknowledgement that there is significant potential for ANI in diagnostics in various environments including low-resource. There are also well documented assessments that it is currently underutilized in these regions. This coupled with emerging technologies makes it likely we will see many more attempted implementations in the upcoming years. There are a variety of factors that make successful implementations difficult. There are available policy recommendations that seem logical enough, however there is a lack of clarity whether these policy recommendations are comprehensive. And if it is not, what gaps are missing."

Additional early notes include rough drafts on the relationships between different notable elements generated during the conceptualization phase. These were meant to be early impressions and provided a foundation for brainstorming future themes while more nuanced information was being discovered.

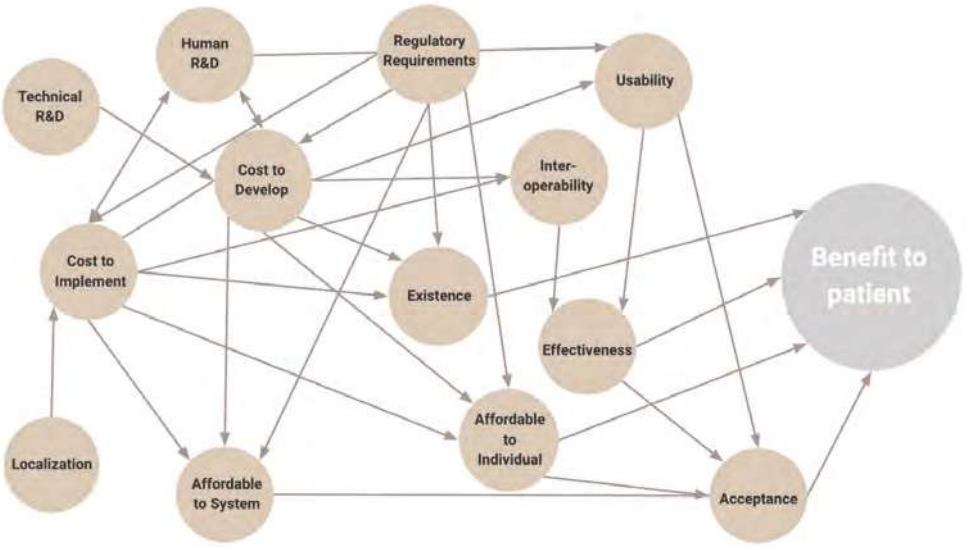


Figure 14. Early Assessments of Key Relationships (May 13, 2021).

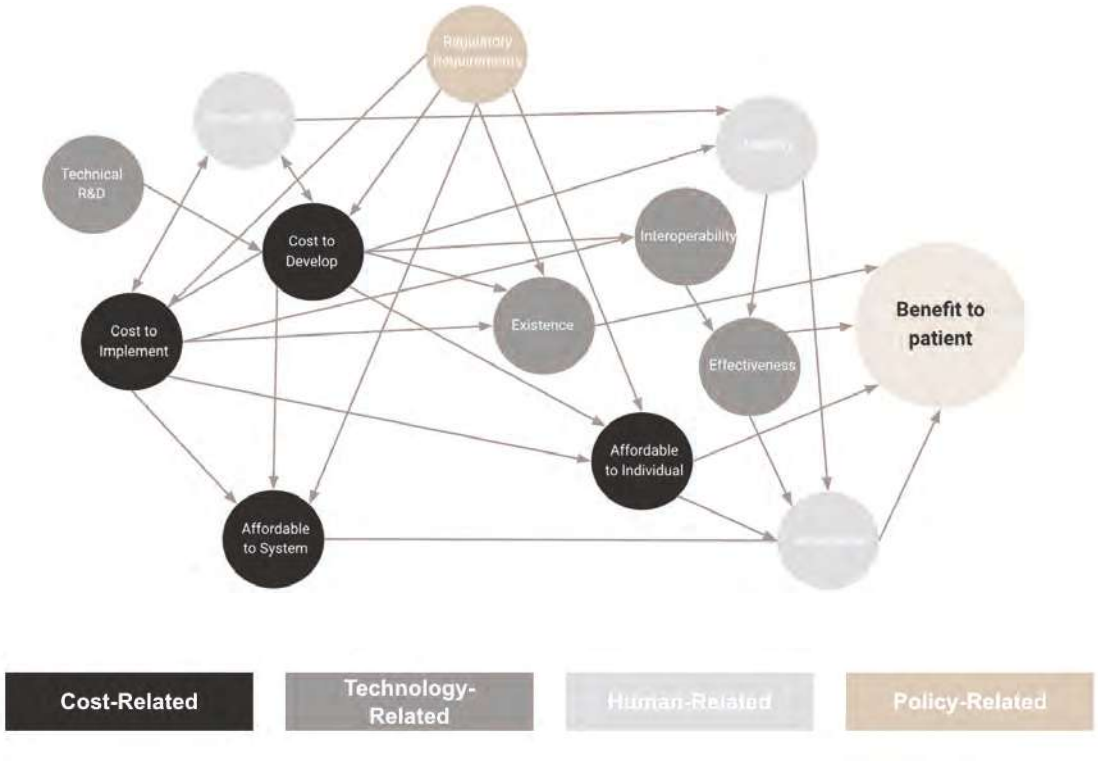


Figure 15. Early Assessments of Key Relationships (Color-Coded).

Step Two: Coding

To ensure we are answering our research questions, researchers followed a theoretical thematic analysis (rather than an inductive approach). That is to say, an approach whereby each segment of data was coded that "*was relevant to or captured something interesting about our research question*" (Maguire & Delahunt, 2017, p. 3355). To do this, researchers

reviewed the entirety of research considered thus far and began extracting information that was key to answering the research questions.

Please note: in this process, researchers used open coding (as opposed to pre-set codes) that were developed and (continually) modified only after a deeper understanding of the data had been established.

Coding - Round One (February 3, 2022)

In the first round, the concepts were captured in a list of over one hundred potential items to consider based on semantic coding. These items vary in size and relevance but were captured in *sticky-note* format to ensure they were organized and reflected in the theming. The purpose of this stage was to capture all possible information and distill it in a format that could be organized in the following step. Please see below for a transcribed list of the sticky notes. At this stage, the items are in no particular order and were added during the review of secondary information to ensure no important information was lost.

Sufficient HHR	HHR retention	HHR upskilling	Technical human resources	Implementation team (e.g. consultants)	Cost reduction
Connectivity	Complementary technologies	System testing	System maintenance	Coordination with physician	Relative risk
Interoperability	Defining project success	Communication with patient	Coordination with patient	Variety of diagnostic testing	Medical bias
Physical Infrastructure	Regional customizations	Ethics & risk	Digital proficiency of population	Patient empowerment	Military & security threats
Viable data sources	Accurate data	Data bias	Universally similar diagnostic data	Context-specific patient data	National economic health
Governance & regulation	Patient trust in healthcare	Patient trust in technology	Individual patient health goals	Public health goals	Project stakeholders
Financing	Private donors	Private organizations	Government funding	Grants	National development (e.g. leapfrogging)
Project metrics	Electronic medical records	Co-collaboration with patient	Associated treatment(s)	Medical device manufacturers	Urgent needs for diagnostics
International cooperation	National culture	Regional culture	National Innovation Strat.	Knowledge sharing	Fragile environments / conflict

Synergies with private sector	Competitive advantage	Automation	Digitally-connected	Process redesign	Rising cost of healthcare (e.g.chronic disease)
Routine scanning	Self-testing / self-sampling	Corruption	Geographic distribution of HHR	Digital networks	Data ownership
Patient consent	Overall patient experience	Economic inequality	Convenience of receiving health services	Global health gaps	Data storage
Preventative diagnostics	Strategic alignment	Urban vs. rural	Proportionality	National health gaps	Health system willingness to change
Patient upskilling	Project scope	Travel times (to receive medical care)	Public health risks	Digital service providers	Project leadership
Wait times	Patient satisfaction	Existing policy recommendations	Individual patient risk	Scalability	HHR costs
Improving efficient use of resources	Technology hype	National innovation score	Availability of telehealth services	LPI & national logistics networks	Patient confidentiality
Affordability for patient	Patient monitoring	Innovation in private sector	Prescription delivery	Healthcare logistics networks	Back-office processes
Data storage costs	Privacy & security	Front-office processes	Public awareness	Marketing materials (e.g. website, social media, etc.)	Public willingness to change
					Government leadership

Figure 16. List of Codes Derived from Review of Secondary Data - Round One.

When researchers examined the codes, some clearly fit close together, prompting researchers to rearrange the above list and group similar items together as seen below giving a first initial glimpse at possible key themes.

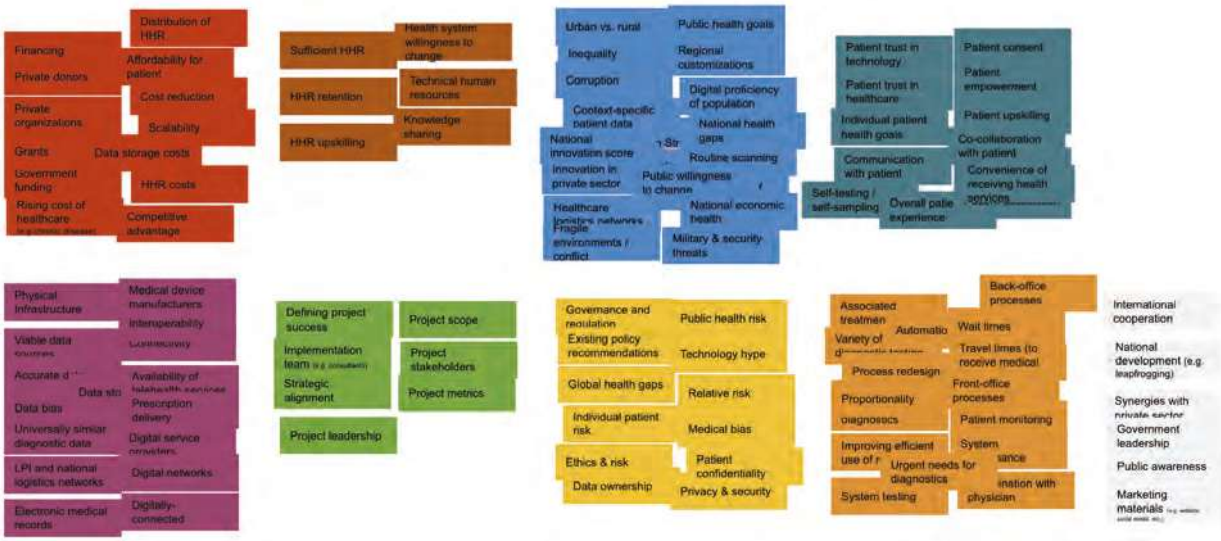


Figure 17. General Grouping Associated with Thematic Analysis - Round One.

Coding - Round Two (October 17, 2022)

Inline with the iterative approach commonly used in social sciences research, this step was then repeated. However, this round included data inputs from secondary research, observations, conferences, and written and verbal inputs from SMEs. Please see Figure 18 for an example of conference notes with early coding.

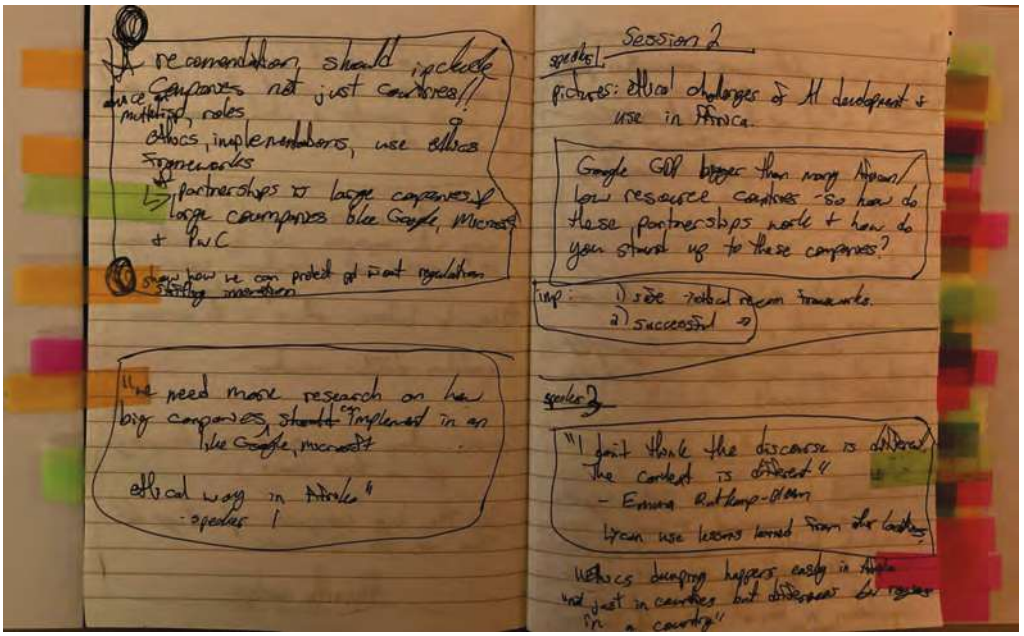


Figure 18. Example of Raw Conference Notes with Early Thematic Coding[143]

[143] Used in conjunction with conference presentation material (e.g. presentation documents). The color-coordination of early groupings are as follows: collaboration (green), strategy (yellow), cost / funding (blue), other challenges (pink), gaps (orange). For a fully scanned copy of

Due to the presence of additional research and data inputs resulting in a greater topic understanding by researchers, this round of coding focuses on conceptual codes rather than semantic codes. During the second round of coding, over 125 unique points were captured on a sticky note and added to a bulletin board (at this point in no particular order) as seen in Figure 19.

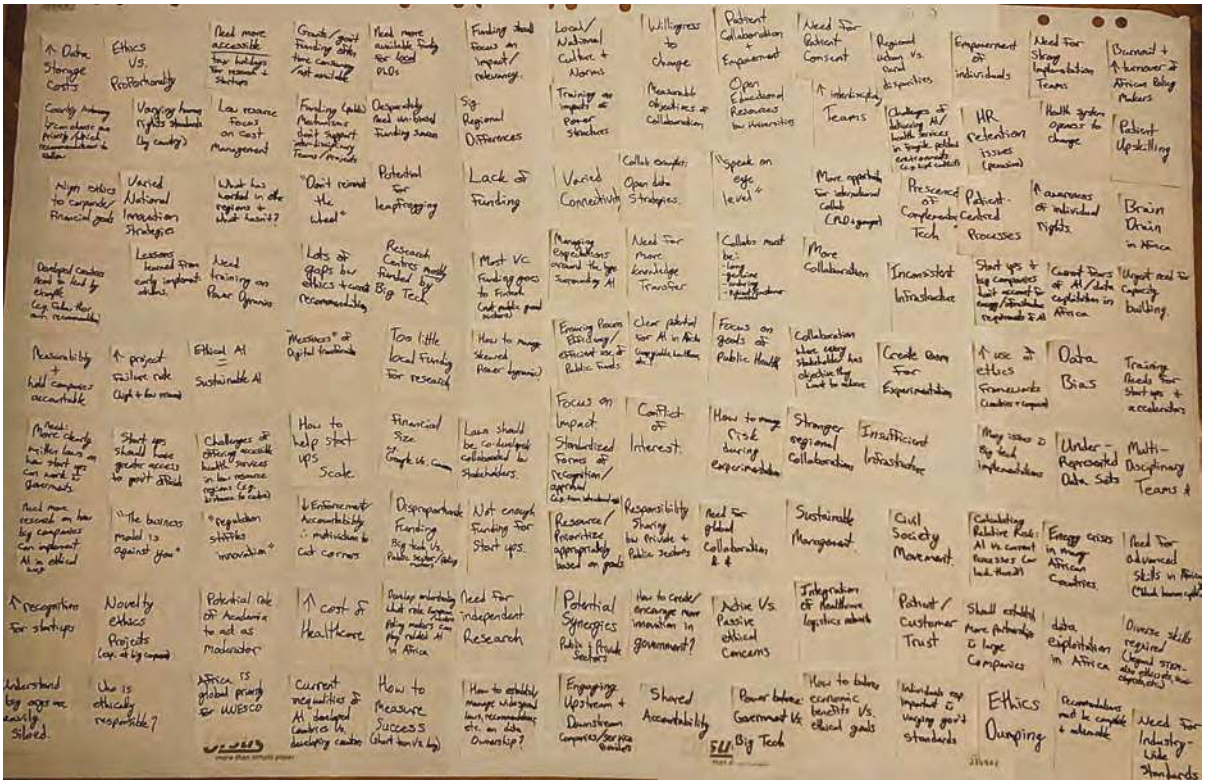


Figure 19. List of Codes Derived From Review of Secondary Data - Round Two.

Please note, there is a natural degree of overlap between the rounds, where many of the coded sticky notes found in Round Two are ones that have been expanded, dissected, and / or combined from those in Round One.

As in Round One, the codes are then grouped together in similar groups as seen below. This grouping process was repeated 4[144] times in this round to ensure the essence of the codes and the relationships between them were adequately captured. The initial round of grouping focused on the conceptual understanding of each code as seen in Figure 20.

conference journals related to this research please email the lead researcher at leslie.walker@student.tuwien.ac.at.

[144] Based on 1) semantic meaning 2) conceptual meaning 3) key stakeholder responsibility and 4) whether the action represents an action, challenge / risk, or outcome.

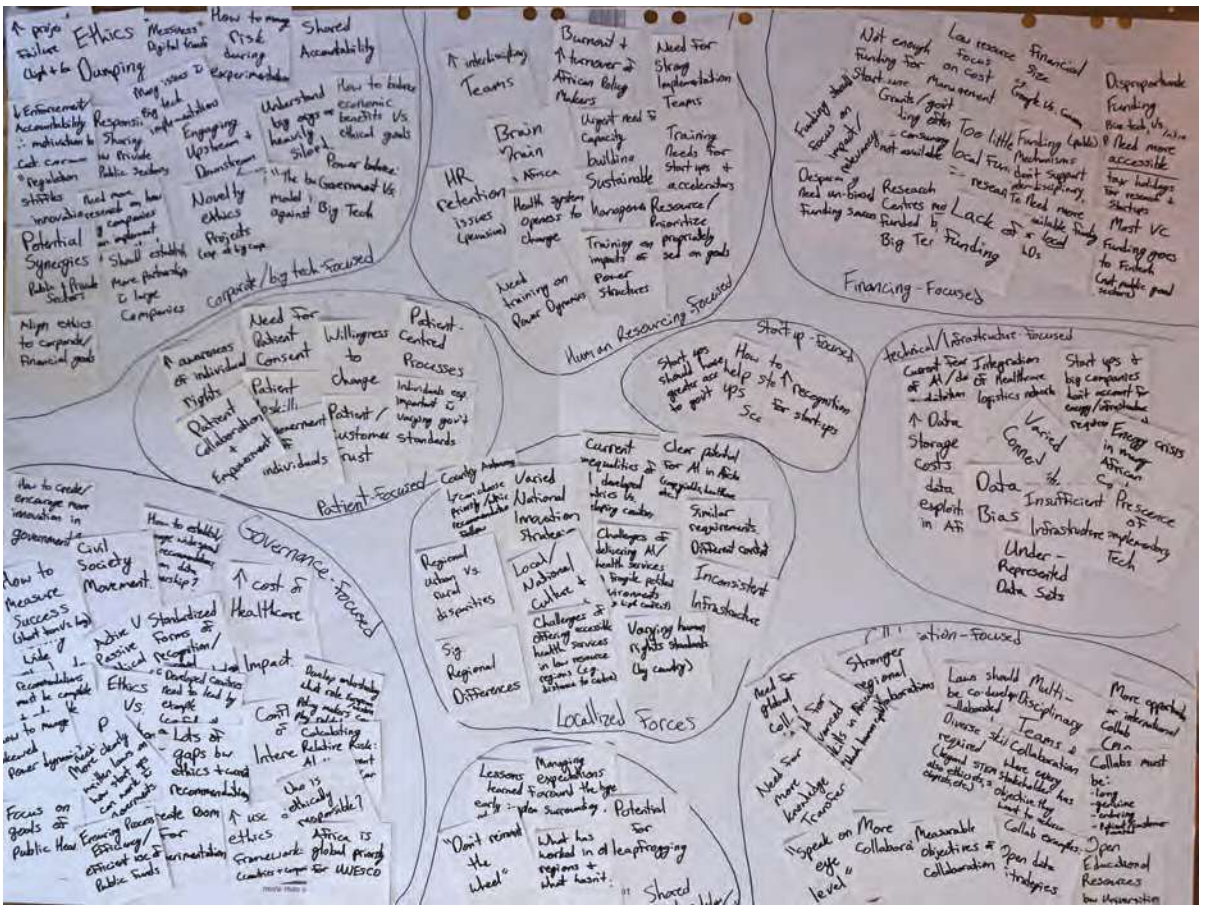


Figure 20. General Conceptual Grouping Associated with Thematic Analysis - Round One.

Naturally there was some degree of overlap and interdependence between the groupings. This is inline with previous observations and understandings of the data due to the highly interdependent nature of inequality, health, and technology within and between countries.

