

University of New England

Reproductive, Maternal, Newborn and Child Health in the Sustainable Development Era:

A Conceptual Framework for Integrated Innovation

By

Mona Haimour

A capstone submitted to the College of Graduate & Professional Studies in partial fulfillment of
the requirements for the degree of

Master of Public Health

College of Graduate and Professional Studies

©Mona Haimour
Spring 2016

DEDICATION

I dedicate this capstone to the loving memory of my parents; especially my mom who was a strong and a gentle soul, a social entrepreneur, and an advocate for girls' education and gender equality

Thanks for making me who I am today

You will always be remembered!

ACKNOWLEDGEMENTS

I would like to express my deepest appreciation to my capstone supervisor, Professor Nang Tin Maung, who has been a great mentor and a constant source of guidance and inspiration. She continuously conveyed a spirit of encouragement and excitement in my work.

Besides my advisor, I would like to sincerely thank Professor Randy Schwartz, Professor John Gale, and Professor David Line Denali whose teaching and expertise were very beneficial in my completion of this capstone. I learned from their insight a lot. Thank you for being a part of my success.

I would also like to thank my friends at work: Yvonne Shelast, Sharon Johnston, Irene Coulson, Keri-Ann Berga and Kate Bowman. They were always supporting me and encouraging me with their best wishes.

Finally, I must express my profound gratitude to my family: my husband, Nash, and my daughters Salma and Sarah for their continued support and encouragement. They helped me keep things in perspective and focus on what excites me. This accomplishment would not have been possible without them. Thank you!

Table of Contents

Abstract	5
Introduction	6
Background and Rationale	8
Current Efforts	13
Strengths	15
Limitations.....	16
Objectives.....	19
Methodology	19
Sorting/coding data.....	19
Retrieving and summarizing text.....	20
Displaying data.....	20
Drawing and verifying conclusions.....	20
The Conceptual Framework for Integrated Innovation (CFII)	21
The CFII Phases.....	21
The Ecosystem.....	21
The Assessment and Analysis Phase.....	22
The Planning and Implementation Phase.....	24
The Outcomes and Impacts Phase.....	26
The Evaluation Phase.....	27
The Underlying Assumptions of the Conceptual Framework for Integrated Innovation.....	27
Discussion, Limitations and Implications for Practice.....	28
Conclusion.....	31

Abstract

Despite the fact that major developments have been made in the area of reproductive, maternal, newborn, and child health (RMNCH) at global level; new global health goals and targets have to be achieved by 2030. In this context, however, the complexity and ever evolving risk factors, determinants, policies and challenges demand the need for new, innovative, transformative, and sustainable solutions. The purpose of this capstone is to propose a conceptual framework for integrated innovation (scientific/technological, social and business), focusing on creating a context for systemic and sustainable change. A qualitative, general inductive approach was adopted. Data was originated from credible resources including publications from global health organizations, peer-reviewed articles, reports, and theories. Themes generated from the analysis were: 1) Enabling and predisposing factors; 2) Guiding principles and means of implementation; 3) Outcomes; and 4) Impacts. These themes were tied into phases that operate in a dynamic system that promotes interaction among all phases, and are embedded within a larger ecosystem: ecological and social determinants of health. To ensure quality improvement and enhance performance, phases are guided by ongoing evaluation. The link between future investment in integrated innovations and achieving targets related to RMNCH in the sustainable development era is important. Findings from this capstone could be used to help innovators of and investors in RMNCH innovations to adopt a systematic approach to guide their future work; aiming to accelerate the scalability and diffusion of the innovations and enabling them to reach the most in dire needs markets and populations.

Introduction

Historically, and over the past decades, the area of reproductive, maternal, newborn and child health (RMNCH) has been recognized as a priority at the global and national levels. This recognition has been rooted in the human rights treaties and worldwide resolutions and agreements that have advocated for fostering women's and children's health and social rights.^{1,2,3,4} Among these are the International Covenant on Economic, Social and Cultural Rights, the Convention on the Elimination of All Forms of Discrimination against Women, and the Convention on the Rights of the Child.¹ However, to turn these rights and countries' commitments into action, global and national efforts have been directed towards investment in research and health innovations, aiming to achieve the United Nations Millennium Development Goals (MDGs) for the period of 2000-2015, particularly MDGs 4 (reduce child mortality by two-thirds by 2015), and 5 (reduce maternal mortality ratio by 75% by 2015).¹⁻⁷

At present, data shows that the global innovation pipeline holds more than 1000 RMNCH innovations (with US\$ 25 million already invested) that are supported by multi-sectors partners including global health organizations, governments of developed and developing countries, non-governmental organizations, private businesses and universities.^{2,3} Evidence shows that whether driven by scientific/technological, social or business models, health innovations have not only saved lives, but also prevented disabilities and improved the quality of life of marginalized populations. This has been evident in reduced maternal, newborn and child morbidity and mortality rates, increased availability and accessibility to antenatal and newborn care and reproductive health services.¹⁻⁷ Health innovations have also combated infectious diseases and proposed preventive solutions to non-communicable diseases.¹⁻⁷

According to Everett Rogers, innovation is “an idea, object, or practice that is thought to be new by an individual, organization, or community.” However, for an innovation to be meaningful, enabling change and dissemination, it has to demonstrate defining qualities as perceived by the targeted audience of the social system which will eventually determine its rate of adoption.^{8,9} These defining qualities are:⁵ *relative advantage* (Is the innovation better than the one it supersedes by users?); *compatibility* (Is the innovation consistent with the cultural and social system context of the intended audience?); *complexity* (Is the innovation easy to use and implement or does it require learning new skills?); *trialability* (Can the innovation be experimented with before making a decision to adopt?); and *observability* (Are the results of the innovation visible and easily measurable?).^{8,9} To facilitate the process of the diffusion of innovation, Rogers emphasizes the importance of using multilevel strategies: strategic communication channels and social marketing methods.^{8,9} These include the use of mass media, advocacy groups, advertisement and interpersonal networking, incorporating ecological perspectives.^{8,9} The purpose of these strategies is to increase knowledge and awareness of health issues, influence perceptions, beliefs and attitudes, as well as to prompt action and adoption of the innovation.^{8,9}

However, and despite that the RMNCH innovations in the MDGs era have proven to have defining attributes that generated high impact at global level; yet new global health goals and targets have to be achieved by 2030. In this context, however, the complexity and ever evolving risk factors, determinants, policies and challenges demand the need for new, innovative, transformative, and sustainable solutions.

Background and Rationale

The World Health Organization (WHO), and the (MDGs) reports (2015) show that substantial global progress has been made in the area of maternal and child health during the period of 2000-2015; evident by 53 percent decline in global under-five child mortality rate (deaths per 1,000 live births); and 43 percent decline in maternal mortality ratio (deaths per 100,000 live births).⁵⁻⁷ The ongoing increase in investment of health innovations, strengthening health systems, and the increase in universal coverage of reproductive health services have significantly contributed to reaching these outcomes.⁵⁻⁷

Despite these promising outcomes, the agreed upon MDGs 4 and 5 have not been fully reached as was originally planned.⁵⁻⁷ Tracking countries profiles indicates that uneven progress has been made and challenges still persist. Profiles show that 50 countries have fallen short from achieving MDG 4; 69 countries have fallen short from achieving MDG 5; and only 4 of the 75 high-burden countries have achieved both goals 4 and 5.⁶ Additionally, global child health data shows that an estimated 5.9 million children under the age of five died in 2014: 45% of these children were newborns (either premature or small for gestational age), and 43% died due to infectious diseases such as pneumonia, malaria, diarrhea, and sepsis.^{5,6} Moreover, malnutrition was identified as the major cause for nearly half of all child deaths. Statistics show that less than 40 percent of infants get exclusive breastfeeding; and 1 in 3 children fail to attain the expected outcomes for their physical, cognitive and emotional growth and development.^{5,6} Ultimately, hindering their abilities to perform normal tasks and roles that are appropriate for their age, and limiting them from receiving basic rights: education and schooling.^{5,6}

