Disruptive and Reverse Innovation Challenges for Developing Countries

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Abbreviations

ACALISE	African Centre for Agro-ecology & Livelihood Systems
ACEED	African Centre of Excellence in Energy for Sustainable Development
ACEIDHA	Africa Centre of Excellence in Infectious Diseases of Humans and Animals
ACEIoT	African Centre of Excellence in Internet of Things
ACEITLMS	African Center of Excellence for Teaching and Learning Mathematics and Science ACE-DS African Centre of Excellence for Data Sciences
ACENUB	African Centre of Excellence in Underutilised and Neglected Biodiversity (ACENUB).
ACEWM	Africa Center of Excellence for Water Management
AFAAS	African Forum for Agricultural Advisory services
AFOVIDA	Asociación Fomento de la Vida
AI	Artificial intelligence
AIMS	Animal Identification Management Solution
AISA	The Organisation of International Schools in Africa
AISH	Academy for International School Heads
AM	Additive Manufacturing
AnMBR	Anaerobic Membrane Bioreactor
APA	Agricultural Policy Analysis
APEPA	Asociación de Productores Ecológicos de la Provincial Aroma
API	Application Programmer Interface
ARCE	Africa Railway Center of Excellence ADERS Asociación para el Desarrollo Sostenible
ARISE	Africa Research, Implementation Science and Education
ASIP	Start-up Initiative Program
ASMU	Academic Support and Monitoring Unit
AVD	Africa Voices Dialogue
AVRDC	The Organisation of International Research and Development Centers for Agriculture. World Vegetable Center.
AVU	African Virtual University
AWS	Amazon Web Services
BBM	Bachelor of Business Management
BD	Becton, Dickinson
BEIS	Business, Energy & Industrial Strategy
BILT	Bridging Innovation and Learning in TVET
BIVMC	Brenton International Venture Manufacturing Corp.
BoP	Bottom of the pyramid
BYD	Build Your Dreams
C3	Cloud Contact Center
CABs	Community Ablution Blocks
CARDI	Caribbean Agricultural Research and Development Institute
CASEL	Collaborative for Academic, Social, and Emotional Learning
CASP	Community Aid & Sponsorship Programme
CATL	Contemporary Amperex Technology Co. Limited

CBOs	community-based organisations
CCK08	Connectivism and Connective Knowledge
CCRP	Crop Research Program CDA Center in Dryland Agriculture
CDC	Centers for Disease Control
CDT	Africa Centre for Innovative Drug Development & Therapeutic Trials for Africa
CEA / IEA-MS4SSA	Centre of Excellence in Innovative Teaching / Learning of Mathematics and Sciences for Sub-Saharan Africa
CEA-CCBAD	Center of Excellence for Climate Change, Biodiversity, and Agriculture
CEADESE	Center for Agricultural Development and Sustainable Environment
CEA-MEM	Centre d'Excellence Africain Mines et Environnement Minier
CEA-SMA CERSA	Centre d'Excellence Africain en Sciences mathematiques et Applications
CEFOR	Center of Excellence in Oilfeild Chemicals Research
CEFTER	Center for Food Technology and Research
CERHI	Center of Excellence in reproductive Health Innovation
CERViDA -	DOUNEDON Centre of Excellence in Sustainable Cities in Africa -
CESAAM	Centre of Excellence in Sustainable Agriculture & Agribusiness Management
CETIC	Centre d'Excellence Africain en Technologies de l'Information et de la Communication CHOVI - Cholera Vaccine Initiative
CGIAR	Consultative Group on International Agricultural Research CICO Cash-in, Cash-out
C&I	Commercial and industrial
CIAT	International Center for Tropical Agriculture
CIFOR	Center for International Forestry Research
CIP	International Potato Center
Climate SABC	African Centre of Excellence for Climate Smart Agriculture and Biodiversity Conservation
CLN	Connected Learning Network
CNG	Compressed Natural Gas
COROS	Cargo Recognition and Organization System
COUR	Coursera Inc.
CPLT	Council for Transparency
CRAFS	Centre for Resilient Agri-food Systems
CREATES	Collaborating Centre for Research, Evidence, Agricultural Advancement & Teaching Excellence & Sustainability
CRFPE	Centre Régionale de Formation de Personnels de l'Education de Dakar CRG CEMEX Research Group
CRI	Culture, Race, and Intersectionality
CRPM	Centre for Rapid Prototyping and Manufacturing
CS-OGET	Center of Studies in Oil and Gas Engineering and Technology
CSIRO	Commonwealth Scientific and Industrial Research
CTA	Call to Action
CUT	Central University of Technology

DG INTPA	Directorate General's Department for International Partnerships
DHET	Department of Higher Education and Training
DI	Disruptive Innovation
DII	Disruptive and Inclusive Innovation
DISA	Defense Information Systems Agency
DIY	Do It Yourself
Dmap	Disability map
DMMEs	Developed Markets Multinational Enterprises
DNDi	Drugs for Neglected Diseases Initiative
DoD	Department of Defense
DOMI	Diseases of the Most Impoverished
DRD	Disability Research and Capacity Development
DST	Department of Science and Technology
DV	The Digital Village
DV&I	Digital Ventures & Innovation
EEGF	Energy Entrepreneurs Growth Fund
ECAR	Electro-Chemical Arsenic Remediation
EC-JRC	Agroecology Consortium, EC-Joint Research Centre
ECSA-HC	East, Central, and Southern African-Health Communities
EEGF	Energy Entrepreneurs Growth Fund
EM	Effective Microorganisms
EMNEs	Emerging Countries Multinational Enterprises.
ERJ	Embraer Regional Jet
ESARO	Southern Africa Regional Office
EV	East Ventures
EYF	Earn Your Future
FARA	Forum for Agricultural Research in Africa
FAS	Farm Advisory Services
FCR	Feed conversion ratio
FERA	Food and Environmental Research Agency
FFS	Farmer Field Schools
FIND	Foundation for Innovative New Diagnostics
GATD	Global Access for Technology for Development
GEFI	Global Education First Initiatives
GEM	Grain quality-enhancer, energy-efficient, and durable material
GFAR	Global Forum on Agricultural Research
GHG	Greenhouse Gas
GIFEC	Ghana Investment Fund for Electronic Communications
GPR	Ground Penetrating Radar
GR	Gas Remaining
GRID	Generational Renewal, Inclusion, and Diversity
GSM	Global System for Mobile communications
GVTs	GoodVision Technicians
HEA	Higher Education Authority
HCW	Health Care Waste
HIC	High-Income Countries
HPS	Husk Power Systems
IAH	Intra-Abdominal Hypertension

IAP	Intra-Abdominal Pressure
IBPGR	International Board for Plant Genetic Resources
ICE	Internal Combustion Engine
ICMEC	International Centre for Missing and Exploited Children
ICPE	Installations classified for the protection of the environment
ICRAF	World Agroforestry
ICT	Information and Communication Technologies
IDI	Infectious Disease Research Institute
IEA	International Energy Agency
IEB	Independent Examinations Board
IGAD	Authority on Development
IITA	International Institute of Tropical Agriculture
ILRI	International Livestock Research Institute
INPAR	Instituto Presbiteriano Álvaro Reis
INSEFOODS	Sustainable Use of Insects as Food and Feeds
IOL	Intra Ocular Lens
IoT	Internet of Things
IP	Intellectual property
IPCL	Indian Petrochemicals Ltd IPDM Integrated pest and disease management
IPGRI	International Plant Genetic Resources Institute
IRPM&BTD	African Centre of Excellence for Innovative Rodent Pest Management & Biosensor Technology Development
ISBT	International School Board Training
ISSB	Interlocking Stabilized Soil Block
ITM	Infection-and-Treatment' Method
IVCC	Innovative Vector Control Consortium
IVI	The International Vaccine Institute
IWMI	Innovative Water Solutions for Sustainable Development
KAIND	Kitchen Appliances Innovation & Development
KEPHIS	Kenya Plant Health Inspectorate Service
LAI	Local institution Lentes al Instante
LeNNS	Learning Network on Nutrition Surveillance
LFC	Leverage Freedom Chair
LPG	Liquefied Petroleum Gas
LUANAR	University of Agriculture & Natural Resources
JICA	Japan International Cooperation Agency.
KDSL	Kenyetta Digital School of Learning
LIF	Lucky Iron Fish
LMICs	Low- and Middle-income Countries
M2M	machine-to-machine
MAKA	Menstruation Administration Knowledge Affordability
MAPRONANO	Centre of Materials, Product Development & Nanotechnology Makerere University
MaRCCI	Makerere University Regional Centre for Crop Improvement
MBRCGI	Mohammed Bin Rashid Centre for Government Innovation
MCL	Maximum Contaminant Level
MEST	Meltwater Entrepreneurial School of Technology

MCS	Mukuru Clean Stoves
MDI	Microfinance Deposit-Taking
MFI	Microfinance
MIP	Multi-year Indicative Programme
MLP	Multi-Layered Plastic
MNCs	Multinational Corporations
MOOCs	Massive Open Online Courses
MQA	Mining Qualification Authority
MSMEs	Micro, Small and Medium-Sized Enterprises
MUIIS	Market-led, User owned ICT4Ag-enabled Information Service
NAQS	Nigerian Agricultural Quarantine Services
NARO	National Agricultural Research Organization
NCA	Netherlands Court of Auditors
NICU	Neonatal Intensive Care Units
NIMR	Nigerian Institute of Medical Research
NCI	National Cancer Institute
NGO	Non-Governmental Organisation
NIMR	Nigerian Institute of Medical Research
NIMCURE	NIMR Co-Creation Hub
NBF	Nippon Bio-Fuel
NPK	Nitrogen, Phosphorus, and Potassium
NYCBE	Nine-Year Continuous Basic Education
OAU	ICT- Driven Knowledge Park
OCW	Open Course Ware
O2O	Online to Offline
OCW	OpenCourseWare
OECD	Organisation for Economic Co-operation and Development
OER	Open Educational Resources
OPSI	Organization for Environmental Education and Protection
OU	Open University of Mauritius
PACA	Partnership for Aflatoxin Control in Africa
PAFO	Pan African Farmers Organization
PAYG	Pay-As-You-Go
PCM	Phase Change Material
PDPs	Product Development Partnerships
PDTS	Product Development Technology Station
PDVI	The International Vaccine Institute and the Pediatric Dengue Vaccine Initiative
PDVI	Pediatric Dengue Vaccine Initiative
PeLN	Personal Learning Network
PES	Presidential Employment Stimulus
PGM	platinum-group-metals
PHARMBIOTRAC	Pharm-Biotechnology & Traditional Medicine Centre
PH	Patrimonio Hoy
Pih	Payment Integration Hub
PIPRA	Public Intellectual Property Resource for Agriculture
PMP	Practice Makes Perfect
PoS	Point of Sale

ppi	pixels per inch
PrLN	Professional Learning Network
PTRE	Centre of Excellence in Phytochemicals Textiles and Renewable Energy
PUD	Produk Unggulan Daerah
PUE	Power Usage Effectiveness
PYE	Partner Youth Empowerment's
PwC	Pricewaterhouse Coopers
PVA	Polyvinyl Alcohol
QR	Quick Response
RCoEs	Regional Centres of Excellence
RELI	Regional Education Learning Initiative
RIICs	Regional Inclusive Innovation Centres
RIU	Research into Use
RMRN	Regional Multi-actor Research Network
RPI	Refuge Place International
RTB	Roots, Tubers, and Bananas
RUFORUM	Regional Universities Forum for Capacity Building in Agriculture
QR	Quick Response
REB	Rwanda Education Board
RELI	Regional Education Learning Initiative
REPP	Renewable Energy Performance Platform
RESAFAD	Réseau Africain de Formation à Distance - Sénégal RESSAC sustainable management of forest ecosystems in Central Africa
RFID	Radio Frequency Identification
RHA	Rice Husk Ash
RISTEKDIKTI	Ministry of Research, Technology and Higher Education
RUDI	Rural Distribution Network India
RWESCK	Regional Water and Environmental Sanitation Centre Kumasi
SACAI	The South African Inclusive Assessment Institute
SACCO	Savings and Credit Cooperative
SACIDS	Southern African Centre for Infectious Disease Surveillance
SAIs	Supreme Audit Institutions
SC	Save the Children
SCAA	Specialty Coffee Organisation of America
SCB	Standard Chartered Bangladesh
SEWA	Self-Employed Women's Organisation
SHS	Solar home systems (SHS)
SMA	Stone Mastic Asphalt
SMEs	Small and Medium Enterprises
SOMIFI	Société des Mines de Finkolo S.A.
SOMISY	Société des Mines de Syama S.A.
SSA	Sub-Saharan Africa
T4T	Technology for Tomorrow
TACE	Transformative Agriculture Commercialization and Entrepreneurship
TB	tuberculosis
TBN	The Baobab Network

TCL	Temperature-Controlled Logistics
TESDA	Technical Education and Skills Development Authority
TESSA	The Teacher Education in Sub-Saharan Africa
TIA	Technology Innovation Agency
TRDDC	Tata Research, Development, and Design Centre TSS Technical Support System
TVET	Technical and Vocational Education and Training
TWGs	Technical Working Groups
UA	University of Africa
UAI	Chilean Universidad Adolfo Ibáñez
UHMWPE	Ultra-High-Molecular-Weight Polyethylene
UNDP	United Nations Development Programme
UNCTAD	United Nations Conference on Trade and Development
USEPA	U.S. Environmental Protection Agency
VR	Virtual Reality
VOC	Volatile Organic Compounds
VoG	Volume of Gas
WACCBIP	West African Centre for Cell Biology of Infectious Pathogens
WACCI	African Center of Excellence for Training Plant Breeders, Seed Scientists and Technologists
WET	Water Education Today
WFP	World Food Program
WISE FUTURES	Water Infrastructure & Sustainable Energy Centre for the Futures
WT	Women Teachers
WTGs	Wind Turbine Generators
WUR	Wageningen University & Research
YIC	Yangon Innovation Centre
ZEHS	Zero Emission Haulage Solution
ZfG	Zoom for Government

Abstract

Frugal innovations are initiated by SMEs and entrepreneurs in a wide range of domains from agriculture to energy, from health to ICT. The objective is to provide easier solutions to day-to-day problems in a more efficient way. They have a local positive impact. Few of them succeed in expanding their impact on a wider market.

Inclusive innovation is based on local adaptations of current technologies in developing countries which provides to a wide market a good enough value at a low price.

Inclusive disruptive innovation creates more efficiency at a lower price by developing a new disruptive technology. Some of the disruptive inclusive innovations are transformed into reverse innovations adapted to markets in advanced countries seeking good enough value at a lower price.

Herewith we present and analyze a wide range of inclusive disruptive and reverse innovations developed and implemented by the most innovative developing countries, including China and India. Inclusive, inclusive disruptive, and reverse innovations supported by relevant educational programs are economic and social growth accelerators for a developing country as shown in the following chapters.

RDD Partnerships between Northern and Southern countries, supporting agriculture, health, and environmental innovations help to close the economic and social gap between advanced and developing countries by supporting innovation policy in developing countries.

Types of Innovation

In advanced countries, technology newness and market impact determine the basic four types of innovation, Incremental innovation; Sustaining innovation; Radical innovation, Discontinuous innovation; and Disruptive innovation. In Emerging Markets innovation starts with frugal innovation followed by inclusive disruptive and reverse innovation.

Incremental Innovation Versus Sustaining Innovation

Incremental Innovation

The product resulting from incremental innovation is better than the previous version. Products can be made more modest, simpler to utilize, or more appealing without changing the main functionality of it and services can be made more productive through incremental improvement.

Albeit incremental development does not create new markets and frequently does not leverage profoundly innovation.

The product or service may also appeal to a larger mainstream market if you're capable of providing the same functionalities and value at a lower cost.

Incremental innovations cannot guarantee an enormous effect since they are many times just somewhat better compared to what is now out there.

There's a risk of over-complicating products and adding too many features no one wants to pay for.

Incremental innovation is focused on continuity and ensures to the customer an improved value.

Sustaining Innovation

Sustaining innovation goes beyond incremental innovation and proposes more and more value to more and more segments of a larger and larger market.

Sustaining innovation seeks to improve existing products and processes. It does not create new markets but rather creates existing ones with better value. Sustaining innovation occurs on an incremental basis, frequently in light of client or market interest, or innovation enhancements.

An instance of sustaining innovation is the smartphone market.

Every year, smartphone manufacturers release updated and improved products to meet consumer demand and to integrate new technology. Keeping up with open channels for feedback and communication permits organizations to improve and offer more prominent benefits to clients continually.

Sustaining innovations keep on developing the market gradually, yet presently not to a similar extent. Right now, the focus shifts to expanding benefits.

iPhone versions of the phone appeal to the same customer segments and do not create new value networks. New models of the phone sustain the existing business model in the premium segment of the market to meet the needs of more demanding customers who are willing to pay more for a newer, slightly improved version of the phone.

Radical Innovation

Radical innovation at the same time utilizes progressive innovation and another business model. Radical innovation takes care of worldwide issues and addresses needs in totally new ways than what we're utilized to and even gives answers for requirements and issues we didn't realize we had, totally changing the market, or even the whole economy.

Windows operational systems behind personal computers and the internet behind both personal computers and cell phones are examples of radical innovations that have transformed the way the entire world functions and communicates.

These radical innovations provide our society with a platform to build on top of leading to highly accelerated economic growth.

