Value co-creation through social innovation in healthcare: a case of WE CARE Solar

Jashim Uddin Ahmed, Mohammad Asif Gazi, Rifat Iqbal,
Quazi Tafsirul Islam and Niza Talukder
School of Business and Economics, North South University, Dhaka, Bangladesh

Abstract

Purpose – Maternal mortality is an acute problem for many countries around the world, particularly those at the bottom of the pyramid (BoP). Most remote locations in these underdeveloped nations, for instance, in Africa, have to cope with the problem of interrupted electricity supply making healthcare practitioners often experience a helpless compulsion to compromise in providing quality medical attention, especially during childbirth. Along with many public, private and nongovernment initiatives, WE CARE Solar (hereafter WCS) – a social innovation venture comes with an idea of developing portable solar suitcases to respond to this intransigent problem.

Design/methodology/approach – This paper introduces a social enterprise that established its operation in Africa and so far has served in more than 30 similarly impoverished economies. Data was collected, analyzed using documentary research method. The authors have also collected and correlated the statements from the founder of WCS to complement the authors' findings. With this paper, the authors intend to establish the type of innovation tools that are needed to provide value with a social innovation initiative in the health sector in the least developed country perspective. To facilitate better social outcomes and to ensure greater good, innovation requires to be accompanied by stakeholders' involvement.

Findings – The findings indicate that WE CARE Solar has a positive social contribution toward ensuring safe motherhood and childbirth in underdeveloped countries by providing access to reliable solar power sources. The six-step social innovation process can be adopted by other social ventures to propose innovative solutions to social needs. Analyzing WCS's service delivery from the perspective of the 4As framework and value co-creation model, it is suggested that sustainable social change can be established with value co-creation through community engagement with multiple stakeholders.

Research limitations/implications – This research was solely focused on one organization alone. Future research could look into the model to ascertain its acceptability in similar social innovation in healthcare initiatives.

Originality/value – This paper attempts to address a gap in social innovation in healthcare and its adaptability using the 4As framework with the value co-creation model. The authors propose this model from the data accumulated throughout the research, which could also serve to assist organizations looking for scalable and sustainable change.

Keywords Social innovation, Healthcare, Bottom of the pyramid, 4As framework, Value co-creation, Africa

Paper type Research paper

Introduction

The healthcare system in most countries is focused on organizing people, institutions and resources accordingly for efficient treatment. Developed countries are adopting different innovative approaches in respective healthcare structure, delivery and related support network. Although consumers in the bottom of the pyramid (hereafter BoP) are also augmenting health infrastructure, human capital, community and technology engagement,

the progress in the health indicators is far from being satisfactory (Dwivedi, 2015). Africa, in particular, is having a relatively poor healthcare performance indicator among other large BoP residing nations.

Poverty and social inequality in Africa are mainly affecting the healthcare system throughout the region (Marmot, 2005). People with poor health status often move down to the social ladder with very little chance to move up (World Health Organization, 2011). Throughout the last decade, geographic differences have worsened the healthcare system in this region. According to the UN's Food and Agriculture Organization (FAO), by 2030, people ranging between 15 and 24 years of age are projected to increase by around 90m, mostly in the rural areas (CNBC Africa, 2018). As the poverty line is low in most rural parts in Africa, the national healthcare system fails to work efficiently. Rapid shifts in the key positions, lack of policy integration, inadequate resources and technology, inefficient management and implementation are the key constraints for improved healthcare systems in most African countries (World Health Organization, 2011).

In 2007, the progress assessment report of health indicators showed that sub-Saharan Africa falls behind in meeting all the indicators from the rest of the world that was set through the Millennium Development Goals (MDGs) (Tumusiime et al., 2012). Sub-Saharan Africa still ranked the highest in child mortality rate (children aged less than one month) across the globe, although the under-five-year mortality rate has decreased by half from 1990–2000 to 2000–2011 (El Arifeen et al., 2017). In 2011, only 48.4% of childbirth was attended by healthcare professionals, raising the number of maternal deaths in Africa. Sub-Saharan Africa and South Asia comprise 88% of global maternal deaths and rank the highest with 201,000 maternal deaths (66% of total maternal death) in the world (UNICEF, 2019). In terms of disease prevention, the region significantly lacks healthcare support. In 2018, an estimated 7.52m people in South Africa were recorded with HIV. In 2017, a total of 21% of people with HIV were living in South Africa (TB facts, 2019).

Lack of innovation and improper institutional policy have resulted in a degrading situation in the healthcare system in Africa. The World Health Organization (WHO) reports that due to disease and poor healthcare systems, each year, the African continent is losing US$2.4 trillion from the economy (Newey, 2019). According to a survey conducted by Kruk et al. (2016) between 2006 and 2010, more than 40% of the total primary care facilities in Kenya, Namibia, Rwanda, Tanzania and Uganda have scored poorly to support maternal care facilities. More than 40% of Africans live in rural areas where lack of infrastructural and basic facilities, for example, electricity, creates difficulties to ensure minimum healthcare facilities in those areas.