Step Three: Searching for Themes

As mentioned, a theme is a pattern that captures something notable about the data in relation to the research questions. Researchers began this phase by assigning high-level titles to each group as a general means of labeling (as seen below). However, these do not represent the final themes. This step is only an initial means of organizing the data in order to get a better understanding of the various elements involved.

Searching for Themes - Round One (June 24, 2022)

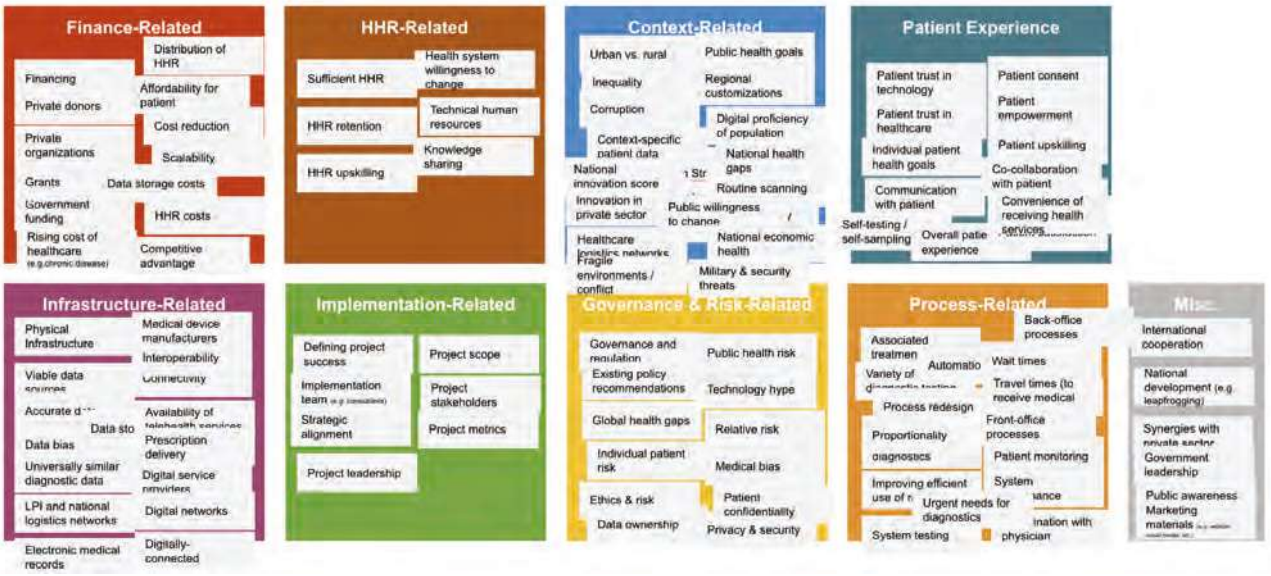


Figure 21. General Labeling Associated with Thematic Analysis - Round One.

It is important to note that not only are many of these codes highly interdependent, the labels are also interrelated. The challenge associated with this step is organizing the codes into broader descriptive themes.

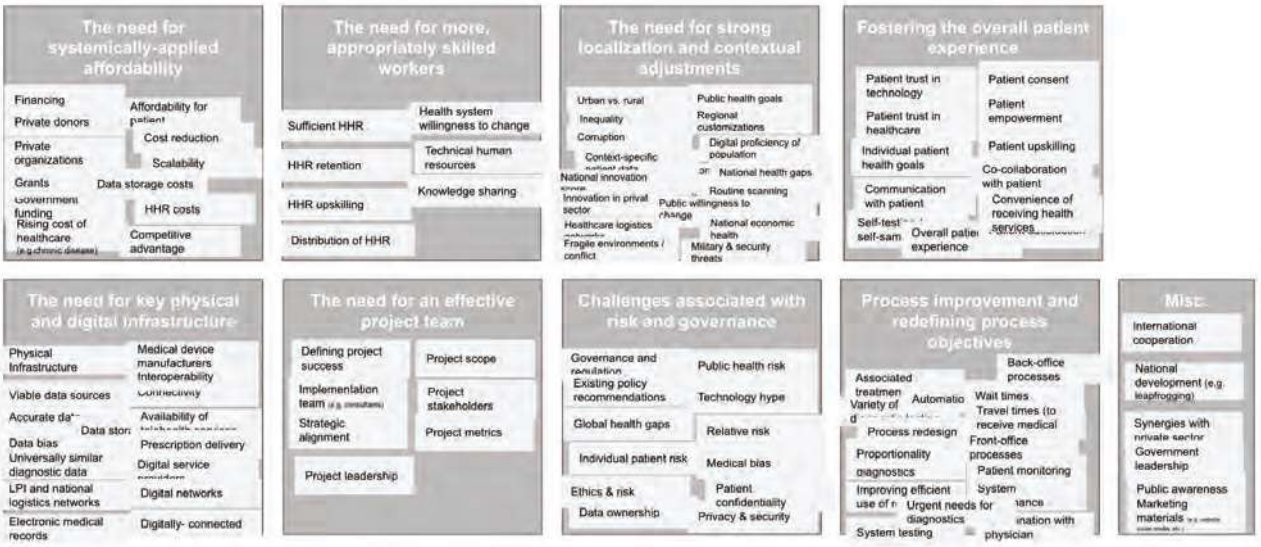


Figure 22. Broader Descriptive Themes of Thematic Analysis - Round One.

Searching for Themes - Round Two (October 29, 2022)

Once the initial grouping was complete and studied holistically, researchers reorganized the codes (dissolving some groups, combining others, relabelling etc.) in order to capture the key concepts behind the codes as seen in Figure 23.

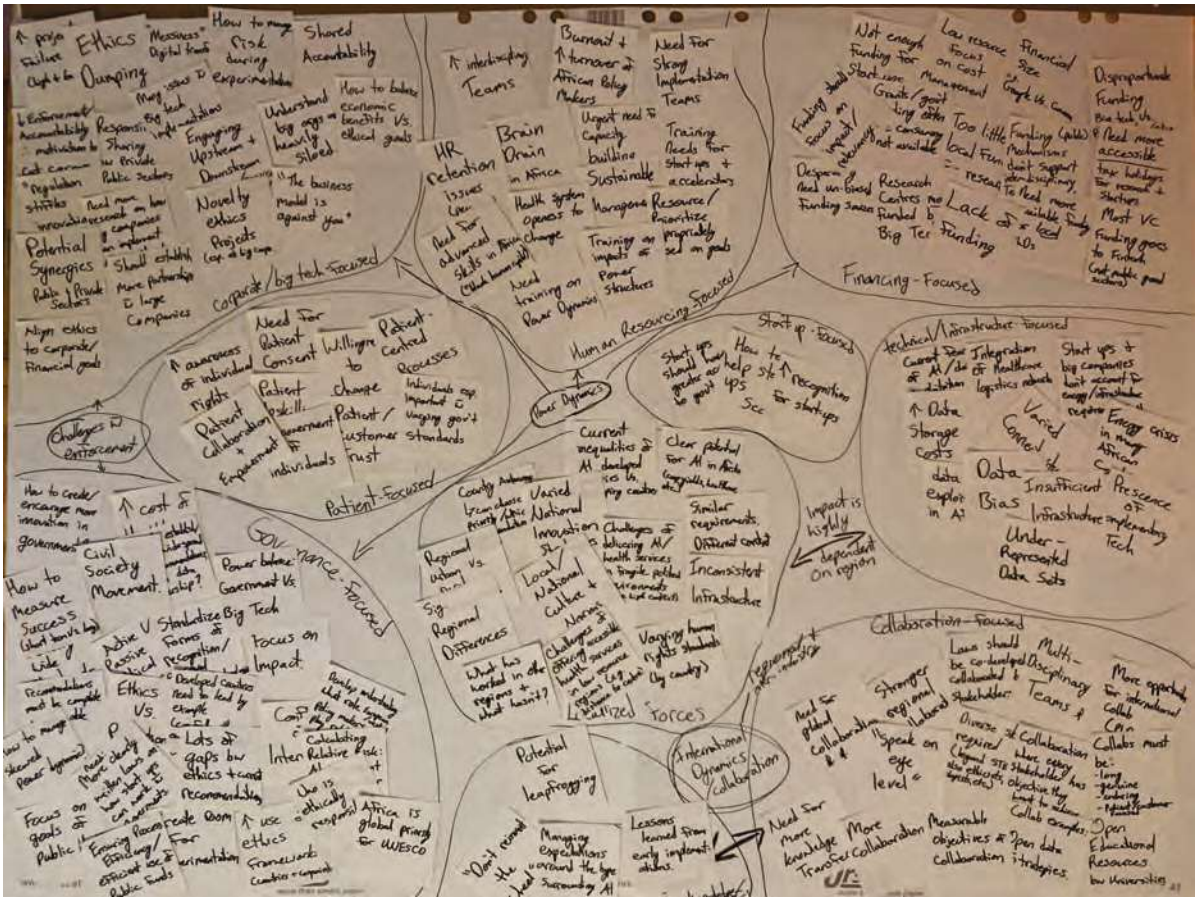


Figure 23. Reflection on Grouping Associated with Thematic Analysis - Round Two.

This process was then repeated once more but with a focus on the stakeholders associated with each code as seen in Figure 24. Please note that this focuses on mandates and responsibilities of stakeholders and not necessarily who this impacts (as ultimately each of these codes impacts the individual / end patient so that exercise would be verbose). This was completed in an effort to understand the dynamics between key players and how they relate to policy recommendations moving forward.

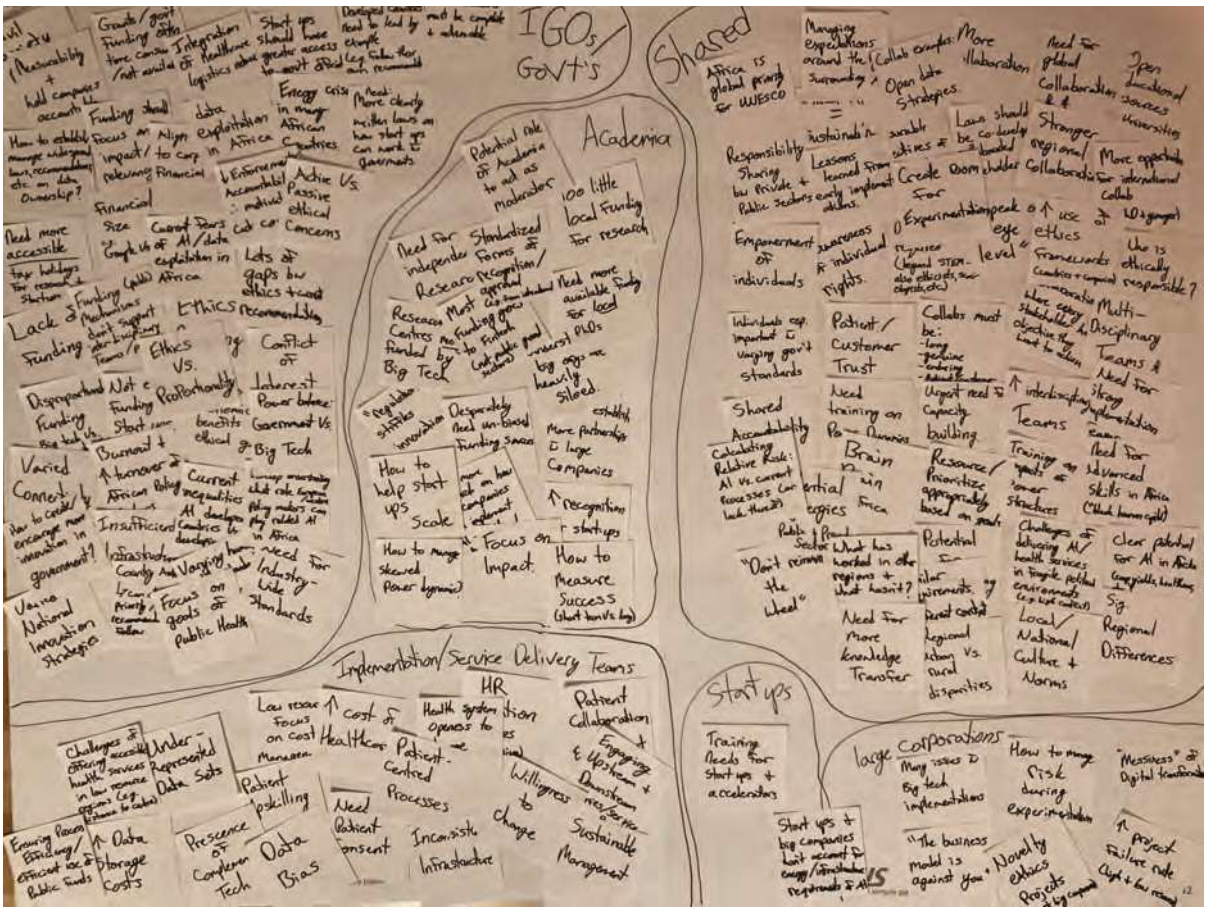


Figure 24. Regrouping Based on Stakeholder Mandates.

This was then further dissected, whereby each grouping was divided into circumstantial (e.g. risks, trends, etc.) and actionable codes. Each actionable section was then further divided into subthemes as seen in Figure 25. From this, researchers were able to determine what actionable items should be included in the recommendations[145]. This exercise is done in an effort to understand what actionable items need to be considered to ensure recommendations are practical in a real-world setting; particularly which parties are responsible for different roles, such as implementation, enforcement, etc. as many coordinated roles and processes are required in order to safely deliver ANI-enabled medical services.

[145] However please note, just because a code is listed under a specific stakeholder, it does not necessarily mean it should be their responsibility to implement. For instance, although companies should care about ethical AI implementations and should integrate this methodology into their processes, the responsibility lies with local, national, and international governments to determine the standards and requirements for execution.

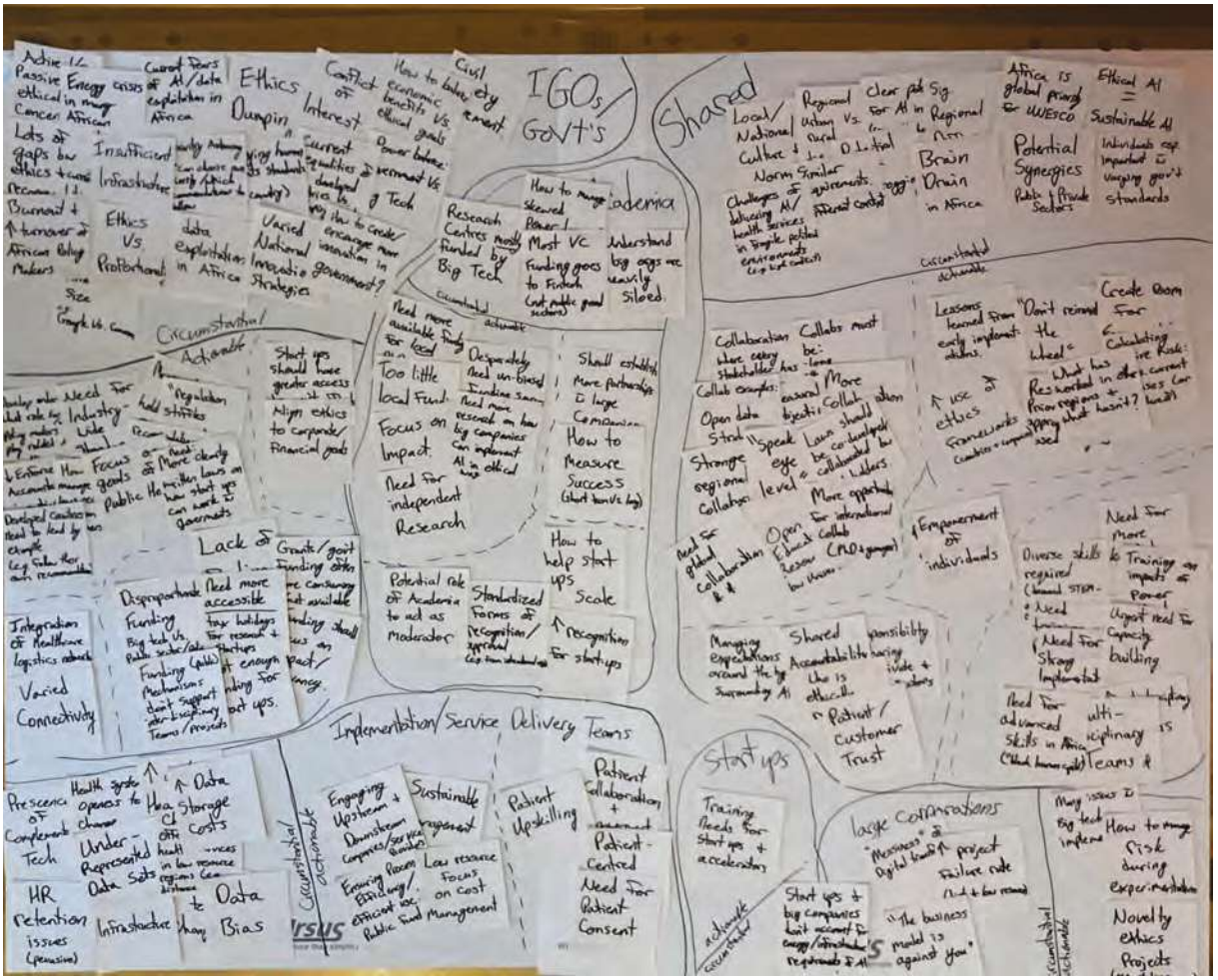


Figure 25. Dissecting Groupings Based on Circumstantial Versus Actionable Codes.

Step Four: Reviewing Themes

In this stage researchers reviewed the themes developed in Step Three and considered whether each theme was logical in terms of the broader data set. Questions asked by the researchers include:

- Are these themes logical?
- Are the themes clearly reflective of the secondary data?
- Are the delineations between themes reasonable?
    - Are the themes too inclusive?
    - Are the themes too exclusive?
    - Is there too much overlap between any of the themes?
- Are there subthemes?
- Did we miss anything important?

As a result, some of the themes were refined and the codes readjusted.

Reviewing Themes - Round Two (October 29, 2022)

Below includes the rough notes and groupings that were refined after reviewing the themes based on the notes above. Please note, at this stage of ideation the themes are in no particular order.

High-level theme 1: *Importance of collaboration*

- *International / interregional*
    - *Inter-industry (governments, corporates / Big Tech, startups, academia and intergovernmental organizations)*
- *Understanding of power dynamics "speak on eye level"*
- *Clear goals and objectives for each collaborator (that are measurable)*
- *Must be: long, genuine, enduring and patient / customer focused*
- *Share lessons learned from early implementations "what worked and what didn't" pay attention to localized forces but don't reinvent the wheel.*
- *Examples: multidisciplinary teams, open educational resources by universities*

High-level theme 2: *Managing the power dynamic between players (governments, corporates / Big Tech, startups, academia and intergovernmental organizations and of course patient / customer).*

- *Financing (disproportionate funding from Big Tech and not enough independently funded research centers, local versus international funding, VC focus on fintech not public good industries)*
- *Training (empowering and upskilling patients)*
- *Governance (balancing potential economic benefits with ethical goals)*
- *Resourcing (more interdisciplinary teams with STEM, business and ethicists)*
- *Do a better job engaging local startups (access to government, funding that is actually accessible, more recognition, standardized forms of recognition e.g. UNESCO stamps of approval, training and tools to help them scale)*
- *Do a better job engaging academia to help act as a mediator particularly between government and Big Tech*

High-level theme 3: *Widespread human resourcing constraints in Africa*

- *Severe ongoing Brain Drain*
- *Need for advanced skills in Africa "Black Human capital"*
- *Training needs for startups and accelerators*
- *Urgent need for capacity building*
- *Managing burnout and high turnover of African policy makers (widespread retention issues for high skilled positions)*
- *Focus on interdisciplinary teams*
- *Need training for startups and accelerators*
- *Need strong implementation teams to manage low project success rates to make best use of limited resources*

High-level theme 4: *Impact of country context*

- *Varying human rights standards by country*
- *Countries should have some degree of autonomy specifying their priorities. These may not always align with broader global health goals.*
- *Varied national innovation strategies*
- *Projects often have similar requirements but a different context*
- *Urban versus rural (look at local characteristics and don't make assumptions: two rural regions in two different countries may be more similar in a practical / implementation sense than an urban / rural region in the same country). Be flexible when looking at prior examples / lessons learned.*
- *Challenges related to resources: infrastructure, suitable and adequate HR, data, etc. prioritize based on goals*

High-level theme 5: *Need to do a better job engaging corporations (including 'Big Tech')*

- *Clear potential synergies between public and private sector*
- *Need to do a better job aligning ethics to corporate / financial goals*
- *Responsibility sharing between private and public sector*
- *Understanding the dynamics of big orgs (heavily siloed)*
- *How to avoid PR / novelty ethics projects (focus on impact, long term projects, etc.)*
- *Dispel the notion that "regulation stifles innovation". The only sustainable AI is ethical AI. Define what that means better*

High-level theme 6: *Challenges with governance*

- *Must focus on impact (should be able to measure and communicate this). Particularly related to operational improvements and efficient use of public funds*
- *Measure active and passive ethical violations*
- *Must calculate relative risk (AI versus current processes / lack thereof)*
- *Encourage or mandate the use of ethics frameworks for companies and entire countries / regions*
- *Develop more industry / national / and region - wide standards*
- *How to encourage more innovation in government*
- *Create standardized forms of recognition to reward ethical organizations, processes and projects.*
- *Need more clearly written laws on how startups can work with governments*
- *Developed countries need to lead by example*
- *Open internal dialogue related to challenges with enforcement*

High-level theme 7: *Patient-focus*

- *Give patients / customers a seat at the table*
- *Patient upskilling and empowerment requirement (in particular increase the awareness of individual rights)*
- *Patient empowerment is particularly important with regions with subpar ethical / corruption standards*
- *Challenges related to local culture and willingness to change*
- *Building trust takes significant time and effort*

Step Five: Defining and Naming Themes

This step represents the last refinement stage that focuses on identifying the 'essence' of what the themes are about (Braun & Clarke, 2006, p. 92).