Since Radical innovation is so not quite the same as what individuals are utilized to, it truly does generally confront huge resistance from the start. These kinds of developments commonly demand a lot of investment and innovative improvement before they're prepared for the standard markets.

Robotics, artificial intelligence (AI), blockchain technology, energy storage, medical lasers, 3D printing, and genome sequencing are radical innovations that create small markets in different domains and slowly improve them.

Discontinuous versus Disruptive Innovation

Discontinuous Innovation

Discontinuous innovation is an innovation that is likely to create a new trajectory and face the challenge of having to move 'outside the box', beyond its prior experience (Tripsas and Gavetti, 2000; Hodgkinson and Sparrow, 2002).

Given the way that various firms might have various evaluations of what a discontinuous innovation is, a solution of innovation practices for determination will permit them to pick the appropriate combination (Bessant et al, 2010)

The selection of discontinuous innovation can be grouped into three clusters:

Enable– the role of organizational processes: utilizing elective dynamic pathways, utilizing elective/committed execution structures, utilizing elective assessment and estimation models, and sending elective financing structures.

Engage– the role of people: preparing organizations of help, assembling business inside and outside the firm.

Experiment– the role of tools and methods: building alternative visions, probing and learning methods, bridge-building to/from outside the box.

Discontinuities might be driven by innovation, competitors, regulatory occasions, or massive changes in economic and political circumstances.

The new competitive arena emphasized lower prices or differentiated market segments but not product variation (Tushman and O'Reilly III, 1996; Vanhaverbeke and Peeters, 2005).

Technological discontinuities are innovations that dramatically advance an industry's price vs. performance frontier (Anderson & Tushman, 1990; Tyre & Orlikowski, 1994; Norling & Statz, 1998).

A technological discontinuity is identified when an innovation pushes forward the performance frontier along the parameter of interest by the mainstream market and does so by changing the product or process design, as opposed to merely enlarging the scale of existing designs.

Market newness in discontinuous innovation is based upon the assumption that discontinuous innovation is identified by the existence of potential customers but no actual demand and a new competitive environment (Picaud, 2013). Discontinuous innovation becomes a disruptive innovation if the targeted customers are seeking features and values that the mainstream market sees as secondary.

Disruptive Innovation

The term disruptive indicates a new technology that responds to unserved needs by a segment of the mainstream market (Corsi and Di Minin, 2011).

The disruptive innovation paradigm claims that new products or services are considered disruptive when they respond to a new market segment that is usually small, unprofitable for incumbents, and has differentiated needs in terms of product attributes (Bower & Christensen, 1995; Christensen, 1997).

Disruptive innovation introduces a different set of features, performance, and price attributes, for two segments of the market: a segment of the market that is ready to pay a higher price for a new value and a segment seeking good enough - lower price products. (Govindarajan et al., 2011). Laptop, a mobile computer, disrupted the PC market by deserving customers who are seeking mobility of the computer even if memory is lower and speed slower than a home PC.

Frugal Innovation

Frugal innovation, also known as "Bottleaad innovation", emphasizes simplicity, affordability, and accessibility. It involves finding innovative solutions to problems by

utilizing limited resources and constraints as opportunities for creativity (Manoj, 2021). The term 'frugal' derives from the word 'Bottleaad,' an everyday Hindi term that means 'an inventive solution,' conceived out of creativity and resourcefulness.

It implies tackling a client's concern most innovatively when their assets are limited (Khan, 2016). Gupta and Wang (2009) characterize frugal advancement as 'development that endeavors to make Products, services, processes, and business models that are frugal in three angles: frugal utilization of raw substances, frugal effect on the climate, and very low expenses.

Few frugal innovations could be adapted to developed countries as reverse innovations. Herewith are examples of frugal innovations (Manoj, 2022).

Sewage Pipe Home, India

Perala Manasa Reddy saw the issue of access to clean drinking water and sanitation facilities for the unfortunate when she was a structural design student. This provoked her to concentrate on more low-cost housing options when she went over Pod-style homes worked from sewage pipes. She developed an Indian variant of OPod which is a low-cost hand-crafted from old sewage pipes that have restrooms, a kitchen, and rooms attached. This solves housing problems among the poor.

Multi-harvester, India

Deepak Reddy is a mechanical engineer from Telangana who fabricated a multi-harvester machine to assist the farmers of his town with beginning development on land left infertile for a long time.

The land had a lot of stone debris which is hard to eliminate and requires enormous cost. He likewise came to realize there are sections of land of such land all over South India. Cost-effective hardware to do this undertaking was important and he was effective in creating it. It can likewise be utilized to collect harvests.

Amphibious Bicycle, India

Bihar-local Muhammed Saidullah is a serial inventor and his inventions include this amphibious bicycle, Mini tractor, Spring loaded cycle, Fodder cutter operated Mini water pump, Key operated Table Fan, Conserved Energy operated bicycle and Mini turbine for electric generation. The amphibious bike that can run on both land and water to decrease the chance of meeting his wife. He rode his cycle in the Ganga to make a trip from Pahelaghat to Mahendrughat and, surprisingly, named the bike after his wife - Noor.

Mitti Cool, India

A traditional clay craftsman and creator Mansukhbhai Prajapati is enamored with making new things utilizing mud.

He developed Made from terracotta clay, the 50 liters MittiCool refrigerator ideal for storing water, milk, fruits and vegetables. This product provides efficient cooling without electricity.

It works on the principle of evaporation. Water from the upper chamber's drips down the side, and gets evaporated taking away heat from the inside, leaving the chambers cool. The top upper chamber is used to store water. A small lid made from clay is provided on top. A small faucet tap is also provided at the front lower end of chamber to tap out the water for drinking use. In the lower chamber, two shelves are provided to store the food material. The first shelf can be used for storing vegetables, fruits etc. and the second shelf can be used for storing milk etc.

This Rajkot-local development was highlighted at a gathering coordinated by the Centre for India and Global Business, Judge Business School, School of Cambridge, the UK in May 2009.

The Bottle Charger, Kenya

A group of designers from Nairobi, Kenya have completed just that! With just one cup of boiling water, the Bottle Charger can power a smartphone in just 15 to 30 minutes, depending on the temperature around the device (ektitli site). The device was created with those living off the grid in underdeveloped nations in mind.

The Bottle Charger uses the presence and absence of heat (hot water) for the expansion and contraction of a fluid (air) within the plastic bottle to exert pressure on the B.U.C.T. (Blackbeard Unidirectional Constant Turbine) Module to create electricity.

The Container Charger makes electricity as long as you have some boiling water that is around 70 °C or higher.

This enables you to charge your microelectronics-based devices (mp3 players, GPS units, digital cameras, smartphones, etc) for 15-30 minutes depending on certain conditions e.g. winter, summer, indoors, or outdoors.

The Bottle Charger's different parts can be dismantled for simpler transportation including, the long aluminum twin pipe installed with heat sink fins all over.

They can then be easily assembled when needed. The Bottle Charger is a simple, yet multipurpose and highly handy power solution. Only hot water (70 °C and above) is required for the magic to happen.

Urine-Powered Generator, Nigeria

Four young ladies, Duro-Aina Adebola (14), Akindele Abiola (14), Faleke Oluwatoyin (14) and Bello Eniola (15), who introduced this special gadget at The Maker Faire Africa this year in Lagos, does precisely that. It changes 1 liter of urine completely to create 6 hours of electricity.

Urine is placed into an electrolytic cell, which breaks the urea into nitrogen, water, and hydrogen. The hydrogen goes into a water channel for filtration, which then gets driven into the gas chamber. The gas chamber drives hydrogen into a chamber of fluid borax, which is utilized to eliminate the dampness from the hydrogen gas. This sanitized hydrogen gas is driven into the generator.

Nuru Energy, Rwanda, Burundi

For Sameer Hajee, the decision to give up a lucrative career as a micro-process engineer in Silicon Valley was a simple one (Singh, 2011). After working for four years he needed a change in geography. A couple of months after the fact, he was working for a telecom operator in Afghanistan.

Six months in the war-torn country offered Hajee a remarkable viewpoint on the effect of energy in one of the most impoverished districts of the world.

Hajee is the founder and CEO of Nuru Light, a social enterprise based in East Africa that provides Nuru Lights and other USB-charged devices, such as mobile phones, are all charged straight from its plug-and-play recharge station, comprising of the POWERCycle pedal generator, the Nuru Solar Panel and the Nuru Octopus Charger.

Inclusive Innovation Versus Inclusive Disruptive Innovation

Inclusive innovation is related to the adaptation of existing technology to the conditions in the developing country which does not require the development of a disruptive technology. Inclusive disruptive innovation is another category of innovation that could be transformed into reverse innovation because the t process improves efficiency and cuts costs.

We present further cases of both kinds of innovation initiated by advanced and developing countries and governmental policies encouraging in selected countries.

Inclusive Disruptive Innovation Versus Reverse Innovation

Inclusive disruptive innovation adapts technologies from advanced countries to developing countries and targets a wider low-end market than frugal or inclusive innovation by creating livelihood opportunities providing affordability achieved without sacrificing quality or efficacy, for low-income consumers who base their decision of consumption on cash availability (World Bank, 2013).

Inclusive disruptive innovations could be transformed into reverse innovations fulfilling the needs of the low-end market in advanced countries.

Disruptive Innovation - good enough performance, inclusive, disruptive, and reverse innovations can accelerate the economic and social growth of developing countries.

We present herewith cases in different domains of reverse innovation.

Disruptive Innovation: New Value – Good Enough Performance

New value disruptive innovations use new technologies and target customers in developing countries who are ready to pay higher prices for new versions. Good enough performance disruptive innovations target two undeserved market segments one seeking to fulfill new needs and ready to pay a higher price The second segment seeks, due to unaffordable high-price products, good enough products with good enough performance as regards traditional attributes and by offering a low price and design simplicity.

Definition

Christensen (1997) refined the concept by asking why great companies pursuing innovation in mainstream markets suffer from market myopia and are overtaken by entrant firms introducing products based on new disruptive technologies. Disruptive innovation addresses an interaction where a product sets up a good foundation for itself at the lower part of a market and moves to dislodge competitors (Christensen, 1997; Tan et al., 2016).

The concept of a low-end market, including good enough performance and new value markets, is defined by Christensen in opposition to the higher value, and higher price provided by the improvement of functions of a product based on the current technology.

A good enough performance market is less demanding customers seeking a product at a lower price (Govindarajan and Kopalle, 2006). A new value market is seeking new functions in a product that are important only to a small segment that is ready to pay a higher price for the product.

Disruptive Innovation Process

Challenges and Competition

In advanced countries, as more customers adopt the new product or technology, the existing market begins to feel the impact. The traditional players in the market may struggle to compete with the new product, and they may be forced to either adapt or lose market share. The evolution of disruptive products conceived in and for developed markets brings innovative technologies to commercialization in the same markets as the established ones.

Over time, the novel product or technology turns out to be the novel standard. A new market and value network is created, with the new product or technology at the center.

The battle is won in advanced countries by companies that develop the new technology better and faster, satisfying at first the request for new attributes and, along with

technological evolution, catching up on the mainstream attributes. In emerging economies, the main challenge is the difficulty of reaching a vast market that often lacks adequate complementary assets such as distribution and logistics infrastructures.

New Value Disruptive Innovation

New value disruptive innovation targets early adopters' innovation-oriented customers who seek new attributes in existent products and are ready to pay a higher price.

The most noted example of this kind of market provided by Bower & Christensen (1995) and Christensen (1997) refers to the hard disk drive industry between 1976 and 1992. In this market, mainstream clients continually required upgrades in two attributes, total capacity and recording density given by large-size disc drivers.

The industry and incumbent firms were led by this trend until an emerging segment asked for mobile computers requiring smaller sizes but less efficient disc drivers.

In the beginning, this segment remained marginal and was mainly covered by new entrant firms that could afford to do so by their relatively limited cost structure, but while the products offered gained improved performance, including the mainstream segment attributes, the market based on sustaining technologies was progressively displaced, causing the failure of incumbents. In this case, as in the other industry examples provided by Christensen (1997) and Christensen & Raynor (2003), the new segment belongs to the same market where incumbent companies operate.

The electric car market is following the same process, with new entrant firms such as Tesla followed by mainstream car companies such as VW, BMW, or BYD.

Good Enough Market

The good enough market includes underserved customers due to too expensive products. Nokia 100 cellular, a low-price, good enough product, successful in developing countries is an example of a low price good enough product.

Nokia 100 was launched in August 2011 (gadgets360 site). The phone came with a 1.80-inch display offering a resolution of 128x160 pixels at a pixel density of 114 pixels per inch (ppi). The Nokia 100 was powered by a one-core processor. The Nokia 100 is powered by an 800mAh detachable battery. Nokia 100 packs 8MB of inbuilt storage. The Nokia 100 is a single SIM (GSM) mobile that receives a regular SIM card. Connectivity options on the Nokia 100 include FM radio. As of 19th April 2023, the Nokia 100 price in India starts at 15.77 $.

New Value Disruptive Innovation Market

New value disruptive innovation significantly transforms the demand and needs of an existing market or industry, disrupts its former key players, and creates whole new business practices or markets with significant societal impact (Assink, 2006).

It results in developed economies from a new entrepreneurial activity or a spinoff company from an incumbent firm (Bower & Christensen, 1995; Christensen, 1997; Christensen & Raynor, 2003; Walsh et al, 2002).

The first compact Canon Photocopier brings a new value disruptive innovation by adding the compact feature, providing a higher value at a higher price (Dedehayir et al., 2017).

This disruptive innovation creates a new value network (Christensen and Raynor, 2003) based on products with a different group of features from the mainstream product (Guo et al., 2016).

A new market value will not attempt to disrupt the mainstream market, therefore, its focus is on attracting new customers such as fashion designers, architects, or even lawyers whose needs cannot be met by big multipurpose professional photocopiers (Shin, 2017).

These products are based on disruptive technology and are initially offered at a premium price to price-insensitive customers served by the dominant technology (Parry and Kawakami, 2017).

This innovation often results in a major technological breakthrough, a new product, service, or a new business model and needs long-term strategic planning because it inherent high uncertainty factors influencing high (Chen et al., 20 17).

Tesla has different capabilities compared to the more traditional car manufacturers.

Its software, battery innovation, and the capacity to iterate swiftly are abilities that traditional vehicle manufacturers are not good at, and which will take time and assets for them to acquire.

Another example of new market disruptive innovation is Netflix, whose initial mail-in movie subscription service wasn't attractive to Blockbuster's mainstream customers, but rather to those early adopters who were already used to online shopping.

In any case, Netflix did not arrive at the mainstream until in the wake of disrupting itself from its DVD mail administration to web streaming. Presently there are lots of internet-based film subscription services accessible for clients to look over and this model has gradually turned into a standard, progressively changing the industry.

Schmidt and Druehl (2008) refined new market disruption into two types: fringe-market low-end encroachment and detached-market low-end encroachment.

Fringe-Low-End, High-End Market Encroachment

We use the term encroachment to mean that the new product takes sales away from the old product. Cannibalization is a distinct form of encroachment where both products are sold by the same company.

The new product opens up a fringe market where customer needs are incrementally different from those of current customers.

Southwest Airlines opened up a fringe market of customers who otherwise would have driven, then attracted vacationers (lower-end customers of competitive airlines) and eventually began encroaching upward into a higher-end market, that of conventional business travel. Schmidt and Porteus (2000), call this low-end encroachment because the encroachment begins with a market segment where customer willingness to pay is low, and progresses upward to a segment with a higher willingness to pay. We now further describe this as fringe-market low-end encroachment because the new market that is first opened up is on the low-end fringe of the old market.

The Laptop opens a fringe in the computer market with a smaller disk drive with less core value memory, but small and mobile high value. This is the reason why his price is higher for the office-home personnel computer.

Tesla opened a fringe in the car market that has less core value in the number of kilometers per battery fulfillment but has a green value due to less pollution, and a lower cost per kilometer. Those are the reasons why his price is higher than a diesel or oil car.

Detached-Low End High-End Market Encroachment

The new product opens a detached-low-end market encroachment where customer needs are dramatically different from those of current customers.

Zoom was focused on conferences and training applications. Today it is also a Workspace Reservation. An innovative solution empowers groups to hold flexible workspaces somewhat early or when they show up to the workplace.

It is also a virtual Expo Floor, where event attendees can interact with sponsors, engage in live conversation, and explore content within the customizable Expo booths.

In the United States, zoom for Government (ZfG) is designed to conform with the federal government's security requirements. While initially created for government organizations, ZfG is likewise accessible to U.S. state and local government clients as well as other supported organizations and organizations.

ZfG has been authorized at the FedRAMP Moderate Level and received Provisional Authorization (PA) from the Defense Information Systems Agency (DISA) for the Department of Defense (DoD).

In the domain of healthcare Zoom's inclusive platform meets the dynamic needs of organizations looking to connect with patients and provide more accessible, personalized healthcare experiences from clinical trial assessments to virtual physical therapy to real-time stroke consultations, enabling meaningful connection at a moment's notice with Zoom's reliable, HD video and audio and cloud-based smart room solutions.

Case Studies of New Value Disruptive Innovation

Personal Computer

The commercial availability of microprocessors and smaller disc drive led to the new value disruptive innovations of small computers. Initially, those computers were toys for hobbyists. In comparison to mainframe and minicomputers, they were highly inferior. Like in the past, major minicomputer creators like DEC, Honeywell, or NCR overlooked toy-like computers.