Within the same continuum, global maternal health data shows that about 830 women die every day due to preventable pregnancy and childbirth related complications.¹⁰ This figure also

contributes to the global increase in stillbirths.^{5,6,10} As well, the maternal mortality ratio is 239 per 100,000 live births in developing countries versus 12 per 100,000 live births in developed countries.¹⁰ Only half of the pregnant women worldwide receive antenatal care; 225 million women have not received reproductive and family planning services; 8 percent of maternal mortality are due to unsafe abortion; 270,000 women die of cervical cancer yearly; and 1 in 3 women experiences domestic and/or social violence.^{5,6,7,10} The majority of these dreadful figures exist in high-burden countries and low-resource settings which demonstrate a state of health disparity between and within countries.^{5,6,7,10}

Examining the causes related to these figures yields that they are primarily attributable to the social, economic, and environmental factors surrounding at-risk and hard-to-reach populations and communities.^{6,10} Evidence shows that socio-demographic factors such as young maternal age; living in poverty or with low-income; lack of access to basic physiological needs such as clean water and air, food, proper sanitation, and safe houses; low maternal education level; lack of health information; and cultural and social practices that promote gender inequality have limited women's behavioral capability to make appropriate and informed-health decisions, ultimately affecting their health, economic and social status and quality of life.^{5,6,7,10} Additionally, other geographical and physical environmental factors; such as living in rural areas or fragile settings that lack adequate/basic health services and infrastructures; and the inability of women and their families to secure transportation to reproductive and antenatal health services have created a state of social exclusion resulting in limiting their ability for receiving and/or seeking quality health services, usually offered in urban settings.^{5,6,7,10}

Barriers at the organizational and institutional levels including lack of robust public health infrastructures (e.g., data, public health surveillance, ongoing funding, capacity to respond

to emergencies and crises); along with lack of universal health coverage or uneven coverage of reproductive health services; policies and regulations that hinder the diffusion of key health innovations and interventions, failing them from reaching the most needed populations: women and children; and lack of skilled health workforce and care during and after childbirth have all contributed to the magnitude of this global public health issue by holding back the global community from achieving all the targets related to the MDGs 4 and 5.^{5,6,7,10}

It appears from the available evidence, and as discussed above, that multiple levels of influence have shaped the area of RMNCH in the MDGs era, providing ecological and social determinants of health perspectives to examine the interaction between them, and interdependence of, within and across all levels. Altogether these perspectives determine the depth and breadth of this issue, and inform the need for multilevel interventions that target the identified causative factors. Reflecting on this global public health issue validates the need for new innovative solutions that challenge the status quo and be the engine for sustainable development, framing the post-2015 era. This is consistent with the recommendations of experts in the field who advocate the need for a paradigm shift, and new contexts of health diplomacy and innovation that call for new strategies including:^{1,12} transformational leadership, creating and enabling conducive environments, new models and mechanisms of partnerships, new policies, capacity building, and community engagement.^{1,12} Overall these strategies should be aiming to design, implement, and disseminate integrated innovations (scientific/technological, social, business and financial) and interventions that are evidence-based, affordable, and sustainable.^{1,5,6,11}

To address the previously mentioned challenges, new global efforts and commitments to improve the area of RMNCH, and reduce health inequity have been established. The Global

Strategy for Women’s, Children’s and Adolescents’ Health has been formulated and launched in 2010, and revisited for targeting the 2016-2030 period, expanding on its vision, priorities and actions related to RMNCH.⁵ The new revision focused on areas including:⁵ reaching out to populations living in humanitarian and fragile settings; preventing stillbirths; increasing of women’s and children’s accessibility to basic living needs; investing in future generations by focusing on early childhood development and adolescents’ health services; and strengthening health workforce and health systems.⁵ These new priorities have informed the Post-2015 Sustainable Development Goals (SDGs), particularly SDG 3:^{1,13} “ensure healthy lives and promote well-being for all at all ages.” and the means for implementation and action (e.g., SDG17) emphasizing the importance to scale-up proven and successful innovations, and the need for future investment in research and integrated innovations.^{5,11,13} These innovations, if planned with equitable global leadership and partnerships can be developed in low-and middle-income countries (LMICs), maximizing on their assets and human capital while creating a demand and market for generating new innovations that have high health-impact and social value.^{1,5,11,13}

Additionally, a new Global Investment Framework (GIF) for Women’s and Children’s Health, published in the Lancet Journal (2014), uses simulation to project that accelerated and targeted investments in existing gaps related to RMNCH will have high socioeconomic returns on investments.¹⁴ This simulation has been based on analysis of credible studies and successful achievements gathered from countries in East Asia and Africa during the MDGs era. For example, the GIF forecasts that an increase in health spending by just \$5 per capita in high-burden countries every year up to the year 2035 would have 9 times socioeconomic rate of return.¹⁴ This forecasts is mainly attributed to health benefits such as major reduction in maternal

(lower by 5 million deaths), newborn (prevention of 32 million stillbirths), and child (lower by 147 million deaths) mortality and morbidity rates, and decrease in total fertility rates in high-burden countries.¹⁴ These projected estimates would be achieved if family planning and reproductive preventive and promotive health services are increased proportionally for the most needed populations.¹⁴ All of which demands the need for a multi-sectoral approach and leadership focusing on increasing health expenditure; reforming policies; promoting community engagement and innovation; and investing in strengthening public health infrastructure; particularly health workforce.¹⁴ Furthermore, the GIF proposes that health benefits would lead to other benefits throughout the individual's life course. This includes enhancing educational attainment for children; increasing employment and productivity per capita; empowering women to have social and political roles; reducing gender inequality; enhancing population stability; and controlling the competition over environmental resources.¹⁴ Such benefits will help in generating greater Gross Domestic Production, and promoting social stability and unity.¹⁴ As well, drawing on findings from credible studies on benefits achieved in six Asian countries, the GIF concludes that: for every dollar spent in investment in key RMNCH interventions, a potential return of almost US\$ 20 is expected.¹⁴

These encouraging benefits along with what have been achieved in the area of RMNCH at the end of the MDGs era, and the Global Strategy for Women's, Children's and Adolescents' Health have been helpful in informing the post-2015 era and goals, and reassuring the global community that more investment in the area of RMNCH is critical to advancing sustainable development, reducing health inequity and poverty, fostering human rights, and achieving economic prosperity and growth across all nations.^{1,5,12,14}

Current Efforts

Over the past decades, innovators of and investors in health innovations have incorporated evidence and diverse knowledge generated in other fields and sciences to inform their work. To illustrate, the scientific/technological innovations are primarily driven by research and development (R& D), information and communication technologies (ICT), and the health governance models.¹⁵⁻¹⁷ These innovations, along with the integration of guiding principles and strategies (e.g., consumer engagement, capacity building, diverse communication forms, and accountability for health care at the community) have made an impact on human sociality and health behavior, reaching populations in the least developed settings and improving their health literacy and status.¹⁵⁻¹⁷ See examples: Sayana[®] Press, Chlorhexidine digluconate for umbilical cord care, Community Health Nurse (CHN) on the Go, mobile phone “app” and the Uterine Balloon Tamponade (UBT) innovations presented in Appendix A: Table (1-1).^{2,3,18-21}

Similarly, social innovations have been motivated by social movements including second-wave feminism, civil rights, and disability rights, recent advancements in ICT and governance health models.²² Evidence shows that the prevailing characteristics of social innovations demonstrate their responsiveness to address system failures.^{15,16,17,22-25} This includes recognizing the value of human and environmental resources, enhancing capacity building, promoting equitable partnerships and ownership, and integrating different levels of the system. These characteristics are new and have helped in creating broader context and ecosystem for health innovations by incorporating the ecological and social determinants of health.^{15,16,17,22-25} This has resulted in accelerating the implementation and scale of the innovations.^{6,7,8,14,15} See examples: Sayana[®] Press, Community Health Nurse (CHN) on the Go, mobile phone “app” and the Lucky Iron Fish[™] innovations presented in Appendix A: Table 1-1.^{2,3,15,27,28}