To optimize the efficiency of the healthcare system in a developing country, having a higher capacity for technological and social innovation is salient (Gardner et al., 2007). Therefore, this study will try to explore the parameters of social innovation and value co-creation in healthcare service delivery through the lens of the 4As service delivery model proposed by Anderson and Billou (2007). The study aims to pursue this goal through the case of WE CARE Solar (WCS), an organization that makes portable solar suitcases to transfer solar energy to the hospitals in many rural parts in Africa. The research chose Africa because the region ranks the lowest in most of the healthcare indicators (especially child mortality and maternal death) set across the world. Through the case of WCS, the study will try to explore how an organization is practicing social innovation in healthcare while cocreating value in its healthcare service delivery process to the rural part in Africa. The rest of the paper is divided into six sections.

The first section discusses the theoretical perspective of social innovation in terms of service delivery using the 4As framework, along with the value co-creation model in the context of healthcare in Africa and other BoP countries. The next section explains the research methodology (documentary research) that has been used for this study. The third section presents an overview of WCS. The next section discusses the insight of WCS through the social innovation process. The fifth section depicts the value co-creation process of WCS through the

4As framework, also the main findings of the study. The last section sheds light on the scope, opportunity and possible outlook of WCS while coordinating the findings for future research.

Literature review: social innovation in healthcare

According to Phills *et al.* (2008), social innovation refers to offering solutions and means to solve social problems while focusing on value creation for the society itself. Mulgan (2006) emphasizes that while business innovation is centered around making a profit, social innovation is driven by the creation and more efficient solution to social problems. However, while Mulgan *et al.* (2007) also define social innovation as being driven solely by social motives, they insist on a wider definition that social innovation is unique and different from improvement, creativity and invention. The aforementioned authors also defined social innovation as new, novel ideas that work and can be successfully implemented and diffused in society while solving a wide array of problems. However, the domain of social innovation is mostly vigilant in social entrepreneurship, design, technology, public policy, business, community development areas (Mulgan *et al.*, 2007). The proper implication of social innovation in the healthcare delivery system is yet to be covered. In general, social innovation is required when there is a huge demand in the market to cater to a social need rather than creating individual value for multiple stakeholders such as entrepreneurs, investors and ordinary users (Ims and Zsolnai, 2014).

In their extensive literature review using a web crawling method, Milosevic *et al.* (2018) identified four components of social innovation. These are objectives, actors, outputs and innovativeness. Objectives are what social problems are being aimed to solve. Actors are developers, supporters, promoters and support providers who come from both private and public sectors (Butzin and Terstriep, 2018). Outcomes are not always as convenient as a product, service or technology and often they include a change in behavior, culture and the introduction of social technology. Innovativeness is any technological or nontechnological scientific, financial, commercial or organizational activity that is being introduced. According to Milosevic *et al.* (2018), this should always be new to the community it is being introduced to. Mulgan *et al.* (2007) emphasize the actor component of social innovation as they describe how the institutionalization of innovation makes it possible for an innovation to be diffused in remote communities.

In the past decade, the concept of social innovation in health gained momentum, attention from the media and has received researchers' attention as well. One of the major goals has been to anticipate health iniquities and address them. The findings of VicHealth framework (Solar and Irwin, 2010) for health equity is a model developed from the work of the World Health Organization Commission, which concludes that there are four types of social innovation. The first type is social movement, which is an informal network among groups. The second type is service-related social innovation, which tries to improve services related to socioeconomic participation through people-centric service delivery and design standards. The third is digital social innovation, in which innovators, actors and beneficiaries cooperate for digital technology-based solutions to social problems. The fourth is a social enterprise, which are organizations that can sometimes be profit-oriented but intend to utilize or reinvest their resources for a social cause. One of the innovation types that go well with the concept of WCS is digital innovation. In their work, Mason *et al.* (2015) explain how digital social innovation impacts health equity using open data, open networks and open hardware. The concept of open hardware refers to making technology related to the production of an innovative tool available for other partners and communities. Currently, most digital social innovations are mediated through the open hardware, often offering new medication, devices and services to the beneficiary communities (Gardner *et al.*, 2007).

The largest and the poorest of the global population of roughly 4.5bn people primarily residing in Asia, Africa and South America are referred to as the BoP market (International Finance Corporation, 2018). Many authors (e.g. Hammond and Prahalad, 2004; Hussler and

Payaud, 2019) argue that catering to this market the right way can allow organizations to not only tap into new markets but also help reduce poverty by ending their economic isolation. Earlier in 2007, Anderson and Billou (2007) argued that in order to sustainably deliver services at the BoP, the 4A model could be used as a tool to guide these businesses. 4A model proposes ensuring that products or services offered are Available, Affordable, Acceptable, and consumers are Aware. A decade ago when 4A was introduced, African nations had a 95% of BoP population with a market size of about US$429bn, it only made sense for organizations attempting social innovation in that region to adhere to the 4A model as a guide (World Resources Institute, 2008). Social innovation in health could involve the solution and the implementation of that solution in the BoP model while utilizing local skills available to the beneficiary communities (Gardner *et al.*, 2007). In the healthcare system, value is cocreated by several actors and drivers. Osei-Frimpong *et al.* (2015) have found social context, beliefs and perceptions and partnerships as the three vital areas to initiate and support value co-creation in the healthcare service delivery process. The concept of the 4As model through social innovation adaptation and value co-creation is yet to be explored in the healthcare sector.