Although IBM reluctantly released personal computers (PCs) in 1982, it outsourced major components to outside firms. Underlying both hardware and software technologies PC rapidly grew. PC's graphical user interface was far more attractive than having the necessity to send text commands.

As a result, in the 1990s, networked PCs grew as a strong substitute for minicomputers. Like in the past, mini and mainframe computer makers suffered and experienced creative destruction.

Compact Disc

In 1969, Dutch physicist Klaas Compaan at Philips Laboratories used a glass disc to store black-and-white holographic images using frequency modulation (Utterback, 2005). Four years later, in 1973, Philips engineers began to contemplate an audio application for their "video" disc system.

Sony attached the Philips/Polygram coalition after Matsushita declined and in June 1980 the coalition formally proposed their CD standard. A year later Sharp successfully mass-produced the Transistor laser. This step was crucial to conveying a consumer product. In the fall of 1982, Sony and Philips introduced their respective players to consumers in Europe.

The system was presented in the United States in the spring of 1983 and 30,000 players and 800,000 compact discs were vended that year. This has opened up new channels for music sales, storage, and portability. Compact disc disrupted Vinyl Record Albums and Tapes.

Digital Cameras

Canon digital camera disrupted Kodak Silver Halide Film. The single functional model for conventional photography has been replaced by at least four paths: capture/view/verify; capture, share; capture, print, share; or capture, share, print. The processing unit for digital photography can be as small as one picture or as large as the capacity of one's memory card.

There is no economic penalty for taking and later discarding images. The captured image can be watched on the camera's display immediately. New photo kiosks and digital mini-labs are emerging as alternatives to the one-hour film labs in malls and

retail outlets. The advantages of digital imaging explain its rapid adoption in commercial applications, but the complexity of the new digital photography paths may help to explain its difficulty in displacing conventional photography in the broader consumer market.

Fuel Injectors

In 1957 the Bendix Corporation produced the first commercial electronic gasoline fuel injection system for the AMC Spoutr. In 1957, Chevrolet and Pontiac presented an alternative "Ramjet" mechanical port fuel injection system. On the Corvette, it boosted output to the magic one horsepower per cubic inch, but it was not exactly trouble-free and was often replaced in the field with a big carburetor.

In 1958, a limited edition Dodge 361 engine had Bendix electronic fuel injection, but a less expensive mechanical injection was offered the next year. Robert Bosch GmbH licensed some fuel injection technology from Bendix and in 1967 introduced electronic gasoline injection into the automotive market with its D-Jetronic system that was installed in the Volkswagen 1600 Model 3 vehicles that were destined for California which at this time had stringent emission standards.

Fuel Injectors Disrupted Carburetors

Transistor

In 1952, Sony took a license from the Bell laboratory to produce the Transistor.

Though, regardless of having the capability of powering disruptive innovations, Transistor arose in a crude structure. In the good old days, vacuuming tube technology was far substandard.

Subsequently, Sony embarked on R&D to address the limitation. Upon some advancement, Sony succeeded in innovating a pocket-sized radio out of the Transistor in 1955. Nevertheless, this radio delivering exceptionally low cranky sound was profoundly primitive. Within a range of 10 years, during the 1960s, Sony prevailed with regards to offering high-quality radios made of Transistor innovation. Existing vacuum tube radio owners found this radio better as well as less costly.

Sony targeted American college students who were looking for mobile radio to enjoy rock and roll music with their friends. The sales hopped from an estimated 100,000 units in 1955 to 5 million units by the end of 1968.

Imaging Industry

In the 1960s, the chemical-based film dominated imaging. Upon taking the patent of the first film in a roll in 1984, Mr. Eastman developed a camera in 1988. In the same year, George Eastman and Henry A. Strong founded The Eastman Kodak Company.

Over 70 years, Kodak consummated film-based imaging techniques, chemicals, and cameras. During the 1960s, television camcorders used to be exceptionally bulky.

They used to be carried over shoulders. Electron tube technology was at the core of the video camera. Sony was desperate to offer a substitution. Coincidently, Sony again found Bell Laboratory as the benefactor of the technology.

However initial electronic image sensors, based on charge-coupled device technology, were highly primitive. In 1969, it could at best produce 8 pixels by 8 pixels back and white highly noisy images.

Sony's leadership saw disruptive potential in this primitive emergence of technology. Upon taking a license, Sony started investing in R&D to advance the underlying technology core to acquire disruptive power. Like in the past, Kodak ignored the possibility of this technology. Indeed, even after developing a model of an electronic camera in 1974 and getting a patent, Kodak executives ignored it.

It was too primitive. Moreover, they also perceived an underlying threat to their highly lucrative, profitable film-based imaging business.

The road to commercialization of CCD was a thorny road where other companies withdrew one after another. However, Sony did not give up the challenge of CCD and finally succeeded in developing a practical-level CCD in 1978. They expanded the CCD pixels, which was just 8 x 8 = 64 pixels in 1972, to around 120,000 pixels enthusiastically like a fixation.

This CCD was formally commercialized as "ICX008" the next year. The ICX008, which was mass-produced after a ton of difficulties, was introduced on the planet's most memorable CCD color camera "XC-1" in January 1980.

FedEx

In 1973 Frederick W. Smith with Federal Express began operations in Memphis, Tennessee, with 389 team members (FedEx site). Memphis has been chosen because it's centrally located in the U.S., its airport was rarely closed because of bad weather, the airport was willing to make improvements to the operation and additional hangar space was readily obtainable.

FedEx began with a mission and vision to tackle the tasks and inadequacies in shipping practices.

FedEx sees the benefits of next-generation innovation for its team members and operations, including computer-assisted vehicles, artificial intelligence, robotics, and drones.

FedEx has been collaborating with Mercedes-Benz Vans since 2018 to help develop and test its intelligent and innovative technology product, Cargo Recognition and Organization System (Coros). Coros is a machine learning and computer vision package tracking solution that brings added efficiency, transparency, and intelligence

to package delivery operations. Coros uses a set-up of vision sensors, edge computing, and machine learning to bring last-mile coordinated factors into the period of artificial intelligence, utilizing PC vision to give constant visibility into a parcel's journey, automate manual processes, and help couriers during stacking and conveyance operations with package cautions and direction. In 2019 Acquainted FedEx Freight Direct to meet developing online business market needs for conveyance of weighty, bulky Products to or through the entryway for homes and organizations.

Visa

In 1958, the world experienced a radical change in the way people spent money when the Bank of America issued their first credit card.

Around then, the credit card had a small spending limit of $300, and the unfortunate part was that the card just worked in California. Nonetheless, this guided us into a period where individuals could spend credit as opposed to physical money.

The credit card innovation was an invited improvement, and by 1974 it had gone worldwide.

In 1976 the marketing department decided to change the name to a universal one- as such, the name "Visa" was birthed. Enabled by an interoperable tokenization platform, Samsung Pay, Microsoft Wallet, Android Pay, and Apple Pay are expanding their participation in mobile payments across markets around the world.

Amazon and Kindle

Amazon disrupted the way we buy products online. It has grown to become the one-stop shop for virtually everything you need. Amazon has grown from fledgling online bookseller to one of the most valuable and powerful corporations in modern history. Amazon played a pivotal role in popularizing e-commerce. Its vast product selection, competitive pricing, and user-friendly shopping experience drew consumers away from brick-and-mortar stores to the convenience of online shopping. When the COVID pandemic hit around the world, e-commerce businesses boomed, and Amazon was a key player.

Amazon Kindle disrupted the book industry because it changed the way people buy and read books. Before, people would have to go to a bookstore, find a book they wanted to read, and then purchase it. Then, they would have to take it home and read it. With Kindle, people can find what they want to read, buy it, and then read it right away. It also allows people to buy books without having them shipped to their houses.

Apple iPhone

On 9th June 2007, the iPhone Apple was released but many experts believed it failed to deliver many features (Prabhala and Umamheswara Rao, 2017). It was 2G, not 3G.

It had competing smartphones such as the Nokia N95 or HTC TyTn were fully broadband 3G. iPhone prevented installations of "Apps" as competitor models could.

Apple positioned the iPhone to be a web platform with only web apps. It had a very poor 2MP camera not like rivals' 5MP cameras. iPhone had no physical keyboard. Competing smartphone BlackBerry by RIM had a full QWERTY keyboard, while Nokia's smartphones split between full keyboard designs or slider N95.

The iPhone bettered the competition on user experience, Internet web browsing, better package, fewer models, looks slimmer, and a huge App Store on apps with games. The iPhone was targeted at an underserved audience that benefitted from the unlimited data tariffs that operators offered as standard with the original iPhone.

Tesla Electric Car

Tesla, for instance, has various capacities contrasted with the more conventional car producers. Its software, battery innovation, and the capacity to iterate quickly are abilities that conventional car manufacturers are not generally excellent at, and which will take time and assets for them to secure.

Tesla is disrupting the traditional automobile industry by introducing electric vehicles (EVs) that challenge traditional internal combustion engine (ICE) vehicles in terms of performance, range, and sustainability.

Tesla's EVs use disruptive electric powertrains, which are more efficient and sustainable than traditional ICE engines.

The company's focus on design has helped to break down the stigma around EVs and make them more appealing to a wider range of customers.

Tesla has disrupted the traditional automotive sales model by selling its vehicles directly to consumers, bypassing traditional dealerships, and offering over-the-air software updates that allow the company to improve its vehicles after they have been sold.

Crypto Currency

New value **disruptive innovation** has entered the world of finance. Bitcoin along with other digital currencies has made cash more digitized, dematerialized, and democratized than ever before. Bitcoin is also a technique for persons to take **"money"** from the hands of bankers.

Bitcoin is an example of how technology is transforming the global financial system and how it can represent an alternative to the storage of economic value (VentureBeat site). Bitcoin is powered by blockchain technology. It is a consistent stream of cryptographic checks, which keeps an exact and public record of exchanges without the requirement for centralized control or financial intermediaries. As a feature of its numerical characteristics, the supply of Bitcoin is perennially restricted at 21 million. No government, individual, or organisation can change that supply cap, nor could they

at any point control this network of exchanges, which is currently utilized by countless individuals, and which settles a greater number of exchanges than the world's leading credit card organizations.

IBM Watson and GPT4 Open AI

IBM single-handedly altered the way we process data today. The company became a machine learning and artificial intelligence pioneer with the technology/design of **"Watson."** IBM Watson products unlock new levels of productivity by infusing AI and automation into core business workflows.

OpenAI guarantees that counterfeit general knowledge helps all of humankind. GPT-4 can produce, alter, and repeat with clients on innovative and technical writing tasks, like composing songs, writing screenplays, or learning a client's composition.

Good Enough Disruptive Innovation Market

Definition

Good enough disruptive innovations are those that begin in a low-end market, with inferior performance as regards traditional attributes and by offering a low price and design simplicity (Christensen, 1997; Christensen and Raynor, 2003; Govindarajan and Kopalle, 2006; Yu and Hang, 2010). This is the case only for products targeted at low-end markets.

A good enough disruption paradigm changes the existing market's game. It is based on the existing mainstream value networks and introduces similar products or services at lower cost and price (Chen et al., 2017) and that cost is substantially lower (Nagy et al., 2016).

The first customers are part of the existing market segment with similar performance criteria to mainstream customers but with lower purchasing power (Dedehayir et al., 2017; Schmidt and Druehl, 2008). Those customers had not owned or used the prior generation of products or services (Hang et al., 2015) or new users (Dijk et al., 2016). DI must be affordable with a good enough presentation (Yu and Hang, 2011).

Case Studies of Good Enough Disruptive Innovation

Ford Motors

In 1913, Ford disrupted the automobile industry by designing the world's first assembly line. This innovation meant that the company could mass-produce new vehicles more affordable for customers.

Before Ford's disruptive innovation, it was practically impossible for anyone outside the high class to own a car.

Napster

Before Napster introduced the first peer-to-peer sharing network for music, most people were still relying on purchasing CDs for their music (Illipse and Sietzema, 2019). With the arrival of the MP3 file format a few years before Napster launched, a new market was created: the digital audio player market.

Soon people started to realize that it was not necessary to "Rip" CDs anymore since most of the songs were found online, already compressed in a suitable format for their mobile MP3 players.

Napster provided to these users by allowing the transfer of audio files between persons. Since this market did not previously exist, Napster created the market of audio file sharing and can therefore be regarded as being disruptive (Sun, Williams, and Stewart, 2016). It was the starting point of a digital music revolution, where all the value chains changed and copyrights and ownership became the biggest issues.

Google, Search Engine

In the research domains requiring books, papers, and expert knowledge Google search engine provides a wide virtual library and makes it possible for the world to find answers/solutions to pressing questions with just one click at a low cost.

Google now gives IT experts access to open-sourced technology in the developer space, which they can use to develop their customized machine learning-powered apps.

Walmart

Walmart made shopping more accessible to everyone regardless of their locale by offering the lowest prices possible for all products.

Within a short time, Walmart became one of the most popular online stores in America because it came up with an innovation that seeks to make products and services available and accessible to consumers at cheaper prices. The more they experienced rapid expansion, the more they were able to discount their products and services. Thus, they attract millions of customers weekly across different regions.

Facebook

Facebook changed the way we communicate with people across the globe. Mark Zuckerberg, the brain behind Facebook, was a Psychology student at **Harvard** who wanted a simpler way of connecting with friends online.

Facebook was originally designed as an application to help undergrads connect and meet with each other in college. The initiative quickly outgrew the Harvard campus and today it's the most popular social media platform in the world.

Netflix

Netflix made movies more accessible to people who did not want to go out to buy movies whenever they wanted to watch movies. They at first began as a pretty boring innovation, mailing out DVDs to clients who needed a blockbuster-like experience at home.

Initially, the organization designated individuals searching for simple amusement who probably might not be keen on watching the most recent chart-topping movies.

However, after they experienced a level of success in the marketplace, the founders and brains behind Netflix moved from their digital business strategy of mailing DVDs to streaming a wide range of movies at a lower cost than mailing DVDs.

Uber

Uber is one of the most disruptive innovation companies in the world. In towns and cities worldwide, taxi cabs have proven to be the best form of public transport, especially when you are in a hurry and cannot wait for a bus, train, or even your car. Naturally, therefore, you need to shell out extra cash for a taxi cab.

Uber decided to carve a niche for itself as one of the ultimate disruptive brands by making transportation cheaper than taxis, available and affordable.

DropBox

Dropbox disrupted the traditional costly file storage by introducing a lower-cost cloud-based file storage and collaboration platform. The organization's innovative way of dealing with file storage and sharing has made another market and value network revolve around cloud-based file storage, and it has moved traditional document storage providers to stay aware of the interest for more available and helpful storage choices.

Dropbox was one of the first companies to offer cloud-based file storage and sharing.

Dropbox's user interface was designed to be easy to use and intuitive, even for non-technical users. The company introduced collaboration tools that allowed users to work together on shared files in real-time.

Dropbox incorporated other efficiency apparatuses like Microsoft Office, Google Docs, and Slack, which made it simpler for clients to utilize Dropbox inside their current work processes.

Spotify

Spotify upset the conventional music industry by presenting a music real-time feature that permitted clients to pay attention to music on demand. The organization made another market and value network based on music streaming and has moved conventional music organizations to adjust to the new market dynamics.

Spotify was one of the first companies to offer on-demand music streaming, which allowed users to listen to any song they wanted, whenever they wanted. The company introduced personalized recommendations based on a user's listening habits and preferences.

Spotify integrated with other tools such as social media platforms, music production software, and fitness apps, which made it easier for users to use Spotify within their existing workflows. The company has invested in music discovery features, such as curated playlists, that help users find new music and artists.

Airbnb

Airbnb originators Joe Gebbia, Brian Chesky, and Nathan Blecharczyk developed the business in 2008. At first, Gebbia and Chesky got going involving their place as an informal lodging to make a couple of additional bucks to pay the lease. With a major plan meeting coming to the San Francisco region and a city loaded with sold-out lodgings at that point, they saw a likely market for the thought and developed a site called airbedandbreakfast.com.

AirBnB has its presence online and provides hospitality services and rental services. It allows the hosts to post their apartments, homes, and cottages on their site and renters can take those homes or apartments for rent (AirBnB, 2018).

AirBnB does not own houses, it just acts as a broker and takes a commission on every house that is rented. Earlier, it was only focusing on low-value customers, a good enough service, but eventually, it started focusing on high-value customers as well.

It created a new market wherein hosts can use the technological infrastructure of AirBnB to promote homes, cottages, and apartments in a very efficient manner (Guttentag, 2015).

Airbnb has listings all over the map, from Savannah, Georgia, to Honolulu, Hawaii, to international listings. The service currently has more than 5.6 million listings in roughly 220 countries around the world.

HBO

Way back in 1972, a new television channel called the Home Box Office (HBO) came to life on a cable system in Manhattan. The company showed first-run films to a very small local crowd until a company called Time-Life took a chance on the company and streamed the "Thrilla in Manila" boxing match in October 1975.

HBO wanted to bring never-before-seen entertainment to the family home.

By 1982, around 9.8 million people had the channel. The company has been devoted to supporting new shows, and new forms of entertainment to the whole planet.

Inclusive Innovation Policy

Inclusive innovation policy governs innovation in a way that fairly shares its benefits and mitigates its tendency towards reproducing inequality. Inclusive innovation aims to activate more segments of society as producers of innovation, encouraging the development of technologies, business practices, or services to solve social challenges for particular demographic groups. Herewith we present governments, companies, individuals, NGOs, and private initiatives of inclusive disruptive innovations.

