

Vending machines used for contraceptives in developing countries

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Questions

To what extent have vending machines / condom machines been used to make contraceptives available in developing countries? In particular, “smart” vending machines that use the “Internet of Things” to report when they need restocking, or include internet enabled tablets for information or video chat.

- If there is limited experience of doing this, to what extent have vending machines been used to make other health commodities available in developing countries?*
- What do we know about how successful this was?*

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1. Overview

The evidence found for this report shows that vending machines have been used to make contraceptives available to vulnerable groups in low and middle income countries in a number of programmes. Examples from different parts of the world include:

- A six-year HIV prevention pilot programme started in 2009, which plans to install 100 CVMs using mobile phone-based technology in several bars and nightclubs in Tanzania. This year, the United National Population Fund donated even more CVMs to be distributed in areas with the highest HIV prevalence rates in Zambia.
- CVMs are due to be installed in Thai shopping malls and schools as part of the “Condoms for Teens” programme.
- Brazil plans to install several CVMs in all schools, and a national competition was launched for students to design “better” versions for use in the future. An El Salvador pilot provided the only project available to include both CVMs and oral contraceptive machines.

The effectiveness of CVM programmes has been mixed:

- Campus based CVMs “could perhaps” help female students with uptake of condoms in Ethiopia.
- There is insufficient data to prove how successful CVM programmes aimed at youth have fared in Ghana, Thailand and Brazil.
- Resistance to use of such machines exists: in Vietnam, only a fifth of the restaurants and cafes approached accepted CVMs offered by DKT International. In Trinidad, a government-based CVM research effort including hoteliers and other entertainment organisations is still facing opposition from several religious organisations.

A number of common issues/challenges have been faced by some of the initiatives:

- Rwandan hotspots were found to have irregularly stocked CVMs in “condom kiosks” due to problems with public-private partnerships; poor management also affected potential CVM programmes in Sierra Leone.
- Because CVMs have been vandalised, entrepreneurs in Ghana and Kenya have designed more technologically advanced vending machines to encourage higher use and proper upkeep. CVMs have been stolen in India - reasons for this include irregular stocks and poor maintenance of the machine.
- Several universities in Taiwan now have their own CVMs on campus; students from one Vietnamese university have designed and installed a free campus CVM to spare students’ embarrassment in buying condoms. However, some machines have been dismantled in Chinese universities due to opposition.

Lessons have been learned from such initiatives:

- Challenges concerning the location of proposed public CVMs were found with the “100% Condom Use Programme” in Mongolia, the “PLACE” study in Jamaica, as well as in programmes/projects in China, India and El Salvador.
- The high price of condoms obtained from CVMs have contributed to low use of such machines in Congo, China and Vietnam. Tokens and/or coin denominations needed for

use in the machines were found to be problematic in Mongolian, Chinese and Indian regions.

- In order for CVM use to be successful in these countries, coordination of their maintenance by various stakeholders is essential. Although technological advancements in their development have been made, use of the “Internet of Things” in CVM development has not become mainstream as yet.

There is limited data confirming use of vending machines for other health-related commodities in developing countries. One such success is the installation of sanitary towel machines in girls’ schools in India. HIV testing kits sold via vending machines are currently being piloted in some Chinese university campuses.

Although CVMs programmes are important in pregnancy and HIV prevention programmes, due to cultural sensitivities regarding condom use, they have not been researched extensively. Most of the available evidence comes from media interviews and investigations. There are limited published evaluations available, especially from Latin American and Caribbean countries. Results presented are gender-blind, however, more data is available for vending machines stocking male condoms, than for female condoms and oral contraceptives for women.

2. Vending machine programmes for contraceptives in low and middle income countries

Condom vending machines (CVMs) have been used in several pregnancy and HIV/AIDS prevention programmes in African, Asian, South American and Caribbean regions:

Africa

Congo

Availability of condoms in the country has increased due to strategically placed CVMs selling three-packs of branded condoms for 100 CFA francs (USD0.28). These dispensers are found in most of Congo's busiest towns as a result of an initiative by the National AIDS Council and the UN Population Fund, which installed 40 machines across the country (IRIN PlusNews, 2008). A condom distribution and sales network was set up in 2007; during that year seven million condoms were distributed - 300,000 of which were from CVMs in areas frequented mostly by young people, such as dance bars, university campuses, theme parks and hotels. Petrol stations were also targeted, as taxi and bus drivers are at high risk of HIV.