Community-based social innovation in healthcare such as WCS is bridging the existing gap in the least developed countries, going beyond the traditional model and achieving what was impossible a decade ago. A renowned concept that was coined by Mulgan (2006) explains and later elaborates that the social innovation process follows different aspects based on the domain it covers. Murray *et al.* (2010) showed how social innovation generates a prompt idea, fosters a social proposal along with building prototypes. After successful adaptation from the society, particular social innovation sustains for a long time, starts to scale in number and gradually thrusts systemic change to the society. As per (Murray *et al.*, 2010), these steps can be explained in the following:

(1) *Prompts, inspirations and diagnoses:* This stage entails not only analyzing the symptoms but also finding the root cause of the problem to identify the exact solution.

(2) *Proposals and ideas:* At this stage, creative new ideas are developed to solve the problem in question. It is imperative to include as many sources of stakeholders as possible to get support and ideas to develop an innovative solution to the problem.

(3) *Prototyping and pilots:* This is the point where the ideas are tested through developing prototypes, and through the entire trial and error process, the product or idea gets strength. Obtaining feedback from potential users and experts is the key to success at this stage.

(4) *Sustaining:* This is the time when the idea gets recognition and slowly turns into daily practice. Therefore, it involves looking for the financial sustainability of the project that will move the innovation ahead. In the public sector, this means preparing budgets, sourcing funds, allocating teams and other resources.

(5) *Scaling and diffusion:* Several strategies are required for the growth and spread of innovation. Demand from the market also matters as much as the supply to establish a successful new model to solve the existing problem. The diffusion of innovation is possible at this stage as the participating stakeholders are helping with the promotion and spread of the idea.

(6) *Systematic change:* The social innovation process has an ultimate purpose, which is to create systematic change, which mostly involves a new perspective on thought processes and practices along with social movements, regulatory and infrastructure changes.

On the other hand, the 4As framework (Anderson and Billou, 2007) can be identified as an appropriate market strategy that comprises an innovative approach as it is often difficult to serve the enormous customer base in the BoP segment due to well-known barriers such as illiteracy, poverty and uneven or nonexistent distribution channels. By utilizing the 4As – acceptability, availability, affordability and awareness – it is possible to achieve growth and profit in the developing nations, which results in significant social good (Anderson, 2006).

Furthermore, to offer unique experiences, firms need to maintain quality interactions with the users to cocreate offerings that will provide value for both the firm and the users (Prahalad and Ramaswamy, 2004). For significant outcomes, social innovations must consider societal needs by involving stakeholders through an open process of participation, exchange and collaboration with relevant stakeholders (Voorberg *et al.*, 2015).

Documentary research methodology

Documents refer to sources such as files, official proceedings, images and statistical records that have primarily been stored in the form of text (Silverman, 2006; Scott, 1990). These documents are often prepared for purposes other than the specific research in concern. Bailey (1994) describes the documentary research method to be the process of analyzing and studying the documents containing information about events, organizations or individuals we wish to study. In the context of social research, documents serve as a significant source of information (Mogalakwe, 2006).

Some authors argue that the documentary research method is significant in the field of social science research, which, if combined with a theoretical framework, can prove to be more acceptable in research (Atkinson and Coffey, 2004). Despite the significance of documentary research methods, they are not popular with mainstream social researchers and often act as a support system to other research methods (Ahmed, 2010). However, if we can apply the four quality control criteria proposed by Scott (1990), we can use the documentary method as a single essential tool for research. Scott (1990) suggests the document must be authentic, credible, representative and meaningful to be acceptable. Besides, it has been proposed as one of the major research methods in social science research and is cost-effective as well (Ahmed, 2010). The readiness of gathering data in an inexpensive manner, unbiased data sourcing sometimes from a third party uninvolved in the research is the biggest strength that fits our purpose and this method perfectly (Ahmed, 2010). Since the organization in question and founders we were in contact with were situated in two different continents, hence making it impossible for us to physically visit and collect data, the documentary research method fitted our purpose perfectly.

The increasing number of documents and information sources available in recent years makes documentary research methods as suitable for conducting studies in many cases. In this particular case, WCS being a healthcare initiative, documentary research method is a suitable method as most social and public health research involves the use of large amounts of documents (Durand and Chantler, 2014).

In this study, the researchers used a documentary research method to increase the effectiveness of this study. The sources included WCS websites, online news articles, academic research articles, documentary videos and reports published by different government and nongovernment organizations (NGOs). McCulloch (2004) emphasizes how in the past few decades, there is an abundance of information due to the rapid growth of the Internet. He also cautioned authors to read between the lines of the various documents acquired through different sources. This is exactly the case in this paper and to achieve triangulation of data, multiple sources including the founder's statements were collected and studied to achieve clarity of understanding.