Introduction

Inclusive refers to the inclusion of groups that are currently marginalized with low income, women, youth, persons with disabilities, and ethnic minorities (Foster and Heeks, 2013a).

Inclusive innovation uses current technologies, creates and increases livelihood opportunities for excluded populaces by providing affordability achieved without sacrificing quality or efficacy, access because bottom-of-the-pyramid consumers cannot travel great distances and availability for low-income consumers who base their decision of consumption on cash availability (World Bank, 2013).

The government can encourage public-funded research and R&D organizations to do more to meet the needs of the poor, for instance bestowing competitive research grants, prizes, and public awards on research teams that produce relevant innovations (Utz and Dahlman, 2007). A possible mechanism for orienting STI policy to cover the problems of the poor is that of aligning public R&D efforts to sectors and areas that allow people-oriented development and delivery.

Competitive public sector procurement for the production of specific goods and services for the poor can also contribute to inclusive innovation (Utz and Dahlman, 2007).

To expand the importance and reception of innovation, strategy requirements to help nearby developments at both, the degree of creation and of the move of existing advances that might fulfill the requirements of unfortunate networks (UNCTAD, 2011). This mirrors the significance of dispersion and effort in inclusive innovation.

Inclusive innovation aims to activate more segments of society as producers of innovation, encouraging the development of technologies, business practices, or services to solve social challenges for particular demographic groups, such as applying innovation to agriculture to improve crop production and benefit farmers and customers.

The capacity to consume is improved by inclusive disruptive innovation because the products will be more affordable, easier to access, and more available (Prahalad, 2006).

GovTech Initiatives

Governments innovate to improve services provided by national institutions in health, security, transport, or telecommunications or by proposing to innovative entrepreneurs financial and technical support through research centers or direct grants and loans.

GovTech is the ecosystem wherein state-run services co-work with new businesses, SMEs, and different entertainers that utilize information knowledge, advanced innovations, and inventive techniques to give Products and services to take care of public and client issues (OECD, 2023).

They propose new forms of Public-Private Partnerships (PPP) for absorbing digital innovations and data insights to increase effectiveness, efficiency, and transparency in the delivery of public services (scioteca site).

Mostly top-down government initiatives are seeking to ensure that high-value innovative activities are regionally distributed and are encouraging the participation of more people, places, and sectors in the innovative economy.

New Forms of Accountability

Governments are increasingly incorporating AI into the design and delivery of policies and services. Several forward-thinking governments and external ecosystem actors are promoting algorithmic accountability, emphasizing transparency to build trust with citizens. Algorithmic responsibility signifies 'guaranteeing that those that form, secure and utilize calculations are in the long run liable for their effects.

The Chilean Universidad Adolfo Ibáñez (UAI) and the Committee for Straightforwardness (CPLT) chose to cooperate to create a norm of algorithmic straightforwardness for the policy management of the nation (Hermosilla and Muñoz, 2023).

This way started in 2021, when the CPLT and the UAI, through GobLab, the public development research facility of the School of Government, directed an examination of the number of Chilean state organizations were involving calculations in their decision-making systems. Through this process was generated a first registry that included, for example, neural networks that analyze the legality of medical licenses to detect possible fraud, algorithms that are used to plan a gathering at the migration office or to dole out endowments, and the School Confirmation Framework that enlists students as per choice models like geographic nearness or on the other hand assuming the student has a sibling in the establishment.

In 2022 the CPLT attached the Ethical, Responsible, and Transparent Algorithms project, an initiative led by the Universidad Adolfo Ibáñez (UAI) and funded by IDB Lab, the innovation laboratory of Inter-American Development Bank (iadb site).

The IDB was established in 1959 as an organization between the US and 19 Latin American and Caribbean nations: Argentina, Bolivia, Brazil, Chile, Colombia, Costa

Rica, the Dominican Republic, Ecuador, El Salvador, Guatemala, Haiti, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Uruguay, and Venezuela. The IDB as of now contains 48 part nations, including borrowers and non-borrowers. Through this drive was developed an Overall Guidance (GI) on Algorithmic Straightforwardness, a guideline that will be distributed during 2023 and make Chile the primary country in the district to have a rule of this sort.

For both the UAI and the CPLT, it was essential that the development process of the GI is participatory and allows spaces for different actors to get involved. Both public foundations - that should cover their calculations - and common society entertainers - that might require access to such data - partook in working gatherings and a pilot to test the applicability of the future regulation.

New Approaches to Care

Bogotá Care Blocks, Colombia

The City of Bogotá through the Secretariat of Women's Affairs developed a novel approach to the development of women and caregiver-centric infrastructure and service provision, hoping to make it more accessible, empathetic, and closer to the needs of caregivers (oecd-opsi site)

They have reached a total of 300,000 women through 15 Care centers. Caregiving in Bogotá is carried out by nine out of ten women, 90% of caregivers live in low-income households, about 70% have only secondary education, 21% experience untreated chronic conditions derived from home care, 0% have financial autonomy, and so on.

To address the limitations of physical access to Care Blocks, Bogotá executed the "Care Buses ". These free shuttles run from specific bus stops or supply citizens living in rural areas with selected services.

In a major city like Bogotá, the Consideration Framework's primary development is in its way of activity: it at the same time offers types of assistance for the people who give care and the people who require care.

Bogotá created a human-centered innovation in an age when many innovations introduced care as a city ordainment principle in the Master Urban Plan that rules the city for the next 15 years. Care blocks advance a new, women's activist urbanism: one that revolves 'Smart' city arranged around the frequently neglected requirements of ladies' inhabitants, perceives the significance of neglected care work, and uses innovation and information strategies to repeat its administration plan and execution.

Cargo Drones For Public Health, The Dominican Republic

The Dominican Republic is using flying and driving cargo drones for public health to autonomously deliver medicines to remote areas (Germann et al, 2023). Local communities in the isolated mountains of the Dominican Republic do not have

consistent access to healthcare services. It is the cost of local transportation that serves as the biggest impediment. Local clinics could run out of medicines or cannot test patients locally. When this happens, patients have to travel to the hospital in person for a full day of travel due to the limited number of local transportation options. In November 2018, Pfizer partnered with WeRobotics and DR Flying Labs to carry out autonomous cargo drone deliveries. DR Flying Labs is one of 25+ Flying Labs in Latin America, Africa, Asia, and Oceania. Flying Labs are neighborhood information centers run completely by nearby specialists who are prepared, equipped, and upheld by WeRobotics on a case-by-case basis. Pfizer-WeRobotics freight drone M600 was chosen since it is profoundly dependable, somewhat reasonable, and locally repairable.

Drones to Deliver Blood, Rwanda

In 2016, the government of Rwanda contracted the company Zipline to establish drone delivery of blood to health facilities throughout the country (Amukele, 2022). Drone-based transportation of blood in Rwanda was altogether better compared to street-based transportation as far as both responsiveness and emergency clinic blood management.

12 733 blood product orders were delivered by drones to 20 district and provincial hospitals in Rwanda over 32 months from March 17, 2017, to Dec 31, 2019.

About 40% of these distributions were emergency orders and the remaining 60% were usual standing orders. At 12 months, there was a 67% reduction in blood product expirations at the 20 district and provincial hospitals.

Driver Advisory Council for Uber India

The Driver Advisory Council for Uber India was developed by Aapti with public bodies such as India's NITI Aayog.

The Council consists of 35 members and connects drivers from six different cities – Bangalore, Chennai, Delhi NCR, Hyderabad, Kolkata, and Mumbai – directly with Uber. The model enables participatory action and reflexive praxis among workers and has established a successful and sustainable alternative for platform governance.

The Council represents an unprecedented mode of engagement between gig economy platforms, workers, and public agencies. Beyond the satisfaction of drivers and Uber, this initiative has also pushed policymakers to address related legal loopholes, with the Indian Government proposing a Code on Social Security which presents a co-pay system to cover health and other benefits for workers.

Preserving Identities and Strengthening Equity

Maxakali People, Brazil

The Maxakalís are a little Native gathering that faces significant difficulties connected with social detachment and the absence of access to Brazil's protected privileges. In

2020, the state Courtroom of Minas Gerais and the Discretionary Court launched a task as a team with the Maxakalís to co-make solutions elevating access to citizenship, a majority rule government, and equity, while attempting to determine types of primary and verifiable foul play.

Maxakalís Native individuals were once perhaps of the biggest local area living in what are today the Brazilian Provinces of Minas Gerais and Bahia.

There are as of now 19 Native ethnic gatherings of 30 000 Native individuals living in Minas Gerais, of which 2 500 come from the Maxakalí ethnic gathering and live in the locale of Aguas Formosas in the upper east of the state.

The drive citizenship, A majority rules system and Equity for the Maxakalí Public (Programa Cidadania, Democracia e Justiça) started running in January 2020 as a work of the Court of Minas Gerais and the Provincial Constituent Court working closely together.

The really basic issues recognized were the absence of character and constituent records, which makes it difficult to cast a ballot and embrace straightforward everyday cycles, for example, legitimizing organizations (relationships), to assist with acclimating the Maxakalís to political race processes, mock decisions were held in Tikmüün and contextualized regarding nearby culture and instructive level.

The main problems and demands of indigenous people were mapped by the Brazilian Public Defender's Office and the conflict resolution sector of the Court of Justice of Minas Gerais. Based on this mapping, more than 50 judicial hearings were held in the Maxakalí villages, which consisted mostly of procedural check-ups and documental and/or on-site verification accomplished by talking with the people.

Presidential Employment Stimulus (PES), South Africa

The Presidential Employment Stimulus (PES) supports job creation, job protection, and livelihood support programmes as part of a wider economic recovery progress (stateofthenation site).

The business improvement has empowered the fastest development of public work in South Africa's set of experiences, by supporting projects that could increase inside merely months to give work to the people who need it. The PES has made 1 098 304 work and vocation amazing opportunities for jobless South Africans. Of the members, 84% are youth and 62% are women.

The Administration gave vital info, oversight, and an approving climate for advancements attempted by divisions, who claimed and executed the projects.

Financing was supported for programs based on scale, nature of social results, organisations, effectiveness, and additionality, guaranteeing that the intercession decidedly affected business as usual, yet in addition gave results that could not have possibly in any case existed. The Division of Essential Training set right around

600,000 youngsters as school colleagues in more than 22,000 schools on each side of the country.

A Social Business Asset was gotten up in a position to support "social work" permitting north of 45 000 individuals to work 16 hours seven days on regions including food security, youth improvement, orientation-based savagery, place-production, catchment the executives, local area expressions and that's just the beginning. Another 45,000 individuals are filling in as a feature of Youth Administration, a comparative model.

The inventive area has profited from the production of more than 32,000 positions. These positions were made by welcoming craftsmen to deliver new inventive work.

North of 100,000 subsistent farmers got creation input vouchers to assist them with getting back to work after lockdown interruptions.

The Treetown, Sierra Leone

Freetown, the Sierra Leonean capital, campaigns to plant and grow a million trees (C40 Knowledge site). It prioritizes areas at risk of landslide, as well as riverbanks and the low-income areas most in need of regreening. By adopting a local area proprietorship strategy and utilizing mixed wellsprings of money and computerized development, Freetown has developed a replicable, practical funding model for metropolitan nature-based solutions.

Freetown, Sierra Leone, is among the world's rainiest urban areas. The public government regulates the legitimate system overseeing metropolitan greening and land use, restricting Freetown's possibilities for checking tree misfortune and requiring reforestation. In the initial long time since its send-off in January 2020, 560,000 trees have been planted.

To improve the equitable distribution of trees and green space, 35% of areas targeted for new trees or vegetation are informal settlements that currently have low coverage. Planting by roadsides, schools, and residential areas, almost 165 hectares to date, aims to reduce heat stress and improve air quality.

Establishing in Freetown's water catchment and greenbelt (104 hectares) expects to further develop water security. Establishing in the upper water catchment and on high slants around Freetown (280 hectares) plans to decrease the gamble of glimmer flooding and avalanches. Mangrove reforestation (32 hectares) means to diminish coastal erosion and flooding.

TheTreetown is helping to discourage environmentally harmful practices, such as sand mining, and to reduce deforestation and mangrove destruction in targeted areas. There has already been a discernible reduction in flooding and landslide risk as a result of planting in the upper catchment areas. The mission has likewise straightforwardly or in a roundabout way made more than 1,000 green positions along the worth chain, from laborers in tree farms to local area producers - of whom 80% are young people and 48% are ladies.

TheTreetown uses a community growing model, where reforestation is co-designed and co-managed by the community and the city government.

Freetown occupants are engaged with dynamic on where trees are planted and get installments to plant, develop, and carefully track trees on a versatile TreeTracker application.

Freetown partnered with a global technology firm, Greenstand, to develop a customised system to track tree planting and growth.

The application is accessible to different urban areas, however, the point of interaction should be custom-made to your region.

The computerized framework makes a special geotagged record for each tree planted. Producers return to each tree occasionally to water and keep up with it, and to check and report its endurance, getting miniature installments through mobile cash like clockwork over the initial three to five years of the tree's life (when trees need most support). Producers' financial remuneration is attached to follow. Seedlings have additionally been secured from nearby nurseries to expand the advantages to the local economy. The model has enabled 80% of the total resources leveraged for the project to be injected into local communities.

Freetown got US$ 1.8 million from the World Bank, which was basic to the underlying planting in 2020 to 2022, and one more US$ 1 million (from 2022 to 2024) from the Bloomberg Worldwide Test, which has empowered real planting. The Bloomberg cash infusion is likewise being utilized to fabricate an information base of possible financial backers, incorporating firms with supply chains into Sierra Leone.

Support Centers Programs

Regional Inclusive Innovation Centres (RIICs), Philippines

In July 2019, a new Philippines Innovation Act was signed into law. One of its flagship policy initiatives is a planned set of RIICs, which will link government departments with industry and academic institutes across all regions of the Philippines to carry out market-oriented R&D and develop new products, business models, and processes.

The development of the roadmap and plan for the RIICs was a more bottom-up policymaking process than is typical in the Philippines. Consultation and validation workshops were run across many different regions of the country, bringing together representatives from different sectors of industry, academia, and civil society to share their views and needs. Beneficiaries Four RIICs are being piloted in areas outside the capital city of Manila.

These are currently virtual rather than physical, but the aim is to develop them into hubs that will enable startups as well as micro, small, and medium-sized enterprises (MSMEs) across all areas of the Philippines to access support and develop

collaborations with industry partners, universities, government agencies, and other innovation intermediaries.

Bottom-up entrepreneurial initiatives are seeking to develop technological solutions to societal challenges, directing innovation toward achieving inclusive outcomes. This strategy involves the development of technology-based solutions to social or economic challenges such as waste collection, education provision, low incomes in the agricultural sector, or infrastructure issues facing excluded groups. It is founded on the hypothesis that technology has a key role to play in addressing these challenges.

Together with the USAID-STRIDE project, have nine local RIIC innovation programs that link innovation and entrepreneurship efforts, all with their respective regional brandings. Currently, the RIICs initiative is piloted as a virtual platform connecting stakeholders from government, academe, and industry in Cebu, Legaspi, Cagayan de Oro, and Davao (Aldaba, 2019). The Department of Trade and Industry is partnering with community stakeholders such as startups, industry, farmer cooperatives, and researchers to build the capacity of stakeholders in R&D ideation and design-thinking process carry out studies, and adapt new technologies to address socio-economic problems in the pilot areas.

Cebu

Cebu is looking at advanced manufacturing, particularly in electronics and transistors. To pursue this, Cebu-based companies are partnering with academe to conduct joint R&D and formulate training programmes to improve worker capabilities. More attention is given to Internet capability, broadband access, computerization, and electricity supply.

Legaspi, Davao and Cagayan de Oro

Legaspi is focusing on pili nuts to track down ways of enhancing the item, while Davao and Cagayan de Oro are focusing on Coffee, cacao, and products of the soil. In Davao, an intuitive application that will assist miniature, little, and medium undertakings with accessing taxpayer-driven organizations and advancement programs is being created.

To support these agricultural areas, researchers and other stakeholders are focusing on R&D to provide technology solutions to problems such as low productivity, insufficient postharvest facilities, lack of quality of planting materials, pests, and diseases. Herewith the list of the centers (Pascual, 2022):

Shine Cagayan Valley

Sustaining Harvest through Innovation & Nurturing Enterprises. It is secured on the citrus area as its pilot industry, with the banana area next in line for the replication of best practices and convergence models.

Thrive Central Luzon

Thrive Central Luzon – Technological Hive of Regional Innovation for a Vibrant Ecosystem.

Linc Calabarzon

Linc Calabarzon – Linking Innovation Networks for Competitiveness in Calabarzon. BARAKO refreshes the production and commercialization of the Liberica coffee.

BRIDGE Bicol

BRIDGE Bicol – Building Resiliency and Innovation to Drive Growth of Enterprises in Bicol. Fisheries.

Startup Island

Startup Island PH Mentorship Program is one of the three pillar events started by the Department of Trade and Industry 7 with the local startup community.

The first batch of mentees went through the program in 2018 and the second one in 2019 at The Company IT Park. Some of the mentees that went on to become growing and impactful companies are Oh My Grocery PH, Light of Hope PH, Revastaff among others.

Startup Island PH ultimate aim is to empower, equip, connect and support startups through its three main programs: Mentoring & Matching Sessions, and Community Mixers. All three events are done in partnership with the local startup, creative-, and tech- communities and companies.