Defining and Naming Themes - Round One (September 14, 2022)

- **Key theme 1: Implementation Team**
    - Sufficient project financing is a critical factor of implementation success which needs to be properly accounted for in the planning stages of a project. Naturally, the amount of financing varies significantly depending on the type of project and broader context, any underestimations of project costs significantly hamper project success.

- **Key theme 2: HHR-Related**
    - Appropriately skilled resources (HHR, technical, etc) and any factors such as insufficient quantity (e.g. below WHO recommended levels) or other factors such as burnout, significantly decrease not only if an ANI project will be successful, but whether it will be attempted at all.
- **Key theme 3: Patient Experience**
    - Regardless of location, a degree of patient enablement is required, however this degree is dependent on the gap between the patient's current knowledge and expectations and the proposed new process (e.g. if a patient lacks digital savviness, willingness to change, trust in old (or proposed new) processes etc. then this must be addressed or else project success is at significant risk).
- **Key theme 4: Necessary Infrastructure**
    - Although there is variability in how diagnostic processes can be accomplished, there are basic needs and constraints for delivering these services (e.g. each diagnostic ANI project will require certain inputs such as viable data sources, medical scanning equipment, and so on). These inputs will vary depending on the type and scale of the project, however there are basic infrastructure needs for project success and these should be identified by SMEs from both technical, medical and operational backgrounds.
- **Key theme 4: Operational Efficiency (proportionality)**
    - ANI has the possibility to transform diagnostic processes through greater efficiency, proportionality and enhanced communication with the patient. However, proper business and strategic planning (along with clearly defined metrics & KPIs) are required to ensure processes are practical, effective and ultimately impactful to the end patient.
- **Key theme 4: Governance & Risk**
    - Although major international organizations have provided recommendations for managing governance and risk, the newness and fundamental shift we see with ANI (particularly in vulnerable and critical sectors such as healthcare), the ethical approach is 1) not linear and 2) will likely not look the same in application in every location. Therefore, risk management strategies and significant collaboration with patients is a complete necessity.
- **Key theme 5: Context-Related**

- Finally, a localized understanding is critical, including an understanding of the socio political economic context and healthcare context (such as goals, and current metrics). Although a micro-level understanding is out of scope for this research paper, it is undoubtedly important and deserves a great deal of attention when attempting to implement an ANI diagnostic project. The likelihood of project success is significantly increased when localized knowledge is used in conjunction with universal principles, best practices, and the latest collaborative understandings of these types of projects.

When conducting the analysis, researchers observed some common patterns amongst successful digital health projects regardless of the context. Characteristics such as managing scope or beginning with digitizing one process (and then possibly expanding or extrapolating this process in the future) were typically more successful than large widespread transformations that were attempted all at once. Researchers hypothesize that this primarily has to do with risk and cost management, whereby any lessons learned can be integrated into future improvements. This principle seemed to be true in both high-resource and low-resource environments. Therefore, researchers attempted to codify which key themes could be considered as general, universal principles and which were exclusive to a certain context.

Further to this thinking researchers noted two distinct types of themes:

1) Factors that can be reasonably controlled / impacted by the project team (such as scoping, resourcing, timeline, spend, etc.) and
2) broader factors that are not easily influenced by the project team (such as a country's infrastructure, political stability, natural disasters, etc.).

The cross-section of these two categorizations are seen below in Figure 26.

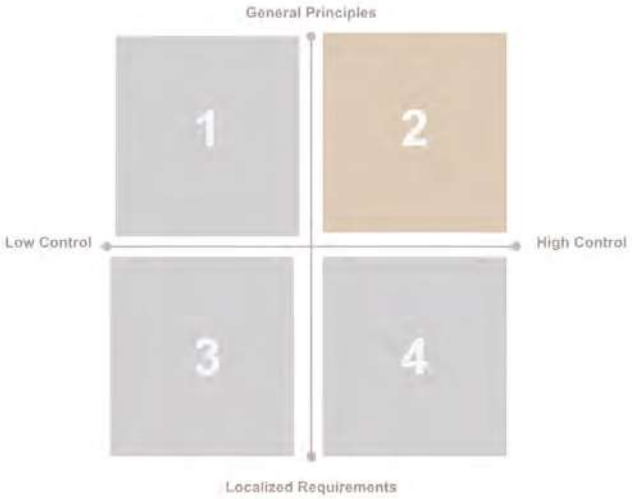


Figure 26. Cross-section of Control Versus Localization.

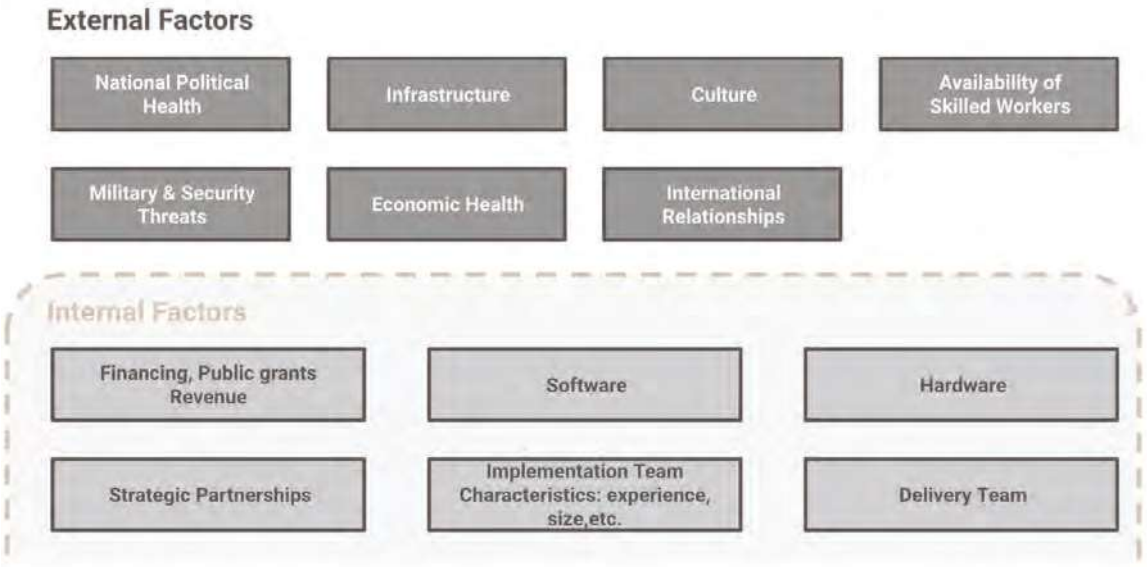


Figure 27. Considering an ANI Project Landscape.

Defining and Naming Themes - Round Two (November 4, 2022)

Once again this step was repeated. As new information was discovered, themes from Round One were discarded, broken up, or combined. Please see the rough notes related to key themes below for reference.

1. ***The current power dynamic and primary objectives of key stakeholders makes equality and ethical enforcement difficult.***
    - *Key stakeholders: governments, corporates (e.g. 'Big Tech'), startups and accelerators, academia, implementation / service delivery teams (e.g.*

healthcare providers) and intergovernmental organizations. This research focuses on governments and IGOs due to the scope.

- *The problem is there are a lot of shared / mutual responsibilities and without a uniting force driving them key risks and concerns can "fall through the cracks" and make execution difficult and ambiguous.*
- *As such, IGOs are well poised to initiate these suggestions although it is crucial that they be accepted by all other stakeholders as well.*
- *A lot of these trends aren't specific to healthcare (e.g. the Brain Drain in Africa). Although there is a crisis in HHR, many highly qualified workers (such as technical skills and ethicists) are not remaining in Africa. Although the costs of these trends are particularly detrimental to industries such as healthcare, researchers encourage practitioners in other industries to look to these recommendations as well. Additionally, the greater level of government coordination, the more likely we are to see adoption. Therefore there is the possibility to coordinate and synergize with other public good industries beyond healthcare (although each industry should still consider its own priorities and objectives within the greater country context).*
- *Although there are many things that corporations can do to apply ANI in a more equitable and ethical way, it is ill conceived to think that corporations will spontaneously self-enforce and invest in these activities at the required levels. There are natural forces creating a conflict of interest, therefore governance bodies (IGOS, national and local governments) must take on the responsibility of balancing these. For instance, regarding corporations particularly Big Tech the phrases "the business model is against you" and "regulation stifles innovation" came up during the course of this research. Governments and policy makers should do a better job of 1) enforcing key principles in a consistent way but also 2) adjusting processes to indicate that these notions may not necessarily be the case moving forward (or at least not to the same degree). This includes hiring more diverse teams in government, such as technology experts to help dispel prior notions that governments are slow, reactive and overly conservative regarding policy.*
- *Academia can also play a significant role of acting as a moderator between government and Big Tech. More open research that is focused on locally relevant and high impact research topics that are appropriately funded. Due to*

resource constraints in academia, there may potentially be a shift in the primary roles of academics.

- ***Subtheme:*** *Managing the financial imbalance between players (governments, corporates / Big Tech, startups, academia and intergovernmental organizations and of course patient / customer)*
  - *Financing (disproportionate funding from Big Tech and not enough independently funded research centers, local versus international funding, VC focus on fintech not public good industries)*
  - *Training (empowering and upskilling patients)*
  - *Governance (balancing potential economic benefits with ethical goals)*
  - *Resourcing (more interdisciplinary teams with STEM, business and ethicists)*
  - *Do a better job engaging local startups (access to government, funding that is actually accessible, more recognition, standardized forms of recognition e.g. UNESCO stamps of approval, training and tools to help them scale)*
  - *Do a better job engaging academia to help act as a mediator particularly between government and Big Tech*

2. ***The importance of greater cross-sectional collaboration cannot be understated***
   - *International / interregional*
   - *Inter-industry*
   - *Understanding of power dynamics "speak on eye level"*
   - *Clear goals and objectives for each collaborator (that are measurable)*
   - *Must be: long, genuine, enduring and patient / customer focused*
   - *Share lessons learned from early implementations "what worked and what didn't" pay attention to localized forces but don't reinvent the wheel.*
   - *Examples: open educational resources by universities*
   - ***Related subtheme:*** *desperate need for more diversified teams across most high skilled sectors*
3. ***Widespread human resourcing constraints in Africa threaten project success***
   - *Brain Drain*
   - *Need for advanced skills in Africa "Black Human capital"*
   - *Training needs for startups and accelerators*

- *Urgent need for capacity building*
- *Managing burnout and high turnover of African policy makers (widespread retention issues for high skilled positions)*
- *Focus on interdisciplinary teams*
- *Need training for startups and accelerators*
- *Need strong implementation teams to manage low project success rates to make best use of limited resources*

4. ***Despite the value of shared lessons learned, the localized context heavily impacts project specificities.***
    - *Varying human rights standards by country*
    - *Countries should have some degree of autonomy specifying their priorities. These may not always align with broader global health goals.*
    - *Varied national innovation strategies*
    - *Projects often have similar requirements but a different context*
    - *Urban versus rural (look at local characteristics and don't make assumptions: two rural regions in two different countries may be more similar in a practical / implementation sense than an urban / rural region in the same country). Be flexible when looking at prior examples / lessons learned.*
    - *Challenges related to resources: infrastructure, suitable and adequate Human Resources (HR), data, etc. prioritize based on goals*
5. ***Governments and IGOs must do a better job engaging corporations (including 'Big Tech')***
    - *Clear potential synergies*
    - *Need to do a better job aligning ethics to corporate / financial goals*
    - *Responsibility sharing between private and public sector*
    - *Understanding the dynamics of big orgs (heavily siloed)*
    - *How to avoid PR / novelty ethics projects (focus on impact, long term projects, etc.)Dispel the notion that "regulation stifles innovation". The only sustainable AI is ethical AI. Define what that means better*
6. ***Governance systems should strive for greater consistency, impact and accessibility***
    - *Must focus on impact (should be able to measure and communicate this). Particularly related to operational improvements and efficient use of public funds*

- *Measure active and passive ethical violations*
- *Must calculate relative risk (AI versus current processes / lack thereof)*
- *Encourage or mandate the use of ethics frameworks for companies and entire countries / regions*
- *Develop more industry / national / and region - wide standards*
- *How to encourage more innovation in government*
- *Create standardized forms of recognition to reward ethical organizations, processes and projects.*
- *Need more clearly written laws on how startups can work with governments*
- *Developed countries need to lead by example*
- *Open internal dialogue related to challenges with enforcement*

7. ***Ultimately, each of these recommendations should be patient-focused (or customer-focused in the case of applications in other industries).***
    - *Give patients / customers a seat at the table*
    - *Patient upskilling and empowerment requirement (in particular increase the awareness of individual rights)*
    - *Patient empowerment is particularly important with regions with subpar ethical / corruption standards*
    - *Challenges related to local culture and willingness to change*
    - *Building trust takes significant time and effort*

Step Six: Writing Up

This is the final stage and end point for thematic research. As such, the final iteration and cumulative final round of the write up is included in the main body of this report. For the sake of process transparency, rough drafts of earlier iterations have been carefully archived with the other research materials.

Writing Up

Due to the lengthiness of the write up process, reviewers have omitted the multiple rounds from the appendix of this report. For an overview of the iterative rounds of write up, complete with dates and key themes, please feel free to reach out to researchers at leslie.walker@student.tuwien.ac.at. Although please note that the next section Appendix E: Subject Matter Expert Feedback and Framework Refinement involves the write up version of the research outcomes prior to the feedback and refinement from SMEs; of which the

feedback is integrated into the final version of research outcomes that can be viewed in the main body of this report.

Appendix E: Subject Matter Expert Feedback and Framework Refinement

Feedback was solicited from a carefully selected group of SMEs that had a broad range of experience and expertise. The names of the interviewees have been redacted, however this stage involved individuals listed in Appendix C: Overview of Subject Matter Experts. In all cases, researchers provided the SMEs with the abstract and closing framework and asked for feedback. The feedback was then coded as seen below. Based on this, the closing framework was then refined to reflect this feedback, including any additional observations and closing thoughts.

Additional Notes:

- This coding exercise is distinct from the coding conducted in the thematic analysis stage of research in that this transcript is coded based on actionable edits and suggested refinements of the closing framework (as opposed to creating like thematic groupings).
- The color coding is consistent for all 4 transcripts and supplemental written documentation and conforms to the following color scheme:
    - Green: indication of agreement / acceptance of the research framework (no further action required).
    - Gray: context setting, clarifications and broader discussions on the subject matter (no further action required).
    - Orange: additional clarity / specificity required to refine the closing framework (action required).
- The SME interviews are listed in chronological order.
- All personal / sensitive / company information has been redacted from the following transcripts. The redaction of information was inconsequential to the feedback and outcomes of the interviews.
- Some interviews include written feedback, of which a coded image has been included to capture this.
- For those who are interested in the interview guide, written feedback, and / or interview recordings, please send an email to leslie.walker@student.tuwien.ac.at.

Before viewing the interview transcripts, there are a few key high-level observations to emphasize. First, the objective of this exercise was to engage SMEs to provide a sense check of the research results. All of the SMEs demonstrated strong agreement with the general

research approach and outcomes, which was indicated through written and verbal quotes (highlighted in green throughout the transcript logs). Additionally, none of the interviews involved any point of significant disagreement or opposition that would lead to substantial changes in content or restructuring of the closing framework. Lastly, there was also agreement on the particularly notable recommendations (denoted by an asterisk in the closing framework) from all the interviewees. In fact one interviewee, P. Jakubowski, independently highlighted three of the four notable recommendations in his written feedback prior to the interview (and before learning of the relevance of the asterisks); thus suggesting strong SME alignment to the research outcomes outlined in this report.

Although the closing framework was refined based on the SME feedback, these changes were exclusively done in an effort to improve clarity, detail, and readability. The essence of the themes, subthemes, implications, and associated recommendations remained the same.

SME Interview Transcript #1 (Coded)

Date: March 25, 2023
Length: 75 minutes

Interviewer: Leslie Walker (denoted as W)
Interviewee: Redacted (denoted as N)

W: [Intro and welcome]... In terms of specific feedback I am hoping for conceptual feedback and logistics. As mentioned, my thesis is close to 200 pages at this point so this [the documents provided to N] is a lot of the "what" and conclusions of the research, but if you want the "why" of the research then that is in the full report. Essentially just flagging risks or questions or things that you would change. I highlighted some of the three main gaps - when I say gaps it's where current policies are either absent, insufficient, inconsistent, misattributed, etc. in current policies. So your thoughts on any of these, in particular based on your area of expertise with challenges with implementation and scaling from your work at CDL.

N: Yes, I saw the documents. Can you clarify what stage you're at? Do you have all the information gathered? Or are you actively looking for more? Just so I can understand.

W: So I essentially have all the information gathered. I've done multiple rounds of thematic analysis and from that derived key themes, subthemes and associated recommendations based on the literature review[146]. So this is the early final draft of which I'm going to validate with SMEs and then update it. To have the external validity on it and say that SMEs think this is legitimate.

N: Okay, so the case studies got scrapped?

W: I still did the case studies, but I ended up having to do a systematic literature review within the case studies as opposed to interviews. Which was unfortunate but was necessary. All of this is captured in my recommendations for future research.

N: Okay, let me read the first part. [...] I don't want to be too nit-picky but I don't know if it's a "paradox" per se. Unless you bring up the notion that - I think the paradox is people said it was going to solve inequality.

W: Potentially it's an irony instead of a paradox.

N: Yeah. [...] Can you clarify a little bit. You say "*while developing these recommendations it was observed that the formatting of current policy recommendations is particularly problematic with low-resource regions. A laundry list format is simply an oversimplification of possible solutions.*" Can you clarify what you mean by the laundry list format?

W: Exactly. So within the full report I take examples from AI ethics recommendations from IGOs and most of them are bullet point lists of admittedly idealistic and cannibalistic recommendations. Most are about 30-70 items long. The problem with this is that it infers there is no relational mapping between the items. No relative importance, impact, effort, etc. And strategic prioritization becomes increasingly important the less resourced you have.

N: Yes.

W: So by saying "*here's a nice to have, here's a nice to have"* is arguably more relevant to a high-resource environment which can pick and choose. But in low-resource contexts, that's just ineffectual in real-world settings. Resource constraints make strategic prioritization more important.

N: Right.

[146] As a note, this was misspoken, it was actually based on the systemic review.

W: When I looked at the data, there were a few items that were particularly notable. For instance, “if you don’t address this point, the impact of all the other points are significantly limited. So that deserves a highlight or a star. I understand there’s localization and it isn’t necessarily going to be the same in every region. But for instance, failure to address power imbalances is kind of like a church holding a bake sale. It’s a nice thing to do and it’s positive but it’s not likely to change any persistent systemic biases.

N: Okay, can you give me an example?

W: For instance, one example stated that you should avoid putting infrastructure in places of local cultural significance. That’s an oversimplification of the full recommendation but you get the idea. There was an example where they built some tech infrastructure on indigenous land and that impacted cultural heritage. Essentially, this was based on a decision by the local government to promote job creation. So you now have job creation and economic benefits at the expense of potential cultural loss. But you’re in a low-resource region where people don’t have access to basic health services. So it’s not clear what the correct answer is. Without addressing these power imbalances.

N: What do you think is one of the - so want you’re saying is that small, resource-poor governments are kind of being held hostage by larger tech companies wherein they;re offering potential benefit to the population but potentially at a great cost. Do you explore what some of the recommendations are?

W: Yes, that is what is highlighted. The first two are related to addressing that power imbalance because it keeps coming up that this power imbalance is something that needs to be addressed if you want to change pervasive systemic issues. Creating greater collaboration between the private and public sector to help manage the direction and the other [recommendation] is coordinating with other countries to increase the bargaining power.

N: Okay I would say that so far - I know you’re talking about a lot of issues - but in terms of power imbalances I think it would be beneficial to specify a little more about who you’re talking about. If you’re specifically talking about national governments versus private interests, etc. When you say power imbalances in low-resource settings, I might have been thinking more about the patient / provider relationship rather than a government / corporate relationship. Because it could mean so many things because there are so many stakeholders.