Effectiveness:

There is no evaluation of this initiative. However, packs can be obtained for half the price (50 CFA francs) from other distribution points, such as hospitals and pharmacies (IRIN PlusNews, 2008). Donor agencies also make free or cheap condoms and abortifacients available.

Ethiopia

Condom use in Ethiopia has proved effective in helping stem the spread of HIV. DKT Ethiopia's condoms are usually sold well below market cost, and are heavily subsidised for those in need through various organisations that work with the government's HIV/AIDS Prevention and Control Office, and by direct outreach to sex workers (Jeffrey, 2014).

Effectiveness:

DKT Ethiopia planned to install CVMs in restaurant bathrooms in 2008, although there is no evidence to show that this was actually conducted. Anecdotally, it is said that when companies put in CVMs in restrooms, they are empty of condoms by the end of the day; however, there is no evidence to prove this due to cultural sensitivities regarding condom use. Results from one study suggests that installation of CVMs at large universities in southern Ethiopia "could perhaps be a new and effective way to increase the uptake of condoms among a vulnerable demographic of female students who are traditionally intimidated by the stigma associated with condom procurement" (Wells & Alano, 2013: 8).

Ghana

Condoms are scarcely available in non-traditional outlets (NTOs) such as hotels, drinking spots, salons (Ghana Ministry of Health, 2015: 14). In 2011, the Ghana AIDS Commission (GAC) purchased 400 CVMs and had installed the majority by 2013. A National Condom and Lubricant Programming Strategy (NCLS), launched in Accra in 2015, aims to improve access and use of quality condoms and lubricants in the country.

Non-government organisations (NGOs) and civil society organizations (CSOs) are key channels for targeting condom distribution in areas where HIV prevalence is highest (Ghana Ministry of Health, 2015: 6). The two social marketing entities currently operating in Ghana are the Ghana Social Marketing Foundation (GSMF) and the NGO DKT International. The private or commercial sector is vibrant but fragmented, with several players. Condom brands are positioned using CVMs for different market segments to ensure closer access to where the users live, and at hours when they are needed.

Effectiveness:

The introduction of CVMs in 2013, popularly referred to as "Condom ATMs", in the upper east region has seen high patronage by local youth. However, condom distribution channels, especially through non-traditional outlets and CVMs, are still underutilised (Ghana Ministry of Health, 2015: 22). Local media reports that most CVMs in Bolgatanga have been destroyed and can no longer be used (RON Blog, 2015); initial findings also state that the pilot lacks "viable long-term resupply plan and maintenance", and that "appropriateness of the actual machines" needs to be "reassessed" (Ghana Ministry of Health, 2015: 44). Therefore, a more thorough evaluation of this CVM pilot project must be commissioned.

Rwanda

Population Services International (PSI), a non-profit social marketing organisation based in Washington DC, initially installed about 60 vending machines in several hotspots in Kigali, and later installed 690 more across the country. A new scheme, dubbed the “24/7 Condom Distribution Kiosks Initiative”, involves strategic placement of “condom kiosks” or CVMs in four HIV high risk areas in Kigali. The government initiative, in partnership with the AIDS Healthcare Foundation and the City of Kigali (CoK), is part of a broader effort to control HIV spread through safe sex practices, emphasising on geographic hotspots and high risk groups, such as female sex workers (Kantengwa, 2016). This group is the major driver of HIV transmission in the country, according to the Rwanda Demographic and Health Survey (DHS) 2015.

Effectiveness:

Newspaper survey research indicates that many CVMs at hotspots and lodges in Kigali are either run down or idle due to lack of condoms (Kantengwa, 2016). Stock levels in some lodges were found to be “inconsistent” as the machines are only “filled once in a while”. This indicates that the capital’s inhabitants are still at high risk of HIV.