As for business innovations (despite that they have been solely developed in the business and economic world), the integration of their core variables and principles (e.g., mobilizing the private sector, user-centered design, consumer-driven culture, engagement of end-user and stakeholders, financial incentives) into health innovations have been helpful in maximizing their value, relevance and features.^{3,17,26} For example, to address the affordability and accessibility barriers to health solutions in low-resource settings, the integration of principles (such as, investment in emerging economies in the LMICs, creating demand and marketplace for local innovations, reaching people at the bottom of the pyramid (BOP)- people who live on less than \$2 a day-and engaging them in manufacturing and distributing innovations that improve their health, social and economic status) have been effective.²⁶ Furthermore, the impact of these core variables and principles have been helpful in creating local context that leverages innovative solutions and scales up through new governmental policies and regulations in LMICs.²⁶ These factors have been described by the Innovation Working Group as “healthy businesses.²⁶” See example: the Maker Movement for MNCH (Maker) and the Lucky Iron Fish™ innovations presented in Appendix A: Table 1-1.^{2,27,28}

According to the Grand Challenges Canada,^{29, 30} an integrated innovation is “the coordinated application of scientific/technological, social and business innovations to develop solutions to complex global health challenges.” This approach is found in the “Grand Challenges in Global Health Initiative” established by the Bill and Melinda Gates Foundation in 2003, with the purpose to support projects targeted at solving global health priorities and issues. In response to the emerging global health issues, this initiative was reviewed and expanded to focus on global development as well as global health and is now called “Grand Challenges.^{29,30}”

The Grand Challenges Canada (a partner with the Gates Foundation) has adopted the integrated innovation approach to support its grants and funds directed at solving complex global health issues.²⁹ This integrated innovation approach is driven by scientific R&D and technological ingredients (informed by health, social or behavioral sciences) to guide identifying new or modifying existing innovations.^{29,30} Once developed, the new innovation gets examined and scaled in broader contexts: social, cultural, ethical, legal, and environmental for the purpose of predicting new strategies that will enhance its implementation and scalability in altering environments.^{29,30} This eventually helps in creating a demand market and opportunities for investment that enhance the affordability and accessibility by users.^{29,30} These features are important for the functionality and sustainability of the integrated innovation approach.^{29,30} See example: The Lucky Iron Fish™ presented in Appendix A: Table 1-1.^{27,28}

Strengths

Examining the RMNCH innovations presented in Appendix A: Table 1-1, yields a number of strengths based in the guiding principles and strategies that are incorporated into the processes and outcomes of the cycle of innovation (planning, design, prototype, testing and evaluation). These guiding principles include the implementation of new approaches such as:^{2,3}

- User-centered design;
- Human-centered design;
- Building on the existing evidence;
- Using of what is available in terms of local resources;
- Simplicity over sophistication in design and application; and
- Investment in emerging economies

With regards to strategies, adopting a multi-sector approach for partnerships within and between countries; inclusion of the private sector; shifting to system-oriented innovations, community engagement; and capacity building have added resilience and durability to health

innovations.^{2,3} Overall, these strengths reflect on a movement of continuous quality improvement within the innovation context aiming to generate high returns on investment and sustainability. As well, and more importantly, these strengths align and intersect with the principles and elements that guide the global and public health frameworks and practices. For example, the defining attributes of the RMNCH innovations presented in Appendix A: Table 1-1 are consistent with the elements of the right to health (e.g., availability, accessibility, acceptability, and quality), human rights principles (e.g., participation, accountability, and non-discrimination),^{2,3} and the ten essential public health services (e.g., research for new insights and innovation, assure a competent public healthcare workforce, link people to needed personal health services, and assure the provision of healthcare when otherwise unavailable).³⁰ Looking forward, these strengths along with their high impact will lay the foundation for a trajectory of interdependent and interrelated ingredients that guide the future for a robust innovation marketplace, ultimately achieving the SDGs, particularly SDG3.

Limitations

Despite the fact that the RMNCH innovations presented in Appendix A: Table 1-1 have been transformational; limitations and gaps still exist. The Innovation Countdown 2030 Initiative's report (2015) refers to limitations encountered by experts and innovators in the global public health field.³ These limitations include:³ a) Lack of a robust global innovation ecosystem that supports investment in ideas generated from low-resource settings, b) Lack of curation and brokering systems that enhance the functionality and visibility of the innovation pipeline, c) Lack of new strategic financing mechanisms that build on integrating the assets and human capital in LMICs, and are capable of leveraging the interest and addressing risk tolerance for investors, and d) Lack of strategic models required for enhancing the visibility of resources and innovations and

aiming to create opportunities for investment and to reach the attention of investors, innovators, and policymakers.³

Furthermore, in a systematic review conducted by Mason et al. (2015) on social innovation for the promotion of health equity, a number of knowledge-action gaps have been identified.²² These include:²² a) The need for a consistent, coordinated and methodological evidence base that shares knowledge about the defining characteristics of each innovation and its effectiveness.²² Such evidence-base data is proposed to increase transparency and will potentially be helpful for public health practitioners in making informed-decisions for their practice, b) The need for systematic analysis and comparative studies of the costs/benefits/impacts of new social innovations compared to the already existing ones.²² This will potentially help in creating an evaluative evidence that will inform global and public health practice, and c) There is limited analysis and knowledge related to diffusion of social innovations including strategies, social marketing and communication channels.²²

Additionally, health innovation and technology diffusion related limitations have been reported by Piot (2012).¹⁹ These limitations are attributed to:¹⁹ a) Lack of clear processes that enhance the adoption of new innovations and increase access to already existing ones, b) Lack of standardized systems for evaluating and monitoring the performance of innovations, c) Inadequate use of incentives aimed at promoting innovations that focus on primary prevention levels of global and public health, d) Inadequate engaging of people at the BOP, and e) Inadequate customization of knowledge generated by other sciences and fields to inform global and public health innovations and technology.¹⁹

Moreover, the thematic analysis of a qualitative study conducted by Logie, Dimaras, Fortin and García, researchers and recipients of the Grand Challenges Canada fund, has revealed

the following limitations:³² a) Capacity building: the authors expressed the need for additional support from their sources of funds.³² Examples include more time and human resources to support their work to help them scale up and market their projects including the use of online platforms for orientation and training, b) Lack of mentorship: this limitation has been mainly experienced by new investigators/researchers who have participated from Canada and LMICs.³² Their main challenge was to compete with more experienced and established researchers in the field, targeting ongoing funding for their advanced phases of innovation.³² The participants felt that this challenge has hindered their career development and future work.³² Therefore, they have suggested the need for creating a mentorship program to support and promote capacity building of the “rising” researchers and innovators, and finally, c) Lack of potential commercialization that promotes partnerships beyond business models, focuses on customer engagement, aims to create a sustainable market for integrated innovation, and value social return on investment.³²

As evident from the literature findings, the limitations associated with health innovations including RMNCH innovations require a greater strategic focus and consolidation of efforts that are inspired by successful innovations and lessons learned from the MDGs era. Additionally, and as evident in the RMNCH innovations, presented in Appendix A: Table 1-1, there is a need for an integrated approach to guide the overall process of development, implementation and evaluation of RMNCH innovations. The adoption of such an approach will ensure that the benefits of each type of innovation are recognized and aligned in a way that accelerates the scalability and diffusion of the innovations resulting in a widespread impact and sustainability. This is consistent with the recommendations proposed by the SDGs, and the Global Strategy for Women’s, Children’s and Adolescents’ Health (2016-2030), ultimately aiming to strengthen the

global partnership for sustainable development, and to harness North-South, and South-South cooperation on innovation.^{1,5,12}

Objective

This capstone aims to propose a conceptual framework to guide the development, implementation, and evaluation of integrated innovations, focusing on creating a context for systemic and sustainable change: outcomes that are suitable for the post-2015 sustainable development era.

