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REVOLUTIONIZING PRIMARY HEALTHCARE IN AFRICA: EMPOWERING YOUTH THROUGH THE HECKLING MODEL OF HEALTH SYSTEMS ENGINEERING AND INNOVATION

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ABSTRACT: *This perspective hypothesizes the Health Entrepreneurship Compensation of Knowledge and Innovations among the Next Generation (HECKLING) model, which aims to kickstart a dialogue and delve into research in utilizing the skills, innovation, and vast youth population in Africa to generate employment opportunities in complementing community Health Promoters/volunteers. The proposed entrepreneur model fosters a holistic approach to sustainable flower farming by integrating healthcare, environmental responsibility, community engagement, and economic growth. It creates a symbiotic relationship between flower farms, healthcare providers, volunteers, manufacturing companies, and research institutions, paving the way for a resilient and thriving community ecosystem. By harnessing the potential of Artificial Intelligence, the model seeks to enhance health outcomes within communities*

The model proposes integrating health systems engineering concepts into the virtual healthcare hubs and virtual digital tray centers aligning with the principles of primary healthcare, preventive medicine, entrepreneurship, and sustainability. It acknowledges operational efficiency and ensures the long-term sustainability of community health initiatives which have the potential to compensate community health volunteers consummately.

By applying the concept of carbon credits to preventive and health promotion efforts, the model could create new opportunities to incentivize and reward individuals and organizations for their contributions to improving public health reducing healthcare costs, and promoting community development.

Integrating health systems engineering concepts into the virtual healthcare hubs and virtual digital tray centers aligns with the principles of primary healthcare, preventive medicine, entrepreneurship, and sustainability.

KEYWORDS: Community Health Volunteers, Compensation, HECKLING, Innovation, Digital trays, Virtual Health care hubs.

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BACKGROUND

The contribution of community health volunteers and promoters in ensuring access to essential health services, especially limited resource settings has been underscored (Angwenyi et al., 2018; Woldie et al., 2018). Ideally, their efforts should be acknowledged and compensated appropriately (Ormel et al., 2019) to keep them motivated as lack of motivation reduces their performance (Aseyo et al., 2018). Despite recognition of their vital role, resource constraints and debates about sustainability and equity influence decisions regarding compensation. Low-income countries, including Kenya, have diverse policies regarding compensating community health volunteers, with some providing stipends or allowances while others rely solely on volunteerism (Ballard et al., 2021). Resource constraints often influence these decisions, as many countries face limited healthcare budgets and competing priorities. Nonetheless, there's a growing recognition of the invaluable role these volunteers play in healthcare delivery, particularly in rural and underserved areas (Angwenyi et al., 2018; Bhaumik et al., 2020).

Some countries are exploring ways to formalize and support these roles, viewing compensation as an investment in health system strengthening. However, debates persist regarding the sustainability, equity, and potential dependency associated with volunteer compensation. In Kenya, efforts such as the Community Health Strategy aim to integrate volunteers into the healthcare system, sparking discussions about appropriate compensation models within the country's healthcare sector (Division of Community Health, 2020); (*Kenya National Community Health Strategy 2020 -2025*,).

Is volunteerism in Community Health Strategy sustainable?

The sustainability of volunteerism in the Community Health Strategy hinges on addressing the underlying factors influencing the willingness of future generations of youth to engage in unpaid work in Africa. While the older generation may find pride in voluntarism, ensuring the commitment of younger individuals depends on several factors. The intrinsic motivation derived from a sense of purpose and a genuine desire to make positive contributions to communities can inspire the youth to willingly participate in volunteer work. Recognizing and nurturing this innate drive becomes crucial for fostering sustained engagement among the younger demographic. By emphasizing the significance of their contributions, providing opportunities for skill development, and creating supportive environments, the Community Health Strategy can enhance the appeal of volunteerism, thereby promoting its long-term sustainability among future generations of youth in Africa.