The other thing it sounds like, is when you mention the laundry list there are "nice to haves" but that's not always practical for people with more immediate concerns.

W: Some of the recommendations are "you should do the utmost possible to uphold the patient experience" but then another part is like "resource allocation needs to be efficient" etc. Which are somewhat cannibalistic in nature and the IGOs admit that they are. But my argument is that, is it sufficient to throw all the "nice to haves" in a booklet and wrap it up and say that's good? Whereas I would argue that we know a lot more. This could be a lot more intelligent. This could be a lot more practical.

N: Yeah, I think your point - it's a really tricky issue because when it comes to the right to high quality healthcare, the right to privacy, the right to dignity, and things like that. It feels very dangerous to try to compromise on those ideals. But like you said, in the real-world, if those ideals cannot be upheld, do you just not give any healthcare? Or do you give sub-optimal healthcare?

W: Exactly, and with healthcare context is so important. I was talking to one of the other SMEs and they said "*if you're on a sailboat in the middle of the ocean and someone has a heart attack or breaks a limb then you can cut them open, bind their arm, etc. to treat them to the best of your ability. However if you were to do that in a high-resource city you could go to jail.*" So context is very important in terms of the attempt to save a life with minimal resources.

N: Yeah. It sounds like almost part of the issue is that the recommendations are so broad and so impractical for people in these constrained settings, that they're overwhelming and they need more actionable recommendations that are prioritized.

W: Exactly. And it doesn't need to be terribly prescriptive. There are specific localized things to consider. But the broad health disparities around the world which are well documented indicate that this is a real hinge point in terms of addressing this. So not necessarily saying "*this is priority 1, this is priority 2*" but the ability to say "hey, these are bottlenecks. Or failure to address x, y, and z significantly impacts the ability to address other recommendations. Here's an asterisk, star etc. that it's particularly notable. If someone deems it not relevant for their location then that's fine." But the data indicates that this is worth an extra consideration.

N: Okay, one thing I would note is in the next sentence you say "*thus representing a subtle way that policy can unintentionally contribute to the biases it is attempting to reduce*" - maybe this is my bias - but when talking about AI and healthcare, there is a lot of biases with models especially based on the data used to train it. But it sounds like the type of bias youre talking about has to do with policy recommendations in terms of access to AI. So earlier on I think you need to be more clear on the specific inequalities that you're talking about. Because this field is so broad and there are many different issues, really youre talking about barriers to implementation and access to populations in these settings. I think a bit more specificity of narrowing that down would be helpful because otherwise my mind goes to other issues that I've heard of in this space.

Okay, so with the bullet points that you've highlighted you say "*foster stronger partnerships to larger companies / specifically align…*". That one I find a bit confusing. Do you mean partnerships between companies or partnerships between governments and companies?

W: Private / public sector collaboration.

N: Yeah. So I would use that, otherwise it's a little unclear. And it sounds like you're saying the recommendations need to take into account the private sector incentives.

W: Yes, so through this research collaboration models came up, which indicated that for successful collaborations you need to consider the motivators to see sufficient engagement. And you're seeing this with a lot of ethics washing or novelty ethics projects, where companies want to appear ethical but the actual programs are pretty shallow in terms of their impact. They are often short term or intermittent for example but are designed to be highly marketable. So to prevent this you should consider the key motivators for groups in a collaboration, both positive and negative. With this often people think "*oh we should tax them more and we should provide them with more financial penalties.*" And that's part of it, but there are also a lot of studies showing that companies that engage in more CSR have an innovation advantage. There are opportunities for shared synergies as well. And this is largely excluded from AI ethics policy at the moment which is kind of irresponsible when you consider that the locus of control of AI sits well within the private sector. It's not in academia, it's not in the public sector. So it's missing key drivers within this space.

N: Yeah, so I think in my mind there are two kinds of potential issues. One is that you have an overly restrictive - so for example let's say you're a very small country and you have very

restrictive guidelines and regulations. You're a small market, so you're essentially just going to get passed up by all of these large corporations, because it's not worth it to them. Like it's worth it to them to deal with GDPR because Europe is a big market. But it's not worth it for them to deal with a little country with all these regulations, there's not enough of an incentive. It also sounds like in this situation the solution would be greater international collaboration.

W: Exactly. So that is point two. In terms of the coordinated approach between countries.

N: Mm Hmm. But on the flip side of that you can also make the opposite argument that small, unregulated markets - countries that are willing to completely forgo ethics because they're poor - could be the victims of aggressive companies. I guess this is a bigger theme, especially with Africa and healthcare. They're kind of -

W: - they talk about -

N: - the world guinea pigs.

W: Exactly, some experts have stated Africa is kind of ground zero for data exploitation. So within this point, I talk about collaboration with the private sector with risk management strategies, with greater patient input in terms of which risks are tolerable and which risks are not tolerable. In terms of - too often it is approached as combative between the private and public sector. Whereby the private sector says "*regulation stifles innovation*" and the public sector says "*we need more regulation in order to achieve something*". And that's not necessarily the case. It is a much more nuanced conversation than that.

N: Yeah. I think that the way that you've worded this one makes it sound like it's overly tilted towards the corporations. So when you say something about private / public sector collaboration, maybe mention a focus on mutually beneficial [objectives] or protecting public interest without scaring off corporations. Something about that balance. Otherwise the way that it's worded right now, makes it sound like the government should potentially bend over backwards to meet the private sector needs. Which I don't think is what you're trying to say.

I like your second point though. It's clear. I like the coordinated approach. That's essentially what we were just saying, for instance about GDPR. Because yeah, you create weird

competition and races to the bottom when there's no coordination. Essentially whoever is willing to sell out their population gets better access.

[Reading…] Yeah I'm not sure where the patients are fitting into all this. But yes, patient centered care is a big topic.

W: Yeah essentially the whole play with this point [bullet three] had to do more with operational efficiency. It's less consequential to be less operationally efficient in high-resource contexts because you have more resources, you can fund a project longer, you can throw more money at it. But in low-resource contexts you have to be particularly efficient with resources because you're trying to reach a baseline standard of care and treatment. A few examples of this are - this is a Canadian example - but a company digitized parking services. They got feedback on it and the patients ultimately said they would have rather alternate solutions, such as non-traditional service hours and the ability to access health services remotely. Both of which would have negated the bottleneck of high use working hours related to the parking services. So it was a misalignment between project spending, time and energy and what patients actually care about. In a high-resource context it's unfortunate but in a low-resource context it can potentially have devastating consequences.

N: Yeah, one thing that's coming up is in a Canadian context, the alternative - okay so you might be able to say the AI solution is x percent better than the traditional healthcare solution. But someone might still have a higher degree of choice - maybe not long term if the government decides to wholesale adopt this - but for now the patient probably has more choice. But when you're talking about the low-resource setting you're really talking about the difference between potentially no access to care and potentially questionable AI focused care. In that sense, that's where the power imbalance becomes a lot bigger. Because if the patients don't have choice and the ability to advocate as well, then the potential for their voices to be completely ignored is a lot higher. In that case people will just take what they can get. So in that sense, yes, patient-centered criteria makes sense.

[Reading…] okay, future advocate and disseminate information on the value of patient empowerment…

W: Yes, so the previous points were more of a top-down policy-related approach but this point [bullet 4] is more of a bottom-up approach. In terms of less recognize the limitations with policy, and the reality is there isn't always a sufficient trickle down of policy. So there

was a study that indicated that patient and community empowerment is one of the best ways to protect against exploitation especially in low-resource environments. Especially because in these regions touchpoints with medical facilities are typically few and far between. So even optimizing the experience at a healthcare facility, but people only go once a year, you then have so many missed opportunities for improvements to health.

N: Okay. So I'm just reading one of the parts that came before this. I guess it's further explored in this chart [the closing framework].

W: Exactly, even then this is a high level overview of the themes, subthemes, implications, and associated recommendations with an asterisk around the ones that were identified as being particularly notable.

N: I see. [Reading…]

W: These are all the ones that are not currently sufficiently integrated into policy recommendations.

N: I would say I'm still a bit confused - you say in subtheme 1a the first bullet point - I'm not actually sure what the relationship between those two. What is the exact power imbalance in this case?

W: Related to the economic power imbalance. How low-resource countries have to make difficult decisions between potential health services or income with potential long term risks such as data exploitation. So engaging with corporations is a way to emphasize shared goals as opposed to being combative in nature.

N: To me, the next three bullet points are more cohesive. They're more aligned in terms of the story they're telling. The first bullet point is unclear to me how engaging with them will offset the power imbalance, but I think the next three bullets elaborate a bit more.

[Reading…] Current systems and policies do not currently foster local competition. This is a big theme. [Reading…] When you say that local competition, do you mean because there's a lot of monopolies?

W: Mm hmm.

N: Okay, because I've heard there's kind of two things. One is the competition aspect and the other is more generally what the incentives are of entering the market but those are closely tied. So yes, competition makes sense.

[Reading…] Okay yeah. [Reading…] Government officials. Hmm. I don't want to nitpick but what would be the recognition for startups?

W: One of the people that I talked to who was a startup founder in Cameroon said that they had a lot of trouble - or a lot of unequal access to government officials compared to a lot of the large corporations. So they said "*okay fine. Even if there isn't any funding it would help to have something like a 'UN Seal of Approval' or a green check beside their name to provide greater international clout or better access to government officials*", which I thought was a fair point. It's not always money that these organizations need, it can also be greater access.

N: Okay in that case, I would mention when you say forms of recognition, it almost sounds as if you're talking about those fair trade organizations or an organic designation. As in if you follow these steps then you're getting recognized as meeting certain ethical standards. So I would mention - if it's specific to ethics - I would maybe mention that. It's an interesting idea though.

W: That's what I thought.

N: Yeah, I was going to say to me the biggest issue is funding.

W: There were a bunch of studies done on the effectiveness of funding, especially from high-resource countries to low-resource countries and the results were mixed. It's very heavily dependent on the funding decisions, who gets the money, the broader context, etc. Essentially, the research suggested that funding alone is grossly insufficient.

N: I can see that. It's a combination of funding plus the market. And if you're in a place that doesn't have a good innovation ecosystem then even if you create a good technology and you get some grants from your government you'll still take it elsewhere. Or it just won't thrive because there's a lack of knowledge / enterprise.

[Redacted]. It's not uncommon that you'll fund a Canadian initiative for a while but once they get bigger then they move to the States. Which is not ideal. So I'm assuming it's the same situation.

[Reading…] These are all good.

W: So you can see it's a lot more nuanced. When I had to choose the most notable four in the abstract, so much of the nuance of where these points come from gets lost.

N: I think after going through these points I might have notes on the abstract. The abstract is good but the struggle is you want to capture everything, but sometimes what happens is it ends up being too vague.

[Reading…] This is all very interesting though. It's a good PhD topic. A lot of people start out with something more broad and then they make it more specific. But if you're doing experiments or something then you're really limited in terms of time and resources, whereas your topic is a completely different approach so you're able to look at a bigger systemic issue. Which I think is more common in the social sciences.

[Reading…] What do you mean "*sources of funding skew digital priorities*"? Do you have an example?

W: Yes, so most digital health research funding is funded by Big Tech.

N: When you say "*skews priorities*" you mean they focus on things that-

W: -they focus on things with larger market size, higher income potential and things of that nature, not necessarily aligned to public interest or public good.

N: Yes, that's an issue with health research generally. [Reading] Which essentially the only way you can do it is having grants, government bodies or not for profits because if there's not a big enough market - although I can see with AI that changing. Because if you can get the cost low enough - you have these huge populations - with AI you can potentially scale in a way that drugs or what not is way more difficult. It can be kind of depressing with some health startups that say "*we want to cure x*" but some of the mentors / investors say "*well who's your market? How big is it?*".

As an aside I was talking to someone from material science. I think that's a really cool stream because it's quite broad and the types of things going on in that stream are super broad. He was saying that often you have people with really cool cutting edge technologies who come from academic research backgrounds and the biggest issue is finding the market. He gave me an example: let's say you have a new coating for waterproofing that's potentially better than

the currently available alternatives. You're potentially disrupting an entire supply chain and a number of established relationships between vendors and buyers of materials. If the vendor sells their own coating along with other materials, then how do you get yourself into that chain? And it's not only that. You also have a number of complications with the physical reality of building something. The problem for example, is if you have a new chemical compound that you've created, if it's too chemically distinct from a lot of the existing places, a factory won't necessarily be able to handle it properly and it has to potentially create new um -

W: - infrastructure-

N: - yeah, infrastructure for it. And who's going to do that? But with AI - to a certain extent - the physical infrastructure you need is so much less. That's not entirely true though because the internet is actually run on physical infrastructure, we just forget that it is. Actually, we had an interesting lecture recently about how a lot of the words that we use around the internet or digital things are meant to obscure the fact that it's actually physical. What is the cloud? Is it up in the sky? No, it's just data centers. They're buildings on earth. They're servers. It's not this abstract thing.

Anyways, with AI - one thing that gets discussed at CDL is the concept of systemic disruption as opposed to point solutions. With point solutions being that you take an existing process and you plop an AI into that. Take one aspect of a diagnostic test and instead of sending the image to a radiologist you send it through the AI. That would be a point solution, whereas a systems solution would be much larger. You would change the entire interaction, which has the potential to upset more established industries. Which is actually one of the arguments why low-resource settings are a lot more open to these kinds of things. Because the infrastructure that exists is potentially very weak.

W: When they talk about leapfrogging, it very much depends on the context whether leapfrogging was a strong likelihood for a developing economy. With the scalability and the degree of disruption, leapfrogging isn't necessarily just can we digitize a little faster or can we skip landline phones and go directly to cell phones. It can be more of an advantage because they don't have the hangover of previous infrastructure.

N: It is very true that in developing countries - if you want to do something in a legitimate way - there is a lot of red tape. There's an economist who was originally Peruvian and he

wanted to start a legitimate business in Peru and just to get the business license took more than a year and it was an absurd process with so much bureaucracy. So it's no wonder that no one does things correctly. You have to create an environment that incentivizes that behavior. Healthcare is very regulation heavy, so I can see why having good policy recommendations is necessary.

[Reading…] Human resourcing… when you say human resourcing do you specifically because startups or technology focused companies can't begin there?

W: There are widespread skill gaps in both technology and healthcare. Many countries including South Africa and Cameroon are experiencing a significant Brain Drain especially with younger people because they don't see long term economic opportunities in that country. So the ones that are trained leave and that perpetuates issues. They have much less healthcare workers per 100,000 people as compared to Canada but also technology specialists, which makes these projects very difficult to implement.

N: If you want extra - I don't know if you want to go down this rabbit hole, but if you want extra social science points there's a colonial implication of only working with big international companies, which inevitably are always from the western world. And by failing to encourage local startups and local capacity building, you're definitely perpetuating those systems. That's a big theme so that's definitely some terminology you should include in your research.

[Reading…] It's interesting because - I think this is because this is a comprehensive review. Themes one and two have more to do with - to a certain extent - creating, building, and fostering ecosystems that allow AI companies to engage in more health partnerships. Whereas the other ones are more focused on the ethical considerations.

One question in all of these countries, is the expectation that all of these technologies be implemented in a public healthcare system or do you expect that a lot of these services will be private?

W: Initially private but ultimately public. Maybe I should also specify the timeframe that I'm looking at. I'm looking at the next decade or so, so I think there's a high likelihood that in that time at least some AI elements will be integrated into public health systems.

N: But I guess that presents a possibility that if a government is willing to hop onto these partnerships, that's actually potentially pretty appealing to a corporation to have one huge account. As opposed to having to convince an entire market of consumers. With the trade off of the regulatory burden, but that be considered an advantage to fostering a relationship.

[Reading…] Okay.

[Reading…]. Oh I really like - theme three is really strong. I like how it's worded when talking about the impact of the system disruption as opposed to what it means for a simple patient / provider interaction. [Reading…] Oh good, this is great. This is exactly what I was thinking about with the AI thing. It's great. I really like theme three.

W: That means a lot coming from you because you have such a high academic / logical standard with your own and other people's academic thought process [laugh].

N: [Laughs] I know I can tend to focus on the more critical side. [Reading…] I'm assuming you dive deeper into what that [patient input] might look like?

W: Yes. One of the examples is that in high-resource regions teams use a lot of prototypes to generate early and often feedback. But prototypes can be very expensive. Studies have shown that product narratives, such as storytelling, is comparably just as effective at generating accurate patient feedback but it is much less expensive. So that's just one example of how we can reduce the barriers between high and low-resource locations.

N: What do you mean by not using prototypes?

W: In terms of using product narratives in lieu of prototypes.

N: Oh okay. So do you mean they completely skip the prototype phase?

W: It depends. They can skip the prototype phase- well they still have a phase dedicated to obtaining patient or user feedback, but they just use different strategies in generating that feedback.

N: Interesting. That's a way of getting consumer feedback before a prototype is available.

W: Or in a low-resource context when a prototype isn't available. And the studies that I looked at suggested it was comparably as effective at generating patient feedback. There are some shortcomings. There is a skill set for instance, around developing product narratives. So

the quality can also vary just like with prototypes but in general it can be an effective tool. Particularly in regions with limited budgets.

N: -I see, to be able to get broader feedback. [Reading…] "*Eating your own dog food?*"

W: It's a common phrase used in the private sector.

N: You'll need to explain to me what that means.

W: Eating your own dog food essentially means using your own solutions. You're using yourself as a feedback generating test case to improve your products. For instance, Google uses their own software services to generate internal feedback.

N: Why dog food?

W: I'm not sure exactly [laughs].

N: On the whole I think this is really good. I understand the abstract a lot better now that I've read the themes but it would be good if it was better captured. I really like it. I feel like you've made huge progress. It's amazing to see.

W: I really appreciate your insights throughout the whole process. Especially with feedback regarding conceptualization. The nudges you gave me really helped.

[Further closing statements and thank you.]

SME Interview Transcript #2 (Coded)

Date: May 28, 2023
Length: 90 minutes

Interviewer: Leslie Walker (denoted as W)
Interviewee: Redacted (denoted as J)

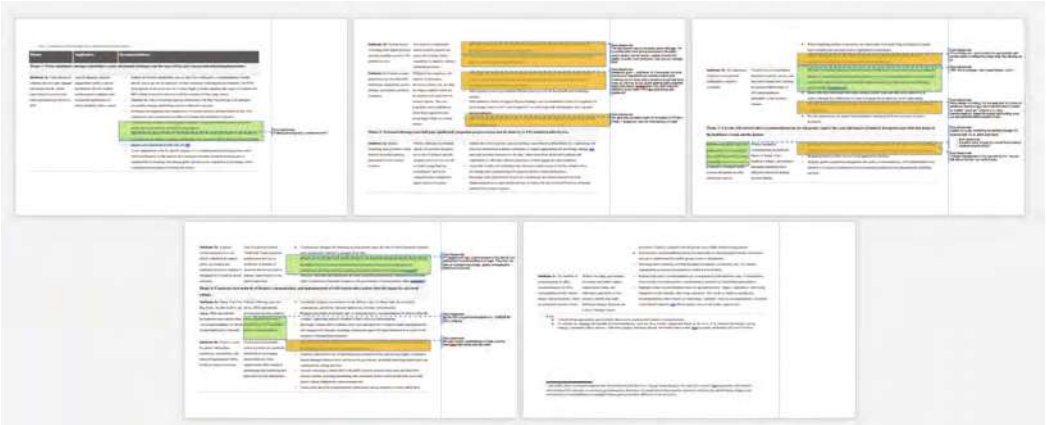


Figure 28: Visual Overview of the Written Feedback (Coded) - Interviewee J.

W: [Intro and welcome]

[This interview included over 40 minutes of broader discussions on AIs current and predicted impacts on society prior to discussing the closing framework associated with this research paper. This portion of the interview has been excluded from this report in favor of content that is directly relevant to this research paper, specifically feedback on the closing framework. For those who are interested in this preamble, please reach out to the lead researcher at leslie.walker@student.tuwien.ac.at for the full transcript.]

So I guess we might as well go through the closing framework if possible. I saw some of your comments and I will save them or I can either address them now or talk about them. Your first one [comment] in terms of the colors - that was to indicate mapping in terms of breadth - to show the breadth of recommendations. So with a lot of policy work you have different levels. You've got the society level, the community level and the user and individual level and then you also have some that are structurally transcendent where they are overlapping. So it's based on that, just to show in general where in policy these fit.

J: Okay. Yeah if you're okay then we can probably talk. Just confirming, you want to record this?

W: Yes, I'm recording.

J: Okay. I guess I wasn't too critical looking at the subthemes. I was more focused on the recommendations. But yeah, so I guess for the first subtheme my comment is about incentives being the number one. So when talking to Big Tech based on what incentives are

in place now, there is no reason for them to invest anything unless there's something in it for them.

W: Exactly.

J: So that's the number one recommendation in that section for that very reason.