The CVMs were introduced under a public private-partnership initiative to increase access to and availability of condoms. The Rwanda Biomedical Centre (RBC) - which installed the machines - provides oversight for coordination of different strategies. However, implementation of the strategies is a shared responsibility of various stakeholders, such as the Society for Family Health (which provided the initial stock of condoms), the private sector, the social marketing sector (which provides condom brands at a subsidised price) and outlet (hotspot) owners. Cyrus Ntaganira, of the Society for Family Health, said their role is now to ensure that owners of hotspots know where to find wholesalers: “We have distributed 2,673,057 condoms via social marketing between January and March 2013. However, the owners of hotspots have to demonstrate responsibility for their clients and keep re-stocking condoms in the vending machines” (African Seer, 2013).

Sierra Leone

One company, Fomel Industries and National Industrialisation Centre (FINIC), designed and manufactured what is thought to be the first CVM in Africa. It can operate continuously as it functions without the need for batteries or other forms of power. Managing Director Foday Melvin Kamara explains: “You know buying a condom is stigmatizing so a lot of people still shy away from going to the stores to buy a condom. We were contacted by the United Nations Population Fund (UNFPA) in 2002 and they asked us to design a machine that can sell condoms...In two months we came out with the design that dispenses a packet containing 3 condoms. It works by inserting two coins of 100 Leones (USD0.03) and press the lever and a packet of condom will pop out” (African Agribusiness Magazine, 2014).

Effectiveness:

Initially, the initiative to install CVMs in guest houses, hotels and entertainment centres frequented by young people was not successful. FINIC MD Kamara explains: “We had a project with the HIV and AIDS Secretariat for these machines to be installed in all those entertainment centers in the country. However, the project did not go well with the type of management the Secretariat then had, but we are planning to revitalise the project because they now have a new management system. We also plan to work with CARE Sierra Leone because they are also engaged in the campaign to reduce sexually transmitted diseases in the country. We have written to them and we are waiting for their response on that. So at the moment the machines have not yet been deployed to those centres where we intended to use them” (African Agribusiness Magazine, 2014).

Tanzania

In 2009, bars and nightclubs in several cities had CVMs placed in the bathrooms as part of national efforts to combat HIV. PSI, who implemented the project, stated that 100 machines would be installed in bars in the Iringa, Morogoro and Mbeya regions (IRIN, 2009). Mobile phone-based technology was to be used for distribution of condoms and the other health products it offered to the Tanzanian public.

Effectiveness:

As this is part of a six-year pilot project, no evaluation is available yet.

Zambia

As part of its collaboration with the Government of Zambia’s continuous efforts to increase condom availability, accessibility and use, UNFPA donated 250 CVMs to the National AIDS Council in Zambia in January 2017. The dispensers are to be distributed to provinces with the highest HIV prevalence rates (UNFPA Zambia, 2017).

Effectiveness:

This is the second donation from the agency, together totaling an estimated USD64,650. Although there is no evidence available to prove this, it can be assumed that the CVMs are a positive influence in decreasing prevalence of HIV in the country.

Asia**China**

Health authorities and experts had been appealing to universities in China to install CVMs for many years, but were repeatedly turned down (Hui, 2015). In 2015, all Beijing universities were

instructed to install CVMs and introduce an HIV/AIDS prevention class for freshmen, a move to curb the increase in prevalence of the disease among college students. Research confirms that most young people think condoms are used for preventing pregnancy, but are unaware of the importance of condoms in preventing HIV/AIDS (Hui, 2015). Nonetheless, this decision was a controversial one for Beijing which attracted some criticism.

Effectiveness:

Although some colleges dismantled their CVMs due to social pressure, research from two Shanghai colleges evaluating the impact of installation of the machines on students' behaviour and attitudes has revealed that CVMs did have a positive influence on their sexual behaviour (Liang et al, 2002).

In 2006, numerous hotels in Shanghai refused to stock condoms distributed as part of an AIDS awareness initiative in accordance with the Regulation on AIDS Prevention and Control, Shanghai Municipal Commission of Population and Family Planning. Fan Jincheng, deputy director of the Social Development Bureau of Pudong New Area, admitted there was a problem with hotels stocking condoms: "Among the 200 hotels above the level of three stars, only 10 to 20 of them have agreed to install the condom vending machines sent by the government, and more than half of the hotels refuse to accept free condoms." He added that the biggest obstruction came from people's way of thinking (Lang & Relsted, 2006).