Methodology

For the purpose of creating this Conceptual Framework for Integrated Innovation (CFII), a qualitative, general inductive approach has been adopted. According to the National Institutes of Health, and other authors; Jabareen (2009); and Thomas (2006) this approach aims to provide a systematic way of reviewing, analyzing and categorizing data as well as giving interpretations as evident in the sources of data or text that is relevant to the purpose of the study.³³⁻³⁵ The outcomes of the analysis are then translated into categories or themes that are relevant to the context of the study, and are further presented and described in a logical manner that concludes relationships between themes.³³⁻³⁵ The following process of analysis is used to construct the CFII:³³

1. **Sorting/coding data:**³³ the selected data that represent domains related to RMNCH, health innovations, sustainable development goals, and innovation models and frameworks (keywords that are relevant to the capstone objectives) have been mapped. The raw data come from a variety of credible sources including guidelines and frameworks from public and global health organizations, peer-reviewed articles, books,

theories and reports. This step has been achieved through extensive reading and interpretations of the original data, followed by iterative process of word searching, and linking and relinking the concepts.³³⁻³⁵ All of which has helped in developing a descriptive coding scheme (coding, sorting and recording) of the data and the formulation of conceptual categories.³³⁻³⁵

2. **Retrieving and summarizing text:**³³ to further reduce the data generated from the descriptive coding scheme, code chunks have been retrieved along with summaries of the main conceptual categories (deconstructing of data and categorizing of concepts).³³⁻³⁵ To ensure that the original meaning and contexts are maintained, retrieved data have been checked for interpretations against the original texts multiple times.³³⁻³⁵ Such tactic has helped in the revision and refinement of the categorical system, reducing redundancy and overlapping. The end result is the formulation of interpretive codes.³³⁻³⁵
3. **Displaying data:**³³ the final summaries of the interpretive codes have been displayed into diagrams and concept maps.³³⁻³⁵ Such step has helped in integrating concepts and themes, identifying patterns and relationships between the emerging conceptual themes, and exploring conclusions.³³⁻³⁵
4. **Drawing and verifying conclusions:**³³ the relationships among and across the conceptual themes have been established through the use of a number of tactics including clustering; networks; noting patterns; and building chains of evidence.³³⁻³⁵ These tactics have helped in developing inferential codes. Verifying conclusions has been carefully done through the use of a consistent and stable process of analyzing data and formulating all the levels of codes, as explained above. This has enhanced the reliability and validity of the concluded relationships.³³⁻³⁵

The Conceptual Framework for Integrated Innovation (CFII)

The proposed conceptual framework supports a thoughtful approach for the RMNCH integrated innovations that is suitable for the sustainable development era. The framework operates through interacting phases as illustrated in Figure 1-1. Each phase represents several fields of inquiry around which the framework has been built and the data organized. The areas of inquiry that inform this framework include the Rio Political Declaration on Social Determinants of Health (2011),^{37,38} the Post-2015 Sustainable Development Goals,¹ The Global Strategy for Women's, Children's and Adolescents' Health (2016-2030),⁵ the Health in All Policies (HiAP) approach,³⁹ the Diffusion of Innovations theory,^{8,9} the Community Organization theory,⁸ Health Innovation Frameworks,^{29,40,41} the Centers for Disease Control and Prevention: A Framework for Program Evaluation,⁴² and evidence from reports on RMNCH innovations.^{2,3}

The CFII Phases

- 1. The Ecosystem:** All the phases of the integrated innovation development process are embedded within a larger ecological and social determinants of health (SDH) ecosystem. This suggests that integrating these perspectives in the planning and management of integrated innovation will help achieve sustainable outcomes and impacts. According to the (WHO), the SDH are “the conditions in which people are born, grow, work, live, and age, and the wider set of forces and systems shaping the conditions of daily life. These forces and systems include economic policies and systems, development agendas, social norms, social policies and political systems.”^{37,38} For example, the SDH have been recognized and assessed in the Sayana® Press innovation project (e.g., rural areas in Burkina Faso where women have no access to the intramuscular injectable contraceptives).^{3,15} Another examples are the MNCH Maker innovation in Kenya (e.g.,

the status of labour & delivery units in local hospitals, the local market and policies for manufacturing medical products),² and the Lucky Iron Fish (e.g., the social and environmental contexts where Cambodian women and children live: rural areas, highly dependent on fish and rice in their diet and are unable to meet the expense of the iron supplement).^{28,29} Altogether these SDH have defined the ecosystem of each respective project and provided perspective to what needs to be assessed.

- 2. The Assessment and Analysis Phase:** The top half of the framework represents the overarching assessment of the enabling factors and the bottom half represents the assessment of the predisposing factors. The assessment of the enabling factors focuses on the targeted audience of the innovation: individuals or populations who are directly experiencing a health problem/issue and may take action in the innovation process and outcomes. The potential targeted audience can be women, children, families, or healthcare providers, which is dependent on the targeted community/setting/context for the innovation. This assessment is driven by a strength-based approach and focuses on areas that include the individual's capacity; potential; behavioral capability; desires; wants and needs; priorities; culture; perceived benefits; and perceived barriers.^{1,5,39} These strengths have been recognized and advocated for by the Global Strategy for Women's, Children's and Adolescents' Health (2016-2030).⁵ This same approach applies at the community level; the assessment of the targeted community where the innovation will be implemented include characteristics such as community needs; assets; human capitals; participation; and relevance.^{2,3,8} Another aspect of the assessment is identifying the potential key stakeholders or participants from multi-sectors that can be engaged throughout the innovation process.^{1,2,3,5,8,39} These components of assessment have been

demonstrated in the Sayana® Press project where women live in the rural areas of Burkina Faso have been surveyed for their needs, desires and priorities related to contraceptive methods.^{3,14} Another example, is the Community Health Nurse (CHN) on the Go, mobile phone “app” project where the frontline CHNs work in rural Ghana have been assessed for their learning needs and opportunities for professional development, input that have shaped the next phases of the innovation.² Altogether these targeted audience have become key participants and engaged in defining the health innovation and its potential attributes.

The benefits of assessing and engaging the targeted audience early in the innovation process include: generating authentic participation; authentic insight; appreciative intelligence and appreciative knowledge, all of which helping in defining the public health needs or issues in terms of size and consequences for the targeted community. Additionally, other benefits may include enhancing the focus and quality of innovation, action and partnership.^{1,2,3,5,8,39} Also, assessment of the existing evidence pertaining to the health issue of priority and the focus of the integrated health innovation, whether it comes from research or previous health innovation, is valuable.^{2,3,42} For example, the Lucky Iron Fish™ innovation has built on the existing evidence: that cooking in iron pan increase the iron content of food and enhance its availability to users.^{27,28} Another example is the use of the “7.1% Chlorhexidine digluconate” in low-resource-settings. This medical agent has been in medical practice for 40 years and proven to be effective.^{3,16,17}

Similarly, the assessment of the predisposing factors focuses on identifying the systemic, structural and organizational factors and forces that may facilitate/hinder the innovation

development cycle, implementation, adoption and diffusion.^{1,2,3,5,8,9} The assessment aspects related to this area include the preceding and reinforcing factors that contribute to the health issues of the highest priority. These aspects entail healthcare and public health infrastructures, data and health surveillance systems, policies, practices and resources. Other organizational and leadership factors at the local and national levels need to be assessed. Elements related to financing systems, resources and capacities should be also considered.^{1,2,3,5,8,9} For example, the integration of these assessment elements into the MNCH Maker project in Kenya (e.g., organizational factors including policies on labor and delivery units, local markets, manufacturing policies) have helped in shaping the focus of the innovation, its attributes and potential leadership and implementation strategies.²

These assessment may be done together or individually. Both qualitative and quantitative data collection methods can be used to determine the scope and significance of the selected health issue. Findings from the components of the assessment phase provide baseline data for analysis and help determine how to respond and who should respond. The analysis should be done in smaller and larger contextual aspects.