W: So if you see the star, the asterisk - essentially right now with current intergovernmental policy recommendations they list it in a bit of a laundry list format. In kind of broad categories. And the problem is a lot of these are contradictory or a bit cannibalistic in terms of "you should do this, you should do that". Or "you should be efficient with resources" but also "you should also make sure everyone has a perfect experience". But of course those are counterproductive to each other. With that, I put an asterisk beside the ones [recommendations] whereby the secondary research indicated that failure to address this will likely lead to insufficient change. And so for instance, in that category it's the one related to financial incentives because we're seeing a big rise in novelty ethics projects or ethics washing - things like that. Where it really is that these projects are intended to be marketable and not necessarily sustainable. So you'll notice an -

J: - yeah, okay makes sense -

W: - asterisk on that one as well as some of the other ones later on.

J: There's a few others, yeah. Okay that makes sense. That makes a lot more sense because I wasn't too clear but that makes a lot of sense.

W: Yes, so right now they [the recommendations] are listed kind of in chronological order in terms of how they were addressed in the main body of the research paper. In terms of "actively engage with them" and then "specifically call out the financial bit".

J: Got it. Okay thank you. And also I scrolled down and I noticed the second footnote actually explains the question I had on the colors so I should have read a bit further past that first one.

Okay, so subtheme 1b. [Reading]. Right, so. Encouraging those public - private sector partnerships and focusing on a performance informed budget process, etc. My concern is: who from the public sector can do that? If you have these partnerships, then Big Tech is going to take whoever is from the public sector for a ride. With the exception of a few select

countries in the EU. You're going to get some policy maker that has - what is it, a public affairs degree - that doesn't have a clue about technology or how contracting works or how to build a robust statement of work with a Big Tech company. So that Big Tech can come in and dictate the rules in their favor. So how do you ensure when you have these relationships that you're not being taken advantage of. I might have mentioned this elsewhere, but that's where that partnership with academia really comes into play because that's where you will really find that skillset. And then you need to incentivize them to get buy in but that should be easy and you get - at least from a knowledge perspective - maybe not from a business perspective - you're not going to be walking in blind and clueless and if there's something that is really bad for society or it can be exploited by Big Tech - you can at least have some kind of safeguard to make sure that doesn't work it's way into a contract.

W: Exactly. That's a great point. Theme 2 talks about personnel and skill gap shortages, especially in low-resource contexts. However, the problem is this is a bit of a double whammy for them because they already don't have enough people, let alone people with the right skill sets. Especially given the evolving needs of digital policy. So you're right, this is probably an opportunity for - right now, in many countries including the ones studied in this paper - academia is still quite siloed. I think there's a real need for them to be the mediator in a lot of these conversations. Of which they haven't really risen to the occasion to at this point.

J: You're absolutely right because I had a chat with [redacted] who's now a VC-ist out in California. [Redacted]. I very much enjoy doing public policy in this space and he said "*don't bother. Governments have no power. They don't know what they're doing. That's a terrible idea. Go into a large tech company that actually dictates that*". That's a very fair point because - and I mention that in a later point - the government is so far behind in developing proper policies and regulations around tech. Looking at even something as simple as cyber security for IoT devices. I think there's only California that has some kind of policy which is very very very basic. It's basically saying "*you need to use a unique password to get access to all your devices*". That literally had to be written and that's a leading policy in that space: so that not every single device has the same way to access and the same password. It's stupid. But that's where the government is. It's so slow. Now they're restricting - I think you brought that up - that they're restrictive to the development of technology that could be socially beneficial.

W: Exactly. So a few of these themes and subthemes are overlapping in terms of the solutions for one are involved in the challenges for another. In terms of - you need to engage with stakeholders that have not previously been engaged because this is not something to expect government officials in low-resource contexts - when they're already saying "*we do not have enough resources. We do not have enough people to meet basic service needs. Let alone innovate and improve our policies in this space*". Also I feel like academia is a great place to do this, but collaboration and knowledge sharing needs to be much more improved between countries. In terms of the power imbalance, a coordinated approach allows for a larger market size but also a sharing of resources so that not every country - government rather - needs to reinvent the wheel which is what is currently happening.

J: That is spot on. That is one of the best recommendations in that whole list. To your point, that's how you pool resources. If you have a project that addresses common problems between a number of nation states, then just pool your resources - you have one expert here, one expert here. Just get them working together. Then you're a united front and you can bring something to the table - you can bring those incentives. Because all of a sudden - let's say Google is now not only providing benefits to one million people, it's 100 million people because you have all those countries working together so it's a bigger incentive and more value to them, more benefits - there are just so many points. The challenge then becomes how do you get these parties to work together.

W: Right now when we talk about - how you mentioned that inequality is on the rise, even from a health perspective. The problem is that Big Tech is moving into a lot of African markets and the problem is these markets need to balance economic benefits, such as job creation, potential cobalt resources, economic gains with potential exploitation. So it's not always clear what is the right thing to do. So expecting a lot of these low-resource locations to defend themselves against exploitation just isn't reasonable. Especially when you consider that the Big Tech firms, most of them have revenues larger than Canada's GDP and Canada is the high-resource location. So what reasonable hope is there for the Cameroons of the world. That you really need to adjust it. And there is a lot of evidence to show that the EU has been very successful in this area. A lot of the policies that they've set in terms of data protection and what not have transcended the EU due to the global nature of a lot of digital products. It's just cheaper to improve them - or update them rather and use those same updated products in other places. So this shows how effective policy can impact places outside of the borders in which it was created.

J: Yeah. I absolutely love watching the EU [regulate] Big Tech. It's a great time, every single time.

W: [Laughs] I agree.

J: When they slapped Apple for having those charges - move to USBC.

W: Exactly, the biggest fine ever, very recently.

J: They're picking away at the planned obsolescence now aren't there? I think.

W: Yeah.

J: That's good.

W: So I think - exactly, in terms of how do we get those skill sets in government when there's already a skills shortage. You need more knowledge sharing, you need more collaboration, and I think there was one other one. You need to do a variety of things. The problem with this is it really is a systems approach. To solve these problems you really need to do a few things. When I made the asterisk, I said that failure to address these four things will significantly limit the success of the other recommendations. And right now, IGOs do a poor job at prioritization or strategic thinking. They just leave that to each individual member country to decide. However, my argument is not only is that not helpful but it is counterproductive - in terms of when resources are scarce, strategic prioritization becomes even more important. And failure to put a star beside some of these key ones then gives no sense of relational mapping, relative impact, importance, scale, anything like that. It could be a much more intelligent conversation than it is now. "Try to avoid data exploitation" okay well thank you, that's not helpful.

J: That's an interesting point about the UN. Is there any international organization that facilitates that kind of collaboration?

W: Yes and no. Really not a cohesive one. For instance the UN offers a set of AI ethics recommendations but that's a really high-level list that is not so effective. They essentially do not mention Big Tech in it. The problem is - there are a few other international organizations, you also have the WHO or other health organizations that do touch on digital health. Some of them argue that the private sector is outside of their scope. But my argument in this paper is that it's no longer - when we look at the locus of control of AI, you need to then reflect on

your objects and ask yourself "can we ignore Big Tech and still meet our objectives?" I argue that the answer is no because so much of the locus of control is in Big Tech. In that case I would seriously question the viability of the UN moving forward.

J: The only thing that I can say is this being comparable is the F35 project, which is the opposite of healthcare - it's the destruction of human beings. But the way that was run was you had a private player: Lockheed Martin that was contracted by the US government to develop this aircraft and then countries bought in. So I mean in this case, I don't know how much influence they had over decision making but that is something that could be brought in for something more socially beneficial. You buy in and commit resources - maybe not money due to the economic status of some of these nations, or states rather. But you buy in or you put something into it such as a small team of experts. You just contribute. Let's say the bulk of this project is going to be funded by Canada. Canada is driving this initiative and these other countries could also benefit. And we can tailor it to benefit you but you need to pitch in. you need to do something. We can't just create something and send it over to you. It's not going to work. We don't know what you need. So is there any vehicle - and I agree. There's no way to do that without the resources of Big Tech because they are the ones that have the technology that you need. If you don't involve them you're working with twigs and mud while they're building ChatGPT. The divide is too huge. Even if you're looking at academia - sure if government and academia worked together you could find a great R&D project that's neat and good but it lacks scalability and it lacks commercialization potential. What we just hit there is the scalability. It's something that when you build a custom solution it's something that you don't typically look at. It's something that works great in a lab environment but let's say you want to spread it to 20 hospitals in the region. Each hospital has its own resources. How do you know that something that works with one is going to work with the others? You don't.

That's one of the points I think you had there where I mentioned there's a lot to talk about. [Reading].

W: Subtheme 3a.

J: Yes. Change management comes at the end. The biggest thing is, if you want to break out of these outdated - well what would then be outdated processes, you have to start by understanding what they're doing now. And this is my bread and butter at PwC. So you look at what is being done now and what are the issues, what are the gaps. You figure those out.

Okay, what technology can we put in to address those gaps and then you design like thinking about - okay you use the term "North Star" which is great. Like this is the north star we want to get to, this is the future state. And the second point in there about involving the end user is really good. You get their buy in, you get their input and then they become the champions of your solution and you get all this extra support for your solution that you otherwise would not have gotten. They would have maybe even been in opposition. So once you design those future state processes you then build the solution to align with that. Because to your point it's otherwise putting lipstick on a pig. You have these subpar processes, you can digitize them. That's great but it's still not good, it's not going to work. You hit the same boundary as scalability because all the issues that are surrounding it will stay there. So you have to change everything. And pick away at it. Start with the quick wins - I think you mentioned that. Do the quick wins and those can also help fund, internally, the program because you're saving money here, saving money here. So when you save, then pool it towards the overall big transformation budget. You can even use it on some medium projects. So it's a big - it's a broader transformation approach that goes beyond just having an idea and making sure it's communicated. You need to think it through from the very beginning and again, to get away from the challenges of getting boxed in by the existing processes you need to go into that conversation with the stakeholders and say "*this is what you're doing now. These are the things that don't work. Forget all of this and start from the beginning. In an ideal world, what would you do?*". This is also where the private sector comes in and they say "*hey this is how we think you could do it*". And they'll do it in a way where it works conceptually but there are some nuances that come from the end user which are not captured. So then you hit some middle ground where you have the industry leading approach and technology in place that's also encompassing the local nuances and process requirements from the end users. And that's the solution you end up with so that both the end user - the patients are heard and their addressed and you're reducing the amount of effort that would otherwise be addressed. Because a custom solution that - if you have something out of the box, tweak it a bit but you don't have to rebuild everything. And that's an approach that's not often taken.

W: Exactly. I think that's so clever because the amount of projects that I've worked on that either have had random inefficiencies or random side quests of having insufficient end user input. Such as one to digitize parking services where the patient feedback was they would rather have remote digital health services. So you just spent millions of dollars - or patients would rather nontraditional service hours which can be enabled by humans and technology.

So you've now solved a problem that wasn't actually a problem. You've invented a problem because of the traditional processes. That's an "oopsie daisy" in a high-resource location but it's devastating in a low-resource location.

J: Yeah and it's something that I'm now seeing with my clients where they are trying to solve a routing problem - a vehicle routing problem. They had a tool that wasn't great, a lot of manual effort, whatever. They spent two years putting together this pilot from the ground up and they built something that's much more advanced, can handle routing much better, captures all the little nuances and tweaks they want to do, but one of the perspectives we came in with was "are you overcomplicating this?". Yeah we get that this is how you do this, but should you - should it be this complex? Have you tried a simpler solution doing it differently? Because there's something much simpler and quicker and cheaper that you can do. Would that get you 90% of the way there and then you can tweak the last 10%? Because then you can avoid building something from the ground up. It's everywhere that type of perspective.

W: It's amazing, while I was at [redacted] how often we would be selling G Suite or a solution like that. And every client would be like "*we are very unique. There is no overlap between what we do and what other people do and we need a custom made product. 95% of the time - actually I'm going to say 99% of the time it was like 'no, other organizations also struggle with cost management or cost reduction, inefficiencies, HR overhead*". Whether you're a bakery or a large organization there's an element of inventory management whether it's cupcakes or humans.

J: Yeah, you think you're special and unique and you may be individual but your business processes aren't.

W: Exactly. Exactly. And that's where I think you're right in that there are so many advantages to the scalability of Big Tech. the problem is it takes a lot to have these conversations with clients in terms of how do we simplify processes and i think right now - i can't remember the stat off the top of my head but something like 80% of new digital health processes are just based on legacy reasons not practical reasons. It's just because one person is trained a certain way so they train the next person and they train the next person and that's really problematic especially in low-resource contexts because the inefficiency is brutal in a place where you need efficiency, you need resources to stretch further.

J: Sorry, one point that I didn't want to miss. It's a bit of a less fun one, intellectual property and I may have misunderstood but IP is very tricky when it comes to - kind of net new builds. Is that it is one of the incentives for Big Tech, that is to work together to build out IP but that IP is yours. Trying to retain it's great and there's a lot of space to negotiate it in terms of a royalty split and stuff like that. But IP would be very tricky - a lot of the software vendors that I've worked with would say that "*you know, we'll build whatever you need but then it's ours*". Then the counter point is "*no, we want to profit - if we pay you to build something we want to keep profiting off of it*". That's kind of the two positions and more often than not, the tech will win unless there's enough leverage to push it in the other direction.

W: Okay, that's a good point so maybe with this point I should focus less on IP because I said "local talent and IP" and instead I should say "local talent and expertise". Because the problem with this is, there's a lack of sufficient human resources with the right skill sets especially in low-resource locations. The problem is those low-resource locations, including the ones in this report are experiencing a significant Brain Drain. Or in the case of Canada it's not uncommon for Canadian incubators to fund start ups and essentially when they get off the ground they move to the states. That's going on in a lot of other countries as well. So one of the bits of feedback I received was: when you receive funding, you shouldn't just look at the characteristics of the project but also the characteristics of the recipient to make sure that you're also championing local talent and skill development.

J: That's just something that can very much lead to clustering. The clustering effect is - it cannot be compounded by things such as special economic zones and all that - just general tax breaks and incentives. But I think it's the biggest draw - well one of the biggest incentives is we're going to set up HQ [headquarters] in Yamoussoukro - is that the capital of - is that Cameroon? Did I get that right?

W: Cameroon is Yaoundé.

J: Anyway, if you set up the center of excellence for some kind of disease that's of relevance - or some kind of AI medical process that's relevant to a lot of African nations. Then all the experts: epidemiologists, technologists, they all start going there. And that will start building that critical mass. So if I'm a Big Tech company or a big medical company or medical device company, I want to benefit from this. I want to build some type of integration on my device with that AI thing. And I want to start building around this thing. I'm going to set up shop there too. I'll start hiring some local people because it's often cheaper. Maybe I'll hire some

expats and then bring in some local people that I can then upskill because my salary costs will be lower there than in Boston or wherever. So that kind of economic impetus or momentum can lead to a lot of growth. And that's a huge benefit if you can get to that point. That comes with the multinational collaboration to make sure it's a big enough project so it's one of those points to mention. It's tied to a lot of other ones actually being followed through on. But I think that's what you're touching on with championing local talent. In an idealistic scenario you can really go far. But then the side things - what are the incentives from the public sector to build that out.

W: Exactly -

J: - fun fact. The same person who invented the Irish coffee and the duty free was the reason for China's massive economic growth through their special economic zones.

W: Interesting.

J: Well done ireland. You've changed geopolitics.

W: [Laughs] Changed the world forever.

J: Sorry but you were saying.

W: Yeah, what I was going to say is with championing the local talent - the problem is when looking at young educated people, from Cameroon for instance. 90% have intentions to leave for a few reasons but one of the main reasons was for better economic opportunities - job and economic opportunities elsewhere and higher quality of living. So then you're kind of in this catch-22 because even if they have a valuable skill set, if they're not in an environment that is conducive to strong tech or business infrastructure. Or has Big Tech coming there to create jobs then they're likely to leave anyway because - but then if Big Tech comes in and you don't have sufficient regulations then you get exploitation going on. So it's really challenging - which comes first, the chicken or the egg.

J: Yeah and that's where that initial investment from that conglomerate - sorry that multistate group or Big Tech that initiated that initial investment saying "I'm going to set up shop there". And that can be part of the initial agreement to build whatever this AI tool might be. There can be a group of African nations that want to fund this project with Microsoft and one of the things is "*we'll give you this money, we'll support you with this but a) you have to set up shop in Yaoundé and b) you have to hire 20% of local talent. It doesn't need to be for leads*

but you need to hire them". So when you're looking at people leaving, they can leave to join microsoft while still being there. It doesn't address the quality - well not necessarily the quality - you don't necessarily escape the societal - basically if you don't like being in cameroon you're still in cameroon. It's not going to change that. You're not going to change the entire country with getting this job but if you're working with Microsoft, well now you've got global mobility. So if you work on this for two years then we can set you up somewhere else. So if I was in that position I would be like "instead of having to go to the US and hope I get a job, I'll just stay here and get a job with Microsoft, say I worked with Microsoft and then I could get a job anywhere". So that's the thing - there's ways to do it but it's not easy, especially given the skillset that's present in the public sector. It's not something that I would expect to be done. Typically they're not good negotiators.

[Redacted]

W: While specializing in digital enablement in the public sector it was disappointing to see how inefficient the projects were. And that was in Canada. We don't even have a corruption problem. It's just a huge challenge.

[Redacted]

J: You're right.

[Redacted]

W: Also I'm all for risk management - essentially passive versus active ethical violations - so my argument is - in the public sector an active ethical violation would be "let's demolish that orphanage to put in a coal factory" whereas a passive ethical violation would be - like indecision is also a decision. So failure to change policy fast enough - although you can't pinpoint it to a specific ethical violation, failure to have sufficient ethical policy has led to growing inequalities - growing health inequalities - and this is where government really fails. They put too much focus on active ethical violations in terms of let's talk this problem to death and not demolish the orphanage for the coal factory but they spent 0% of time talking about "*what are the trends in this country that we are not addressing*?" or "*what impact are we having being slow to address things?*" and most of the time it's just as big of a violation - or has just as big of an impact, arguably even more than - okay you demolish an orphanage that's unfortunate but it's just one place. But it [passive ethical implications] has systemic implications so the impacts are much more widespread.

J: In Canada you can see lots of evidence of the government not doing anything and things getting worse. And also you can use a quote from a canadian musician: Geddyy Lee - "*if you choose not to decide, you still have made a choice*".

W: [Laughs] Exactly. Exactly.

So i see - a quick point - three of the four that i put an asterisk on you had - even before we had talked about the asterisk you had pretty good points - so you had for instance, when talking about Big Tech "*incentive is number one*", [reading…] the next one is the positive feedback on the coordinated approach, the next one is [reading…] "*this is the number one biggest point in my opinion*" and then the last one was the one under the "*number one biggest point*" so that's nice to see that there was alignment even before we had talked about the -

J: - Yes, I'm aligned.

W: Then my only thoughts would be for point four. So the first three [themes] were very much related to the content of IGO recommendations whereas theme four is more related to how these recommendations are organized and communicated and also their origins.

J: Four is not one I've had a chance to go through [...reading].

W: So for instance with this point [4c] you see a lot of international organizations such as the Global Peace Index that use a large amount of data to essentially rank countries based on peace and also provide recommendations and things of that nature. They use a data-driven approach as to why countries should focus on certain things as opposed to other things. As opposed to the UN or WHO, the recommendations are much more high-level, much more vague and less actionable. The recommendations don't give any sense of relational mapping in terms of what are those hinge-points, such as failure to address x will significantly impact - for instance if you fail to address power imbalances then you're essentially like a church bake sale. It's a warm fuzzy but it's not likely to change any systemic issues.

J: [Laughs] Yeah. I'm impressed that there are organizations that can go to that level of detail on these complex topics. I think that might be -

W: Yes, the best book I've ever read is called "Peace in the Age of Chaos" and it talks about the Global Peace Index and how the data comes about and the idea of systems thinking. You can essentially look at the trajectory of a country or how a country is tracking based on a variety of different factors and then they have a global ranking of countries which heavily

impacts things like business decisions, investments, government decisions, etc. And more and more governments are starting to adopt it. Before there was a need for - you know "*is the data 100% accurate? Does this give a complete picture?*" but we live in an era now where we have sufficient data and analytical processes where we can make more informed decisions than in the past. So organizations should look to things like this to say "*you know, you can use tools like this to integrate data-driven strategic decision making within sensitive diplomatic conversations*".

J: Yes, so I fully agree with 4c. The question of how that will be done is still a question, but insofar as what needs to be done yeah I agree -

W: - Exactly -

J: - High-level [recommendations] aren't helpful.

W: The preference would be something like an action-priority matrix in terms of what are the quick wins, they may not be the same for every country but some things inherently have a lower cost and higher impact than other things. But even if it's so much as this list where you put an asterisk beside the ones that governments should take a second look at, or if you're in a low-resource location - the problem is when you give a laundry list of recommendations, for high-resource locations it's like grocery shopping they can say "okay let's choose this one, this one, this one" but a low-resource context they may only be able to do one or two initiatives. Well what one or two initiatives should those be?

J: Yeah, if you have any quick wins what are they?