Despite this, introducing CVMs in universities may not be feasible in the long run, according to Jing Jun, a sociology professor at Tsinghua University (Hui, 2015): "Vending machines require regular staff to replenish them, but that service may not last long." CVMs appeared in Tsinghua University, Beijing several years ago, but were out of use only after a year or two due to poor maintenance. Asking Tsinghua University to reinstall those machines was unnecessary, as convenience stores and pharmacies inside or near the university sell condoms (Hui, 2015).

A study by Uretsky on businessmen who regularly visit commercial sex workers, but avoid HIV testing for fear of threatening their economic and political status, made a positive initial evaluation of local condom distribution programmes. The government's plan of condom promotion in hotels and entertainment establishments resulted in one hundred CVMs being distributed in local hotels. However, their use was fraught with challenges – especially as most CVMs were located in "conspicuous locations" such as public entrances, as well as requirement of a one yuan coin¹ which was "rarely used" in the Dehong area (Uretsky, 2016:199-201). It was also suggested that unless there is an incentive for government officials, it is difficult for them to implement such a condom programme effectively.

India

The National AIDS Control Organisation (NACO), which is a division of the Ministry of Health and Family Welfare in India, has launched several innovative approaches to promote condom use, including a CVM programme. In 2005-07, NACO installed 11,025 CVMs in 10 states under Phase I of a national programme. HLL Lifecare Ltd (HLL), one of the largest manufacturers of

¹ It is more common to pay for shopping in China with banknotes (Euromonitor International, 2015).

contraceptives in the world, associated itself with Delhi Metro Rail Corporation (DMRC) in order to make both male and female condoms available in stations across the capital (The Times of India, 2014). Another 10,025 CVMs were installed in four metros (Delhi, Mumbai, Kolkata and Chennai) and in two major towns (Uttar Pradesh and Orissa) in Phase II of the programme that began in 2008 (NACO, 2016).

Effectiveness:

Since their installation, a total of 2.2 million condoms have been sold by CVMs in India (NACO, 2010: 22-23). However, few people accept the concept of CVMs (i.e. to make condoms easily available to the public) and therefore do not use the machines (Bhasin & Chitlangia – The Times of India, 2009). Recent data demonstrated that only 7 per cent of females felt that condoms should be available in CVMs in all public toilets, although a significantly larger number (59 per cent) of males felt so (Mutha et al., 2014).

As in parts of China, lack of suitable coin denominations in India is considered an important reason for slow development of the vending channel. Following the high inflation and devaluation of the Rupee against all major currencies during the early 1990s, coin denominations can be too small to be convenient for a vending machine (Euromonitor International, 2005).

Approximately, 600 of the 3,000 CVMs that were installed by NACO in different locations around Delhi from 2007-2009 are not working, having been vandalised (to steal either money or condoms), removed, or dismantled for scrap metal. CVMs installed in government offices, DTC bus terminals and depots, and community toilet complexes are still operational, probably due to appropriate security measures. However, machines installed in areas such as Delhi University and RML Hospital have had few users. One of the main reasons is ignorance regarding the exact locations of the machines (Bhasin & Chitlangia, 2009). The CVMs were installed by Hindustan Latex Family Planning Promotion Trust (HLFPPT) in collaboration with NACO. Each CVM costs around Rs 5,800 (USD90.5). 380 CVMs that were removed from high risk sites had to be installed at new locations; 82 NGOs now ensure that the CVMs are stocked with condoms at all times.

In Mumbai, the CVM scheme also failed to yield the desired results for want of proper planning and research in selecting the installation sites (railway stations, petrol pumps, public toilets, paan shops and other public areas) and proper maintenance (by HLPPT), according to experts. The government spent Rs 2.57 crore (USD3.81million) to procure and install the CVMs, but the sales have been far from encouraging (Khan, 2009). Of the total 3,530 CVMs installed in the city, about 875 are non-functional. Sales from the remainder have been at an average rate of one condom per machine per day, whereas the maximum vending capacity of a machine is 22 packs per day, each containing two condoms. Revenue generated through condom sales was only Rs 2.76 lakh (USD4140) to June 2009. Sale of four pieces per machine per day would make the project successful (ibid).