To achieve clarity about the scenario, the authors attempted to reach out to WCS. Communication was established using email and professional networking sites. Documents and information were collected, which were prepared by Laura Stachel, the Founder of WCS herself. The data provided us considerable and productive insight into WCS's challenges, communities, changes and achievements in the African communities.

Case findings: WE CARE solar

WCS was founded by Laura Stachel, who is a clinical physician, an obstetrician in the United States (US). In 2008, Laura visited and witnessed hospitals in Africa lacking modern healthcare facilities, and most of them did not even have electricity. Laura observed a large national hospital in Nigeria, where she expected a shortage of modern equipment and technology; however, what she could not realize was the supply of electricity [1] was scarce at night – for at least 12 h. A hospital that has no electricity has a lot of implications; however, in terms of maternity-related complications, it meant that doctors and nurses were operating or conducting deliveries at night with the help of candlelight or kerosene-based light. There were often cases when doctors and midwives had to cancel the procedures as the lights went out at night. No electricity at night meant no way to store blood or arrange blood transfusion. Furthermore, doctors could not be reached during an emergency as there were no devices to contact them without electricity.

Upon witnessing the actual scenario, Laura wanted to improve the quality of those hospitals and approached people for support. Help came from her husband Dr. Hal Aronson, who at that time was working with solar power. Hal thought solar power could be the solution to all these problems in Africa. Initially, they made solar electric panels and shipped them to this remote hospital in Africa. Soon the hospital was provided with a solar-powered system that supported a blood storage refrigerator; there were lights in the operation theater, which decreased maternal death by 70% in the first year.

However, the lack of dependable electricity was a common phenomenon in that region. When other hospitals reached out and asked for help, Laura decided to act. In 2011, Laura formed a nonprofit organization, WCS, and provided the villages with a small solar kit. However, it wasn't until 2013 when they received funds from MacArthur Foundation and started mass producing these solar kits.

Initiatives and operational activities

The solar suitcase is the most renowned product from WCS, it is a portable yellow-colored off-grid solar device, with multifunctional purpose. It weighs only 16 kg, which makes it portable and can be carried on back to remote hospitals to serve the general medical purpose of childbirth purposes. The features of the solar suitcase include lights, charging point, fetal monitor, battery charger and headlamps to attend patients and conduct surgeries at night. The lights set in these devices last an astounding 70,000 h. The lithium battery also has a life of five years. The kit is uniquely created to be used as a wall cabinet and all the hardware needed to set up a suitcase is installed in the suitcase itself (We CARE Solar, 2019).

In some partner nations, the bigger hospitals were equipped with a full-scale permanent solar setup. These setups included solar panels to power equipment in the operation theater, lights during operation, solar-powered refrigerators to store blood for emergency transfusion.

Besides regular initiatives, WCS also provided their solar suitcases in Sierra Leone and Liberia where solar suitcases were handed to local healthcare professionals who were running quarantine camps and dealing with an ongoing Ebola outbreak. In Nepal, during the 2015 earthquake, these solar suitcases were proved to be successful in remote inaccessible

mountains (Wheeler, 2017). In the most recent event, these solar suitcases saved lives when Hurricane Maria left 95% Puerto Ricans with unstable electricity supply. In 2016, Laura started the We Share Solar program, which included training students and teachers to build, assemble and maintain their solar products through. As of 2019, they have either large-scale solar setup or just individual suitcases in around 30 developing nations ranging from Africa to Asia.

Since the beginning, the organization mainly aims to serve women, children and economically disadvantaged populations through addressing solar energy to overcome maternal health and electricity crisis. Table 1 highlights some key contributions that WCS has already made.

Challenges and risk reduction strategy

Operating a nonprofit organization such as WCS, which has operations in multiple African states, is a challenging task. Firstly, the major challenge was to arrange commercial transport and it became more complex for large amounts of lithium ferrous phosphate batteries, which were mistakenly assumed to be hazardous as per aviation guidelines. Secondly, the documentation process to import without duty or tax of these batteries and panels would take months to process. Lastly, initially, the local communities were not equipped to repair, install, replace and modify these solar devices and this would often cost them money that they did not have.

WCS has implemented a three-pronged strategy to deal with these issues. The latest device solar suitcase 3.0 is rugged, rough and has longer-lasting batteries and the organization hopes the devices will last longer than before. Secondly, they have trained local health workers and technicians with the basic know-how of the devices, so they can easily repair minor issues by themselves and make the devices operational again. They also have arrangements with local partner organizations to ensure the availability of funds for replacement parts, especially batteries. In the future, these devices will be equipped with remote access capability to ensure that remotely the devices can be monitored for troubled parts and local health workers can be informed in time.