W: Failure to do that is really a subtle way in which these IGOs are contributing to the biases they are attempting to reduce because this format is much more conducive to high-resource locations.

J: I agree. Okay 4b [reading..]. So the last point, direct financing from whom? When you say "encourage direct financing to vetted and approved start ups" -

W: Yes, national financing or there is some IGO funding that can go towards this, but I would say it's primarily referring to national funding.

J: And who does the vetting?

W: Ideally - that's a great question. I need to clarify that. Contextually it can vary although primarily it would probably be national governments[147]. Although one of the recommendations listed above referenced "IGO seals of approval" because one of the issues was that startups in low-resource locations don't get financial support but they also don't get access to government officials or sufficient clout. So having an IGO seal of approval such asn a "UN passed ethics check" will give international clout or exposure in ways beyond financing. Because the problem is in low-resource locations you often don't have sufficient financing so you need to consider other ways in which you can support these groups. It can be better processed by IGOs but the problem is that IGOs aren't necessarily in the business of a large-scale vetting service.

J: That's the thing. Generally the rule of - and this is going back to my masters - generally the rule of thumb is that governments shouldnt pick the winners. By extension organizations such as the UN shouldnt be picking the winners because they don't know what makes a product good or viable. And this is where that collaboration between the private sector - so in this case you can look at VCs for example, accelerators, incubators. It comes under complex contractual agreements where they will need some kind of incentive to be participating in this. But this is something that is picked by them - what is the y-combinator - and the government says "*this is something that might help*". So we'll talk to them and say "*hey, you're working with them - we'll give you x amount of money if you develop your product in a way that suits us*". So the vetting has to happen - well it doesn't have to happen - best practice is that it's picked by non-governmental actors - people who are experts in both the technology and business side of things.

W: That's a good point. Originally this point was put in because historically some low-resource countries received funding and because of corruption the funds didn't go to the place they were supposed to go. So in order to circumvent that you want to inject it directly to the source. But you're right in terms of operationalizing that you need to make sure there is a viable way to do that.

J: That's why - well corruption can be anywhere - but if you start involving multiple states together they can put together a better financial vehicle that doesn't go to one person or one department that makes that call and there's more oversight on where that money goes.

[147] This was misspoken and depending on the context funding could come from national governments or IGOs.

But in general one other thing I would mention here - and you touch upon it well in these two points here - these are very very good. One of the issues with tech policy from my perspective and my learnings is that typically where you build policy typically you want to make sure it's foolproof, robust, thorough and all that. You've got all the weird cases captured, there's no weird loopholes, nobody can really circumvent it. But when it comes to tech and the pace in which it goes, policy or regulations that you develop in one year might not be the right policies the next year based on where the technology has gone. So you may be inadvertently restricting innovation based on policy that can't be adapted. When I say "can't be" I mean it can't be adapted at the pace it needs to be because by the time you've got it fixed to where it should have been a year ago, it's been five years and you're even further behind because it takes so long to get anything through. So you need to build policy that has built in flexibility to allow for growth and innovation while still maintaining those social safeguards. Where you mentioned "create a safe space for experimentation" - that speaks exactly to that. Because - this is a fairly new space for government policy -

W: - That's true, thus far it hasn't been a substantial conversation because thus far the consequences for the lack of adaptability in policy really have - comparatively were not as noticeable in the past because the rate of change was a lot slower. So it was - when you have such a rapid rate of change, you feel improper policies a year later, whereas before it would be four or five years - there wasn't that same proximity. When you look at a rapid rate of change the need to be adaptable just skyrockets in a modern context.

J: I'm just adding a quick note [writing]. So on that point yes, improve the clarity and all that, yes, but - and this is another tricky space and we do this some times with procurement where we involve them in the procurement process as we're building requirements for an RFP [request for proposal] so we bring in the vendors to check "does this make sense?". The goal there is that the set of requirements makes sense to both what we're looking for and what they understand is that the product in the market - and you speak to a bunch [of vendors] so you're not tailoring everything to one person or one company and similarly here - and I know this happens through lobbyist now, so there's a more harmful vector for those viewpoints to make their way into the laws but by proactively involving them and bringing them into the same room - saying okay, we want to build a regulation on how we'll make sure, to avoid discrimination in AI for example for healthcare and you bring in everything and you create a framework for the law, policy, or regulation. And you say "*okay this is what we want to do*" and then ask "*is there anything concerning to you that is going to prevent you from building*

something out?" or "*is there anything that's missing?*" I'm assuming they're somewhat altruistic in that they have some sort of perspective and don't just completely want to profit off them - even assuming they won't. You can repeatedly ask these questions and get their feedback revising it. That's how you build that policy that's flexible and adaptable where your policy makers internally are happy with the restrictions that are in place because they feel it will safeguard the public. But at the same time, you get the perspective from the commercial side saying "*okay this is a bit restrictive but okay we can live with this. It's not going to significantly impede our ability to deliver products or goods in this space*". Admittedly this is a tricky space because if you say X public sector employee has spoken with this person from the Big Tech companies it's like "*okay, what's going on?*". So there is a lot to be said about transparency and making sure the process is well regulated in itself.

Going back to [redacted]'s point, as a policy maker or government worker you're not really going to be able to drive this. And to a certain extent that's true. So bringing in experts from the actual field will - and again this is where academia can come in maybe as a neutral third arbitrator that says "*here are the red flags we think you should address with this policy*". And every time a new policy comes out, you have these experts weighing in, and opinion columns and newspaper articles saying "*bill C-11 is not good*". Okay so why didn't the government talk to this person? Did they talk to anyone? Or did they only create the policy based on their own internal ideas?

[...Reading…]

And I think 4a I did read. I think the points on 4a and 4b do overlap quite a bit. Regarding the culture shift - basically the last point of 4a and the third point of 4b are -

W: - Yeah you're right.

J: "*Messiness of digital transformations*" oh yeah. Again it comes back to that tripartite communication between private sector, public sector and academia. Get those working together to hit that ideal sweet spot for innovation in healthcare and other areas.

So be conscious that again, I've been focused on general tech and innovation and all that and not as much on healthcare. Aside from looking at the impact is bigger because you're dealing with people's lives and wellbeing and you have PII [personal identifiable information] considerations that you're dealing with personal data so it's more complex on a technical level. But at a high-level the general concepts still apply.

W: That's what the data indicated in terms of whether you're walking about any public good sector - or anything in the public interest such as education, healthcare, etc. a lot of the same themes come up when you look at it at a macro-level. The main point is there is significant under optimization in policy now that has significant room for improvement of which these strategies could also be used in other sectors.

Well Paul, thank you that was so helpful.

J: That was enjoyable.

W: Good, I'm so glad to hear! [Further closing remarks and gratitudes].

SME Interview Transcript #3 (Coded)

Date: May 31, 2023
Length: 60 minutes

Interviewer: Leslie Walker (denoted as W)
Interviewee: Redacted (denoted as R)

* Please note, this interview involves screen sharing and direct references to certain points visible by both participants.

W: [Introduction and context setting].

When I was at PwC, I would go to all these different clients and I was doing digital enablement in the public sector, right? And then I started to notice patterns in terms of the types of clients we had and whatnot. They're primarily wealthier clients, things like that. Anyways, there's already a lot of significant, global wealth and health inequalities, and the problem with AI, is that a lot of these emerging technologies are being used in public good sectors but primarily in developed country contexts in wealthy contexts so mainly cities in developed countries. So then that just really puts a wedge in terms of health inequalities. This led to a comparative case study analysis with Canada, Cameroon and South Africa, high resource, low resource, and a dichotomous context respectively.

R: All right. I remember reading that. Yeah.

W: From the systematic analysis I developed the key themes and then also recommendations.

R: So, what was the feedback you got, like from your defense committee?

W: So they essentially said it was good and it was interesting. They said that I need to look at - essentially two things at play because I'm looking at more of a meta / macro-level -

R: Yeah.

W: Especially when you're doing interviews but when you're doing a systematic analysis, you have to look at specific definitions like artificial narrow intelligence, and you really have to put it into a worded box. And so, I could essentially extend the words in my box because right now, I just strictly looked at ANI in a healthcare context in a diagnostic context. And in environments where that didn't work, I looked at comparable technologies, like, IoT or whatnot, that follow similar patterns. But they essentially said that I should extend the box. I won't do that on this project just because it is out of scope, but in general, they said congrats on the interesting topic.

R: And then, from the other people you talked to and - I'm assuming they have seen the same thing - the abstract -

W: - Yeah -

R: - Closing framework. So, what is the feedback you've gotten from others on that then?

W: Essentially, that it is good. There are a few mainly semantic issues, they wanted me to clarify who, exactly and how certain recommendations would be done. Things like that, but in general, they were like, Ah, yes. Okay. This makes sense. And one of my one of the main conclusions for my research is - so currently AI recommendations from intergovernmental organizations, they're just kind of like a laundry list with broad categories.

R: Right.

W: But you should protect patient data, you should better the patient experience, right? Really kind of broad, vague, and kind of idealistic and cannibalistic recommendations. And my thought and my argument is that there's a lot of room for further optimization because a list doesn't give any indication of relative mapping, priority, importance, impact, anything

like that. And when resources are more scarce, strategic prioritization becomes more important. And right now. All these recommendations are treated as if they're equal and that's just not the case.

For instance, failure to address some of these power imbalances will significantly impact - it's like a church bake sale - you've got projects that are warm fuzzies, but they're not going to change anything on a meaningful level. And so what are those main points that you need to address in order to significantly increase the likelihood of success for the other points [recommendations]? And so, for instance, those are the four with the asterisks on it. The other SMEs that I talked to, they all agreed with those. A few of them even called out those recommendations before the asterisks were even on them. They called out three out of the four of saying "*this is critical, this is critical*", which shows strong alignment to it because the secondary research also indicated that they were critical.

R: Okay, and what do you define as a project in this context? That's just like anything that is related to the application of AI in a healthcare context, in a low resource country?

W: Exactly. And then I do make some distinctions between a successful project and not successful projects in terms of capturing lessons learned from them. So for instance, a successful project would be with the intended outcomes being impactful to processes, finances, etc. Anything like that because there were a lot of projects that were included in the thematic review, but couldn't realistically be considered as successful projects just because they were either replicating redundant processes or things like that. And so that was captured as well.

R: Last question. Because I fully understand the sort of, literature review metadata review that has come up with these themes - and am not necessarily surprised by the four themes that you identified as like, these are the major things that are stopping you know successful application or driving like Health Gap - in sort of like Canada versus Cameroon - I totally get these themes. Are the recommendations also based on this summary? Also from the thematic recommendations from all of these reviews or is this partially that and then you've also added another layer on top?

W: Exactly. Partially that and then also supplemented from additional interviews for instance with UNIDO or UNESCO or other groups working in these environments.

R: Okay. So, I thought what you said before summed up a lot of what I was going to say. So the four teams? Yeah, I get them. I'm not surprised with them at all. It's like "hey, that's kind of what I would expect".

W: Mm hmm.

R: A lot of the recommendations - I feel like a lot of them are just - they're standard, they're idealistic. It's like, let's just get governments and Big Tech to work more closely together. Cool but -

W: - Yeah. -

R: - That's a great statement, but the practical application of -

W: - How? -

R: - What does it mean? What do you actually do? If you were to do one project to get approved, what would you actually do here, right? Which then sort of leads to what you're saying about - there are four big things that we should probably tackle first amongst this long laundry list of other things - which I don't know whether this is in your thesis or otherwise but like I would go back almost like a consulting 101 approach of just "*okay, let's look at the value of solving this problem versus the complexity of solving this problem and just map out why these four are things that we should focus on in amongst all the other ones.*"

W: Okay.

R: But that being said, what is still a little bit lost - and again, it's just a comment, something to stay proactive on - have a line in your thesis of, like "*here's the next steps of where this work should go*". It's like "*these are big strategically important ideas, but what is the tactical execution plan? Its practical application of IGOs and Big Tech working together to solve a specific problem in a resource-poor country*".

W: Hmm. Exactly. And I guess my question with this is, do you have any thoughts in terms of balancing? Because this is macro / meta level research intended for use by IGOs and so it is pretty high level. When you talk about the practical applications of it, there's a degree of localization there. So, do you have any advice in terms of balancing, how to take such high-level recommendations without getting too stuck in the weeds of any practical applications at a local level?

R: Well, I think you've already started bringing that approach, right? And I don't - here's an example of literally my day-to-day where I'm trying to get people to come out of the weeds and take the 10,000 foot view - is my day-to-day right now. I'm focused on how to solve commercial pharma issues -

W: - Yeah. -

R: - a global level. But everybody I talk to is like "*well market access in Nigeria is a thousand times different than what it is in Canada, which is different than France, which is different in the U.K.*". And well, for our general medicine, commoditized products are very different from our specialty care products. Very different from our ecology products, different vaccine products, and my response to that is like -

W: - it is, but it's not.

R: Yes. I totally understand that there's probably a lot more bribery that happens in Nigeria than there is in Canada. But if you actually look at the steps - that in theory, you have to go through each one. They're much more common than you think. So let's stop looking at what makes everything you need and just look at the common issues and try and solve those.

Because if we can solve some of those common issues - I'm trying to think of an example here - just the information that is needed to be gathered to show - to provide the proof point to government officials on the value of the therapeutic product that we want to get access to their market. For you know, that doesn't change country to country like that information. But if you're doing that, thinking that it has to be custom every single time, then you're wasting a lot of resources trying to do that.

And so if we could solve - allow everybody else to focus on what makes it unique but by thinking that every single part of this process is unique, you're shooting yourself in the foot. You'll never move the needle on becoming more efficient as an organization.

W: Exactly. And that's what some of the research showed in terms of the value of more collaboration. Because although I chose dissimilar case studies - I intentionally tried to kind of say "*let's do a pretty obvious high resource, pretty obvious low resource and then let's do something with the dichotomous - really strong private health sector and a really weak public health sector*". There were a surprising amount of similarities and health challenges and digital health challenges as well with the three.

And so and when we look from a policy perspective, especially places like the EU - they've been so successful with many little markets coming together to have shared policy and actually doing pretty well in terms of preventing exploitation.

R: But that's exactly - yeah. So if you're talking about, how do we stop somebody from going into the weeds - like you've already done this. Your work is top-down. Here are the thematic elements.

W: Yeah.

R: Here's some of the strategy and you now have basically a prioritization framework to say "*here are big things that we should focus on now. In order to move the needle on this strategy, then it would be one of the next steps to recommend to - if you've got $100 to spend here -*

W: - Yeah. -

R: *- is where we should spend it because of this reason*". And now - I'm not saying that you need to have - one of the next step items would be "*let's go look at a very practical project that we can work on that addresses this issue and here are the things that we should look at to identify the project, not specific countries*". What are these common elements that exist amongst countries that we can actually say "*hey IGO and Google, we should partner on doing this because it's going to look good for you* - in providing - I don't know…telehealth access in Cameroon. And it's like you're already doing it in Canada. So no brainer or you're already doing it in the US, right?

W: Hmm. Because I will admit, I feel like right now, my thesis is defensible. I think that there's enough rationale as to why I did the project I did, where the data came from, etc. This is something that - these are current gaps that have been well documented and people should pay attention to that. But I do feel like that it is a bit weak in terms of the "so what" implementation of it. So maybe I do frame it as -

R: - But this is where, again your - I remember my pre-defense before my final defense. That was the one where I got hammered way more and so I did exactly what you're doing. I went back to the drawing board prepped way harder, made sure I had solid answers to all these things. But there's a point where it's like, my thesis is my thesis and I answered the research question that I set out to research. Now that has led to many other interesting research questions which - you know, now being an expert in this field of things, I should identify and

know and have a thought on where this goes next. But whether it's me or whether it's somebody else, it doesn't matter. That's science, right? It's just as long as you can, make the case that your thesis has answered your primary research topic and then you're identifying the fact that it has opened up many other doors and have a rational thought on it, then awesome. Good job. You've shown that you understood the work you did. You know it innately, you can answer anything about your specific research topic but you're also thinking bigger picture about where does this go to? What - how does this lead to -

W: Yeah, exactly. Because I do feel like, in terms of the research questions or from an academic perspective, I think "*I've dotted my i's and crossed my t's*" but I think if I just put a little bit, like, just go a little bit further, it could potentially be a pretty strong slam dunk.

R: Yeah. But I mean again, a 250 page thesis - adding another 50 pages is not going to do anything. But add you know, a couple pages on, as you said "so what" and practical application of this.

W: - Future research and things like that. But in terms of "so what", I think I could do a stronger job of linking like the recommendations here with the practical applications as you said.

R: I mean recognize there's been a long time since I divided my thesis and -

W: Well, there's -

R: - maybe I should have gone back and looked at it more. Yeah, it was like - if I can just think about my abstract, there was the research question. Can we develop this thing? We did successfully, but then there's "*where has this led to?*" and "*where does this open up to?*" And that's where I felt like I got hammered on, on my initial defense. And I'm about to get a bunch more reading and fundamental understanding. And then in my actual defense, I was able to preempt but then thoughtfully answer, any of these questions about - whether it be fundamental chemistry - that I'd done to show that I knew the topic inside and out. But that I was also thinking about where does this go - from a research perspective or application perspective?

W: Yeah, exactly. Okay, that makes sense. Because I think that, although the preliminary defense was probably the most stressful day of my life, I think I got through it as unscathed as somebody could. I still got pretty hammered on things, but some other people really got

torn apart with their whole methodology that they've been working on for seven years or whatever. Especially because this wasn't my original approach. And so, I'm well aware that there are flaws with this approach. I didn't choose this approach in the beginning for them.

R: Yeah. But, yes. I mean that's honestly in this area.

W: I guess.

R: What you set out to do - there's the reality of how it is done. And then there's the "*can I defend how things shifted?*" and then here is what I got from how things were actually done. Which judging by your abstract and then this closing framework, you set out with a fundamental research question. Your methodology may have changed, but as long as you can rationally explain the methodology that you did, then you've got the insights, you talk about what those insights mean in the context of what you were trying to do.

Basically, research questions - as you said, get into the "*so what?*". Some of these are extremely high-level which anybody can agree that these are the right things. Cool. What would really hammer this home?

W: So exactly. So essentially with that, at one point, I did put together an action priority matrix (like effort versus impact) with all the recommendations. And I plotted where I thought each [recommendation] would be based on my own understanding, secondary research, subject matter experts, etc. that I ended up moving into the appendix into one of my rounds of thematic analysis. Although I had concerns that it was too subjective and difficult to defend.

R: Yeah. That's a very academic thing to say and that's what I would have said in my first year in consulting and then had to relearn some of the academic theory that I learned. All of this stuff is subjective because you - it becomes an impossible exercise to quantify a lot of these things, right? But it doesn't mean that it's wrong. And so as long as you can explain - like look on the impact side. I can consider these three / four elements that are rated - each of them independently on a scale of one to four. And on the effort, I consider these five elements. One of issues like access technology or people skills, whatever. And as long as you can break it down and say "*challenge me on any one of these things*" and I can show you basically - I can tell you that, "*Canada has a much higher quality technology based on which you can deploy these things versus a resource poor country*".

W: Yeah, exactly.

R: That's the level of structure that they have, right?

W: Yeah, so as long as it's logical and systematic, then it should be fine. Normally I much prefer doing quantitative research for this reason. But because of the nature of the subject matter, qualitative is more appropriate. With that being said, often the case with qualitative is that you get lots of random criticisms. But I can say that these are significant gaps and themes that came up from a variety of sources over multiple rounds of analysis. And so these are notable things. Essentially I've applied some logical framework and although we don't know everything in this rapidly evolving space, we know enough to make more intelligent and strategic decisions at an IGO level than we are currently making.

R: 100%. And I mean, the next iteration of that is that it provides a basis of prioritizing because if nobody else has done that, if nobody else has provided a framework in which to look at, what is there to do next? Well then you have to start at the qualitative level and maybe that is the next step is - we've done this at a best guess level but we should go tackle some of these elements to see if it's quantifiable.

W: But if I have enough subject matter experts who read this and are like, yes, this makes sense to me. Nothing is nothing is jumping out of me as being terribly, horrendously wrong. Like then that's also valuable. So okay.

R: And that's where, like, Take that purely academic theory. Perfect theory had off and put on the - like again, put on your consulting hat and just like What is good enough to get something to move? Because that is like, You know. Big Tech, even the United Nations, they're not looking at the perfect research paper to show that like, you know, they're like "*the technology index of Cameroon is 2.1 and the technology Index of Canada is like 9 and therefore we should go and execute on this project*". It's like "*is there enough of a fit here? Is there a gap that exists? Okay, we should invest money*".