The prospect of gaining valuable skills and experiences through volunteer opportunities may further attract their participation. Feeling recognized and appreciated for their contributions also plays a pivotal role in motivating youth to volunteer, even in the absence of financial compensation.

However, numerous challenges may dissuade young people from participating in unpaid volunteer work.
Economic constraints, arising from unemployment, scarce financial means, and the obligation to provide for themselves and their families, often compel individuals to prioritize paid employment over volunteering. Consequently, those who engage in volunteering may aspire to receive compensation in the future as a means to address their financial needs and obligations (Azunna et al., 2022).

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The lack of recognition and support for volunteer contributions, coupled with safety concerns and social stigmas surrounding unpaid labor, may further discourage youth involvement in volunteer activities. Time constraints arising from multiple responsibilities, such as attending school or engaging in income-generating activities, pose challenges to balancing commitments (Carayon et al., 2018).

The absence of community health-focused educational opportunities in the public domain can divert young individuals towards fields with more accessible training options. This lack of specialized education may lead them away from public health-related volunteering, pushing them towards alternatives like paid internships in different sectors that may or may not offer tangible skill development and economic advancement.

Addressing these barriers requires creating innovative supportive environments for volunteering, including offering financial incentives where possible, recognizing and celebrating volunteer contributions, addressing safety concerns, and promoting the overall value of volunteerism as a means of personal and community development.

Potential of Proposed Health Entrepreneurship Compensation of Knowledge and Innovations among the Next Generation (HECKLING) Model

Africa has a tremendous opportunity to harness the skills of their young, technologically savvy population, particularly in the realm of community health volunteers and primary healthcare. Recognizing that these individuals are unlikely to provide volunteer services for free, there's a potential avenue to leverage their expertise for job creation, particularly in preventive healthcare.

Guidance from health specialists and professionals is essential to help these tech-savvy individuals, who may serve as community health volunteers, develop IT solutions tailored to their communities' specific health needs. Collaboration between these groups ensures that the innovations address both current and future health challenges, emphasizing the importance of preventive healthcare.

The future generation is less likely to embrace offering ‘free service’ and will need compensation due to competing demands of living. In terms of compensation, a model akin to carbon credits could be adopted. Just as carbon credits incentivize environmentally friendly behavior, compensating these individuals for their contributions to community health could follow a similar principle. By assigning value to their innovations and efforts in improving public health, whether through monetary compensation or other incentives, it acknowledges the importance of their work and encourages further participation. This approach not only taps into the skills of the next generation but also establishes a sustainable model for enhancing primary healthcare systems through technology. The term community health promoters or innovators would probably be more appealing to the Zoomers and alpha generations.

With the enormous potential for digital health, (Butcher & Hussain, 2022), the HECKLING model suggests harnessing the innovation and expertise of the youth to create employment opportunities, especially considering the reluctance of young individuals to work without compensation, even in the context of community health volunteering. By capitalizing on their skills, integrating AI technologies, and offering fair remuneration, this approach aims to

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address both the youth unemployment issue and contribute to the improvement in the health status of the populace.