ZamPen InnoHive

Zamboanga Peninsula has recently launched its first innovation hub in Zamboanga City that is expected to propel opportunities for businesses and scientific solutions to societal challenges.

ZamPen InnoHive in Zamboanga City featured a fabrication laboratory with state-of-the-art equipment that can translate ideas into prototypes and models for businesses and products, in order to encourage the establishment and operation of innovative new enterprises and businesses that is crucial to their growth and expansion.

Students and entrepreneurs are encouraged to use the new facility and its technology as a means to accelerate the region's economic standing while also enabling MSMEs to navigate the evolving business landscape, and fostering innovative solutions for their recovery and resilience.

Orobest

Orobest - Advancing Local Opportunities for Business Greatness through Science, Innovation, and Advancement.

Iliganice

Iliganice - Development through Industry, Government, and Academe Organizations and inclusive Local area Commitment.

iSTRIKE Davao

iSTRIKE Davao - Development through Science and Innovation and Chance Versatile base Drives toward Information Economy in Davao.

DMap, Viet Nam

Overview People with disabilities face significant challenges in travelling to work and social events in Viet Nam.

With a more effective means of planning journeys, people with disabilities will have improved mobility, which would, in turn, drive greater employment opportunities and the ability to participate in more social activities.

Dr. Vo Thi Hoang Yen at the Disability Research and Capacity Development (DRD), developed Dmap (short for Disability map) as an app that helps people with disabilities plan their travel and navigate accessible buildings in Viet Nam. It was launched in Ho Chi Minh City, to be rolled out in other Viet Namese cities in the future.

Launched in April 2019, the app has information on the accessibility of thousands of buildings, including restaurants, shopping malls, entertainment centers, and religious buildings. The Dmap app was developed with the support of foundations, philanthropists, UNDP, and USAID. The Dmap app offers an easily accessible tool, given that it is readily available on smartphones, and smartphone penetration rates are very high in Vietnam. It offers information about the reality of the accessibility of public buildings in Vietnam today, rather than waiting for the system itself to become more accessible.

Dmap constitutes a technological platform – readily accessible via smartphones – to improve mobility for people with disabilities and to drive greater societal awareness of the challenges facing people with disabilities. Dmap shows the systematic challenges encountered by people with disabilities, which could further motivate action on the part of national and municipal authorities to improve physical infrastructure.

A software startup called Enablecode is employing and training people with disabilities to work as freelance developers, coders, web designers, and experts in AI business processes.

Bambuhay in the Philippines

The founder of Bambuhay, Mark Sultan Gersava, is a food scientist by profession and an agripreneur and ecopreneur by passion. He is the son of a farmer and a farmer himself from Sultan Kudarat Province and a multi-awarded social entrepreneur for his dedication to uplifting the lives of the farmers. He creates opportunities for better livelihoods for the marginalized in the Philippines by building a venture around manufacturing earth-friendly products to replace those that cause toxic waste.

Bambuhay in the Philippines is seeking to address the twin problems of plastic waste and low incomes in the farming community by supporting the farming and development of bamboo, which is a biodegradable and recyclable alternative to plastic.

Beneficiaries of these types of innovations receive products and services that are more affordable and tailored to their needs and circumstances, improved market access, and enhanced opportunities to use innovative approaches and tools that can increase their incomes.

The startups themselves can also benefit by generating knowledge, networks, and power in relation to different economic activities. There is a clear opportunity for governments to benefit from working closely with these startups, given their efforts to find solutions to systemic or complex social challenges.

Bambuhay impacted 13,910 farmers or equivalent to 2,782 families of farmers providing them with sustainable livelihood, employment opportunities, and relief assistance (movingworlds site). The products provided are bamboo vinegar, handle, casing to minimise absorption of water, reusable bamboo straw, toothbrush, and natural carbon-infused soft bristles.

Yangon Innovation Centre (YIC), Myanmar

YIC was established in 2018, following a sustained campaign by a Minister within the Yangon regional government who was keen to support the development of a local innovation ecosystem. It was designed to be a place where young entrepreneurs could connect with technology companies and develop their capabilities and ideas.

The Centre is managed by Seedstars, a global network of tech entrepreneur hubs that operates primarily in emerging markets. It has links back to the regional government and is advised by a Yangon Regional Innovation Committee, which includes representatives of the private sector, as well as government officials. YIC offers a range of services to the startups it incubates. Seedstars announced 2019 the opening of its first entrepreneurship hub in Myanmar in collaboration with Thura Swiss and CB Bank.

Recyglo in this program started as an 'Uber for recycling' but has now expanded to provide services such as training to businesses and households on how to separate waste and recycle, as well as logistics and traceability solutions for waste management. Lots of waste goes to landfill, which is bad for the environment and outcomes in pollution.

Pasar Sejahtera, Indonesia

Bank Danamon, through the Danamon Peduli Establishment, launched a Corporate Social Obligation program called "Pasar Sejahtera" which aimed toward working on the neatness, cleanliness, and execution nature of conventional wet markets, and to further develop limited working of Miniature Little Medium Ventures all through traditional markets in Indonesia.

The traditional market is part of the history of Indonesian civilization and populace. Further, it is also a public place where the majority of the populace meets each other daily. In the suburbs, traditional markets are the backbone of the local economy.

Most traditional wet markets are dirty and unpleasant, especially in the area of meat and fish stalls. Cleanliness and hygiene factors are overlooked and make people nowadays reluctant to visit traditional markets anymore.

"Over the past few years, the traditional markets have been facing severe competition from the modern retail shops — swalayan, supermarkets, and mini markets.

The Program of Pasar Sejahtera consists of establishing a Waste Bank, as an effort to recycle the waste generated by traditional markets to become fertilizer.

Building the Integrated Waste Facility, to separate organic and inorganic waste and as a temporary place before the waste is further processed. This is donated by Bank Danamon.

Toward the start, Danamon Bank gave advances to conventional market merchants who were considered as Little Utilized Mass Market (SEMM) through neighborhood helpful and who later became autonomously financed.

The programme is funded and delivered by the independent foundation Yayasan Danamon Peduli (YDP) in Partnership with the Ministry of Health and the Ministry of Trade and Industry and has been running since 2010 in 13 sites across Indonesia.

Regional Innovation Clusters, Indonesia

This programme, led by the Ministry of Research, Technology and Higher Education (RISTEKDIKTI) in Indonesia, brings together regional governments, research institutions, industry, and local communities in an attempt to establish specialisations in Produk Unggulan Daerah (PUD), or high-value regional products.

Financing is furnished to explore foundations to work with neighborhood industry and farmers' gatherings to create and move innovative Products in view of existing local assets.

In some cases, this collaboration has taken the form of Science-Techno Parks, which co-locate research and industry activities. Fourteen high-value regional products have been developed and commercialised through the regional innovation cluster programme.

Patchouli Innovation Clusters

Innovation clusters around patchouli oil, prized for its use in perfumes, cosmetics, and insecticides. While the Aceh province in Western Indonesia once supplied 70% of the world's patchouli oil, the industry has been heavily hit by civil conflict and natural disasters. More recently, a team of researchers at a university in the region have developed a novel distillation method for the oil which can increase production quantity and quality.

A Centre for Patchouli Innovation Cluster has been established, with funding from RISTEKDIKTI, which has brought researchers together with government actors, industry, and local Aceh farmers.

The centre has supported the commercialisation of patchouli oil by SMEs and also involves farmers, enabling them to sell their products in-store or online. The most immediate beneficiaries of the regional innovation cluster are research institutions and firms which get the opportunity to commercialise the 'high-value regional products. However, a major rationale for the clusters is the wider benefits they can create for ordinary people across Indonesia's regions.

Coconut Innovation Clusters

The Coconut Innovation Clusters are supported in the North Sulawesi Region. Innovation that transforms local products into "high-value regional products" has the potential to both create new jobs in higher-value sectors and raise prices for local agricultural products, thus improving farmer's incomes.

Mobile ICT for Rural Women in India

An initiative aimed at increasing the entrepreneurial capacity of women was carried out by the local government of Gurajat (India) in collaboration with the Cherie Blair Foundation and Vodafone (UNCTAD, 2014). The venture developed a mobile application custom-fitted to the requirements of the ladies having a place with Rural Distribution Network India (RUDI).

This network is formed by the Self-Employed Women's Organisation (SEWA). The project developed a special mobile service that allows them to engage in real-time communication with RUDI management, check supply levels, and text orders instantaneously. This mobile application uses a Java interface through which the women who form the network can capture sales orders and place orders for new stock using their simple feature phones. This data is gathered and communicated to a Central data set utilizing fundamental text information.

The mobile application also generates several reports (Cherie Blair Foundation for Women, 2012).

Women avoid trips to the warehouse by placing their orders through the mobile service, one trip to place the order and one to pick it up. After their orders are placed, they are packed and distributed to the women in the villages (Vodafone, 2012). This initiative was launched in January 2013.

Future Heroes, Rwanda

In Rwanda, the Adult (15+) literacy rate increased from 38.2 % in 1978 to 73.2 % in 2018 growing at an average annual rate of 12.62 %. 89 thousand (89,000) students are enrolled in schools (Sustainable Development Solutions Network – Youth, 2020). However, significant problems remain.

Access to early childhood education is restricted, classrooms are stuffed, and rudimentary tutoring remains tormented by high redundancy rates and urban-rural divides. In Rwanda, 89,000 students are enrolled in schools.

Future Heroes Rwanda is making videos with content starting from the basics needed for beginners, as well as more advanced content for each level of primary school and high school. We did not forget students who are attending TVET school, they have their courses on our platforms or at our physical hub. The videos are being developed by experienced teachers with education skills.

Digital Alpha Hub will have computers and a projector which will be used by beneficiaries who wish to follow their courses to the hub and there will be a facilitator for moderating courses.

In Partnership with the Rwanda Education Board, the beneficiaries who will be at the desired levels will be encouraged to join public or private schools to continue their education to get degrees. After 6 months of intensive courses, students will be examined for being awarded a certificate.

Future Heroes Rwanda is an internet-driven solution - Digital Alpha Hub. It hopes to give access to education to illiterate youth, disabled youth, and financially unstable children who cannot afford ordinary schools.

Digital Alpha Hub will resort to using the internet as an enabler for each illiterate person without the need for people seeking education to go to a classroom. It hopes to eradicate the problem of overcrowded classrooms and a limited number of teachers.

Primary, and high school courses and TVET (Technical and Vocational Education and Training) courses are available on online platforms such as their website, YouTube TV, Android application, and also at their physical hub. Their vision is to impact 50,000 people in the next 5 years.

Agriresearch, Rwanda, and Burundi

Pesticide and chemical fertilizer malpractice among small-scale farmers have contributed to environmental pollution. Offsite movement of transformation products

of pesticides and chemical fertilizers contaminate groundwater, exposing humans to the chemicals through drinking water, and harm the aquatic ecosystem, leading to the death of fish and pollinators. Similarly, defective chemical fertilizer application methods have harmful effects on both our surroundings and our health.

Agriresearch has come up with an offline Android application that provides useful information regarding daily on-farm practices to boost agricultural production while saving our environment.

Smart Input is an Android application that will help farmers precisely use agricultural inputs including seeds, fertilizers, and pesticides. It likewise contains valuable data with respect to distinguishing proof of good quality seed, where contingent upon the yield a rancher will fill in the flow season they can approach data in regards to great quality seed.

They additionally have very much point-by-point data in regards to agrochemicals including yet not restricted to their hurtful effect on climate and people's lives, what these chemicals can be utilized with negligible pessimistic mean for on the climate and biodiversity in general.

Agriresearch based out of Rwanda came up with a technological solution called SmartInput which is an Android application that will help farmers precisely use agricultural inputs. This remembers data for seeds, composts, and pesticides.

It likewise contains valuable data on great quality seed, where contingent upon the harvest a rancher will fill in the momentum season they can promptly approach particular data.

They also have well-detailed information regarding agrochemicals including but not limited to their harmful impact on people's lives, and how these chemicals can be used with minimal impact on the environment and biodiversity in general.

This application likewise vows to assist farmers with distinguishing potential yields relying upon developed crops, land sizes, and agronomic practices to assist them with anticipating future ventures since, in such a case that a rancher does not understand what the person in question should gather occasionally, the individual in question won't plan as needs be in the forthcoming seasons.

Technology for Social Change and Development Initiative (Tech4dev), Nigeria

According to UNESCO, women make up a minority in the Science, Technology, Engineering & Mathematics (STEM) field. In 121 countries with available data, women make up 29% in the STEM field. This is the issue that Tech4dev wanted to address (UNESCO, 2010). UNESCO states women continue to be significantly underrepresented in every sector of STEM. Men dwarf ladies as students, teachers, analysts, and laborers in these fields. While the quantity of ladies signing up for advanced education is expanding quickly in numerous nations.

The Women Teachers program (WT)

WT is an initiative of Tech4Dev and an offshoot of the Nigerian Women Teachers (NWT) program. Women Teachers (WT) program aims to train 5,000,000 women in coding and deep tech skills across 5 learning tracks; Web and mobile development, Games development, Embedded systems, Data science/ Artificial intelligence, and Cybersecurity across Africa by 2030. This ambitious hope to promote women's participation in the STEM field and address the issue of underrepresentation in Nigeria.

The learning system is lined up with worldwide prescribed techniques as it catches an educational plan that reflects worldwide ability needs as it connects with computerized abilities inside Africa and across the world.

The Digital Village (DV) project

DV project was initiated by the American Tower Cooperation to promote digital inclusion and support digital skills necessary for the 21st century in the host communities where the DV is situated. The DV was laid out by ATC Nigeria to connect the computerized partition and make significant abilities essential for the future of work.

The objectives are to build employability skills in youths across Nigeria, to support and promote literacy in underserved communities, to increase the number of digital-savvy youths in underserved communities, and to increase the number of youths with digital skills needed to thrive in the 21st-century future of work.

The #DigitalforAllChallenge

The #DigitalforAllChallenge is a free computerized skilling project and contests intended to drive computerized proficiency of youth across Nigeria and prod interest in procuring advanced abilities and confirmations by means of on-location and online stages. It is aimed at preparing people between the ages of 16 and 45 years with computerized abilities for empowering equivalent access to innovation-driven financial opportunities.

The objectives are to equip Nigerian youth between the ages of 16 – 45 years with digital skills as a means of enabling equal access to technology-centric economic opportunities and inspire digital skill purchases through healthy competition and incentivization.

NDIP

The NDIP is a program that spotlights conveying both essential and high-level computerized abilities to government workers and young people. The NDIP is planned as a manageability part of the government where representatives who benefit and are

ensured from the preparation are supposed to convey similar preparation to their partners through an organized session or work collaboration.

The objectives are to create sustainability for digital capacity development and upskilling in Nigeria, to increase employability fit for digital opportunities across Nigeria, and to promote decent work for Nigerians by improving the ease of accessing opportunities via job-corresponding efforts.

The Basic Digital Literacy for Rural Clusters

The Basic Digital Literacy for Rural Clusters in Northern Nigeria program, in partnership with the UK Foreign Commonwealth and Development Office, was designed to reach 1000 vulnerable people in 10 states in Northern Nigeria targeting 50% vulnerable women and girls (aged 8-18; 45-65), 30% Persons with Disabilities (PWDs) e.g mobility, speech, polio, etc, 20% for other vulnerable groups. The training was applied across the following Northern States: Benue, Jigawa, Kwara, Kogi, Kaduna, Nasarawa, Niger, Plateau, Sokoto and Zamfara states.

The objectives are to increase the number of digitally literate vulnerable populaces and people living in underserved communities in Northern Nigeria and to increase the number of vulnerable populaces willing to study and contribute to STEM at a tertiary level.

Peepul, CM Rise Program, India

Peepul is the Partner for the School Education Department, Govt of MP, to lead the Academic Support and Monitoring Unit (ASMU) as part of CM RISE Schools.

Peepul is the essential Partner in school cycles and scholarly methodology, limit building, and framework fortifying.

CM Rise Schools are being created as asset-rich elite schools that offer great training with a dream to make a school local area that encourages all-encompassing improvement in all students.

This programme aims to support at-scale teacher learning (directly impacting ~320,000 teachers and ~10,000 academic officials across 52 districts) and professional development through high-quality virtual intervention. CM Rise likewise makes progress toward making a biological system of expert improvement for instructors that is customized and upholds scholastic objectives.

The solution starts with a computerized educator preparing program incorporated into the public instructor learning entry DIKSHA, during the lockdown time frame and fabricates the computerized educator preparing arm of the government.

280,000 Government school teachers across Madhya Pradesh are engaging in the CM Rise courses; an additional 134,000+ teachers from other states have enrolled as well. The courses have seen 90%+ completion rates on DIKSHA, consistently.

Vruksh Ecosystem Foundation, India

While trying to handle the traditional computerized realization which is broken, Vruksh Environment Establishment began an answer called Ekatra in India which assists organizations with making, conveying, and evaluating instant message-based miniature courses that emphatically further develop learning and preparing.

As Ekatra is a low information/no information learning stage, it makes instant message-based advancing surprisingly open and successful. Ekatra assists foundations with making, conveying, and surveying instant message-based miniature courses that decisively further develop learning and training.

This learning model directly appeals to a user-friendly retention model of information which has proven to be dramatically higher.

Over 75% of students are impacted due to the lockdown as they found it hard to study online, over 80% of students said they need hand-holding to shift from offline to online and over 25% said they need proper training to pursue education through online.