- 3. The Planning and Implementation Phase.** This phase focuses on integrating the guiding principles and the means of implementation as evident in research related to RMNCH health innovations and recommendations for the post-2015 sustainable development goals era. These will guide and facilitate the process and outcomes of the integrated innovation cycle (design, prototype, pilot test, implementation, evaluation, scaling and diffusion). The guiding principles include the integration of the principles of human rights; community engagement; consumer engagement; reaching people at the

BOP; adopting multi-sector approach; and effective use of local resources.^{2,3} The integration of these principles, as evident in the RMNCH innovations including the Community Health Nurse (CHN) on the Go, mobile phone “app” and the MNCH Maker have enhanced the defining attributes of health innovations (affordability, simplicity, adaptability, adoptability, accessibility), and ultimately accelerated the rate of adoption and diffusion, all of which generated high return on investments.² This has been evident when the online courses for the CHNs app have been granted official recognition by the professional and organizational bodies in Ghana, guaranteeing a scale-up and opportunities for further diffusion and adoption at national and regional levels.² Furthermore, the means of implementation focus on leadership strategies that can be implemented at community, national and international levels, depending on the level of partnership and cooperation chosen for the management of the innovation. These strategies are intended to facilitate the innovation development process by leveraging resources and bringing stakeholders together in coalition to participate in and support the process.^{1,2,3,5,9, 39} The inclusion of the private sector in this process, along with mobilization of local resources and investments in emerging economies are highly emphasized.^{1,2,3,5,9, 39} These strategies are based on the collaborative-network perspective and capitalize on the core competence of each partner, enhance stability, exchange of resources, money, technology, and transfer knowledge and expertise, ultimately aiming to improve performance, efficiency and help achieve the targeted outcomes and impacts.⁴³ For example, the MNCH Maker project in Kenya has been developed and executed by a local interdisciplinary team (clinicians, biomedical engineers, biomedical engineering

students, and frontline nurses) representing multi-sector and equitable partnership and leadership.²

At the policy level, these strategies involve interpreting and implementing existing strategies that are proven to be effective and appropriate for the sustainable development era.^{1,5,39} Examples of these include the Accountability Framework for the Global Strategy (2016-2030), and the Financing Global Facility launched in 2015.^{1,5} Moreover, selecting and using system metric levels (stakeholder-level-performance measures together with the community-level indicators) to monitor the effectiveness of the innovation at the process and impact levels is highly recommended.^{1,2,3,5,39}

Finally, the need for knowledge sharing and translation systems as a strategy for global public RMNCH health innovations is extremely important.^{1,44} Such systems aim to accelerate dissemination and transmission of new knowledge, enhance connectivity and learning, and exchange of expertise among all disciplines and stakeholders.^{1,44} These systems will inform the global and public health practice.^{1,44} Evidence from the Sayana® Press project shows how the successful results generated from its implementation in Burkina Faso have influenced the dissemination of this product to the community-level health care of 3 other sub-Saharan African countries: Niger, Uganda & Senegal with 230,000 doses being distributed.^{3,15}

- 4. The Outcomes and Impacts Phase:** The outcomes are the expected changes or effects that result from the implementation of the innovation.⁴² The expected outcomes and impacts are driven and guided by the local, national and international frameworks and health indicators related to the RMNCH that are specific to the targeted community or setting.^{1,2,3,5,8,39} Examples of these are the SDGs, particularly SDG3 and its targets.¹ The

outcomes and impacts should be assessed against a predefined evaluation criteria to determine whether the innovation has affected health and achieved the targeted indicators.⁴² The outcomes or effects may target a change in social, behavioral, and/or environmental conditions which will eventually direct the ultimate impact, ensuring sustainable results.⁴² An example of outcomes that have been achieved by RMNCH innovation is the 23% reduction of neonatal death as a result of using the “7.1% Chlorhexidine digluconate” antiseptic for umbilical cord care in low resource settings.^{3,16,17} Another example is the 50% drop in the iron deficiency anemia among the Cambodians women and children that have used the Lucky Iron Fish.^{28,29} These outcomes have been concluded based on randomized controlled trials (RCTs).^{17,29}

- 5. The Evaluation Phase:** All the phases of the proposed CFII should be guided by an ongoing evaluation (formative & summative).⁴² The purpose of the ongoing evaluation is to monitor progress towards the intended outcomes and impacts, promote participation and cooperation among partners, find opportunities for continuous quality improvement, enhance quality of performance, justify the need for further funding, and ensure that the allocated resources for innovations are well utilized and that effective results are maintained.⁴² For example, the Community Health Nurse (CHN) on the Go, mobile phone “app” innovation was evaluated using a quantitative method such as surveys that have assessed users’ satisfaction with the innovation, and implications for practice and patient safety.² The findings of these evaluative studies have positively influenced the rate of adoption and diffusion of the innovation at both national and regional levels.

The general assumptions of the Conceptual Framework for Integrated Innovation are delineated in Table 1-2 below.

Table 1-2: Underlying Assumptions of the Conceptual Framework for Integrated Innovation

<ul style="list-style-type: none">▪ The cycle of the integrated innovation functions within an ecosystem context that combines the ecological perspective and social determinants of health: factors that have strong, indelible influence on the health of individuals, populations and communities.
<ul style="list-style-type: none">▪ The integrated innovation is viewed and defined according to the Grand Challenges Canada “the coordinated application of scientific/technological, social and business innovations to develop solutions to complex global health challenges.³⁰”
<ul style="list-style-type: none">▪ The framework provides a dynamic and open system of interaction and energy among and across all phases.
<ul style="list-style-type: none">▪ The framework has basis in several fields of inquiry including health, business and social sciences that inform the scientific/technological, social and business innovations.
<ul style="list-style-type: none">▪ The framework adopts the Health in All Policies approach to facilitate working with partners that come from multidiscipline, aiming to enhance accountability, address social determinants of health, improve health equity, and achieve the sustainable development goals.
<ul style="list-style-type: none">▪ The application of the phases of the conceptual framework is country/setting/level specific. This allows the framework to be applied with flexibility based on the local context, national health plans and health priorities.
<ul style="list-style-type: none">▪ The context in which the RMNCH innovations operate is complex. Therefore, the use of logical, systematic approaches to innovation development, implementation and evaluation is essential.

Discussion, Limitations and Implications for Practice

The findings from the literature review support that investments, efforts and achievements related to RMNCH innovations during the MDGs era have been influential. This reflects on a movement of quality improvement, enhances quality performance, and adoption of new guiding principles and leadership strategies to facilitate the processes and outcomes of the innovation development cycle, ultimately generating high impact. To that note, the RMNCH innovations have been informed by the exiting evidence, advancement in technologies, and diverse knowledge generated in other fields and sciences. These factors have not only shaped the prevailing attributes of RMNCH innovations, but have also met the needs and expectations of the targeted populations (e.g., customer engagement). Altogether they have added durability and

functionality to the innovations as well as enhanced sustainability. This has been illustrated in the selected examples of RMNCH innovations presented in Table 1-1.

While these were transformational achievements, the RMNCH innovations have not been able to entirely achieve the targets of the MDGs 4 and 5. Additionally, findings from research studies and reports have been consistent with respect to the limitations and gaps that exist in this area. Of particular concern, reports show that limitations have been predominantly attributed to the systemic, structural and organizational factors at local, national and global levels which have limited the visibility and transparency of the innovation pipeline. One of the most worrying findings is the inconsistency in using an integrated approach, by the key partners, to guide the RMNCH innovation cycle, processes and outcomes. This has significantly hindered the scalability and diffusion of proven successful RMNCH innovations, preventing them from reaching the most in dire needs markets and populations.

Besides, the existing models and frameworks that focus on innovations appear to be very specific focusing on selected areas, such as the innovation journey: process and metrics (e.g., the IVEY Business School Model),⁴⁰ or identifying and prioritizing barriers related to RMNCH innovations (e.g., the Concern Worldwide Framework),⁴¹ or lays the foundations for the integrated innovations approach but being limited in its transferability to other organizations (e.g., the Grand Challenges Canada) that target addressing complex global and public health issues.²⁸ Again, and while these frameworks provide knowledge and guidance to the area of health innovation, their capacity to guide a context for systemic and sustainable change, as proposed in the sustainable development framework, is not guaranteed. Therefore, future innovators and investors in RMNCH innovations should build on the existing evidence and focus

on closing health disparities between and among countries by adopting the integrated innovation approach.