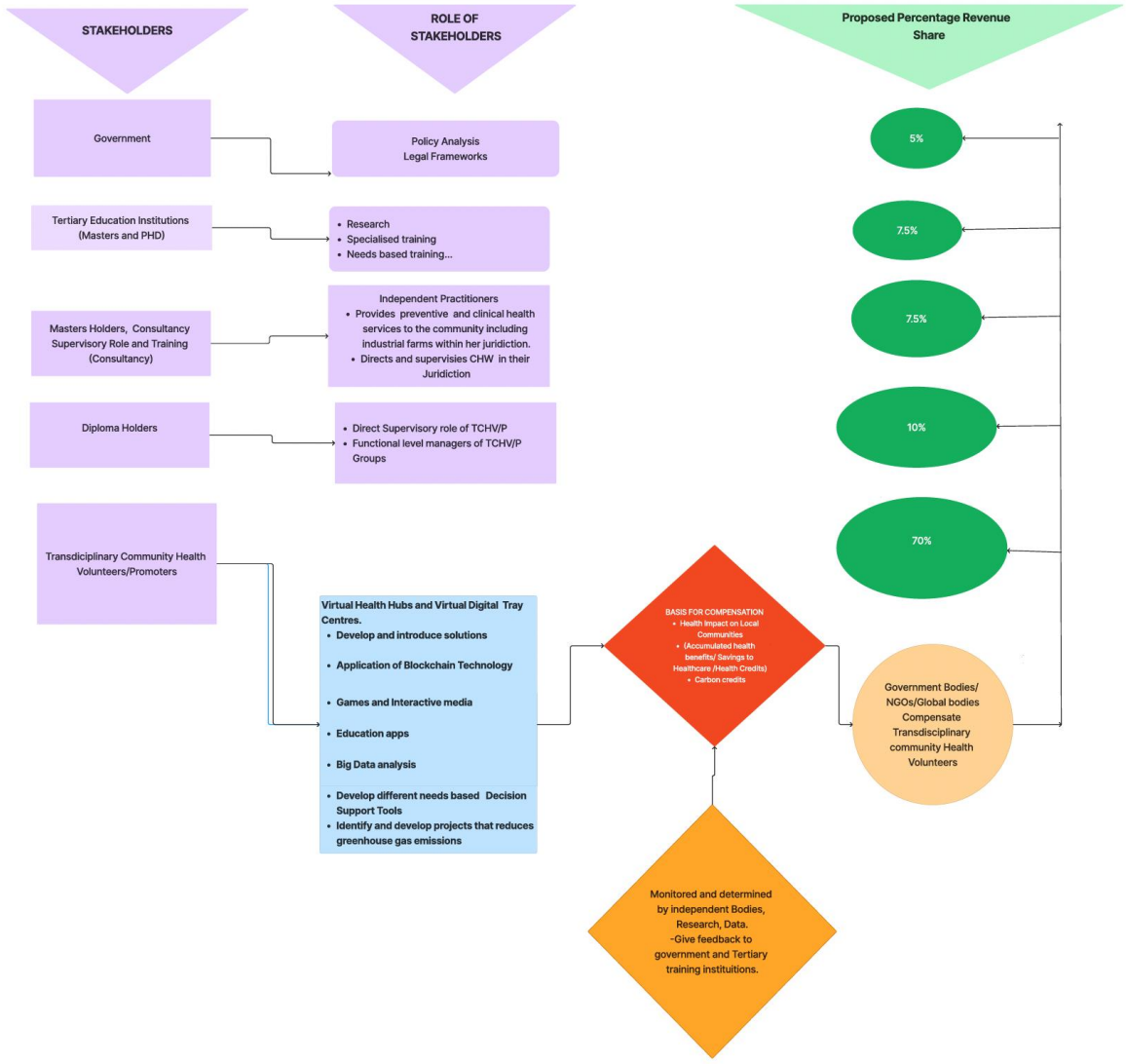
The health sector requires adequate, well-trained, knowledgeable, competent, and equitably distributed human resources for health (HRH) with the right cadre mix.

Through a multilevel player structure, participants are incentivized at various tiers. In this paper, we use Kenya as a case study to further this hypothesis in a flower farm setting.

COMPONENTS OF THE HECKLING MODEL

The proposed entrepreneurial model synergizes sustainable flower farming with community healthcare services, environmental accountability, and local manufacturing. Figure 1, outlined the proposed players and their roles as well as the proposed prorated compensation.