The Oddballs Drive is the local area arm of Vruksh Environment Establishment, a non-benefit social venture worked by business visionaries for entrepreneurs (vruksh site). We recognize pioneers who stand to accomplish more prominent social contact with mentorship, initiative training, and access to capital.

The Nonconformists Drive began as an online pitch occasion across 15 urban communities that makes a stage for social business people, trailblazers, and changemakers to grandstand, interface and grow their points of view. A people group stage to connect all Partners, changemakers, and business visionaries was launched in December 2020.

Youth Action for Global Development, Uganda

Youth Action for Global Development devised a program called Dynamic Hospital Management System which is an online software designed to manage all the areas of a hospital/facility such as medical, finance, administration, and the consistent processing of services within the hospital/facility.

Its objective is to provide total asset visibility, track staff locations using Google Map API, allow a high level of patient history, reduce lead time, and shelf space, facilitate just-in-time deliveries, provide full process control for patients, free online internship applications, high level of security and help in management planning, monitor and optimize resources.

All departments and wards are interlinked together to enable real-time data transfer between them and this is intended to ease communications between the staff. The system automatically tracks staff locations via Google Map API and these rights are mandated only by the super Administrator. The system automatically generates a patient's reference number to help reduce the real-time delay when attending to patients. It has an online internship application platform for internship applications. The

system stores hospital records which is proposed to ease budgeting and planning by the hospital administrators.

Govchat, South Africa

GovChat was conceptualized and developed by its founder, Eldrid Jordaan (govchat.org site).

In 2015, Eldrid started his pioneering excursion to foster a resident government computerized stage in light of his vision and want to help forever straightforward, responsible administration and influence accessible innovation to upgrade state administration conveyance. Three years, Eldrid self-financed a model and mindfulness crusade inside the South African Government. In January 2018, Eldrid effectively closed a solution that laid out GovChat as the authority computerized commitment stage for the South African Government.

By mid-2019, GovChat had raised an extra US$1.5 million from an improvement funder overseen by OkoVusa, set up by JSE-recorded Capital Appreciation as far as an interest-free endeavor advancement credit. As far as this exchange, Capital Appreciation took up a direct 35% of the offers in GovChat.

After a year, Eldrid and his administration and the specialized group have accomplished the improvement of a broad client base and set up major areas of strength for and hierarchical partners. GovChat is currently situated to universally grow.

The allowed-to-utilize GovChat application permits residents to give feedback and rate their nearby open services, going from utilities to emergency clinics - all just by texting local authorities.

Now, citizens can talk to over 10,000 government officials supporting over 30,000 public facilities and services nationally.

GovChat has online gatherings that permit individuals to examine approaches with government authorities, permitting legislatures to construct affinity and entrust with their residents. Since its commencement in November 2017, 7,000,000 individuals have downloaded GovChat.

Inclusive Innovation Cases

Industry

Bamboo Splint Making Machine, India

Shri Paresh Panchal, Gujarat is the inventor (devendrapatilblog site). Bamboo sticks are utilized in the Agarbatti (incense stick) industry. For handling bamboo, power worked high limit machines are appropriate for enterprises yet not for more modest provincial networks that use blades to make strips and sticks. The machine is making bamboo

strips and incense sticks. The primary machine is utilized to cut the bamboo bits of positive size, thickness, and length. The slices cut are then fed into the strip-making machine to produce the sticks.

Chetak, Cotton Stripper Machine

Mr. Mansukhbhai has a total experience of 32 years in the cotton and ginning industry (chetakindustries site). He created the machine in 1991-92 idealizing it in 1998. The machine is a productive and compelling machine to isolate the seed cotton from the shells, saves costs associated with physical work, and lessens the drudgery of ladies and kids. Staple Cutting has been eliminated. He founded 2001 Chetak Industries as the sole supplier of cotton stripper machines in India.

Healthcare

mOm Essential Incubator, UK

mOm Founder & CEO, James Roberts, and developed by mOm & the engineering team at eg technology, are to commence in the NHS as part of a series of pilots to help reduce the need for short-term admission to Special Care and to help maintain the core temperature of babies being moved around hospital sites.

mOm was established in 2014 as a reasonable, folding, and lightweight baby hatchery whose mission is to extend access to great medical care by giving reasonable innovation solutions that can work anyplace on the planet.

The mOm Essential Incubator gives a stable heated environment with performance that meets international standards (momincubators site). It is cost-effective, high-quality, robust, and is designed to work in challenging environments, whilst being easy to maintain.

mOm has worked with its partners Crown Agents and Jersey Overseas Aid to deliver the systems to where they are needed.

Jayashree Napkins, India

The story of Goa's Jayashree Parwar began in 2015 (outlookindia site). She was essential for a serene self-improvement gathering in Bicholim's Pilgao region, in the core of the iron-metal mining belt in North Goa, around 40 km from the state capital.

Jayashree was established in 2009 to plan and offer reasonable apparatus to deliver quality low-cost sterile napkins focused on poor country ladies.

Members of her collective were trying to come up with a niche idea for a business when an acquaintance informed them about a basic sanitary pad manufacturing machine that was available. In the early years of the enterprise, Parwar got together with other self-help groups and started manufacturing 100-200 packets of biodegradable sanitary pads.

Every bundle of 'Sakhi' sterile cushions contained eight units. By 2017, we had expanded our ability to 1,000 parcels," she said. Every parcel is sold at a retail cost of Rs 40. Contrasted with efficiently manufactured business options, their cushions are one of a kind since they are made of pinewood paper from Tamil Nadu, which decays in eight days when covered in soil.

Arbutus Medical, Orthopaedic Surgical Tools, Canada

Arbutus Clinical was established in 2014 after muscular injury specialists from Vancouver General Clinic and a group of biomedical architects developed an innovative careful drill innovation and an organization with DEWALT□, intended to address the issues of low-asset medical clinics, giving a reasonable, proficient, dependable, and clean answer for a muscular medical procedure.

Most of late, Arbutus Clinical has made TrakPak®, a consumable clean-pressed methodology unit that smoothes out the muscular injury system, and skeletal foothold. The TrakPak® framework gives uncommon proficiency and assists emergency clinics with keeping away from enormous capital expenditures.

Arbutus Medical and the AO Alliance have come together to provide hospitals in Malawi with the Arbutus DrillCover technology to treat long bone fractures.

The AO Alliance is a nonprofit development organization whose mission is to reduce human suffering, disability, and poverty through programs that enhance local fracture care capacity for a sustainable impact. With projects in progress in more than 30 nations in sub-Saharan Africa and Asia, the organisation is amidst a three-deliberately ease project in Malawi in a joint effort with the Johnson and Johnson Foundation.

doctHERs, Female Doctors via Telemedicine, Pakistan

doctHERs was founded in 2013 to match the under-utilized capacity of female doctors with the needs of female patients via telemedicine (docthers site). It gives access to reasonable, quality medical care in Pakistan to a subset of the "missing center" populace which isn't served by traditional healthcare providers.

Inclusive Disruptive Innovation

Inclusive innovations are disruptive if they require a specific adaptation to enter a wider market seeking good enough products, at a lower price with acceptable performance. Fourth Industrial Revolution (4IR) technology brings opportunities for production cost reduction, productivity and earnings improvement, and the development and introduction of new products and business lines. Herewith we present case studies illustrating the DII link in selected sectors.

Introduction

Christensen was one of the first authors to propose a link between the BoP and inclusive innovation process that stems from serving developing economies (Hart and Christensen, 2002). Inclusive innovation in emerging economies seems to be applied also in Prahalad's seminal work on innovation for the BoP (Prahalad, 2004), discussing how to make a profit by serving the most unfortunate individuals on the planet with the reception of progressive plans of action and item/administration setups.

As per Immelt et al (2009), auxiliaries of MNCs in arising economies must be conceded full dynamic experts in the markets they serve.

The success of such a strategy would not only be in anticipating or challenging "emerging" MNCs but also in granting new growth opportunities to "developed" MNCs in their home markets with technologies and products that would not have been developed without emerging market inputs (Kenney et al, 2009).

Inclusive Disruptive Innovations (DII) exist at the intersection between disruptive and inclusive innovation to advance sustainable transformation (Iizuka and Hane, 2021). They enter a wide market seeking good enough products, at lower-priced products with acceptable performance.

Fourth Industrial Revolution (4IR) technology brings opportunities for production cost reduction, productivity and earnings improvement, and the development and introduction of new products and business lines. The 4IR is being driven by new technologies that we will refer to as 'emerging technologies' or enabling technologies. These technologies include, among others, Artificial Intelligence (AI), Big Data analytics, Blockchain, cloud computing, the 5G network, the Internet of Things (IoT), autonomous vehicles, unmanned aerial vehicles (drones), Additive Manufacturing (AM), quantum computing technologies, virtual and augmented reality, and robotics.

Initiatives of International Organizations and Developed Countries

Healthcare

The Plumpy'Nut Effect, France

The item is the brainchild of a French pediatrician named André Briend (Calkins, 2013). Briend was important for a band of specialists in the 1990s that was very baffled and unsettled by the absence of successful treatment for unhealthiness. At that point, the common treatment for intense lack of healthy sustenance included managing a watery combination to patients through tubes in clinics. Notwithstanding, this 30-year-old practice neglected to save 20% to 60 percent of patients.

After years of trial and error and experiments, Plumpy'Nut was born in 1998.

Plumpy'Nut is a paste made of peanut butter, powdered milk, and powdered sugar, and enriched with vitamins and minerals. In food help terms, it is a "Prepared to utilize Remedial Food," and that implies that it doesn't need refrigeration, water, or cooking. It likewise has a period of usability of two years.

In around 95% of cases, those being dealt with make a full recuperation.

Children on the brink of death are brought back to life and treatment can usually be completed within four to six weeks.

Since its first trial use in Niger, the utilization of Plumpy'Nut in the war against child hunger has exploded. UNICEF, Plumpy'Nut's biggest buyer, purchased enough of the product to treat two million children.

In 2005, Plumpy'Nut had only one provider: the French organization Nutriset. Presently there are 19 UNICEF-endorsed makers of the nut glue in nations confronting a portion of the most terrible lack of healthy sustenance on the planet like Sudan, Haiti, Ethiopia, and India. The item is licensed in 38 nations and despite a few patent fights in the U.S., its supply has just gone up. Herewith is a portion of the principal organizations proposing the product.

Dansa Foods Limited; Nigeria:

Dansa Foods Limited is a manufacturing company in Nigeria, specializing in the production of quality and nutritious food and beverage (plumpyfield site).

NutriK, a company of the Nutriset Group, was established to operate alongside Dansa Food Limited, providing technical support in the specialized manufacturing, commercialization, and distribution process of ready-to-use food for the treatment and prevention of malnutrition. The Dansa & NutriK Partnership is 100% dedicated to supporting the government of Nigeria, the United Nations, NGOs, and civil society in their effort to eradicate malnutrition.

Edesia, USA:

Edesia was established in 2009 as a nonprofit devoted to treating and preventing malnourishment through ready-to-use foods (RUF). Edesia's mandates are to Produce high-quality RUFs; Collaborate on research and development to improve distribution systems and optimize the use of RUFs; Support local producers of RUFs in

the developing world; Engage in educational efforts and direct advocacy to raise the profile of global malnutrition.

The team of 150 people from 25 countries around the globe works to produce life-saving foods for malnourished children in Partnership with humanitarian agencies working in emergency and conflict zones. The top 5 countries supported in 2023 are Ethiopia, Chad, Niger Nigeria, and Sudan.

As a nonprofit in the USA, Edesia collaborates with U.S.-based nutrition research institutions and nonprofits, and advocates within the U.S. government to promote targeted nutritionally focused food products in international food aid. Located in North Kingstown, Rhode Island, the new plant was inaugurated in 2016.

Hilina, Ethiopia:

Hilina was laid out in 1998 to embrace the assembling and handling of a scope of food Products explicitly intended to battle the different types of lack of healthy sustenance and other micronutrient lacks influencing youngsters and other weak groups in Ethiopia.

When it was initially founded, the center produced Vitamin-A-enriched sugar as well as iodized salt for UN agencies, non-governmental organizations (NGOs), and the general public.

Hilina also recently established an on-site food laboratory and has transformed itself into a state-of-the-art and inclusive food production facility.

InnoFaso SA, Burkina Faso:

Created in July 2011 and based in Ouagadougou, the capital of Burkina Faso. InnoFaso is aimed at making products for the treatment and prevention of malnutrition and at meeting Burkina Faso's needs regarding these products.

Meds & Food for Kids (MFK), Haiti:

MFK is a self-regulating NGO manufacturing Ready-to-Use Foods (RUFs) located in Cap Haitian, Haiti. MFK was established in 2003 with the mission to prevent and treat malnutrition in Haiti through the local production and distribution of nutritious foods. Malnourishment rates in Haiti are high, with one out of five kids under 5 persistently malnourished (stunting), and one of every ten with acute malnutrition (wasting).

Nutriguinée, Guinea:

Established in 2017, Nutriguinée is a new asset for the health of the people of Guinea.

Nutriguinée is a project with a strong social impact, on several levels: Contribute to the improvement of the nutritional care of the vulnerable populaces and nutritional

autonomy; Support agricultural development through the valorization of local raw materials such as groundnut, rice, maize, fonio, and cowpea; Participate in the socio-economic development of Guinea through job creation.

The Factory, India:

The Factory is located in Pune, about 160 km from Mumbai. Its location facilitates transportation to Mumbai port, across India, and in the Asia subregion. The plant is exceptional with the best in class hardware set up, guaranteeing the assembling of quality Products pressed in hygienic conditions.

Thanks to India's agricultural production, most of the raw materials used in manufacturing our products are sourced locally.

SAMIL, Sudan:

Created in 2011, SAMIL is a mutual initiative between the Yagoub group and NUTRISET. Its objective is to produce high-quality nutritional products in the Republic of the Sudan to meet local needs. On account of the experience of Yagoub, SAMIL has laid out a cutting-edge office in Khartoum and can now address the greater part of the issues in the Republic of Sudan for RUF.

SAMIL truly does benefit too from a cutting-edge nut process innovation that will permit them to valorize the plentiful neighborhood peanuts and, in this manner, SAMIL expects a huge effect on the farming and supply chain.

Thanks to the quality control set at SAMIL and the quality requirements on RUF, the quality level for the production of peanuts will increase and should allow Sudanese peanut production to improve its access to the export market.

STA SA, Niger:

STA SA, established in 2001, plans to add to working on the dietary status of the weak kids, specifically by assembling Products for the treatment or counteraction of lack of healthy sustenance, and to foster Products adjusted to the dietary patterns of individuals of Niger. STA was created as a successor to the 'VITAMIL' production facility set up in 1991 by CARITAS NIGER with subsidies from the Dutch Royal Tropical Institute (KIT) to support the government's activities concerning infant nutrition.

Tanjaka food, JB, Madagascar:

Established in 1963, JB company is part of the family-owned Basan group (basan site). JB manufactures food products (biscuits, wafers, snacks, etc.) mainly distributed on the local market but also exported to COMESA, COI, and SADC zones.

Lucky Iron Fish (LIF), Canada

LIF is a group of researchers in a Canadian university created in response to the 2 billion people suffering from iron deficiency. Iron is a crucial nutrient that helps blood transport oxygen from the lungs to the body. Without an adequate measure of iron, individuals experience exhaustion, shortcoming, and absence of focus, windedness, and migraines.

LIF uses techniques like the tried and true intercession of utilizing cast iron cookware to build the general iron content of food.

When placed into a pot of boiling, acidified water for 10 minutes, this reusable, fish-shaped ingot releases iron into the cooking water. Thus, the food absorbs the iron from the iron-enhanced water, expanding the general iron substance of the feast. It has been assessed that one dinner arranged with a LIF can considerably add to by and large everyday iron requirements.

LIFs are reusable, and last for up to 5 years and costs $18. The Lucky Iron Fish can give one family a source of iron for up to 5 years simply by cooking with it. All you have to do is boil the fish with 1 liter of water or broth and 2-3 drops of citrus juice for 10 minutes, remove the fish, and add ingredients to your water.

Once someone buys an Iron Lucky Fish, the organization contributes an equal amount to its Impact Fund. The company uses its Impact Fund to donate Lucky Iron Fish to developing countries and improve educational resources in communities. Women and men receive training to deliver Lucky Iron Fish within these countries and raise awareness about how to solve iron deficiency. Over 1 million lives improved globally.

EinDollarBrille, Eyeglasses, Germany

GoodVisionGlasses is a brand of OneDollarGlasses, a global social business settled in Germany, and Europe, and established by Martin Aufmuth in 2012.

It can be manufactured in the field with a simple machine that does not require electricity based on Siemens' Solid Edge software, which is part of the Siemens Xcelerator portfolio. (Siemens, 2013, sw. siemens site). The glasses be designed and modeled in 3D using this software, it also helps make the manufacture of the bending machine and the tools needed to produce the glasses in the field more efficient and repeatable.

The OneDollarGlasses are manufactured on bending and milling machines specially designed for this purpose (onedollarglasses site). The display outlines comprise a lightweight and adaptable casing made of incredibly powerful, rustproof, and hypoallergenic spring steel wire (1mm). The casings are made by hand on a twisting gadget which needn't bother with a power supply. Various physiognomies can be considered independently while bowing the casing. The circular cleaned, solid Central points are given the scores and steps for affixing in the display outlines on the processing connection and can be embedded in a matter of moments.