W: Okay. And frankly I think this is like a chronic issue in academia, this need for perfectionism and just being so heavily siloed or being so narrowly-focused. And one of my arguments in this is - that yes, there needs to be more collaboration from the private and public sector but academia is a great potential mediator for that because they have the skills that the public sector doesn't necessarily have. But essentially - so one thing that I was looking to do is an action priority matrix and then going through the recommendations and

essentially labeling things based on whether they're a cause or a symptom. So for instance, addressing something will you know - inequality prevention or health containment, health maximization, things like that. And then some are meant to solve actual problems and not just kind of you know, these are just chronic problems that you'll have every year. Do you think something like that would be valuable or is that over -

R: Again,something that you need to do is to defend your thesis. I don't know that - I would hope your supervisor provides that type of insight. This is where I mean - as you said circling the drain. It's like you could probably go around a hundred times and get a hundred different answers on: should I? Shouldn't I? My perspective is if there are no glaring gaps and you're just trying to solidify the arguments and pre answer some of the questions then I would just identify that these are opportunities and things that one could improve this work. Or secondary research questions that should be investigated further, which help improve upon this work. But it doesn't need to be you and it doesn't need to be now.

W: Exactly. And that's a really good point because you need - okay, great. This is a really interesting topic. Let's make this an actual project and let's throw some money at this. And let's add in some more use cases and I was like "*that's all well and good, but I need to move on with my life. I need to graduate. The borders of my thesis need to be this [signals]. I don't really care if you guys package it and do other things with it. But I'm out after these three case studies because I'm not in the business of making a five or seven year PhD out of something that was supposed to be four*".

R: Yeah, and that's totally fair. But again, I'll bring back to make sure you've properly put the box on what this work is and is not right, show how you went and filled that box. You've got the answers to what that box is. And then just lay the groundwork for what the next boxes could be coming out of this, right?

W: Yeah, okay. I think I'm currently doing it in a sloppy way. But it could be refined a little bit. But it's nice to hear that you are not surprised by anything in the closing framework. That there's nothing glaring that you're like "*what is that?*".

R: No, the last thing I want to say is they're all so high-level that it's - of course, you need to get Big Tech and government toward mobile together. But, you know, I think every single paper on the topic ever has probably said that right. And what's always missing for me is like, okay, give me a practical tactical example, or action that I could take from this.

W: Okay, I can definitely do that. That's really helpful.

R: So, yeah - and this is where I say this sort of practical application - this is one of the things why I didn't want to stay in academia. Throughout undergrad and grad school, you're taught by like 90% of professors who have only ever been in academia who are trying to say "*well, this is what they do in industry*", but it's like you have no idea. You have nothing to back that up with. You've worked in this applied science background for so long. So what does it actually mean? How does this actually translate into the real-world? And that's honestly why I wanted to go to consulting. To say "*okay, I've learned all this. People say it's important. What does it actually mean in the real-world?*". And that has been two very different things.

W: That's true. Even - what am I arguing in this research paper is that the way academia writes research papers is - it has too much unnecessary jargon and it's unnecessarily complex. It reduces the accessibility of our research and then it keeps it really siloed and sitting on a shelf somewhere as opposed to actually being used elsewhere. So we should be striving to use more readable understandable language for people outside of academia so that they can actually take these insights and use them like in places that matter because -

R: I feel like that would be opening a very large rabbit hole that - you'll get a lot of push back from. It's the same as "*why does lawyer jargon need to be complete gibberish to anybody but a lawyer? Or why do people in banking have to speak in a language that makes absolutely no sense?*" Because when you actually have somebody with any sort of knowledge break it down, it's like "*wow, it's super simple*". What a derivative product is, is extremely simple.

W: Exactly. And if a research paper is only meant to stay in academia or if it's only meant for academic discourse then you can [keep unnecessary jargon]. But for instance, when you're talking about AI, the locus of control is so far within industry not within academia. So it's foolish to exclude any audience members from industry from your report if you're going to be talking about something that's so heavily embedded in industry, not academia.

R: Which brings back to sort of one of the points I had. Practically, what does this mean? What is, a practical project that can be executed that tackles one, two, three issues that you've identified. Because you bring it to the real-world versus a bunch of academics being like "*yeah, you know, those are good questions. All right. Let's go to the next one*". Without anything actually being done.

W: That's a good point. Even if the first step is restructuring the approach in the writing of the AI ethics recommendations by these IGOs, no more of the same format. Look at it more from a strategic lens. In order to do that, follow these exercises ABC kind of thing, even if it's as high level as that then you're right. I think that would be helpful for them.

[Thank you and closing statements].

SME Interview Transcript #4 (Coded)

Date: June 23, 2023

Length: 120 minutes

Interviewer: Leslie Walker (denoted as W)

Interviewee: Redacted (denoted as K)

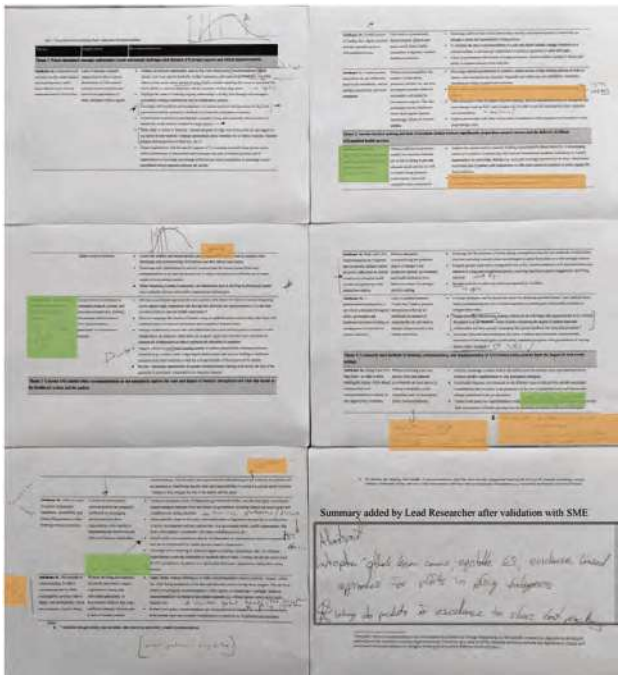


Figure 29. Visual Overview of the Written Feedback (Coded) - Interviewee K.

W: [Intro and welcome]

[Reference to the closing framework]

K: What you're talking about here is that there needs to be some type of discussion and framework first of all and then that leads to your point on white paper, green paper, legislation.

W: Yes.

K: [Reading] *In reference to subtheme 1a* I'd say national and regional governments…[Reading] IGOs?

W: Inter-governmental organizations.

K: What are you defining as an IGO?

W: The standard definition of an intergovernmental organization… so international bodies that aren't necessarily NGOs.

K: So multilateral?

W: Exactly. So the UN, World Health Organization, things of that nature.

K: That's been explained somewhere?

W: Yes, so for context my PhD is now 270 pages total so this is the closing framework in the conclusion to summarize all the key themes, subthemes and put a little bow on it. But the subject matter experts don't need to read the whole thing -

K: [Reading] For IGOs where private sector actors are out of scope, I would contest that statement. If you're looking at the aspect of - maybe it just needs a bit of clarity here. If you're looking at the landscape you're going to have multinational corporations large, medium, small, so I think what is the point here is large organizations know what they're doing depending on the sector and all the application of AI, they know what kind of tools they want to use and they know how to apply it. They actually work without the framework of government sometimes because they can't wait for the legislation so they just go ahead and do things. However, what you're talking about here is maybe micro, small, and medium enterprises which may be out of scope. But they may not be so aware of the framework conditions on the ground.

W: So my question for you is for Big Tech, for the Alphabets, - how do organizations like the UN manage or address the Alphabets, the Googles, the Facebooks. Because with artificial

intelligence, the entire locus of control of AI is with these companies. Yet when I look at IGO recommendations it's primarily directed to national governments. But the problem is that it creates a bit of a mismatch especially when you look at resource-poor countries. You have these little tiny guys going up against the behemoths like Alphabet and Facebook and Google.

K: I think the point here is it's more about accessing global knowledge columns and participating in global knowledge commons. So if you look at the lion's share of information it is those big companies and let's say economies that are strong and established. But in a developing country context it's about participating and contributing your own content.

W: Exactly. But then who regulates them?

K: Regulation has to be on the national level.

W: But then is it reasonable to expect low-income countries to realistically balance - when you look at the revenues of these large companies they dwarf that of resource-poor countries - even Canada a "resource-rich" country.

K: Totally.

W: So is it reasonable to expect that - if we want equitable access to things like digitally-enabled healthcare, is it reasonable to expect these small national governments to protect against exploitation?

K: I think there needs to be a framework regardless and applying that framework. And how well you can utilize that framework which varies from country to country. Frameworks have to be flexible given the state of play that technology is changing so quickly, frameworks need to be adaptable. There has to be a level of fluidity there. But the question is large corps are generally going to do their own thing anyway. They have their own rules of the game. Regardless of - these are transnational corporations that work without the remit of national governments of the sphere of influence because they are the technology providers.

W: Exactly. Just as we move forward in society the challenge gets more difficult to manage. With the scalability of these companies via the use of artificial intelligence, they have tools to potentially threaten principles of humanity such as democracy. It is now a different stratosphere in terms of global challenges. Therefore this requires a scope shift and different

ways of looking at these problems. As opposed to just "oh, here's some slap on the wrist" because of data issues or what not.

K: I think that's where development blocs come into it. If you're looking at regions like [Southern African Development Community (SADC)] for example in the African context or [Association of Southeast Asian Nations (ASEAN)]. When you have conglomerates of countries, if I can call it that yeah - groupings of countries. They have common strategies that align in how they want to deal with data, how they want to deal with information, how they want to deal with technology. Now that's let's say "macro-macro" level.

W: Exactly, and that was recommended in one of the later subthemes. I just…I think it will be interesting to see - or when looking at policy recommendations, when IGOs focus on national governments when so much of the control is in other places. Does that threaten the effectiveness of IGOs in meeting their objectives in a modern world?

K: I think you need to look at it in terms of a set of tools. The technology is not a be-all-end-all, it's a basket of tools and industry 4.0. The question is how do you apply it at the national level.

W: I agree with you when using the tools but in terms of managing risk with the tools it also needs to be -

K: - That's for example, do you participate - in looking at virtual reality, it's one of the tools of industry 4.0. Used in healthcare, used in telemedicine, etc. etc. etc. the question is are you participating by just buying something off the shelf from the Global North or do you actually want to develop content and solutions yourself. So it's about equitable skills. It's about framework conditions with IGOs on the ground. Let's say the innovation ecosystem needs to be robust enough but regardless, governments need enough awareness of what is happening, they need to have an understanding of where they want to go, what's their development trajectory. For example, if you're looking at development strategies of countries: the 2025, 2030 plan etc. it's usually a plan over a decade saying "this is what we want to achieve in the area of". In terms of policy, or in terms of framework, that's very much light objectives or quite not tangible objectives that are difficult to measure. But in any case you can't copy what's going on in one country and directly apply it to another. The framework conditions are very different.

W: I definitely agree.

K: So your policy needs to involve an element of what's going on with the technology provider, it's got to filter down to what your framework conditions are, let's say at the regional or bloc level and then how does that translate to the country level. Then within the country level how does that translate to regions or states. And that brings in the system of innovation ecosystem. Different bodies within a country are part of that dialogue.

W: One thing that I'm wondering is - experts are talking about how countries are becoming increasingly arbitrary. Physical borders are becoming less relevant as so much economic and technology activity happens virtually.

K: Who are managing? That's the question.

W: So my question is, these tech companies are quite large. That once they get too large they become "too big to fail" and they essentially become ungovernable. When they no longer exist within american borders, they are no longer just an american entity. They are a global entity, and who manages global entities -

K: - Markets.

W: - if not IGOs? It can't just be a market thing because then people can get hurt.

K: I can't give a relevant example because in relative terms things are quite new.

W: Exactly and I guess that's my point with this research. When we look at such a significant shift in power dynamics in the world and technology dynamics in the world, competitive advantages and what it means to be a country. When companies have more power politically, economically, technologically then countries should we adjust our definition of what an entity or country means? If IGOs continue to use historic frameworks, that creates a lot of problems moving forward because that misses a lot of the big picture going on financially and technologically.

K: What I think it ultimately comes down to is industry 4.0 and is data-driven. It all comes down to quality data. In very simplistic terms, I might be a bit off base there but what it all comes down to is "input in, input out" so it comes down to the quality data you have. Regardless of where you are from helps you provide the solutions related to AI. Look at the example of China. They have a completely different paradigm altogether. They say "we;re happy to have Google here in the country but these are the conditions". There are case examples but it ultimately comes down to how people regulate their data which is very

difficult. So cognisance is very important and understanding at the policy level so these global fora are important in that respect.

So multilats in that point, they provide a platform for knowledge and exchange. I'll give you the example of UNIDO and what happened before COVID. There's a lot of fear with industrial development organizations. People saying what are the negative impacts of industry 4.0, there is going to be job loss, etc. etc. But then COVID happened and those same people were saying "shoot, how do we conduct business". So it was a push towards digital transformation. So we were a platform as a neutral broker. You need to think about reskilling and futureproofing your business.

W: With Big Tech, one of the SMEs said "if you want to leverage digitally-enabled health services, or any other type of public good service, you need to leverage Big Tech. Otherwise you're dealing with sticks and mud and they have ChatGPT. The difference is just too huge".

K: But then you have to think about the leapfrogging effect. A reverse bell curve. If you have the gold medalist here, and then silver, bronze, and the laggards here, you still have to set framework conditions to help them move here. So what skills do I set for my workforce? In some countries, South Africa, India. India's a challenging one. Malaysia for example. You have this opportunity because you don't have so much of a lock in.

W: Well generally researchers say that depending on a variety of factors, such as whether they have a conducive business environment, basic levels of infrastructure, etc. that increases or decreases their likelihood of being able to take advantage of the leapfrogging effect. Some countries will, some countries won't. Those that can will do pretty well. In places like Canada and Austria, there are such strong pipelines and infrastructure. There's

K: - Conducive business environments. But in some countries like Austria, the ease of doing business is quite difficult. The set up costs for a company are massive.

W: Exactly and when you look at digital disruptions in these contexts it's not easy because these processes are so embedded. That arguably, lower infrastructure countries have an ability to take advantage and leverage this other than these countries that are so grounded in their current practices.

K: Yes, I agree. [Reading]. Within the point on the multilateral perspective, it's about partnerships. Nobody can have all the skills in one house. It's about agility, flexibility, and

modularity from the application side. It's not about locking yourself into something but rather thinking "what do I need to do to protect myself from the internal, external shocks of the landscape". If you're looking at it in terms of a system of innovation being a complex, dynamic system. It's in flux. So you need to adjust your policy matrix to this and technology is one big component of that.

W: Completely agree. That was referenced in another one of the following subthemes. Better leveraging the relationships between private sector, public sector, and academia and being more honest about what each does well and what each doesn't do so well.

K: I think that's quite difficult (encourage self-regulation through transparency…). Because what you see on the market is the tip of the iceberg. In biotech and what drugs are on the market, the amount of R&D that has been done for other things is so much more. So I think that's quite difficult. How do you do that? I think one thing you can do is awareness building. People need to be aware of what it means to use Instagram.

W: Two-related points to that. One is having open and transparent forums and dialogues in terms of what is involved in specific algorithms and having those be open to feedback and scrutiny. Things like that can be helpful.

K: I think what could help you here is talking to a tech developer. When you're talking about code and algorithms, I can't speak to that. There was a case in South Africa where Microsoft tried to sue a PhD. It came down to code usage. It's like suing someone for using the English language.

[Reading]. Why only for large players? I think what you need to do here is also - especially when looking at developing countries - when you look at the bulk of it. The bulk are micro, small, medium in terms of number.

W: Yes, in terms of number but in terms of impact not even close.

K: I agree. I'm coming from the point of global knowledge commons and it should be across the board.

W: Hm I agree it should be across the board.

K: Look at the tools we're dealing with here. Social media platforms. This offers business opportunities to people in developing countries. Everyone's got a phone but not everyone's got a laptop.

W: The main thing is how do we get especially low-resource contexts to have these opportunities without bearing the risk. There's a lot of talk about data exploitation being the next frontier of exploitation in Africa. Or similar to colonialism and interactions with Indigenous groups. Where they sold huge pieces of land for essentially coloured beads and that's what's happening now. People are trading something highly valuable, their personal data to be able to look at cat memes.

K: Exactly. But who's cognisant of that?

W: Yeah that's my point. There are few people that have this ultra high-level view other than IGOs. Because this is not just a Cameroon problem, it's a global problem. And as we're seeing more global problems, climate change, AI, and whatnot, I think there's an opportunity for IGOs.

K: What I would suggest for you, beyond the scope of this interview, I'll put you in touch with Rasigan Maharajh. [Redacted]. A veteran on AI policy and Big Tech.

But when you look at this, can you separate AI out?

W: Not necessarily. This is more based on the scope of my research is why I'm specially calling it out. But the main idea is when you look at broad AI policy it's very vague and difficult to action on. We're seeing a rise in ethics washing and novelty ethics projects where companies want to give the impression of high AI standards but they're not actually meeting that. But when we look at the locus of control, they are driven by different motivators than national governments and you need to include that when you address them within policy or in broader industry conversations.

K: What you're talking about here, this is not something that only affects tech companies.

W: It's funny you say that because although I looked at ANI in healthcare, most of the research observations transcend this scope and to your point could be extended well beyond AI.

K: [Reading] At the national level? Or super national level?

W: What do you think? I was thinking the super national level.

K: In essence the UN should provide something like that, we have guidelines, we have SDGs. The question is how much autonomy do you have to actually do that. You're at the behest of donor funds and national strategies. Our work is about leveling the playing field to a certain extent. Although that's very difficult because with any organization you have interest levels. It's quite utopian in thought. Because it's ultimately competitive for the protection of the state.

W: Which is true, but another point that I bring up is that ethical AI is the only type of sustainable AI. If we can't have at least some baseline level then the whole system won't work because people won't be able to participate in it or profit off of it. I understand there's a bit of a prisoner's dilemma as companies or countries want the industry to be sustainable and have trust but there's a motivation for individual companies or countries to -

K: - if you speak only to the share point -

W: Is that not the tail wagging the dog? Let's look at other industries, such as food. If we look at a head of lettuce there is regulation from start to finish on how that lettuce is produced, who farms it, what chemicals can go on it, what lettuce you can grow in what region, how you sell it and so on. Whereas AI and technology -

K: - But that transcends borders.

W: A lot of food production transcends borders as well. With technology policy, the vast majority, 99.9%, focuses on post-development. But pretty well in every other industry there's regulations for pre-development.

K: This is exactly what I'm saying. With a physical asset like lettuce you're talking about dirt, with AI you're talking about snippets of code.

W: But that makes no difference. You can't exploit shared resources to make lettuce in any way you want and you shouldn't be able to exploit shared resources to make tech whatever way you want for the share price.

K: How would you go about doing that?

W: In the same way you do in other industries.

K: I think the only time you're going to see that happening is in a crisis.

W: But I would like to think as international policy makers we're smarter than that.

K: I would assume so as well. But these companies transcend governments. But governments have become the new clients.

W: There's two ways to look at it. One the government is a client of these tech companies. But at the macro-level there is a shift in how companies and governments are interacting. Tech companies are becoming the new funders and governments are becoming the regulators and mediators.

K: If you ultimately go down to the end user. Let's talk about buying green. 5-10 years ago there was thought that companies should be held more accountable because the end user said this is not acceptable to us. So does it come from the level of government or should they inform it?

W: Systems theory would say it's a combination of both. In the beginning it starts more top down and then it goes more bottom up.

K: [Reading] That's exactly what we just talked about. Skewed sources of funding.

W: Yes.

K: This is the digital divide we're talking about. Yes, I agree with that. [Reading]

In Japan, businesses themselves are embellishing themselves with logos, SDGs, SDGs they're really working towards that as a framework.

W: See I feel like there is so much room for gamification with SDGs, making it fun, social, and competitive. You're so much more likely to get engagement from the end user but right now it's so bureaucratic and stuffy.

K: That stuff exists, like a global hackathon. If you have a development problem and coming together to solve it. It exists but giving it leverage and a platform.

W: Exactly.

K: [Reading]. What do you mean focus on performance-informed budgeting?

W: Essentially busying yourself is not the same as being busy. A lot of projects in a lot of organizations beyond just IGOs aren't terribly productive. They don't have high value-add sustainable outcomes. Which is a problem when you consider the opportunity costs. The resources could be much better spent on other projects with more compelling outcomes.

K: If we're talking about reskills and agility as civil servants and bureaucrats, we ourselves need to be aware of the skills of tomorrow.

W: I completely agree.

K: You see it in pockets. I think you'll see that more in specialized organizations than secretariat organizations.

W: This was a big part of my job as a consultant, going to public sector groups and plotting effort versus impact and it was transformative in a lot of cases.

K: Then the issue is funding. If you're a multilat you're at the behest of your donor groups or the priorities for donors. There's a trade off here. National priorities versus the funding priorities.

[Redacted].

W: Flexibility and use of data. With more research and data you can better understand ROI. I think donors are becoming more receptive to that and are holding charities increasingly accountable. How much of my donation goes to marketing, how much goes to admin and they're holding these organizations to a much higher standard.

K: But then bring that into the context of who's funding. For example you have countries funding and ultimately it comes down to where they can have their footprint in the world. Donors have a strategic priority in terms of country and also strategic prevention. But then what about the foundations, where does that fall into spec? I think ultimately that comes down to access to markets.