Figure 1: Conceptual Model For Health Entrepreneurship Compensation of Knowledge and Innovations among the Next Generation (HECKLING) Model



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Key Components:

Healthcare Provision:

- Flower farms are mandated to source health services exclusively from Nurse Practitioners within their jurisdiction. The NP also provides health services to the households within their geographical jurisdiction.
- No private clinics are permitted within the flower farms to ensure centralized and regulated healthcare provision.
- Nurse practitioners maintain comprehensive and quality medical records for all farm workers as well as the household members within their jurisdiction.
- The NPs are accredited to the SHIFby the government

Environmental Accountability:

- Flower farms are held accountable for their greenhouse gas emissions and other environmentally hazardous emissions.
- The farms are responsible for monitoring, reporting, and reducing their environmental impact.

Community Volunteer Teams:

- Nurse practitioners manage and lead Transdisciplinary Community Health Volunteer (TDCHVs) teams in the provision of healthcare services.
- The TDCHVs develop and implement innovative practices that reduce greenhouse gas emissions
- The farms finance these volunteer teams, compensating them for their services under the supervision of the nurse practitioners.

Local Manufacturing Support:

- TDCHVs, in collaboration with county industrial parks, produce materials required by local manufacturing/flower farms companies.
- The manufacturing/flower farm companies commit to purchasing the produce from TDCHVs
- Research institutions guide product development and ensure quality control.

Waste Management and Carbon Credits:

- Incorporate benefits from industrial waste management, utilizing waste for productive purposes.
- Earn carbon credits through sustainable practices and emission reduction efforts.

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Revenue Model:

- Flower farms allocate funds to finance the nurse practitioners and their community volunteer teams.
- Revenue generated from sustainable practices, waste management, and carbon credits is reinvested into the community healthcare system and local manufacturing support.
- Governments commit to plowing back health care savings to the NPs and their teams.

Role of the Government

It is expected that the government will play regulatory and policy development as well as re-orientating primary health care to achieve Sustainable Development Goals (Hone et al., 2018).In addition By quantifying the health savings resulting from the interventions of TDCHVs and reinvesting these savings back into the volunteer groups, the government can recognize their efforts, foster sustainability, and further enhance the impact of community-based healthcare initiatives.

Tertiary and Training Institutions

Community Health Strategy (CHS) to support Universal Health Coverage (UHC), requires to have well-trained Community Health Workers (CHWs) to provide essential health services (Division of Community Health, 2020). However, challenges persist in implementing this strategy. Empirical data and reports highlight the need for CHWs to possess adequate assessment and decision-making skills, especially in critical situations like the COVID-19 pandemic.

Current CHWs lack these skills and often perform tasks beyond their scope of practice (Cometto et al., 2018).

It is crucial that when a community health volunteer (CHV) makes a referral, the receiving end should be a highly skilled healthcare professional capable of managing the client effectively.

To achieve this, there should be a deliberate knowledge gap between the community health volunteer and the first point of contact within the mainstream healthcare system. This gap ensures that the healthcare professional handling the referral possesses the necessary expertise to address the client's needs comprehensively. By establishing this intentional knowledge gap, we enhance the efficiency of the referral process and improve the overall effectiveness of healthcare interventions.

Training institutions play a crucial role in addressing the skills gap (Bvumbwe & Mtshali, 2018). As a result, there's a push for the re-orientation of Registered Community Health Nurses (CHNs) to bridge this gap and ensure proper alignment between training and practice. The registered community health nurse would preferably be a degree holder.

They need to adapt their curriculum to equip Registered Community Health Nurses (RCHNs) with the necessary skills to effectively serve communities, including disease assessment and decision-making abilities. Additionally, ongoing training and professional development programs are essential to ensure CHNs remain competent in responding to emerging health

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challenges like COVID-19. By re-orienting RCHNs and enhancing their training, the health sector can better utilize CHWs and Community Health Volunteers (CHVs) in delivering promotive, preventive, and curative services, ultimately advancing the goal of achieving Universal Health Coverage.

At the highest level are the "Trainers of Trainers," individuals who not only disseminate knowledge but also mentor others. These would be expected to be Masters of Nursing Holders or Master of Allied Clinical Health professionals. These TOTs would then train the RCHNs who need to be equipped with skills and act as trainers of Transdisciplinary community health Volunteers.