Discussion: through the lens of social innovation process

The solar suitcase has been awarded for innovation, and it enables health workers not just with lights for tending patients or operating, but also offers usability of mobile, computer or medical devices. WCS suitcases have been proven to be effective in off-grid medical units not only as a regular alternative to electricity but also as the main source of electricity during natural calamities as an emergency response (We CARE Solar, 2019). Being a remarkably efficient solar power provider for ensuring safe childbirth even in remote locations around the

Area of contribution	2014	2015	2016	2017	2018
Number of health workers trained	3,977	6,737	9,549	12,333	15,948
Countries covered	33	38	40	44	44
Number of partners	23	29	40	48	53
Number of deliveries conducted in solar suitcase facilities	359,692	638,340	1,013,154	1,430,934	1,967,385
Health centers equipped with solar lighting	994	1,684	2,387	3,083	3,987
Nighttime medical lighting (in hours)	9,662,280	16,679,040	24,970,380	34,212,180	46,079,133
Source(s): Islam (2019)					

Table 1.
Cumulative number shows development over the years

world, WCS initiative can be referred to as a perfect example of a social innovation process. While early definitions refer innovation as the generation, acceptance and implementation of new ideas, processes, products or services, the later ones focus on how the organization and its stakeholders can benefit from the novelty of a process and products.

Social innovation, however, can be termed as innovative activities that are targeted toward fulfilling a social need (Mulgan *et al.*, 2007) and, therefore, creating social collaborations. To implement a positive and widely accepted social change, an innovative venture such as WCS has to go through six steps – prompts, proposals, prototypes, sustaining, scaling and systemic change (Murray *et al.*, 2010).

Prompts, inspirations and diagnoses
This stage entails not only analyzing the symptoms but also finding the root cause of the problem to identify the exact solution, which was particularly true in WCS's case. When Laura visited a hospital in Nigeria in 2008 as part of a research to lower the country's maternal mortality rate (MMR), she witnessed how, with a lack of reliable electricity, the health workers helplessly struggle to provide support in case of basic maternal care and emergency. Upon experiencing electricity outage on her very first day of duty, Laura describes her experience:

> "I remember thinking...I am literally and figuratively powerless here," Laura added. "I cannot do life-saving maneuvers if I can't even see patients. To be in an operating room when the lights go out, that was the scariest thing in the world to me, realizing that a body is open and there is no light to see what there is to do next."

This experience helped Laura to understand that regular hospital functions get interrupted by lack of energy, and the absence of a reliable form of energy is the reason why millions of mothers and children around the world are dying, and many are at risk. Hence, Laura decided to come up with an alternative solution that is sustainable and will enable the doctors and midwives with electricity to save the lives of millions of mothers and children around the world.

Proposals and ideas
At this stage, creative new ideas are developed to solve the problem in question. It is imperative to include as many sources of stakeholders as possible to get support and ideas to develop an innovative solution to the problem. After that 2018 trip to a Nigerian hospital, Laura and her husband laid out the plan for a portable solar suitcase for the hospital, which uses solar power as an alternative form of energy; hence, it is economically and environmentally viable because it is renewable and inexpensive. Laura and her team engaged the medical service providers in various communities and bigger hospitals to gather insights and experiences for further product improvements. The primary requirement was to develop a solar suitcase that is tough, easy to use and carry and designed to provide longevity requiring minimal maintenance.

Prototyping and pilots
This is the point where the ideas are tested through developing prototypes, and through the entire trial and error process, the product or idea gets strength. Obtaining feedback from potential users and experts is the key to success at this stage. Laura and her team started making the first batch of suitcases in their community backyard with the help of an assembly line created by neighbors and friends who put together those solar electric kits. Laura shares her experience of prototyping the solar suitcases;

And we did a lot of rapid prototyping. So one of the things that was interesting at the time was that we would look at what were the points of failure of existing solar electric systems and what things failed in our own handmade solar electric systems. And by having many prototypes in the field, we were able to start isolating which things needed to be improved and which things were working well. And it really affected the design process.

Sustaining
This is the time when the idea gets recognition and slowly turns into daily practice. Therefore, it involves looking for the financial sustainability of the project that will move the innovation ahead. In the public sector, this means preparing budgets, sourcing funds, allocating teams and other resources. Gradually, as the demand increased rapidly for the solar suitcases, WCS team needed to gather more funds to go into a bigger production. Once recognized through awards and fellowships, WCS began to receive donations. Especially with the funding of The MacArthur Foundation, WCS's innovation moved to scale their kit production.

Scaling and diffusion
Several strategies are required for the growth and spread of innovation. Demand from the market also matters as much as the supply to establish a successful new model to solve the existing problem. The diffusion of innovation is possible at this stage as the participating stakeholders are helping with the promotion and spread of the idea. It was not only the Nigerian hospital that immediately felt the need for the solar suitcases, but also the entire region was in the dire necessity to escape from the darkness leading WCS to scale up their production of the solar suitcases. Till 2019, solar suitcase has served 1.9m people with 24/7 lighting, approximately 4,000 medical facilities in 27 countries in Africa partnering with international organizations such as the WHO, UNICEF, UNFPA and other government and nongovernment agencies in Africa. WCS also campaigned to provide training to the local technicians on the installations and maintenance of the suitcases. Currently, WCS is at this stage through providing educational platforms for health workers to better advise them on the use of the solar kits, which is helping the innovation to diffuse through the communities paving its way toward a systematic change – the next phase of the innovation process.