To achieve that, this capstone has aimed to propose a Conceptual Framework for Integrated Innovation (CFII) focusing on creating a context for systemic and sustainable change. As presented earlier, the variables and constructs used in formulating the (CFII) have been developed using a qualitative inductive approach. The purpose of this framework is to provide logical and systematic approaches to RMNCH innovations while recognizing the complexity of the ecosystem (the ecological and social determinants of health) surrounding the global and public health issues. As well, the framework presents strengths including being multidisciplinary; conceptually informed; and helps in understanding the integrated innovation processes and outcomes. This framework should not be interpreted as an attempt to dictate the integrated innovation in a rigid format. On the contrary, it allows flexibility that is country/setting/level specific.

Due to time constraints (the duration for this capstone was approximately 16 weeks), validating the internal reliability of the content of the CFII, and testing its applicability on a small scale of RMNCH innovation project were not feasible. As a result, the CFII might not be generalized beyond this capstone. The internal reliability could have been validated if more than one researcher code the same documents and compare and discuss coding differences, ultimately reaching consensus with respect to what to include in terms of categories and conclusions. As well, and since the framework is relatively new, it is important to monitor and evaluate its effectiveness in the near future. If the evaluation shows that it has been effective, this could be used in guiding RMNCH innovation or other areas of health innovations. It would be helpful to know if the suggested guiding principles and means of implementation along with the underlying

assumptions for the CFII are applicable and able to generate desirable outcomes and impacts, as they seem appropriate, in other contexts of health innovations. It would also be helpful if this framework is presented in professional gatherings and conferences where opportunities for dialogue and feedback are promoted.

The author of this capstone emphasizes that the CFII should be viewed as an evolving framework that requires ongoing assessment, review and refinement. This can be achieved through peer review, consultation with experts in the field of RMNCH innovations and piloting it on a small scale project.

Findings from this capstone could be used to help innovators of and investors in RMNCH innovations to adopt a systematic approach to guide their future work. Regardless to the focus of the RMNCH innovation, key partners or stakeholders need to consider the underlying assumptions of the CFII including its ecosystem (ecological perspective and social determinants of health); the dynamic nature of its phases; the flexibility in applying any of its phases and how each one is county/setting/level specific; as well as the importance of adopting the Health in All Policies approach to facilitate multidisciplinary work, accountability and addressing health issues.

Conclusion

The link between future investment in integrated innovations and achieving the sustainable development goals, specifically SDG3 is an important one. However, this link is only valuable if there is consistency, means and systems that can tap into the knowledge created through evidence and lessons learned from the MDGs era. This leads to the requirement of a paradigm shift that focuses on integrated approach that can provide appropriate guiding

principles and means of implementation to take place and achieve desirable outcomes and impacts. Such an approach has to be based within a context that recognizes the complexity of RMNCH issues. This capstone used a qualitative and general inductive approach to derive an understanding of the requirements for the integrated innovations that are capable to generate high impact and sustainable outcomes. This capstone focuses on integrating evidence that comes from theories, global health reports, and RMNCH practice to ensure having a comprehensive understanding of all the requirements. The use of integrated innovation enhances the capability of each type of innovation and ensures a better synergy between the process of planning, development and evaluation and the degree of usefulness of the innovation.

References

1. United Nations. Transforming our world: The 2030 agenda for sustainable development. General Assembly. <https://sustainabledevelopment.un.org/post2015/transformingourworld>. Accessed January 11, 2016.
2. Concern Worldwide. Knowledge matters: Innovations for maternal, newborn and child health. https://doj19z5hov92o.cloudfront.net/sites/default/files/media/resource/knowledge_matters_-_innovations_for_maternalnewborn_and_child_health.pdf. Accessed January 11, 2016.
3. Innovation Countdown 2030. PATH. Reimagining global health: 30 high-impact innovations to save lives. <http://ic2030.org/wp-content/uploads/2015/07/ic2030-report-2015.pdf>. Accessed January 11, 2016.
4. Weil A. Our health is global health. *Health Affairs* [serial online]. September 2014;33(9):1502-1502 1p. Available from: CINAHL Complete, Ipswich, MA. Accessed January 11, 2016.
5. World Health Organization (WHO). The global strategy for women's, children's and adolescents' health (2016-2030). <http://www.who.int/life-course/partners/global-strategy/globalstrategyreport2016-2030-lowres.pdf?ua=1>. Published September 2015. Accessed January 11, 2016.
6. World Health Organization. A decade of tracking progress for maternal, newborn and child survival: The 2015 report. http://countdown2015mnch.org/documents/2015Report/Countdown_to_2015_final_report.pdf. Accessed January 11, 2016.
7. United Nations. The millennium development goals report 2015. http://www.un.org/millenniumgoals/2015_MDG_Report/pdf/MDG%202015%20rev%20%28July%201%29.pdf. Accessed January 13, 2016.
8. Rimer, Barbara K., and Karen Glanz. Theory at a glance: A guide for health promotion practice. (2005). <http://www.sneb.org/2014/Theory%20at%20a%20Glance.pdf>. Accessed January 25, 2016.
9. Rogers, Everett. *Diffusion of innovations*. New York: Free Press, 2003.
10. World Health Organization. Global health observatory (GPH) data: Maternal mortality. http://www.who.int/gho/maternal_health/mortality/maternal_mortality_text/en/. Accessed February 3, 2016.
11. Ratzan S. Innovation in the post-MDG environment: Advancing global health diplomacy in pursuit of the global good. *Journal Of Health Communication*. 2013;18(5):479-484 6p. DOI: 10.1080/10810730.2013.793075.
12. Buse K, Hawkes S. Health in the sustainable development goals: Ready for a paradigm shift?. *Globalization & Health*. January 2015;11(1):13-13. DOI 10.1186/s12992-015-0098-8.
13. United Nations. Sustainable development in action: Special report on voluntary multi-stakeholder partnerships and commitments for sustainable development (2015). <https://sustainabledevelopment.un.org/content/documents/1855SD%20in%20Action%20Report%202015.pdf>. Accessed February 2, 2016.

14. Stenberg K, Axelson H, Boyle C, et al. Advancing social and economic development by investing in women's and children's health: a new global investment framework. *Lancet*. April 12, 2014;383 North American Edition(9925):1333-1354 22p. Available from: CINAHL Complete, Ipswich, MA. Accessed January 31, 2016.
15. PATH. Reproductive health global program. <http://sites.path.org/rh/recent-reproductive-health-projects/sayanapress/>. Accessed February 18, 2016.
16. PATH. Chlorhexidine for Umbilical Cord Care: A new, low-cost intervention to reduce newborn mortality. http://www.usp.org/sites/default/files/usp_pdf/EN/PQM/chlorhexidine_technical_brief_ju1_1_2014.pdf. Accessed February 18, 2016.
17. PATH. A simple innovation to save newborn lives. <https://www.youtube.com/watch?v=RHg9kc1UAQs>. Accessed February 18, 2016.
18. PATH. Health technologies for women and children. Uterine balloon tamponade. <http://sites.path.org/mnhitech/assessment/postpartum-hemorrhage/ubt/>. Accessed February 18, 2016.
19. Piot P. Innovation and technology for global public health. *Global Public Health*. September 2, 2012;7(S1):S46-53 1p. Accessed January 11, 2016.
20. Gardner C, Acharya T, Yach D. Technological and social innovation: A unifying new paradigm for global health. *Health Affairs*. July 2007;26(4):1052-1061 10p. Accessed January 11, 2016.
21. Schnarr K, Snowdon A, Cramm H, Cohen J, Alessi C. The link between health governance models and global health innovation: An exploration of OECD nations. *Advances In Health Care Management*. February 2015;17:39-69 31p. Available from: CINAHL Complete, Ipswich, MA. Accessed January 11, 2016.
22. Mason, Chris, et al. Social innovation for the promotion of health equity. *Health promotion international* 30.suppl 2 (2015): ii116-ii125. <http://dx.doi.org.ezproxy.macewan.ca/10.1093/heapro/dav076>.
23. Phillips W, Lee H, Ghobadian A. Social innovation and social entrepreneurship: A Systematic Review. *Group & Organization Management* (2014): 1059601114560063.
24. Barki E, Comini G, Cunliffe A, Hart S, Rai S. Social entrepreneurship and social business: Retrospective and perspective research. *RAE: Revista De Administração De Empresas* [serial online]. July 2015;55(4):380-384. Available from: Academic Search Complete, Ipswich, MA. Accessed January 11, 2016.
25. Gharabaghi K. Social innovation and entrepreneurship: Implications for the field of child and youth care practice. *Relational Child & Youth Care Practice* [serial online]. Fall2013 2013;26(3):42-51. Available from: Academic Search Complete, Ipswich, MA. Accessed January 11, 2016.
26. Innovation Working Group. Fostering healthy businesses: Delivering innovations in maternal and child Health. <http://www.everywomaneverychild.org/images/Report3Businesses.pdf>. Accessed January 18, 2016.
27. Grand Challenges Canada/Grand Défis Canada. A lucky little fish to fight iron deficiency among women in Cambodia. <http://www.grandchallenges.ca/grantee-stars/0355-05-30/>. Accessed February 18, 2016.
28. Lucky Iron Fish: Our story. <http://www.luckyironfish.com/our-story>. Accessed February 18, 2016.