Community Health Volunteers or Promoters

The community health volunteers are expected to be a Transdisciplinary team utilizing one health approach. The bulk of these carders is expected to majorly be youth. These will be charged with the responsibility of developing innovative solutions, such as serious gaming, virtual reality, big data analytics, and AI applications, which hold promise in revolutionizing healthcare delivery. The documentation and database of original ideas would preferably be anchored on Blockchain technology to avoid theft of ideas. These solutions would be geared to meeting the appeal of the next 10 to 20 years. Decision support systems that leverage technical input from key stakeholders would be structured around a solid framework and operate on the principle of data as the primary currency. Compensation for these innovations would then be tied to performance, encouraging both participation and excellence in contributions to community health. This model leverages the energy and creativity of the youth while ensuring their financial well-being, ultimately leading to improved health outcomes for the nation.

Possible compensation scheme

The proposed HECKLING model (Figure 1), holds significant potential for self-employment among participants due to its emphasis on innovation and entrepreneurship. By empowering young individuals to develop innovative solutions and leveraging their expertise in areas like gaming and AI, the model creates opportunities for them to establish their own ventures or freelance businesses. For instance, developers of AI-powered healthcare applications could commercialize their products, while "Trainers of Trainers" could offer their expertise as technical advisors, consultants, and or educators providing insights into the dynamics of the healthcare ecosystem.

Compensation within this scheme could be prorated and vary based on the level of involvement and the success of individual initiatives. Those who excel in their roles as trainers or developers could command higher fees for their services or earn royalties from the sale of their products. Additionally, participants could benefit from networking opportunities within the HECKLING community, leading to collaborations and partnerships that further enhance their earning potential.

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Access to Innovative Solutions via Virtual Health Hubs and Virtual Digital Tray Centers

In the context of virtual healthcare, the structure of the virtual healthcare hubs and digital health tray centers would be adapted to operate in a digital space. Virtual Healthcare Hubs serve as online platforms that have transdisciplinary stakeholders convene to collaborate on community health initiatives (Schwamm et al., 2020) and have the potential to leverage one health approach(Basu et al., 2023). These hubs would feature virtual meeting rooms for webinars, workshops, and training sessions, facilitating activities such as mentorship programs for "Trainers of Trainers" and innovation workshops for developers. They would also host online forums and discussion boards for ongoing communication and idea sharing among participants.

Administrative functions, including program coordination, marketing, and financial management, would be managed through dedicated online portals.

Virtual healthcare hubs could integrate with telemedicine platforms, enabling healthcare professionals to conduct virtual consultations, share resources, and coordinate care for community members (Gutierrez et al., 2021) more so in rural settings. The incorporation of blockchain technology would not only offer the security of data and intellectual ideas but also promote trust between developers and their clients (Hasselgren et al., 2021)

Virtual digital tray centers which are online hubs are designed to provide digital health services and resources to communities (Awad et al., 2021). These centers would offer access to digital health technologies such as telemedicine platforms, AI-driven health apps, and online educational resources.

Each center would have a team of trained professionals, including virtual health coaches, tech support personnel, and healthcare providers, available to support users in navigating and utilizing digital health tools effectively.

Services provided through virtual digital tray centers could include virtual consultations with healthcare providers, self-assessment tools for health monitoring, interactive health education modules, and access to digital health records (Awad et al., 2021).

To engage and serve the community, virtual centers could host virtual health fairs, online support groups, and community challenges focused on health promotion and disease prevention. African countries, exemplified by Kenya's adoption of the Digital Health Bill of 2023, showcase a readiness within the health ecosystem for the integration of virtual digital platforms. This legislative step, reflected in "The Digital Health Bill, 2023 (The Digital Health Bill, 2023) underscores a proactive approach to incorporating digital advancements into the healthcare system. Kenya's commitment to this bill signals a recognition of the potential benefits and efficiencies that virtual digital tools can bring to the healthcare landscape.