This milling machine can be operated via a decentralized power supply thanks to the low power consumption by a generator or a solar station.

Heat-shrinkable sleeves are made of hypoallergenic plastic on the earpiece ends to increase the comfort of the glasses. As the glasses have very little weight, they do not require nose bridges. Two colored glass pearls give each pair of glasses its design. The glasses are also affordable for very poor people due to low production costs. The correction of defective eyesight is an important prerequisite to being able to pursue gainful employment.

The production can be done locally by spectacle manufacturers who have to attend a 14-day intensive training course on the equipment. These craftsmen work independently and on their responsibility. The creation of the glasses can occur at home so that particularly ladies can work and deal with their kids simultaneously.

A production unit includes all equipment and tools necessary for the production of the glasses. It can be awarded in the form of a loan to a group of 4 or 5 persons, who in addition to funding the ongoing costs for materials can also repay the loan from the production and the sale of the glasses.

After two to three years, the production unit becomes the property of the group. The region covered by a creation unit can be expanded extensively in the event that versatile opticians use motorbikes to visit the people in the villages consistently.

OneDollarGlasses is currently active in Bolivia, Brazil, Burkina Faso, Kenya, India, Malawi Peru, and Myanmar.

Lentes al Instante (LAI), Bolivia:

Around half of Bolivia's 11 million residents live in rural areas. Outside of urban centers, there are few, if any, eye doctors and opticians (siemens-stiftung site).

Since 2013, the organization has operated with the local institution LAI, to provide eye exams and inexpensive glasses. Each pair of glasses is produced in Bolivia and can be adjusted to meet the needs of each customer directly on-site. LAI also runs a training center in Santa Cruz de la Sierra. LAI delivers jobs and steady local revenue for around 10 people producing glasses and around 17 "Consulta Óptica" helpers.

In 2019, LAI reached 40 primary and secondary schools in regions surrounding Santa Cruz in addition to efforts in La Paz, Tarija, and Yacuiba-Chaco with its campaigns.

In Bolivia, intense sunlight also poses a serious threat to the eyesight. Without sun protection by hats or sunglasses, the exposure can be tremendously unsafe to the human eye. That is why sunglasses with dioptres were offered in addition to normal glasses.

The project was part of a collaboration between Siemens Stiftung and the German development organization Gesellschaft für Internationale Zusammenarbeit (GIZ) that focused on improving the quality of science and technology education in schools and growing awareness about hygiene and environmental issues.

GoodVision, Kenya:

In 2023, Kenya is struggling with a severe drought in the north and east of the country, which poses enormous challenges for people as a result of climate change. Refugee movements to large cities such as Nairobi are increasing the pressure in the slums, where the GoodVision team is regularly active.

In Kenya, GoodVision focuses on holistic care for people to supplement Kenya's optical and ophthalmological system wherever possible. Together with local Partners, GoodVision can also offer medical assistance if they identify a need for it at an eye camp. In addition to the German Doctors, GoodVision cooperation Partners also include Lufthansa Cargo Human Care, for example.

Care Netram, India:

GoodVision is dynamic in three states in the east of the nation through Care Netram. In Odisha, where more than 40 million individuals reside, Antje Christ and Martin Aufmuth met Indian businessperson Prashant Pachisia in 2017. They signed a joint agreement, laying the foundations for a vibrant partnership.

Prashant made the vision of Martin possible in India. It's his vision to change the vision landscape that gave birth to Care Netram in India. He is the brain behind Care Netram.

Care Netram is a social enterprise that is working to provide vision care at the doorstep of the rural poor.

Lack of Awareness and Shortage of optometrists are resulting in high costs and poor access to eye care services, especially in rural India and they are considered the main reasons India is known as the blind capital of the world.

Care Netram strives to contribute to solving the above-mentioned problem by skill development intervention training for rural people to become Rural Opticians and have Good Vision Technicians (GVTs) as we call them who work under the aegis of Optometrists.

GoodVision, Liberia:

In 2019, GoodVision USA received a competitive grant from the L'Occitane Foundation and L'Occitane North America to support our vision care work in Liberia. This grant has allowed us to continue to train a tLiberian NGO Refuge Place International (RPI), GoodVision established the foundation for the training of locally based individuals to become GoodVision Technicians (GVTs). Throughout 2020, these GVTs performed optical screenings and conducted rural optical outreaches for visual assessment and the dispensing of glasses. The Liberian capital, Monrovia, served as the central point for the majority of projects, with eye testing being conducted on an ongoing basis in the RPI clinic.

RPI was founded in 2014 by Dr. Mosoka Fallah, an internationally renowned epidemiologist. Jim Suah (top, left) and Matee Morris (lower) the mission of RPI in Liberia is to stimulate and foster an environment that leads to improved health outcomes for impoverished communities throughout the country. GoodVision and RPI work in Partnership with the Ministry of Health in Liberia.

Eliodomestico, Potable Drinking Water, Italy

This solar still, designed by Italian freelance designer Gabriele Diamanti, produces potable drinking water from salt water. It can be used in arid coastal regions all over the world to produce drinking water for those in need.

Eliodomestico is an innovative solar distiller for households, designed to function without filters or electricity. The device is made from readily available materials, such as burnt clay and tin metal, and can be entirely produced by local craftsmen. The body is made of two earthenware parts. The evaporator and the condenser consist of tin-welded metal sheets. The freshwater bowl is prepared with clay.

Its design takes into account the custom of transporting objects on the head. The dirty or salty water is filled in a water tank, and in the evening, clean water can be collected. The water evaporates and re-condenses in a mobile recipient placed underneath the tank. The prototype produces 3 liters of fresh water per day. This results in the production of 10 liters per day per square meter of surface.

The device is self-explanatory and requires no maintenance except cleaning. Its size can be adapted to the respective water demand, an output of 5 to 10 liters per day meets the needs of an average household.

Jompy Water Boiler, Borgen Project, UK

Established here in Scotland in 2010, this sustainable technology is aiding to bring clean drinking water to the developing world.

The Jompy Water Boiler is a lightweight and inexpensive firetop device that sits between cooking pots on an open flame. It enables households to cook a meal while at the same time heating water to temperatures high enough to kill 98% of waterborne bacteria (according to entrants). As a result, the water is safe to drink and can be used for cooking or bathing.

The creation of Ayrshire warming specialist David Osborne has been field-tried in Uganda by Glasgow College PhD research student Lena Hiltrop, with substantial results.

Gravity pushes the water through the Jompy Water Boiler, which then delivers near-boiling hot water within seconds and at a rate of one litre per minute. It works equally efficiently on stoves or simple three-stone fires, making it suitable for use in both rural

areas and urban dwellings. Through more efficient use of the cooking fire, the Jompy Water Boiler also dramatically reduces fuel costs for poor families.

Jompy is used in Uganda, India, and Kenya.

ElectroChemical Arsenic Remediation (ECAR), USA

An estimated 60 million people in low-income countries like South Asia are exposed to naturally occurring toxic arsenic, every time they drink from their local well. The arsenic crisis in the Bengal Basin has been described as the largest mass poisoning in human history (gadgillab.berkeley.edu site). Arsenic is tasteless, colorless, and odorless and its chronic ingestion leads to health problems, such as painful lesions or cancers, only in the long run.

In the preliminary testing at Jadavpur University (Kolkata), the prototype was placed in Dhopdhopi High School near Kolkata for a three-month field trial starting in October 2012. This village school received pipe water for approximately 1 hour per day (inadequate to meet the needs of 2600 students) and supplemented it with groundwater, which was contaminated with about 250 µg/l of arsenic. The prototype consistently reduced arsenic levels below the WHO-recommended maximum contaminant level (MCL) of 10 µg/l over several weeks of operation by a trained community member.

Schools are consequently the regular decision to present the new water innovation and were chosen to test and work ECAR 100l and 600l models.

ECAR is an exceptionally successful ultra-low low-cost water treatment innovation intended to bring locally reasonable and economical arsenic-safe water to provincial networks. In ECAR, standard steel plates utilize low voltage power to create iron oxide (for example rust) particles in water that adsorb and trap arsenic.

During the process, toxic arsenite is converted into nontoxic arsenate, allowing the process to be highly effective under robust conditions.

Operating ECAR is simple: voltage is very low (about 3 V DC) and no corrosive chemicals are needed. ECAR can be operated by educated local community members. Operating costs are extremely low (~ 0.04 USD/l), making it possible to sell the arsenic-safe water at a locally affordable price while simultaneously covering the expenses.

ECAR is sold in Germany, Portugal, Switzerland, India, Indonesia, Pakistan, Bangladesh, Malaysia, Nepal, and Africa: Tanzania, Botswana, Ethiopia, Kenya, and Mexico.

Agriculture

GrainPro- Safe Storage

Established in 1992 in Concord, Massachusetts, USA, GrainPro, GrainPro's item are developed and fabricated by its claimed backup, GrainPro Philippines, Inc., situated inside the Subic Bay Gateway Park, Philippines.

GrainPro has spent significant time in safe products piling and drying of grains and seeds in light of its Ultra Hermetic™ technology (grainpro website). GrainPro's sheltered products piling Products work on a similar straightforward natural component. On the off chance that a holder is sealed shut, any sheathing bugs, microorganisms, and the putaway item through their breath alone will make a low-oxygen, high-carbon dioxide condition. This will hinder shape development and slaughter the bugs.

GrainPro's product piling systems decrease post-gather misfortunes of dry rural wares and enhance general health by forestalling aflatoxins in putaway dry foods, for example, maize, peanuts, and rice. The development of aflatoxins in putaway Products contrarily influences the human safety framework. In Africa, aflatoxin pollution surpasses 40% of the wares exchanged in nearby markets.

In India, flavors producers, for example, food businesses, for example, Jayanti Spices, Sresta Natural Bioproducts, Arvind Ltd, and Suminter Organic Foods utilize Grainpro products piling framework which saves likewise the fragrance and kind of flavors, for example, coriander, red stew pepper and turmeric, coffee, cocoa, and basmati rice.

Chia seed producers in Bolivia, Argentina, Paraguay, and Mexico utilize Grainpro systems. Chia seeds have a high Omega-3 content and are fundamentally utilized in cocoa, creation and makeup.

In 2010, GrainPro satisfied a USAID contract for the conveyance of its ultra-hermetic products piling and solar dryer systems to small Afghan farmers.

GrainPro has likewise teamed up with the UN World Food Program (WFP), the Food and Agriculture Organization (FAO), GIZ, AGRA, and CYMMIT for safe products piling and drying in a few nations. Ultra Hermetic products piling lessens misfortunes, naturally and without chemicals or refrigeration, to under 1% every year.

Mazzi Can, Global Fund, USA

Vecchione is senior VP of Worldwide Great, a cooperation between Bill Doors and Scholarly Endeavors, a product improvement group situated in Bellevue, Washington.

Vecchione had the idea for the pail himself after seeing how much milk in Africa is wasted (Schiller, 2014).

The Mazzi is a plastic 10-liter container specially designed for carrying milk in under-developed places. It has an ultra-wide mouth, so farmers can clean inside easily. There are notches on the side, so the Mazzi can be tied to the bike or slung over the shoulder. There are measurement scales to help farmers get the right price for their products. The funnel–which fits onto a cow's udders–is black, helping farmers look out for telltale residues indicating diseases like mastitis.

Having developed the Mazzi, Global Good has donated all rights to local Partners that are making and selling it. Currently, it's available in Kenya, with other countries like Ethiopia, Uganda, Tanzania, and Rwanda expected to come on board soon.

The Mazzi Can create a clean, effective way to store milk to strengthen farmer linkages to formal markets (techxlab site).

Numerous smallholders rehearsing means cultivating depend on milk as a fundamental wellspring of everyday pay. Utilization of the Mazzi™ milk holder, more affordable than metal jars and promptly cleanable, can work on the quality and amount of milk that is effectively conveyed to showcase, bringing about higher earnings for farmers.

The Milk Transportation System uses a durable 10-liter container designed specifically to reduce spillage and spoilage.

Farmers can drain their animals straightforwardly into the compartment utilizing a separable pipe, which limits pollutants, recognizes indications of udder diseases, and diminishes spillage when the holder is tipped. The compartment's appended cover is then gotten onto the holder, and the units are stackable for simple transportation from the ranch to an assortment of focuses that buy milk.

When the system is used properly it reduces the number of times that milk must change containers, making it much easier to clean and transport. This framework increases the nature of milk at centers in Kenya and teaches farmers about appropriate disinfection practices.

In tests, milk put away with the Mazzi contained multiple times fewer microbes than milk held in jerry jars.

Energy

Rotor – Swimming Power Plant, Germany

Markus Heinsdorff came up with the initial design and idea for the Rotor. Mobile Hydro's first prototype was developed in collaboration with Technische Universität München (heinsdorff site). Rotor is a small, hydropower plant, which delivers an easy way to produce electricity by utilizing the current of a river.

The Rotor is based on the Darrieus Principle that's long been applied to the generation of wind power. This means that the rotation is induced by three vertical blades that are connected in the middle with an axis and are driven by a river's current.

A transmission mounted atop the rotor transfers this rotation to a generator that then produces an electrical current, which, in turn, is fed via cable into a small buffer car battery set up on the riverbank. This battery then makes power available to users on a 24/7 basis for purposes of illumination, charging smartphones, running refrigerators, whatever.

The prototype rotor consists of a tractor tire tube, flat bar steel as frame construction, bicycle dynamos, and blades made of sheet. The pre-owned materials are substitutable and are hence accessible overall for minimal expenditure. A stream speed of 1.5m/s can give a result of up to 150W. The Rotor utilizes low-cost innovation and can be developed in a simple way.

Required materials are substitutable and available worldwide (d-rev site). For families in country regions with streams close by the Rotor implies the accessibility of sustainable power with a super durable result (constantly). It very well may be utilized for lighting, cooling, or charging batteries and smartphones. The circulation of a self-constructed Rotor or a pre-manufactured development unit could likewise extend to potential opportunities for nearby organizations and create jobs.

BioGas Backpack, (B)energy, Germany

As an agricultural German engineer, environmental scientist, and cabinet maker, Katrin Puetz developed the concept and technology for mobile biogas between 2010 and 2013. Since 2013 Katrin has been (B)energy's CEO (be-nrg site).

The Biogas Backpsack is a pad formed swell from adaptable, gas-tight material, plastic sheet, and texture. The two inward layers are made of gas-tight PE-sheet, welded at the two open closures, and outfitted with a welded, strung spine, holding a smaller-than-usual ball valve. The rucksack is loaded up with biogas from the biogas plant by basic strain evening out rather than by pump or compressor.

Therefore, it does not need to be equipped with a security valve to release gas in the case of overpressure.

To utilize the Biogas Backpack resourcefully, it would make sense to produce the biogas in one central, technically advanced biogas plant. Because of the limited amount of biogas, the high content (30-60%) of non-flammable CO_2 in biogas, and the non-pressurized status of the gas, there is no risk of an explosion.

Supplanting wood fills, biogas can mitigate such issues while at the same time decreasing deforestation and soil disintegration.

The Biogas Knapsack expects to furnish poor provincial families with a reasonable wellspring of energy for lighting or cooking, in this way working in everyday environments. Assisting with staying away from the tedious undertaking of gathering fuel wood, the biogas knapsack assists with facilitating the everyday work of ladies in non-industrial nations.

Capacity: 1.2 m³ of biogas Weight: 4.4 kg (in a fully inflated state). Used by Countries Category Europe: Germany, Portugal, Switzerland, Asia: India, Indonesia, Pakistan, Bangladesh, Malaysia, Nepal, Africa: Tanzania, Botswana, Ethiopia, Kenya, Mexico.

Industry

River Ice by Aprotec, Cooling System, Germany

River Ice is a small-scale Garman river turbine, developed by Aprotec, Germany directly connected to an open refrigeration compressor. Polyethylene bags containing filtered water produce ice blocks via the energy of the current. Garman river turbines are well-known technologies (aprotec site). The River Ice turbine is associated

straightforwardly with a mechanical blower, which chills off through polyethylene sacks containing water, hence delivering ice blocks.

For this system to work, a river must have a minimum depth of 1.7m and a flow rate of at least 0.6 m/sec. If the energy flow of a river exceeds 12 kWh/day, it is adequate to produce more than 250kg/24h of ice in tropical areas with temperatures of 30ºC or higher. According to WHO estimations, a great deal of food is spoiled due to inadequate storage options in developing countries.

This amount rises in tropical regions. Particularly affected is fresh fish as an estimated 40% of the stock rots before it can be processed. Cooling devices are not obtainable and the hygiene is inadequate. Many rural communities in proximity to rivers such as the Amazon River, the Orinoco River, the Zambezi, Congo, and the Nile, live on fishing and fish trade without the possibility of maintaining stocks. In these districts, cooling is often as important as electricity. The possibility of keeping fish cooled will lead to greater job potential in the communities. Job creation can also be expected from the distribution, installation, and maintenance of the River Ice plants. The framework could be enhanced by a little PV-driven ultrafiltration plant and thus produce perfect and microorganism-free water for the ice blocks from the river water.

Permafunnel: Internal Funnel for Hand Pumps, USA

The Permafunnel was invented in 2008 by Technology Exchange Labs (TEL) by two alumni from the MIT Sloan School of Management and implemented in West Darfur, Sudan. Hand pumps were found to be unreliable and waste a lot of water. They distinguished a hole between existing innovation-based answers for issues of neediness, and endless NGOs, nearby business visionaries, and creating world networks that come up short on time and skill to recognize, survey, and obtain proper solutions. TEL shuts that hole by enabling last-mile networks with significant data and the opportunity to pick solutions that best suit their requirements.