Systematic change
The social innovation process has an ultimate purpose, which is to create systematic change, which mostly involves a new perspective on thought processes and practices along with social movements, regulatory and infrastructure changes. Laura and her team at WCS are currently heading toward this stage, where the solar suitcases empowered health workers to continue their work even throughout the darkness. Many clinics stayed open for longer hours simply because they had reliable lighting and cell phone charging to contact health service providers and physicians. To this date, WCS is creating an impact and on its way of a systematic change with a total of 4,086 health centers equipped with solar suitcases in more than 20 countries around the world, saving the lives of millions of mothers and children.

Value co-creation through the 4As framework
The 4As framework (Anderson and Billou, 2007) can be identified as an appropriate market strategy that comprises an innovative approach as it is often difficult to serve the enormous customer base in the BoP segment due to well-known barriers such as illiteracy, poverty and uneven or nonexistent distribution channels. By utilizing the 4As – acceptability, availability,

affordability and awareness – it is possible to achieve growth and profit in the developing nations, which results in significant social good (Anderson, 2006).

Furthermore, to offer unique experiences, firms need to maintain quality interactions with the users to cocreate offerings that will provide value for both the firm and the users (Prahalad and Ramaswamy, 2004). For significant outcomes, social innovations must consider societal needs by involving stakeholders through an open process of participation, exchange and collaboration with relevant stakeholders (Voorberg *et al.*, 2015). Therefore, it is strategically imperative for social ventures to incorporate value co-creation into the 4As framework (as shown in Figure 1), especially in the rising markets as the local participants have a deeper understanding of the environment and can influence the social network (Abendroth and Pels, 2013). Social innovation ventures such as WCS are no exception. Besides providing solar kits, WCS realized the people needed the training to use the technology to save lives, and therefore, it launched its *We Share Solar* initiative [2] in 2016.

For an ideal co-creation several management solutions must exist such as effective leadership and governance to manage multistakeholder relationships, design a suitable medium of collaborations (Janamian *et al.*, 2016). Facilitating the process of co-creation also requires interaction between the social innovation venture and the users through the building blocks, which are – Dialogue, Access, Risk Benefits and Transparency (Prahalad and Ramaswamy, 2004). Throughout our analysis, we have observed WCS has held the intent of creating value for its users through repeated engagements and collaborations with stakeholders. One prime example could be when WCS launched its *Solar Suitcase Program 2015* [3] in partnership with local NGOs.

Availability
One of the significant challenges of providing healthcare services in BoP nations is to ensure availability by providing uninterrupted products and services (Prahalad, 2012). Varying solutions to the challenges could be emphasizing on the local delivery methods such as collaboration with small and microenterprises or partnering with grass-root NGOs and local
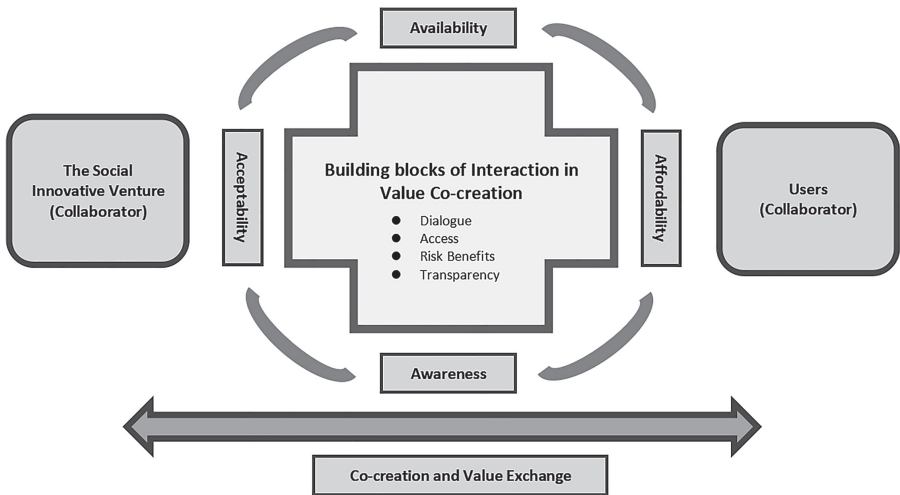
Figure 1.
Social innovation value co-creation through the 4As framework

Source(s): Adapted and modified from Anderson and Billou (2007); Prahalad and Ramaswamy (2004)

authorities (Anderson and Billou, 2007; Ishikawa and Jenkins, 2009). With a focus to reduce maternal and child mortality and to provide emergency health services in many developing nations around the world, WCS has partnered with local authorities, various international agencies, hospitals, healthcare centers and NGOs that can purchase solar suitcases directly. By the year 2017, WCS has partnered with 45 NGOs and UN organizations. To date, a total of 4,118 solar suitcases have been made available to the health centers serving over 2.5m mothers and newborns around the world (We CARE Solar, 2019).