Leveraging on Health Systems engineering concepts

Integrating health systems engineering concepts (Padula et al., 2014) into the virtual healthcare hubs and virtual digital tray centers within the HECKLING model can enhance the effectiveness of primary healthcare, promotive, and preventive medicine while fostering entrepreneurship and sustainability. Health systems engineering enhances operational efficiency(Patriarca et al., 2017), promotes preventive measures, supports entrepreneurial

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endeavors, and ensures the long-term sustainability of community health initiatives within the HECKLING model. Health systems engineering could be realized through;

Operational Efficiency and Primary Healthcare:

Health systems engineering emphasizes optimizing processes and workflows (Wagner et al., 2019). In the context of virtual healthcare hubs, this translates to streamlined virtual consultations, efficient data management, and coordinated care delivery.

Virtual hubs can incorporate systems that automate appointment scheduling, virtual waiting rooms, and electronic health record (EHR) systems to enhance the efficiency of primary healthcare services.(Kane et al., 2019)

Promotion of Preventive Medicine:

Health systems engineering involves designing processes to prevent errors and enhance patient safety (Hasselgren et al., 2021). In virtual digital tray centers, this can be translated into user-friendly interfaces for preventive health measures. Virtual centers could employ AI-driven tools for personalized health risk assessments, early detection of potential health issues, and automated reminders for preventive screenings or vaccinations (Kazi et al., 2020).

Entrepreneurship Opportunities:

The HECKLING model encourages entrepreneurship, and health systems engineering can play a role in developing innovative solutions. Developers within the model can create digital health applications, AI tools, and telemedicine platforms, presenting entrepreneurial opportunities (Khandelwal et al., 2022).

The virtual healthcare hubs can serve as incubators for healthcare startups, providing mentorship, resources, and networking opportunities for young entrepreneurs interested in the intersection of technology and healthcarein a country that has high acceptability of e-commerce in healthcare (Muathe & Muraguri-Makau, 2020).

Sustainability in Healthcare Delivery:

Sustainable healthcare involves resource-efficient practices. Health systems engineering can contribute by optimizing resource allocation, reducing waste, and improving the overall sustainability of healthcare services (Division of Community Health, 2020).Virtual digital tray centers can adopt eco-friendly practices, such as paperless operations, energy-efficient technologies, and minimizing the environmental impact associated with healthcare delivery.

Community Engagement and Sustainability:

Health systems engineering emphasizes patient and community involvement in healthcare processes (Carayon et al., 2020). Virtual centers can leverage social media, online forums, and community engagement platforms to involve the community in health promotion and preventive initiatives, ensuring the sustainability of these efforts over time.

It has been noted that even in developed countries the sustainability of e-health start up is a challenge

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Virtual healthcare hubs and virtual digital tray centers leverage online platforms to promote collaboration, innovation, and accessibility in healthcare delivery, extending the reach of healthcare services to individuals regardless of geographical location or physical presence.

Compensating teams in preventive health and health promotion volunteer programs through carbon credits (https://offset.climateneutralnow.org/aboutoffsetting) or similar mechanisms could be a creative approach to incentivize and reward their efforts. This would not only provide an alternative income for the youth but also possibly reverse the transfer of technology from low to high-income countries (Ishimwe et al., 2023)

Here's how it could work:

1. **Health Impact Measurement:** Just like carbon sequestration, the impact of preventive health and health promotion activities can be measured in terms of their contribution to improved health outcomes and reduced healthcare costs. For example, preventive measures such as vaccination campaigns, health education programs, community health screenings, and environmental conservation can lead to lower rates of disease transmission, fewer hospitalizations, and better overall health(Mailloux et al., 2021).

2. **Measurement and Verification:** Similar to carbon offset projects, there would need to be mechanisms in place to measure and verify the health impact of the activities undertaken by volunteers. This might involve collecting data on health indicators, tracking changes in health behaviors, and assessing the effectiveness of interventions. The savings realized by the Ministry of health/governments could then be ploughed back to compensate the volunteers.