29. Grand Challenges Canada: Bold ideas for humanity. <http://www.grandchallenges.ca/integrated-innovation/>. Accessed January 12, 2016.
30. Grand Challenges Canada/Grand Défis Canada. Integrated Innovation. http://www.grandchallenges.ca/wp-content/uploads/integratedinnovation_EN.pdf. Accessed January 12, 2016.
31. Centers for Disease Control and Prevention. The public health system and the 10 essential public health services. <http://www.cdc.gov/nphpsp/essentialservices.html>. Updated May 29, 2014. Accessed January 21, 2016.
32. Logie C, Dimaras H, Fortin A, Ramón-García S. Challenges faced by multidisciplinary new investigators on addressing grand challenges in global health. *Globalization & Health*. January 2014;10(1):27-27 1p. Doi:10.1186/1744-8603-10-27.
33. The National Institutes of Health. Office of Behavioral and Social Sciences Research. Software and Qualitative Analysis. <http://www.esourceresearch.org/Default.aspx?TabId=638>. Accessed March 1, 2016.
34. Jabareen, Yosef. Building a Conceptual Framework: philosophy, definitions, and procedure. *International Journal of Qualitative Methods* 8.4 (2009): 49-62.
35. Thomas, David R. A general inductive approach for analyzing qualitative evaluation data. *American Journal of Evaluation* 27.2 (2006): 237-246.
36. Community Tool Box. Developing Framework or Model of Change. <http://ctb.ku.edu/en/4-developing-framework-or-model-change>. Accessed March 1, 2016.
37. World Health Organization. What are social determinants of health? http://www.who.int/social_determinants/sdh_definition/en/. Accessed March 1, 2016.
38. World Health Organization. The World Conference on Social Determinants of Health. Rio Political Declaration on Social Determinants of Health. http://www.who.int/sdhconference/declaration/Rio_political_declaration.pdf?ua=1. Accessed March 1, 2016.
39. World Health Organization. The Helsinki Statement on Health in All Policies. http://www.who.int/healthpromotion/conferences/8gchp/8gchp_helsinki_statement.pdf. Accessed March 6, 2016.
40. IVEY Business School. Western University-Canada. International Centre for Health Innovation. The Innovation Adoption Process Model & Metrics. <https://innovatexchange.ca/wpcontent/uploads/2015/03/IveyInnovationAdoptionModel.pdf>. Accessed March 1, 2016.
41. Concern Worldwide. A conceptual framework and research approach for identifying, analyzing and prioritizing barriers to effective maternal, newborn and child health interventions (2011). http://innovationsformnch.org/uploads/publications/2011-01_Innovations-Conceptual-Framework_low_res.pdf. Accessed March 6, 2016.
42. The Centers for Disease Control and Prevention. A Framework for Program Evaluation. <http://www.cdc.gov/eval/framework/index.htm>. Updated September 11, 2012. Accessed March 6, 2016.
43. Camarinha-Matos, Luis M., Hamideh Afsarmanesh, and Xavier Boucher. *The role of collaborative networks in sustainability*. Springer Berlin Heidelberg, 2010.
44. Natividad M, Fioreck K, Parker R. Knowledge networks for global public health. *Global Public Health*. September 2, 2012; 7(S1):S73-81 1p. Accessed March 14, 2016.

Appendix A: Table 1-1: Selected Examples of RMNCH Innovations^{2, 3, 15, 16, 17, 18, 27, 28}

Type of Innovation/ RMNCH area	Defining Attributes/Other Features	Outcomes	Guiding Principles/Strategies
<p><u>Scientific/technological/Social Innovation Reproductive Health</u>^{3,15} Sayana® Press (injectable contraceptive of Depo-Provera (104 mg per 0.65mL dose of depot medroxyprogesterone acetate (DMPA))</p> <p><u>Intended Audience/Need</u>^{3,15} Women live in rural areas in Burkina Faso who have no access to the currently intramuscular injectable contraceptives that can be only administered by healthcare workers in clinical settings</p>	<p><i>*Relative advantage:</i> a self-administered subcutaneous injectable contraceptive, an alternative to the currently available intramuscular injection.^{3,6}</p> <p><i>*Compatibility:</i> met the needs of women live in rural areas by being convenient and allows private use.^{3,15}</p> <p><i>*Complexity:</i> comes in 3-month, single low-dose, Uniject injection system that is easy to use, and requires minimal training.^{3,15}</p> <p><i>*Trialability:</i> approved by drug regulatory agencies in more than 25 countries including the UK and USA.^{3,15}</p> <p><i>*Observability:</i> currently in Burkina Faso, and the community-level health care of 3 other sub-Saharan African countries: Niger, Uganda & Senegal with 230,000 doses being distributed.^{3,15}</p>	<p>*Partners on this innovation project (e.g., PATH, Pfizer) along with the local ministries of health at the site of the innovation project have launched a pilot study to measure the effectiveness and feasibility of this product, targeting mid-2016.¹⁵</p> <p>*Other comparative studies with respect to the subcutaneous injectable Sayana® Press and the intramuscular one are currently underway.¹⁵</p>	<p>*Building on the existing evidence: Depo- Provera is a highly effective (99%) hormonal form of contraception provided that it was given as scheduled-every 3 months^{3,15}</p> <p>*Consumer-engagement^{3,15}</p> <p>*User-centered design^{3,15}</p>
<p><u>Scientific/technological/Social Neonatal Health</u>^{3,16,17} 7.1% Chlorhexidine digluconate (delivering 4% Chlorhexidine antiseptic for umbilical cord care)</p> <p><u>Intended Audience/Need:</u>^{3,16,17} Healthcare workers in low-resource settings and their clients: families with newborns</p>	<p><i>*Relative advantage:</i> a broad spectrum prophylaxis agent, a new intervention in the low-resource settings.^{3,16,17}</p> <p><i>*Compatibility & complexity:</i> comes in simply prepared formats: solution or gel, has long shelf-life, requires no special storage, remarkably cost-effective (US\$0.23 per newborn). Highly functional and acceptable by consumers in healthcare settings or at home by household caregivers.^{3,16,17}</p> <p><i>*trialability & observability:</i> A three randomized controlled trials (RCTs) conducted in community-based settings in Nepal, Bangladesh and Pakistan have shown a 23% reduction in newborns death (an estimated 3.1 million newborns death per year, or 1 in 6 neonatal deaths) from serious infections such as sepsis, and up to 66% elimination of other serious infections.¹⁷</p> <p><i>*Scalability:</i> At national level, the government of Nepal (2013) proceeded with manufacturing, distributing (by community health workers), and implementing Chlorhexidine at nationwide (already in 26 districts). Further, the World Health Organization (WHO) recommended the use of Chlorhexidine for cord care and adding it to its Model List of Essential Medicines for Children.¹⁷</p>	<p>Significant reduction in neonatal death (23%) due to umbilical cord infection.^{3,16,17}</p>	<p>*Building on the existing evidence (Chlorhexidine has been in medical practice, in developed countries, for 40 years^{3,16,17}</p> <p>*Capacity building³</p> <p>*Investment in the markets in LMICs^{3,16,17}</p> <p>*PATH and other partners on this innovation project are currently working on establishing an infrastructure for manufacturing Chlorhexidine in African countries as well as piloting this program, aiming for creating job opportunities and harnessing local markets and infrastructures^{3,16,17}</p>