[Reading] In a lot of places - take Austria for instance. The resources required to start up a company are huge. A PhD or Masters student can't afford the upfront costs.

W: Exactly. And the point with this is you want to encourage local competition and incubate the local talent more.

K: I'll give you a realistic example in the automotive industry in South Africa. Where you have people who are working with startups in an incubator center but you can't kick them out of the incubator center once they've reached that point of stability. And it gets political because the framework conditions are so difficult. Oftentimes it's a lot of businesses who are like "I'm not going to leave this hub because I've got free rent and what am I going to do outside?".

W: I guess my challenge to that would be that it's political anyways. And so one could make the argument from an AI ethics perspective it is better to incubate these players.

K: Yes but even at the level of incubation there needs to be certain criteria.

W: Agreed.

K: Okay now this is an interesting one (allowing greater access to government officials). I'll give you the example of India. Now this goes beyond health technology. You have such a great turnover within ministries that how informed are people within government sometimes?

W: Sometimes not.

K: There are some pockets that exist. With India, it's a subcontinent so one state could be a European country. So one has to look at size and resources there. So when you say you want to champion something on the national level, there are certain states that - with how they are engaged that might not work for other states.

W: Makes sense. Where this recommendation came from is startup founders in Cameroon said that the large corporations get by far greater access to government officials so it creates a really unfair -

K: - Of course they do.

W: Yes. So the said that makes it really hard to start up in this context, hard to develop knowledge, hard to develop enterprise -

K: But then I'll throw another thing in here. Ultimately I think they shouldnt have access to government officials. What I'm talking about here is there - the machine behind it to back it up. If the framework conditions were equitable.

W: That's a fair point because it it does vary depending on the context so I will say more consistent access to governments -

K: - I would rather say, rather than access to officials. I'll give the example of India again. 57 languages and nearly 250 dialects across the country. Now if you have a policy in terms of where you can access funds. It's such a maze on where you can access - it's too much work for me.

W: That was another one of the feedback ones - that this system favors big players because the smaller players are resource starved.

K: This is where the triple helix model is very important. Universities need to be informed, the knowledge base needs to be informed. Institutions supporting technical change and industry associations, they need to be key and complicit in that. So they know the needs of their membership organization and they're the ones who can say "hey this is not conducive for this". Governments should be involved in the framework conditions but not the nitty gritty because things change.

W: Makes sense, yes I'll change the wording on that one.

K: [Reading] Makes sense. The industry associations should be saying these are the rules and regulations important to you. They should be the filter bodies. Companies should be worried about conducting business. [Reading].

W: So this one is somewhat related to the example you previously mentioned on Japan and the SDGs. Although a lot of organizations can't offer money, the brand associated with the UN is huge and it can provide a tremendous amount of clout. With low-resource locations they often say "we don't have money".

K: We do that. We have programs where we reach out to a thousand startups or SMEs.

W: Do people apply for that or do you seek them out?

K: Both. Mixture of both.

W: Interesting.

K: UNIDO has programs that do this.

W: Why aren't they scaled more? Similar to when you -

K: Resources and there needs to be a willingness as well. Some people will just go through a program because there's a free lunch at the end. Going back to the normal distribution you can't hit everyone. There are problems that exist. There are a lot of platforms for championing. Africa is a continent of storytellers, Asia is a continent of storytellers. So they'll say "so and so went in on this program to incubate and so on" so it's articulating that external knowledge.

One thing you've got to be very clear here. You are saying startups here. I'm quite dubious when it comes to the informal sector and innovation. Because innovation is when you get ideation to market. It's not about someone banging a stick with a drum and saying I invented something new. [Redacted]. I think it's a buzzword. Formalize that knowledge. Give people a framework they can bring to market. Give him or her resources to do that.

[Reading]. Explore partnerships with other industries. Yes, I agree with that. Especially when we're talking about industry 4.0. It is transdisciplinary, it's no longer silo.

But I think one thing you need to add here is that point on flexibility. It's really about being agile in your policy.

W: Exactly. One of the following subpoints speaks to that.

K: This is cross-cutting. Policy can't be rigid. The Global North can't compete with China. Why? Because they do things by fiat. It's clear. If they say "this is the decision we make" then that's what they do. That's not without its challenges. A quick overhaul of systems. I'm not putting a value judgment on what's good and bad. But the process - white paper, green paper, legislation based on data is 4-5 years. But in 5 years technology can completely change.

I wouldn't even just say across sectors but also across different areas of government. When it says "innovation is the privy of ministry x". No it's not, innovation is all of the government's approach. You're talking about the ministry of finance, ministry of industry, ministry of development, ministry of education, ministry of science and technology. It's very rare that you see policy documents within a country that refer to each other's policies. It's not a point of overlap. You'll have multiple themes of things going on. It's about communication.

W: In Canada there is little to no communication between different sectors of government.

K: U.K. I mean a lot of countries. This is just a general observation. Even in ministries where

they're wearing several hats makes it difficult.

W: Exactly and when we look at human resourcing constraints especially in low-resource contexts we say "there needs to be more knowledge sharing, there needs to be more upskilling" and the exact words I use is "this is difficult as they often have to wear many hats".

K: This relates to technology as well. With technology being the solution and also the issue within the context of what you're writing. This is something that's important to take into consideration. Certain platforms allow for improved communication and -

W: - Exactly. This essentially creates a paradox where these technologies can help them scale, be more efficient with resources etc. but in order to do implement these you need more resources in order to do this properly- so that there's sufficient adoption, you're implementing the right technology and not just "technology for technology's sake". The problem is a lot of low-resource locations are just trying to stay above water.

K: I think the thing you're missing through the whole aspect is colonial residues. It's something you need to reflect on. Some of the institutions in place - in India for example. There's the remnants of 200 hundred years of…what was.

W: Yes, even when I talk about the value of local competition is there is a big of a colonial implication with a lot of these countries who have already been impacted by colonialism are then buying solutions developed in the West and that's where their data goes -

K: I'm not even talking about that. Look at the level of the institution itself. Look at the mechanisms within an institution. How a folder gets based from desk to desk. If we're talking about agile, that is relevant now but then you've got job creation for a government. When they shed those individuals where do they go? So you're talking about agile, HR, reskilling, flexibility. It's very difficult.

[Reading]. Yeah I agree. Talent it's about having mentors and champions.

W: Is there anything thus far where you're like "no this doesn't make sense".

K: I think what you need to look at is metrics that do exist. Science and technology indicators. You need to look at these because there is a lot of data being collected even in the policy process and every policy process is a bit different.

W: Hmmm.

K: So I think you need to put a footnote somewhere.

W: Sure. The challenge with this is because it is so macro you -

K: You can't have a one cap fits all -

W: You can't.

K: So I think you need to put a caveat there.

W: Exactly. So I spoke to how this research came to be through choosing dissimilar case studies. Each of these themes and subthemes were present in each of the case studies to varying degrees. Generally, the more low-resource a context was, the more it was observed to be impacted by the themes. That's not saying it happened everywhere. But for instance, some remote populations in Canada showed similarities to low-resource groups in Cameroon, arguably more so than they did to folks in Toronto. And so, if we were to look at this problem from 30,000 feet that would be the perspective. This is in no way a localized example. This is a foundational starting point to then take somewhere and get a localized view.

K: I think this point here: "technologically advanced countries need to…" Yes. But I think you need to give a platform for local champions as well. Think about the framework conditions. Even when they're poor but it's a good solution it's snapped up and taken to the Global North. Because that is reasserting that things only happen in the North -

W: Good point that should be reworded. The only reason "wealthy" is in there is when we look at what ANI projects have been applied, they are primarily in wealthy contexts because they have the resource for experimentation and early innovation to implement these things.

K: One thing to address here is: where are the technical specialists coming from? Look at Elon Musk, regardless of whether you like him or not, where does he come from?

W: A wealthy South -

K: Regardless. He's coming from the continent.

W: But there's also a lot of wealth in South Africa. It's the most unequal country in the world for that reason.

K: It's pocketed. There's challenges there but what I'm talking about is the Brain Drain, it's being pulled to the Global North because of framework conditions are not correct or conducive rather.

W: Exactly, which is why the Brain Drain is referenced -

K: What I would rather say is lock in to the national identity of champions within those countries. Now whether that works for organizations such as Google, I think they can have a big championing role within the knowledge landscape.

[Reading]. Yes, completely. Completely clear. And I think what is important here is this aspect of failure not being failure, it's about lessons learned.

W: Precisely and that's why I mentioned leveraging skills from other sectors because in the private sector "fail fast" is very common. It's aspirational because it means you're being efficient with resources and you're being adaptable.

K: The example that I give here is about Yozma in Israel. If you were to ask someone 15 years ago about the type of job they want, they want a government job because it comes down to funding and assessing risk. They brought in the Yozma program which is a venture capital program and they said "hold on, risk is not failure. It's a point of learning" and now you see how many startups are coming out of Israel.

W: Yes, it's a shift in thinking. Whereas I understand why governments or some of these other organizations -

K: - I think agile is also important here. [Reading] The plug-in play principle - it's about modularity?

W: Yes, but more so about taking localized knowledge and combining that with lessons learned from early implementations and -

K: - But you need to do that at the level of primary school children.

W: I agree.

K: It's got to be brought down really to the grassroots level. If I look at China and kids in kindergarten, they're playing with microprocessors. It becomes a currency of knowledge. It's no longer building blocks of red and blue and green. It's this confidence level that's built up

from a young age saying “hey, these are the future skills”. So that within one generation it’s common currency. Then you’re competing at another level altogether.

[Reading] What do you mean about cross-sectional? Sectiorial maybe?

W: Broader. International, across sectors, across specializations / skill sets.

K: I think you can crystallize that down to the triple helix approach. And how I would articulate that is within a system of actors, one might not know their role and responsibility within the system but not only that, the roles and responsibilities of their counterpart. Are you collaborative or competitive, that’s the question? [Reading] Yes, that’s right.

[This portion of the interview drifted more broadly around AI’s role in society and the interaction between academia, private, and the public sector. It has been omitted in favor of more relevant content as it was inconsequential to the closing framework. For those who are interested, please email leslie.walker@student.tuwien.ac.at for a full copy of the transcript and / or the raw audio file].

K: [Reading]. I think this comes down to understanding the actual social conditions on the ground or is it something being driven by the Global North vis a vis local framework conditions. However, that changed. I’m talking about healthcare in general when looking at Corona and the impact Corona had - I mean using drones to deliver medical goods, yeah.

W: Yeah. That example came from Canada where a healthcare company in Canada spent a significant amount of money to digitize parking services but towards the end of the project they got patient feedback that said they would have preferred remote health services or non-traditional services hours, all of which technology can help provide. So it represents a mismatch between money spent and patient outcomes. There were a variety of examples of when resources weren’t aligned to patient outcomes. But when resources are more scarce, you need to be even more efficient with resources.

K: I think what also comes in here is the time for the provision of a technology solution. If there is certain legislation in place, are you meeting that? Technology is changing so quickly you need to adapt quite quickly. Are you missing the boat with the solution you’re providing now but in three months, is there a new technology that’s coming out that would make things more efficient.

W: Exactly.

K: I wouldn't say rather broaden policies, but I would say keep policies more flexible.

W: Hmm.

K: [Reading]. So whose expectations are you talking about?

W: Expectations regarding projects and project failures, the problems that digital health can solve and the problems that it can't and also the messiness associated with digital transformations. The reality is even now, the vast majority of digital transformations fail to achieve the objectives they set out to -

K: - In which countries are you talking about now?

W: All. Even in the U.S. you know the holy grail of digital implementation. It's something like 83% of digital transformations fail. So when you look at something like digital health for example, because AI is so new -

K: So this is something where you've got to have an example. Have you got an example of where things have worked really well? I keep coming back to this point of global knowledge commons. How we share and access information and data. Best practices on how things can be done. Why reinvent the wheel? Partner with someone in Japan because they can help us do something - so it's widening the reach there. It's about that information and data and having accessibility.

[Reading]. I mean this kind of makes me laugh a bit. Not about your work but about the failures of the U.K. post-brexit. They'd rather point the finger rather than saying our [subpar] regulations, but they can't do that.

W: Exactly. So when I look at the timeline - or when I say the healthcare industry will go through tremendous transformation in the next 30 to 40 years.

K: I wouldn't even say that, I'd say the next 5 years.

W: 10 years, sure. So with that we need to look at how we approach politics, how we approach decision making, how we approach failure and things like that.

K: Who are the healthcare champions in the African context? Or let's say the pan-African context. If you're looking at these people who want to champion things, you're not talking about - think are there African champions who could be helping?

[Reading]. "A patient-centered perspective is not wholly embedded within policy, governance…" I think it is.

W: Do you?

K: There is this cognisance that - there's an aspect of we know that most of our populous are not in urban centers so what kind of solutions are being provided? And there is a cognisance of it -

W: - I agree there is a cognisance. But is it embedded into regular day-to-day procedures and decision making? I would argue that it's not.

K: That's where you've got to separate it out. Policy, governance, and healthcare processes - that's very different levels of interaction.

W: …But do you believe it's fully embedded in any of them?

K: No, but there's a cognisance.

W: I agree that there's cognisance but is cognisance sufficient?

K: …No it's not. But then it comes down to resources.

W: It's not about why it's not like that. My point is about that it harms the patient if it's not like this.

K: Okay, when you're looking at countries in Africa and Asia. Accessibility. If you're looking at someone cutting down Maize in a field and you have to walk for half a day to get to your local medical center because you've got [Tuberculosis (TB)] and the point of incubation of TB using microscopy is basically a month. By that time you've gone, traveling across - using whatever forms of transport and you've gone back to wait for your result and you could have infected however many people.

W: But to me this is why there are such tremendous opportunities for these type of technologies -

K: I think what comes across here is it comes far on the side of the negative but there are lots of opportunities for blah blah blah for example…

W: I mean my whole thesis is that although emerging technologies such as AI have contributed many positive benefits, they have been disproportionately in high-resource contexts.

K: Especially when you're looking at African policy makers in developing contexts, they'll say "we know this". I think the point here is - and this is something we get hammered a lot is "do you actually understand the framework?" Yes we do, that's why it's a solution, that's why it's an opportunity. In the case of South Africa and the digital divide and the cost of - look at the cost - the demand for AI, [virtual reality]. To take advantage of these opportunities, it's a little bit more palatable. So someone can say "ah you're providing me a solution here, not just a criticism".

W: Yes.

K: You're making an assumption here that everyone has equal access.

W: Am I?

K: Yeah [reading] "whereby the patient is at the forefront". One would assume that the patient is always at the forefront.

W: In the data that I looked at the patient is rarely at the forefront of regular day-to-day decision making. Often, the vast majority of healthcare-based decisions are based on ad hoc processes -

K: - What I would do there then is "decision making and related processes".

W: Many health processes are based on historic or ad hoc processes that are not necessarily patient-focused.

K: [Reading] "human rights standards" this is very contentious. When looking at South Africa, I've got a very different viewpoint when it comes to the role of China in Africa and the whole aspect of Russia and the war in Ukraine and the guy said "look, Putin is a dickhead but the population of Russia supported us during Apartheid. Oh China for example don't meddle in the day-to-day of what's going on".

W: I agree with the political part. But when I talk about human rights standards it's based on standards set by the WHO -

K: Then say that. Be specific on SDGs so it's not critical to the country itself because that might not be palatable to a policy maker.

W: Sure. But also is it my job to be palatable to policy makers?

K: Ultimately, I'm bringing you to something here so you can work with this in the long run. Maybe you don't see it here, but I see the utility in something like this.

W: I see the utility in it, that's why I wrote it. From the private and public sector.

K: Both. Governments got to be a part of it.

W: I mean right now the private sector has done a lot of things the public sector hasn't signed off on.

K: It's critical here but you need to be explicit here. Purely form a diplomatic standpoint, that would burn a project.

W: Sure.

K: [Reading] What do you mean by "commonly-used methods of ideation, communication…"

W: Based on secondary research and feedback within those industries.

K: So why not be explicit and say "based on primary and secondary research…"

W: Mainly just semantics because the preamble for this framework is "this is based off off…"

K: So it's explained?

W: Yes.

K: Think of me as a policy maker.

W: If I were a policy maker, I would cut it in half, focus on certain recommendations, etc.

K: [Reading] "Eating your own dog food". You were really tired at the time of writing this.

W: No, "eating your own dog food" is a commonly-used phrase in the private sector. It is an equivalent type of verbiage to something like "fail fast".

K: I think the term is having a dog and barking yourself.

W: No, “eating your own dog food” is using your own product so that the employees are your first test point, your first layer of user feedback.

K: Because if that comes to the minister in West Africa which is a big Islamic population -

W: I mean that is not who this is meant for.

K: I think you can soften this.

W: It is a pretty commonly-used phrase.

K: It’s the first time I’m hearing it.

W: I have a footnote in the main body.

K: [Reading]. I think the difficulty here is you’re coming from a private sector perspective but this research is trying to bridge the private sector and public sector so add more of the public sector terminology in there.

W: That’s fair. With UN AI ethics recommendations the UN has acknowledged that the recommendations are high-level, simplistic, cannibalistic. The problem is this can’t be a feel good exercise - that’s not reality.

K: What about realistic directions of policy expectations? That’s a bit softer. Based on empirics or based on - anchored in local contexts. Because that links to what you were saying before. Have an understanding of the environment, have an understanding of the organizational perspective. Don’t say something pie in the sky. We have limitations in our hospitals there that’s what we’re doing. We have a macro-goal but that’s not attainable right now. However, these are the steps we’re going to work towards. One thing that hasn’t come out here is the utilization of roadmaps. Structured evidence based roadmaps.

W: AI ethics recommendations are around 80 points of idealistic recommendations. The problem is -

K: - You get lost in that.

W: Exactly. Low-resource contexts - when you have a laundry list, it’s more conducive to resource-rich environments because they can say “oh that’s a good one, that’s a good one”. But resource-poor contexts are like what can I do with that?

K: This is often what happens. They come with a wishlist saying "I want this, I want this". But in reality are you able to apply that.

W: Exactly. Because we have enough knowledge and research for IGOs -

K: - The term here is policy sandbox.

W: - Mhmm. If you can only do four things, what should they be? If you have one dollar where should it go? These are common exercises in the private sector and they need to be embedded in the IGO space.

K: [Reading] What I'm adding in here is "structured evidence-based roadmaps" which links to the point on policy sandbox which can vary state by state but is enabled through the creation of champions. It works here, yeah you want to do it.

[Reading]. Yeah okay, I agree with that. And this is something you came to in your previous point and this kind of links in with that. Ministries need to speak to each other. The Ministry of Health needs to talk to the Ministry of Industry saying are you bringing in standards and norms into the workforce that align with to make better practices. Are you talking to the Minister of Finance to see if we can feed in things here. Are you talking to the Minister of Innovation to see, saying what kind of things are you developing in the health sector that could be cross cutting that could help us in making evidence-based yeah.

[Reading]. And you want to say risk appetite as well. I'm going to put a couple of buzzwords here you might want to reflect on. The first is "organizational rigidities". When people say "it's always been done this way we don't have to change". How do you change that to have feedback mechanisms and loops?

[Reading]. Yeah. And what I would also say here is to have common platforms for discussion. It's an easy thing they can do. I'll give you an example here IST in Africa. It's a conference and they're talking about tech and innovation. Healthcare is one of the sectors they're talking about. And it's across Africa. So this can inform what policy makers who are coming in - don't just bring in someone who has no bloody idea, bring in somebody who can actually enact change.

[Reading]. "Include policy recommendations that are not dependent on widespread…". What does that mean?

W: Essentially in countries where there is either increased corruption or not a conducive environment there are still ways to support ethical practices. You essentially have to use strategies that circumvent those [bad actors].

K: What you're talking about here is - your three countries were?

W: South Africa, Cameroon, and Canada.

K: Oh Canada. They've got a tribal community as well. Now they've got their own rules of law. How do you work with the local community? You empower the local head of a chief - chief of elders to orient decisions coming from central governments. This is what you're talking about here. So you're using traditional community bodies as advocates. And you can give examples here. Grassroots you know. Women empowerment. You empower them, it filters down. In a lot of countries, South Africa is not the case, but in a lot of countries it's matriarchal.

W: Yes

K: [Reading]. I think we've talked about this. I think a simple way of putting this is to lead by example. A neighboring tribe can be an example. You're not the focal point. The government isn't the focal point. You're using grassroots organizations as the -

W: - Spotlight. Yeah.

K: I think what needs to come here is to monitor global trends for future adjustment of policy and dialogue. What you're saying now is that going to be relevant in 6 months to a year. You know what I mean?

W: And that was part of what I meant by expectations management from before. Digital transformations are messy. Even with the Googles of the world. There's a lot of failures, there's a lot of messiness. So how do we incubate the end patient from harm? How do we create safe spaces for experimentation? And providing stamina for continued change. How do we reduced people losing faith in leaders -

K: - But that's one point that comes from global knowledge sharing. Global knowledge commons.

W: [Thank you and closing statements].