NACO planned to investigate why use of condoms from machines in selected areas was lower than expected using a CVM Programme Evaluation Study (NACO, 2010: 25). However, as approximately 90 per cent of CVMs installed at public places by NACO for HIV/Aids prevention went missing, a 2013 comptroller and auditor general (CAG) report stated that the project was consequently discontinued by NACO (Hindustan Times, 2013). The report explains that the

CVM scheme “was characterised by poor planning and implementation and Ministry of Health did not undertake any feasibility study for it considering sale of condoms was very low as compared to projections by NACO” (ibid). It pointed out that in Phase I of the project, of which 9,860 machines of 11,025 CVMs installed in high-risk areas were not traceable or were lost; 1,130 machines were traced but were not functioning: “As the CVMs installed under Phase I were not insured against theft and damage, thus no recovery/claim could be made in respect of stolen machines” (ibid).

Similarly, in Phase II of the project, 1,546 machines were damaged, 161 stolen and 1,791 could not be installed. The report states: “The sale of condoms through CVMs was very low in comparison to projects of NACO. The intended objective of improving the accessibility of condoms in high risk areas through CVMs was not achieved despite investment of Rs 21.54 crore (USD3.3 million) under the scheme. The hasty manner of release of funds by the ministry under Phase II without ascertaining the status of CVMs installed earlier was inappropriate” (Hindustan Times, 2013).

Each machine had a capacity of 500 condoms; according to NACO, there were 72 CVM refilling centres across Gujarat that looked after the machines at regular intervals and refilled them according to usage (Chakraborty, 2014). However, the reason given for why thousands of CVMs went missing or were stolen was that the contract between NACO and HLL expired in 2009; after which there had been no attempt to maintain the machines.

Mongolia

The “100% Condom Use Programme” (CUP) was piloted in Darkhan Uul Amag in northern Mongolia in 2002 by the National Centre for Communicable Diseases (NCCD), Ministry of Health, with technical support from WHO country and regional offices.

Effectiveness:

A review document highlighted a number of challenges with the CUP: the CVMs were not being utilised due to absence of tokens, or their positioning in public locations (MPHPA, 2009: 8). The use of tokens or coins were assumed to be a hindrance if customers needed to obtain them from the hotel reception (MPHPA, 2009: 10).

Taiwan

In 2013, National Cheng Kung University (NCKU) in southern Taiwan installed two CVMs on campus, making it the first national university in Taiwan to promote safe sex and healthy lifestyles among their students. The safe-sex on-campus campaign to prevent AIDS and sexually transmitted diseases is urgent given the growing percentage of AIDS patients in Taiwan, according to Department of Health statistics. The opening ceremony of the two CVMs occurred on National HIV Testing Day, June 27, which was intended to raise awareness of safe sex among the university students.

Effectiveness:

The CVMs on university campuses were found to make condoms more accessible to students. Prior to the instalment, the students would go to the health centre to get condoms from the nursing staff, according to feedback from National Cheng Kung University (Chuang, 2013).

Following NCKU, twenty other universities in Taiwan were also expected to set up on-campus CVMs (Chuang, 2013). However, there is no evidence to confirm that this occurred.

Thailand

The growing rate of sexual diseases and teen pregnancies is a problem in Thailand (Khaosod English, 2015). To tackle it, the Public Health Ministry reached an agreement with the Education Ministry to double the number of condoms under the “Condoms for Teens” programme: the figure was increased to 80 million per year at a cost of 37 million baht (USD1.1 million). They also agreed to install CVMs in shopping malls and schools. There is no mention as to whether “smart technology” or “Internet of Things” will be used in these CVMs.

Effectiveness:

Two papers that reported on the effectiveness of CVMs distribution in communities [Kaeodumkoeng et al, 2007; Umsuriya et al, 2006], used only numbers of condoms sold per machine and/or customer satisfaction as their outcome measures (Tipwareerom & Weglicki, 2017). There is no other available data to evaluate the success of CVMs in schools.