Affordability
BoP consumers have low disposable incomes and often are not capable of affording healthcare expenses when required. In most of the cases, the patients from low- and middle-income countries look for healthcare when they have access to funds (Goudge *et al.*, 2009). Generally, in three ways, people from BoP countries can avail healthcare services – health insurance (Jaiswal, 2008), innovation of the existing products and services (Christensen, 2013) and subsidies (Prinja *et al.*, 2012). WCS has partnered with Arrow Electronics to build the innovative and latest version of the solar suitcases, which are 20% less expensive than previous ones (Arrow Electronics, 2019) and can be easily purchased by the NGOs and public hospitals at a subsidized rate.

Acceptability
BoP markets have unique sociocultural dimensions; hence, different from other markets around the world. Acceptability means meeting or exceeding the unique need of users (Sheth and Sisodia, 2012). From its inception, WCS has constantly addressed the energy crisis in many African healthcare facilities, and currently, solar suitcases are in demand in the majority of African healthcare facilities to tackle difficult times during childbirth. Healthcare workers are now being able to conduct procedures during the night with greater ease using the solar suitcases. Solar-powered cell phones that come with the suitcases allow nurses to alert medical teams at times of emergencies. Life-saving blood transfusions are now available without delay. All these factors have resulted in wide acceptability for WCS suitcases among the developing and underdeveloped nations around the world.

Awareness
Awareness indicates the degree to which the users are aware of the availability of the product or service and also the method of its use (Dwivedi, 2015). As previously stated, partnering with local governments, healthcare centers, hospitals, practitioners and NGOs has helped WCS to create awareness about its innovative solar suitcases. Along with other initiatives to spread awareness, WCS launched its countrywide program as a part of their global *Light Every Birth* initiative in African countries such as Liberia and Uganda (We CARE Solar, 2017). One of the hurdles was teaching the healthcare practitioners the use and maintenance of solar suitcases, and to date, 16,476 health workers were trained to enable millions of deliveries conducted in solar suitcase facilities (We CARE Solar, 2019).

Implication and conclusion
This paper tries to explore the social innovation process in healthcare through the 4As service delivery framework analyzing the case of WCS. We used a documentary research method to acquire impartial data on WCS approaches to see how it cocreates value in the health sector of the consumers of the BoP segment. The study shows that WCS has a positive contribution to the healthcare centers in the least developed countries to prevent maternal mortality by ensuring an uninterrupted power supply utilizing solar energy. Therefore, similar technology or further social innovation should be welcomed to the least developed countries surpassing

the boundaries for healthcare to other social initiatives such as education and empowerment. By exploring the 4As service delivery framework and value co-creation model in the third world context, the paper suggests that cocreating values through multiple-level community engagement may ensure sustainable social innovation in the healthcare system (Ahmed *et al.*, 2018). Hence, this study contributes to link service delivery and value co-creation literature through the lens of a social innovation case in the healthcare delivery system. The study also poses novelty by highlighting the case through the third-world development model. Thus, the government and other stakeholders should come forward and try to create an ecology to ensure value co-creation and social innovation by encouraging innovation, ensuring resources and furthering collaboration in the least developed countries.

For now, WCS is planning to improve its current version of solar suitcases and enable them for remote monitoring and develop an advanced yet easy-to-use user interface. According to Mannion (2017), the African community is slowly transforming from an aid-led economy toward an enterprise-led solution to developmental problems, which means solutions are sustainable and more effective with more inclusion of local communities. WCS has increased local community engagements, partners through training, resource sharing, which helps ease operating in remote regions. Many nonprofit organizations in African regions follow a common approach to development by focusing only on infrastructural support to develop a community. However, a more effective method to develop community lies in empowering local communities through collaboration and knowledge sharing initiatives. Although WCS has major local inclusion, they may further increase their local partnering and involvement to develop these communities in the longer run. Rather than making these communities dependent on aid, WCS can ensure they can attain self-sufficiency in the future. As more and more African companies now become accustomed to the concept and practices of corporate social responsibility, there is a clear window of opportunity for organizations such as WCS that can benefit from local involvement and resource sharing.

This study is one of the very few papers that evaluate the dimensions of social innovation in healthcare and the social innovation process through Anderson and Billou's 4A service delivery model. Recently, Ahmed *et al.* (2019) explored the delivery of healthcare service through the 4As model. However, this paper takes the study one step further by evaluating the value co-creation process in the delivery of healthcare services through social innovation. The methodology used in this research is the first of this kind for the field, therefore, calls for more interdisciplinary research for future in the area of social innovation, value co-creation and innovation diffusion in the healthcare delivery sector of the BoP.