<p><u>Scientific/Technological and Social Innovation/Workforce Training:</u>² Community Health Nurse (CHN) on the Go, mobile phone “app”</p> <p><u>Intended Audience/Need:</u>² The front line healthcare workers in community-based services in rural Ghana. These CHNs, and due to geographical and limited funding resources don’t receive any opportunities for professional development and training, all of which have influenced their motivation and performance</p>	<p><i>*Relative advantage:</i> built on the existing advancements in information and communication technologies (ICT).² This application provides a Learning Centre Platform of six interconnected, phone-based training and learning modules, websites and resources.²</p> <p><i>*Compatibility & complexity:</i> learning materials have been developed in consultation with and based on the assessment of CHNs’ needs. Instructions are easy to follow and use which promotes self-directed learning.²</p> <p><i>*trialability & observability:</i> Positive results have been achieved (see positive outcomes).²</p> <p><i>*Scalability:</i> the online courses have been granted official recognition by professional and organizational bodies in Ghana, guaranteeing a scale-up and opportunities for further diffusion and adoption at national and regional levels.²</p>	<p><i>*Positive outcomes:</i> enhanced the CHNs’ knowledge and professional development opportunities.²</p> <p><i>*capacity building, motivation, and relational practice which have resulted in increased of job satisfaction and quality of patient care.</i>²</p>	<p><i>*Building on the existing advancements in (ICT)²</i></p> <p><i>*User-centered design²</i></p> <p><i>*Consumer engagement²</i></p> <p><i>*Capacity building</i></p> <p><i>*Simplicity over sophistication in design and use²</i></p>
<p><u>Scientific, Technological and Social Innovation/Maternal Health</u>^{3,18} Uterine balloon tamponade (UBT): a second-line treatment, after oxytocin, for severe postpartum hemorrhage (PPH)</p> <p><u>Intended Audience/Need:</u>^{3,18} Laboring and postpartum women receiving maternity care in low-resource settings, where due to economic and systemic burdens such as cost, lack of access to equipment and training have limited opportunities to receive highly-effective treatments such as Oxytocin and UBT, as a result putting their life at risk</p>	<p><i>*Relative advantage:</i> With the use of available local resources, a low-fidelity UBT has been created (e.g., male latex condom that was tied to a Foley rubber catheter and a plastic syringe, creating a one-way valve system). Once inserted into the uterus and inflated with clean water/fluid, it creates a constant pressure that helped in controlling bleeding.^{3,9} This action is similar to the one generated by the UBT available in developed settings.^{3,18}</p> <p><i>*Compatibility & complexity:</i> Such a device can be assembled at the point of use with an estimated cost of US\$ 3 to US\$ 6. However, to enhance its accessibility, efficiency and distribution, collaborative efforts are directed now to make this product preassembled in a specific toolkit and as per the quality manufacturing standards.^{3,18}</p> <p><i>*Trialability & observability:</i> A systematic review of 13 studies, and described cases in 7 countries in South and Southeast Asia shows that the use of UBT was effective in the treatment of 234 out of 241 cases of PPH, preventing the need for surgical interventions and blood transfusion-options that are usually limited in low resource-settings.^{3,9} Additionally, professional organizations such as the WHO has included the use of UBT in its reviewed guidelines on management of PPH.^{3,18}</p>	<p><i>*The estimated impact for this promising innovation for the period of 2022-2030 is 169,000 maternal lives saved, or 11 % reduction in maternal mortality due to PPH.^{3,18}</i></p>	<p><i>*Building on the existing evidence, UBT is classified as second line of treatment for PPH in developed settings^{3,18}</i></p> <p><i>*Using local and simple resources for developing a compatible innovation^{3,18}</i></p> <p><i>*Simplicity over sophistication^{3,18}</i></p>
<p><u>Technological, Social and Business Innovation/Public Health Infrastructure</u>² The Maker Movement for MNCH (Maker)</p>	<p><i>*Relative advantage:</i> creating local innovation marketplace to develop MNCH innovations that are affordable, accessible and sustainable-alternatives to the ones produced in developed countries.²</p>	<p><i>* Influenced manufacturing and diffusion policies in Kenya to support local production of life-saving health equipment, devices</i></p>	<p><i>*User-centered design</i></p> <p><i>*Consumer engagement</i></p> <p><i>*Inter-disciplinary partnerships & learning</i></p>

<p><u>Intended Audience/Need:</u>² The health infrastructure of Kenya, enabling it to create a local manufacturing market for maternal and child health medical equipment and devices that will help in saving lives and attending to obstetric emergencies, and further meet the pressures experienced by health facilities (since the Kenyan government made maternity services free), high procurement or replacement costs and supply chain difficulties.</p>	<p>*Compatibility & complexity: in consultation with health care practitioners and the assessment conducted in maternity hospitals, clinical needs in labour and delivery and newborn units identified. This has been translated into the need for 9 medical devices.² *Trialability & observability: The Maker Hub will prototype the MNCH medical products as they become readily available.²</p>	<p>and spares as well as creating a local market for innovation, ultimately aiming to be self-sufficient.²</p>	<p>including (clinicians, biomedical engineers and biomedical engineering students from the University of Nairobi² *Capacity building *Investing in local market²</p>
<p><u>Integrated Innovation: Scientific, technological, Social and Business</u>^{27,28} The Lucky Iron Fish™</p> <p><u>Intended Audience/Need</u>^{27,28} Cambodian women and children particularly those live in rural areas and suffer from iron deficiency anemia. These populations are highly dependent on fish and rice in their diet (poor in iron), and are unable to meet the expense of the iron supplement</p>	<p>*Relative advantage: Building on the existing evidence that cooking in iron pan (utensils that rural Cambodians cannot afford) increased the iron content of food & enhanced the availability of iron to users. The lucky iron fish costs about \$5 and lasts at least five years.^{27,28} *Compatibility & complexity: A culturally appropriate and meaningful product: a piece of iron shaped like a local river fish that is believed to bring luck and fortune in the Cambodian culture was developed. Easy to use: cooking the lucky iron fish with boiling water or soup for 10 minutes helps in releasing 75 percent of the recommended daily intake of iron. To foster the iron absorption, addition of lemon juice was recommended.^{27,28} *Trialability & observability: In a trial study that followed the users of the Lucky iron Fish for 12 months reveals that iron deficiency anemia has dropped by 50 percent among participants. Women reported to be more energetic and feeling better, and children reported to do better on their school work and energetic to play.^{27,28} *Scalability: Opportunities for business investment and distribution in the Cambodian market have been created. The Lucky Iron Fish is currently produced in Cambodia with a plan to produce 10,000 piece and another 50,000 next year, targeting new markets including Canada and the U.S.^{27,28} Financing the transition to scale-up the Lucky iron Fish has been granted by the partners on the project: Grand Challenges Canada, The Guelph University and Innovation Guelph.^{27,28}</p>	<p>In a trial study that followed the users of the Lucky iron Fish for 12 months reveals that iron deficiency anemia has dropped by 50 percent among participants. Women reported to be more energetic and feeling better, and children reported to do better on their school work and energetic to play.^{27,28}</p>	<p>*User-centered design^{27,28} *Consumer engagement^{27,28} *Inter-disciplinary partnerships^{27,28} *Capacity building^{27,28} *Investing in local market^{27,28}</p>

Figure 1-1: Conceptual Framework for Integrated Innovation