More recent research includes in-depth interviews of a small group of parents/ guardians of high-school Thai boys to explore the adults' knowledge, attitudes, behaviour regarding condom use, and their role in preventing HIV/sexually transmitted infections. The results reveal that half of the group disagreed with the “National Condom Strategy” of installing CVMs in schools (Tipwareerom & Weglicki, 2017).

Vietnam

In 2004, the first of 20 automatic vending machines in Vietnam stocked with branded condoms were installed in the bathrooms of restaurants, cafes and public toilets in Hanoi, in an initiative led by DKT International to familiarise people with the practice of using condoms (Vietnam Breaking News, 2004). The project was initiated by EZ Vendor and supported by the Vietnam Committee for Population, Family and Children.

Each condom sold by the machine requires a VND500 coin (USD0.02), compared to VND200 for a condom sold in pharmacies. The machines were imported from China at a cost of USD330 each. DKT estimated that if each machine sold five condoms per day, 100 condoms would be dispensed from the 20 machines: “We’re not trying to profit from this kind of sales outlet, but rather we want to increase the use of condoms in Vietnam,” explained Lin Menuhin, DKT’s deputy director (ibid).

More recently, students of Duy Tan University in Da Nang City have created a CVM using mobile phone-based technology that dispenses condoms free of charge to spare people the embarrassment of openly buying them at stores (Tuoi Tre News, 2016). The machine automatically alerts its creators via text messages whenever it runs out of condoms. It also tracks the number and time used for statistical purposes.

Effectiveness:

In future, CVMs are expected to be installed in other areas such as dance clubs, railway stations, hotels and other entertainment centres (Ngoc, 2004). Evidence from other countries where DKT had implemented the same project indicates that the machines are successful. Acceptance of condoms using these CVMs is an important step in upgrading reproductive health by offering easier access for people, and reducing the obstacles to buying condoms. As more than 100 businesses were approached for the EZ Vendor project, the 20 that accepted the CVMs equates to only a 20 per cent uptake. This highlights the fact that condom use is still a sensitive issue in Vietnam.

South America and the Caribbean

Brazil

In 2007, the Health Ministry of Brazil planned to install 400 CVMs machines in schools to combat the spread of AIDS and other sexually-transmitted diseases. According to the government news agency [Agencia Brasil](#), test machines were due to be installed in 100 schools in 2008, with the plan to expand and cover all public schools at a later date. The health ministry eventually intend to also install them in bars, clubs and 24-hour gas stations.

A high number of [CVMs with both male and female condoms](#) were also installed in the Athlete's Village for the 2016 Olympic Games in Rio, due to the rise of the Zika virus.

Effectiveness:

A study conducted by UNESCO in 2007 concluded that two-thirds of the parents surveyed approved of the government offering adolescents free condoms and sex education. This shows that parents in the world's largest Roman Catholic nation approve of the idea. To increase condom distribution, the ministries of health and education launched a nationwide contest for technical schools to design a "better" CVM (which may include the use of "Internet of Things": the interconnection via the Internet of computing devices embedded in everyday objects). Although the team of students with the best design were due to be awarded USD25,000, no further information is available on the success of CVM use in schools or the competition.

There is also no data on use of such machines by athletes or Brazilian adult citizens.

EI Salvador

The “Contraceptive Vending Machine Project” in San Salvador was a pilot programme which was also conducted in Bangladesh (Siems, 1977). It was operated by ADS (Asociación Demográfica Salvadoreña) - which is still the main distributor of condoms in the country today. Ten CVMs and eight oral contraceptive (pill) machines were installed in 1974; a further 50 CVMs were donated two years later.

Effectiveness:

The main challenge in the pilot included inappropriate location of the contraceptive machines (Siems, 1977); however, no update on the outcome of the project is available.

No further programmes using such contraceptive machines have been established since this pilot.