3. **Health Credit Certification:** Once the health impact has been verified, volunteers could receive certification for the health credits they've generated. These credits would represent the positive health outcomes achieved through their efforts.

4. **Health Credit Markets:** Just as there are carbon credit markets, there could be health credit markets where organizations, governments, and individuals can purchase health credits to offset healthcare costs or demonstrate their commitment to improving public health.

5. **Compensation:** Volunteers could be compensated for the health credits they generate based on market prices or predetermined rates. This compensation could take the form of monetary rewards, incentives, or other forms of recognition for their contributions to public health. Cost-benefit analysis models such as Social Return on Investment (SROI) Analysis: (Edwards & Lawrence, 2021) (Banke-Thomas et al., 2015).SROI analysis evaluates the social, environmental, and economic impacts of an intervention, including both financial and non-financial outcomes. It quantifies the value of these impacts relative to the resources invested in the intervention, providing a holistic assessment of its value to society.

6. **Incentives and Support:** In addition to direct compensation, volunteers could receive incentives, training, and support to participate in preventive health and health promotion activities. This could include access to resources, professional development opportunities, and ongoing feedback to enhance their effectiveness as well as linking the Health Volunteers' Transdisciplinary teams with national and international player organizations.(Andonova & Sun, 2019)

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Potential challenges and their suggested solutions

The HECKLING model is expected to paly out in a dynamic ecosystem and hence likely to face potential challenges. Table One highlights some of the possible challenges and proposed solutions.

TABLE 1: POTENTIAL CHALLENGES AND POSSIBLE SOLUTIONS	
Potential Challenges	**Possible Solutions**
1. Regulatory Compliance:	
Ensuring compliance with local and national regulations	- Legal Advisory: Engage legal experts for guidance.
The government honoring their promise	- Training: Conduct regular compliance training.
	- Monitoring: Implement robust monitoring and auditing mechanisms.
2. Financing:	
Securing consistent and adequate funding	- Diversified Funding Sources: Explore grants, partnerships, and community contributions.
	- Revenue Sharing: Establish agreements based on performance and outcomes.
3. Carbon Credits Market:	
Fluctuations in carbon credit values	- Hedging Strategies: Implement risk-mitigating strategies.
	- Long-Term Contracts: Secure stable contracts with buyers.
4. Community Engagement:	
Recruiting and retaining volunteers	- Community Outreach: Conduct engagement activities and awareness campaigns.
	- Incentives: Offer training and recognition to motivate volunteers apart from possible financial gains.
5. Quality Control:	
Ensuring product and service quality	- Quality Assurance: Implement stringent control measures.
	- Training Programs: Provide ongoing professional development.
6. Environmental Impact:	
Resistance to sustainable practices	- Education and Awareness: Raise awareness of environmental benefits.
	- Incentive Programs: Offer tax breaks or subsidies.
7. Coordination with Research Institutions:	
Establishing and maintaining partnerships	- Partnership Agreements: Develop formal agreements.
	- Regular Communication: Maintain consistent feedback and alignment.

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CONCLUSION

Incorporating the concept of carbon credits into preventive health and health promotion efforts offers a transformative approach to improving public health outcomes while reducing healthcare costs. By leveraging the large population of youth in Africa and integrating health systems engineering skills, this proposed framework incentivizes innovation and collaboration in addressing pressing health challenges. Through the development of virtual digital health platforms, engagement of community health volunteers, and application of health systems engineering principles, this approach fosters scalable, sustainable solutions. However, it's important to note that this framework is proposed and would require rigorous testing and evaluation to assess its effectiveness and feasibility in diverse contexts. By rewarding contributions to preventive healthcare, this framework not only recognizes individual and organizational efforts but also lays the groundwork for building resilient and equitable health systems for the future.

Disclosure of interest

The author declares no competing interest.

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