Limitations and future research

This paper contributes to addressing social innovation in healthcare and the social innovation process through the lens of the 4A service delivery model while profiling the case of WCS to connect between theory and the practice applicable to the third-world countries. However, some limitations can be addressed to show the areas for future research. First, this paper solely focused on a single organization offering healthcare service to the rural parts. Therefore, future research work should be recommended on testing the models with more sample size or data sets. Another limitation appears on using only documentary search methods as the basis of this study. Thus, future research may apply more quantitative or qualitative methods with different models such as user adaptation or the innovation diffusion to different social initiatives in the BoP segments. Finally, this research studied the value co-creation process, social innovation, social innovation process and the 4A service delivery model on the dimensions of the healthcare system. Future research may test the models on other social initiatives such as education and empowerment in other underdeveloped and developing country contexts aside from just focusing on Africa.

Notes

1. Electricity and energy are eminent for improved health, which is one of the key indicators of economic advancement in the current world. The access to electricity has been proved to be correlated with decreasing child and maternal mortality rate, higher rates of vaccination and prenatal care and improved nutrition status in children among many developing nations such as India, Pakistan, Bangladesh and so on (Koroglu *et al.*, 2019). Due to its importance, "universal access to affordable, reliable, sustainable, and modern energy" has been marked as target 7 of the recently adopted Sustainable Development Goals (SDGs) by the United Nations (UN, 2015). Though the global population without access to electricity went down to 840m from 1.2bn in 2010 (Ellsmoor, 2019), there are many areas around the world that still remain in darkness. In the year 2010, 57% population of Africa had no access to electricity, with these projections 42% population in Africa will still remain without electricity in the year 2030 (IRENA, 2017).

2. This is an educational program with an overall budget of around $600,000 empowering educators and students. The training programs are conducted in the schools and orphanages in the energy-poor areas in developing countries, and the program curriculum reaches high schools and colleges to access solar power to eradicate energy poverty. This program initially trained doctors, midwives on solar device usage and installation. Later, they launched a program that would train and enable women from disadvantaged regions to learn and then train the people back home in remote communities. Till now, 15,940 people have been trained including healthcare professionals, healthcare technicians and solar installers (We CARE Solar, 2019). In 2017, We Share Solar program has reached 7,200 students to build 1,133 units of solar suitcase serving around 67,000 international youth beneficiaries by this time.

3. For this initiative, We Care Solar partnered with local NGOs to deliver solar suitcase to the rural health centers. Solar suitcase programs include technology innovation, project implementation (training, distribution and maintenance) and research. The program mainly serves females and children (0–19 years). Total budget for this program is around $4,000,000

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About the authors

Jashim Uddin Ahmed, PhD, is a professor and chairman of the Department of Management, School of Business and Economics, North South University, Bangladesh. He is the founder of InterResearch, a leading research organization in Bangladesh. He has been awarded his PhD in Management Sciences from the University of Manchester Institute of Science and Technology (UMIST, currently known as The University of Manchester), UK. He has achieved master's degrees in both Marketing and Management from the University of Northumbria, UK. He also studied in the University of Reading and the University of Lincolnshire and Humberside, UK. His research interests include social innovation, higher education, strategic management and contemporary issues in marketing and management. He has published over 120 research articles and business case studies in reputed journals. Jashim Uddin Ahmed is the corresponding author and can be contacted at: jashim.ahmed@northsouth.edu

Mohammad Asif Gazi is a lecturer at the Department of Management, North South University. He completed his master's degree in Entrepreneurship, Innovation and Management from the University of Nottingham, UK. He completed his MBA and BBA in Tourism and Hospitality Management from the

University of Dhaka. Before joining NSU as a faculty member, he worked as a lecturer at Bangabandhu Sheikh Mujibur Rahman Science and Technology University. His research interest centers on entrepreneurship, innovation and sustainability, tourism and SME and tourism policy.

Rifat Iqbal has been working as a lecturer in the Department of Management under School of Business and Economics in North South University, Bangladesh. She has completed Master of Management from the Australian National University with Merit and Bachelor of Business Administration from North South University, Bangladesh. She has over four years of experience working in various fields of HR and Administration in companies such as Chevron, Bangladesh, Australasian Procurement and Construction Council (APCC), Australia, and so on. Her research interest includes Strategic Management, Innovation Management and Corporate Human Resource Management Practices.

Quazi Tafsirul Islam is a lecturer at the Department of Management under School of Business and Economics in North South University. He has obtained his Masters in Management & HR from University of Dundee, Scotland, UK, with a distinction and was awarded the "MSc Management Award" for being the best student of the program. Prior to this, he completed his bachelor's degree from North South University, Bangladesh. Before joining academia, he worked for three years in Standard Chartered Bank and Eastern Bank of Bangladesh in Retail and Wholesale Banking division in different capacities. His research interest includes HR Innovation, HR Accounting, Employment Practice, Millennial Employment and Technology Adaptation.

Niza Talukder is currently a lecturer at North South University. She completed her master's degree in Economics and Management from London School of Economics and Political Science (LSE) and bachelor's degree in Economics from University of Leicester. Her research interests focus on development economics and sustainable energy.