Jamaica

In 2001, a “Priorities for Local AIDS Control Efforts” (PLACE) study identified over 400 public sites in Kingston where people had higher rates of new and concurrent sexual partnerships than the general population. The Jamaica Ministry of Health developed and piloted a package of site-based prevention programme components that could be tailored for use at sites as diverse as commercial sex streets, fast food restaurants, bars and night clubs. Their outreach officers assisted in the installation of CVMs.

Effectiveness:

Baseline findings from a randomised controlled trial investigating the impact of the programme indicated that the outreach workers found it difficult to place CVMs at street sites (Weir et al, 2008: 805).

Trinidad

In 2007, the Trinidad and Tobago government purchased CVMs as one of several initiatives to manage HIV/AIDS levels. A research effort involving various stakeholders, including hoteliers and event organisers, was undertaken focusing on possible venues for the machines.

Effectiveness:

Authorities had to overcome opposition from several prominent religious organisations in order to move towards implementing the initiative (IPS, 2007). There is no information on whether the CVM initiative took place, or if it was evaluated.

3. Lessons learned

CVM programmes have had varying levels of success in developing countries. One lesson learned is the need to protect CVMs from vandalism, which is where technological advancements can help. A Ghanaian entrepreneur, Prince Nkrumah, invented a CVM which dispenses condoms when a text message is sent to a short code. The machine, which was the first of its kind in the world, has several advantages over existing systems in other countries. It has a cashless system, and has been designed to automatically adjust prices in the event of increases in the prices of goods and services and currency change. The CVM can also automatically send inventory status to managers for an efficient and effective stocking system. There are plans to export the technology to other countries across the West African sub-region (Russel, 2009). Although technological advancements have been made with CVMs, using the “Internet of Things” in their development has not become mainstream in this sector as yet.

Examples provided in this report prove that in order for CVMs to be used successfully, their maintenance by suitable stakeholders is essential. Other preconditions for success include: 1) acceptance of the principle that machines should be located in public places; 2) wide circulation of appropriate coins; 3) establishment of a workable, long-term financial and managerial framework; 4) provision for a competent repair person; and 5) commitment to continuous upgrading of sites based on sales analysis (Siems, 1977).

4. Use of vending machines for other health-related commodities

HIV testing

China is currently piloting the use of vending machines that sell HIV testing kits on university campuses. The goal is to reach students who may be reluctant to go to a clinic for a test because of the stigma associated with contracting HIV. The experimental programme began in 2016 on five college campuses in the city of Beijing, as well as in Harbin, Guangxi and Heilongjiang provinces. Users pay the equivalent of a little over USD4 for a kit, with a container for a urine sample that can be dropped off anonymously at a receptacle in the machine that dispenses the test. Users can check their results online in 10 to 15 days (Feng, 2017). The programme is overseen and subsidised by the National Centre for AIDS/STD Control and Prevention (NCAIDS) (Feng, 2017).

Effectiveness:

No evaluation is available.

Sanitary pads

In Tamil Nadu, India, sanitary pads are available for just Rs 2 (USD0.03) through vending machines. The napkin vending machine is sponsored by UNICEF and ShriCheema Foundation, an initiative in corporate social responsibility by TVS Electronics Ltd. Earlier this year, a Kenyan

entrepreneur devised a new “villager ATM” system to increase access of sanitary items including pads, diapers and condoms through locally fabricated vending machines (Bizna Kenya, 2017).

Effectiveness:

Although there is no published research evaluating the Indian school vending machine programme, it is said to be “a boon to the girl students” (Goyal, 2016).

The innovative vending system will be assessed in the first international competition for hardware-led social innovation, which is organised by the American Society of Mechanical Engineers (the world’s largest mechanical engineering organisation) later this year.

Other health-related commodities

There are syringe disposal vending machines available, but these have mostly been tested in high-income settings. Most health research around vending machines has been in relation to the healthiness of food/snack machines, again in high-income settings. The technology used in such vending machines is advancing: one example is the world’s first **Twitter-activated** vending machine in Cape Town, South Africa. It was developed in 2012 and is used to supply iced cans of Rooibus tea commonly used for its health benefits.

Effectiveness:

There has been no publicised evaluation of the Twitter-activated vending machine, therefore such health-related machines using the “Internet of Things” cannot be appraised fully, as yet.

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