A further 200 Permafunnels were then introduced close by pumps in West Darfur.

In 2014-2016 it is hoped to carefully monitor the installation of a further 200 Permafunnels in the Gambia.

Permafunnel is an internal funnel, which is easily installed in hand pumps to provide a straight water flow. It is machined from the food-grade plastic UHMWPE (ultra-high-molecular-weight polyethylene) and is fully inserted into the spout of a hand pump (nilecat site). The outer diameter is selected to ensure a slight interference which fits with the inside of the spout and can be installed by using a hammer or a hydraulic press. The inner diameter is designed to prevent restriction of the water flow at the highest possible pump rates. The funnel is cut at a 45-degree angle to allow it to be built in deep inside the outlet spout. The upper part is specifically shaped to calm and guide the water flow.

Without a funnel, the chaotic water flow exiting from hand pumps results in water waste of 30% or more. At the point when water is pumped into holders with thin openings (jerry cans etc.) an enormous rate is spilled because of the uncontrolled water stream leaving the pump spout. This waste contributes to unsanitary water points; longer pumping times and hence queues.

Solar Cookers International (SCI), USA

SCI is a charitable organisation given to spreading information and techniques of solar cooking innovation to the most unfortunate regions of the planet (borgenprojects site-Josh Forgét; solarcookers site). The organisation works widely in Chad, Kenya, Ethiopia, and Zimbabwe. Established in 1987 by a little gathering of sun-based cooks in Sacramento, California, SCI started as a little exertion by a group of individuals committed to a solitary reason: to give neediness help through the innovation of Solar power. By 1999, UNESCO turned into a recipient of SCI by supporting territorial gatherings in destitution-stricken nations like India, Kenya, and Honduras. Since its establishment, Solar Cookers Worldwide has conveyed its innovation to more than 30,000 families in Africa.

Sun-powered cookers are especially useful in Africa since they eliminate the requirement for African ladies to pass on their properties to assemble kindling. For example, Sudanese evacuee ladies in Chad are habitually attacked by foe soldiers upon takeoff from their camps, frequently bringing about extreme injury or demise. The presence of sun-based cookers in towns in Chad permits Chadian ladies to accommodate their families while protecting their very own prosperity.

Quite a bit of its help base comes from gifts. SCI additionally fund-raises through the offer of sun-based cookers in the US and other developed nations.

Kenya:

Solar cooking is making a significant difference at Kakuma Refugee Camp, Kenya - particularly for a person living with a disability.

SCI collaborated with staff at the University University of Nairobi Nairobi Stove Testing Testing Center and provided equipment and training for testing testing solar cookers.

Nepal:

SCI partnered with the Foundation for Sustainable Technologies (FoST) to implement a solar cooking project that focuses on fragile communities that depend on polluting fuels, such as firewood or imported gas, and unreliable supply chains. Participants receive both the tools and the education they need to make solar cooking a regular part of their cooking routine. Not only are people able to save time and money in the short

term, but they are also better positioned to weather crises like earthquakes, floods, COVID-19, and supply chain disruptions.

Yemen:

In 2023, SCI expanded its global presence, recognition, and relevance by building capacity for solar cooking and drying in Yemen.

SCI was able to share best practices and knowledge to support the goal of empowering people with 100 solar cookers, 70 household solar dryers, and 6 communal solar dryers.

Procter and Gamble - New Razor

Indian men spent longer shaving than Western men, thus there was no requirement for razors to have numerous sharp edges. This empowered Gillette to make the Guard razor utilizing 80% fewer parts than different razors. The Gillette Guard cost just 15 rupees (US$1) and has now caught 66% of the market in India (winter and Govindarajan, 2015). Developing frugal answers for purchasers in Emerging Markets tends to center around those most essential to clients (Hesseldahl, 2012) beginning from a fundamental rendition of a product and giving clients the alternative to include includes as their assets permit (Roland Berger, 2012).

Environment

NEWgenerator Sanitation System, USA

Since 2002, a group of researchers at the University of South Florida have been working on a new type of wastewater treatment system that will address sanitation issues in poor countries (Burgen).

They invented the NEWgenerator, which is a compact mobile solar-powered generator that turns wastewater into recyclable clean water, nutrients, and energy.

Squander from the latrine enters the tank and it treats the water in a way that is like a Coffee channel.

The center innovation inside the NEWgenerator is the anaerobic layer bioreactor (AnMBR), fit for dealing with an extensive variety of wastewater qualities, discontinuous streams, and delayed closures (WRRC, 2023). The incentive of the NEWgenerator is that it makes flush latrines conceivable in off-network, distant areas. Thus, chlorinated water that individuals can use to flush the latrine and inundate for agricultural purposes.

The breakdown of organic material in the waste produces biogas, a form of energy.

Finally, this technique discharges supplements, for example, nitrogen and phosphorus from the waste that individuals can use as compost for rural purposes.

The NEWgenerator stays inside a compartment that batteries power, permitting the unit to be self-practical. Sun-based power and biogas from the waste power these batteries, making this gadget-free.

The NEWgenerator started testing at a school in South India, where the creation prevailed with regards to reusing a great many gallons of water for 100 individuals each day.

In 2016, the NEWgenerator's lead professor, Daniel Yeh, earned a $1.14 million grant from the Bill and Melinda Gates Foundation to install an improved version in Durban, South Africa. The generators will connect to Community Ablution Blocks (CABs), facilities consisting of toilets and showers. This will multiply the NEWgenerator's ability to produce water by 10 times and serve up to 1,000 people per day.

Mining

Africa is home to the largest global reserves of aluminum, chromium, cobalt, diamonds, gold, manganese, phosphate, platinum-group metals, and vanadium (Assegaf et al. 2017). The number of countries exporting minerals in Africa has shot up over the past 10 years so only a handful of SSA countries are not mineral exporters (Chuhan-Pole et al. 2017). Mining operations create jobs indirectly in surrounding communities, through backward and forward links, and revenue from mining leases supports public administration and service provision, which also create jobs.

Wage jobs with formal mining enterprises—mostly foreign—are well-paid in Africa, though informal artisanal mining tends not to pay well (Chuhan-Pole et al. 2017). Mining is physically difficult and often dangerous due to work accidents and exposure to dust and toxins (Stewart, 2019). Around the world, robots and sensors are already being used in mining, particularly in large underground mines (Gaus & Hoxtell 2019). IoT technology permits improved monitoring of conditions underground. The use of these technologies is likely to reduce jobs in older, large underground mines and improve the safety of the jobs that remain (Gaus & Hoxtell 2019; Technopolis et al. 2019).

Global demand for rare earth minerals offers new opportunities for Africa if more mineral reserves can be identified and profitably exploited. 4IR technology, such as drones and satellite imagery, is an efficient way to prospect (Gaus & Hoxtell 2019). Herewith some innovative applications (Campbell| et al, 2021).

Automated Mobile Mining Equipment

Computerized versatile mining gear is the most vital move towards independent apparatus that is worked from a distance or semi-from a distance, which thus decreases the dangers of injury to representatives as they won't be straightforwardly at the mine face, consequently lessening human openness to take a chance with as stone falls, earthquakes and other risky circumstances.

Kamoa-Kakula Copper Mine, DRC, Sandvik Sweden:

The Kamoa-Kakula Copper Mine is a top-notch, super high-grade, enormous copper mine, situated on the Katanga copper-cobalt belt, in the northeastern piece of the Central African Copper Belt, which ranges from southern DRC and northern Zambia.

Currently, exploration activities continue at Kamoa North and Kamoa Far North (zijinmining site).

Kamoa-Kakula uses clean, renewable hydropower. A 2020 independent audit by Hatch Ltd. of Canada confirmed that the mine would be one the world's lowest Greenhouse Gas (GHG) emitters per unit of copper produced.

Zijin Mining is the largest equity interest holder of the Kamoa-Kakula Copper Mine, ultimately owing approximately a 45% interest in the project. In 2015, Zijin Mining acquired a 49.5% interest in Kamoa Holding Limited from Ivanhoe Mines, thereby indirectly holding a 39.6% equity interest in the Kamoa-Kakula project. Zijin Mining also holds a 13.59% interest in Ivanhoe Mines, making it the second-largest shareholder of the Canadian mining company.

Sandvik Sweden has received a large underground mining equipment order from Jimond Mining Management Company (JMMC), a subsidiary of the Chinese global mining services provider JCHX Mining Management Co., Ltd. to be utilized in the Kamoa-Kakula copper mine in the Popularity based Republic of the Congo.

The request incorporates Toro™ TH663i trucks, Toro™ LH621i loaders, and Sandvik DL432i longhole production drills. Sandvik's keen burden and take gear has been in activity at Kamoa-Kakula beginning around 2019.

Platreef Platinum Mine, Limpopo South Africa, Sandvik, Epiroc, and Normet:

Fresher mining techniques can likewise open new opportunities by setting aside already uneconomic installments feasible while boundlessly further developing health, as seen at one more of Ivanhoe Mines' ventures, the Platreef platinum mine, which relies on massive mining methods, in contrast to the narrow vein mining methods used by most other platinum-group-metals (PGM) and base metals miners in Africa.

The Platreef Venture is a level one disclosure of platinum-group metals, nickel, copper, and gold by Ivanhoe Mines' geologists on the Northern Appendage of South Africa's Bushveld Volcanic Intricate, the world's chief platinum-delivering locale. Platreef is recognized from other Bushveld projects by its mix of grade, thickness, calculation, scale, and potential for huge nickel and copper result credits, and is the world's biggest lacking valuable metals project. Facilities used to purchase underground mobile mining equipment from leading manufacturers Sandvik, Epiroc, and Normet.

Sandvik

A new Sandvik 63-tons ore truck at the Kakula Mine. On December 1, 2020, the

Epiroc, Sweden, won 2022 a significant order for battery-electric mining equipment from Ivanplats that will be used to develop its greenfield mine in South Africa, in the most sustainable and productive manner possible.

Epiroc

Epiroc is a vital part of a sustainable society and a global productivity Partner for mining and infrastructure customers. With ground-breaking technology, Epiroc develops and provides innovative and safe equipment, such as drill rigs, rock excavation, construction equipment, and tools for surface and underground applications.

Epiroc is a fundamental piece of a practical society and a worldwide efficiency Partner for mining and foundation clients. With weighty innovation, Epiroc creates and gives innovative and safe gear, for example, drill rigs, rock exhuming, and development hardware and instruments for surface and underground applications.

Normet

Normet, Finland, is a world-leading, innovative technology company. in mining, tunnelling, and civil engineering projects.

Normet's underground equipment is utilized in hundreds of mines and tunnel worksites around the world. Its equipment is used for concrete spraying and transport, explosives charging, scaling, lifting, installation works, and underground logistics.

Syama Gold Mine, Mali:

Unfaltering Mining's Syama mine in the Republic of Mali is advancing to be the world's most memorable completely independent underground gold mine.

A formalized business relationship exists among Unfaltering and Sandvik for the full mechanization of the Syama underground mine including the conveyance of mobile and fixed gear and delivery of training to maintenance and operational personnel.

Sandvik mining automation and teleoperation systems enable machine monitoring and provide a full fleet overview (rocktechnology. sandvik site). These software systems control and streamline tasks, upgrading efficiency and health while at the same time decreasing absolute ownership costs.

Syama Gold Mine is a large-scale operation, comprising the established Syama Underground Mine, the Tabakoroni Complex, which comprises an open pit, and recently discovered underground Ore Reserve, along with several satellite oxide pits.

Syama is owned by local secondary Société des Mines de Syama S.A. (SOMISY) in which Resolute has an 80% interest and the Government of Mali holds the remaining

20%. Société des Mines de Finkolo S.A. (SOMIFI) owned the Tabakoroni complex, part of the Resolute Group, Australia.

Syama's underground mine is a modern sub-level cave operation producing around 2.4Mtpa of ore. The company controls a fleet of development jumbos, production drills, loaders, and trucks.

Democratic Republic of Congo at the Kibali Mine:

Gold major Randgold Assets is working with three Sandvik loaders fitted with Sandvik's AutoMine computerized mining framework and the OptiMine particular data management solution that offers an ongoing perspective on underground mining tasks to give constant following and creation the executive's devices and examination yields for by and large equipment efficiency improvements.

China Africa Zambia:

Chinese mining firm Nonferrous China Africa is introducing robotized systems to initiate underground mining at its South East Metal Body project.

These incorporate the AutoMine Truck Pulling, AutoMine Light, OptiMine systems and Sandvik robotized improvement drilling innovation (DD422i Hydrostatic transmission - Diesel engine).

Internet of Things (IoT)

Mafuta Diamond-Mining Ship, De Beers, Netherlands

The Mafuta is a precious stone mining transport possessed and worked by De Brews in the western shoreline of South Africa. Worked in 1983 as Moor Express 20 for Moor Express Transportation (later Dockwise), the semisubmersible, multirole, weighty lift vessel was changed over completely to the world's biggest cable layer in 1993.

In 2005, it was purchased by De Beers and converted to a subsea diamond-mining ship by A&P Tyne over 11 months. The boat's new name, Peace in Africa, may have suggested that it was giving a choice to blood jewels. In 2013, still under responsibility for Lagers Marine Namibia, the vessel was renamed MV Mafuta.

De Beers Marine South Africa, together with Orange Business Services, a network-native digital services subsidiary of telecoms giant Orange Group, built an Internet of Things (IoT) platform on board the MV Mafuta, presently the world's biggest seaward precious stone mining vessel, to ensure team avoids large equipment. A blend of sensors and hardware permits excavators to screen and track tasks continuously, expanding safety and proficiency.

Debmarine Namibia bought "Mafuta" for N$650 million ($60 million) in 2013.

Debmarine Namibia is a 50/50 joint venture between the Namibian government and De Beers (Roelf, 2014).

De Brews Marine offers specialized help and five investigation vessels for the endeavor's Atlantic 1 concession, which is only seaward of Oranjemund close to the South African line.

Each Debmarine Namibia transport, an independent drifting mining activity, processes the garbage, and helicopters then, at that point, takes the 'move' in dilemma estimated containers to land, where the diamonds are sorted by hand.

In 2021 the 177-metre ship, originally named Additional Mining Vessel-3 (AMV3) was fitted with heavy equipment for sub-sea crawling extraction and subsequent processing of dredged material on board to sift the diamonds (Larif, 2022). The ship was officially handed over to Debmarine on the 18th and 19th of August, 2021 at Damen Shipyards, Mangalia, Romania. The Boat then set forth from Damen Shipyards on a four-week-long first venture, to the Port of Cape Town, South Africa, where it was normal to be fitted with its proprietary mission equipment by De Beers Marine South Africa, before beginning operations off the coast of Namibia, in early 2022.

The AMV3 is now the largest diamond recovery vessel in the world and the new Flagship of the Debmarine Namibia fleet. The AMV3 was formally renamed "Benguela Gem".

AI / Machine Learning

In November 2006, Kumba Assets Restricted unbundled and Kumba's coal and different resources converged with Eyesizwe Coal to make Exxaro Assets Restricted. Exxaro has since developed to become one of the biggest and principal dark-enabled coal and weighty mineral organizations in South Africa, with other financial matters all over the planet in Europe, the US America, and Australia.

Exxaro is sending the full range of innovation - computerized reasoning (simulated intelligence), advanced mechanics, blockchain, nanotechnology, and gamification - as it establishes the rhythm of digitalisation in South Africa.

Technological innovations include underground wifi with connected machines, an AI tool for international coal trading and for stock coal auction platforms, an automated training verification system, a plant programme that allows maintenance teams to fix and repair faults remotely and introducing gamification to allow miners to leave the pit and instead operate equipment remotely (exxaro site).

Blockchain

Rwanda is the world's biggest supplier of tantalum a rare mineral used to make capacitors found in devices like smartphones and laptops (Passive components, 2019). The goal of the project is to prove beyond doubt that every bag of tantalum ore from

Rwanda was mined, transported, and processed under OECD-approved conditions, without any child or slave labor.

UK-based Circular created a system that ensures tantalum is mined, transported, and processed under OECD-approved conditions, without any child or slave labor.

Fueled by a permissioned blockchain based on Hyperledger Texture, the framework utilizes facial acknowledgment and QR codes to convey a world-first: mine-to-maker discernibility of this fundamental asset.

Microsoft – Starter Edition

Microsoft Corp. on Aug. 11, 2004, launched a five-country pilot program for Windows® XP Starter Edition, a low-cost introduction to the Microsoft® Windows XP operating system designed for first-time desktop PC users in developing technology markets. Designed as a result of Microsoft's ongoing collaborations with international governments, the Windows XP Starter Edition Pilot Program is part of Microsoft's inclusive commitment to enable individuals, communities, and countries to gain access to the technology tools, skills, and innovation they need to realize their potential. Windows XP Starter Edition offers an affordable and easy-to-use entry point to the Windows family of products that is tailored to local markets, in local languages, and is compatible with an extensive range of Windows-based applications and devices.

Starting in October 2004, Windows XP Starter Edition ships on new, low-cost desktop PCs available through PC original equipment manufacturers (OEMs) and Microsoft OEM distributors in Thailand, Malaysia, and Indonesia. Language versions are available in Thai, Malay, and Indonesian.

Microsoft utilized its Starter release intended for individuals in non-industrial nations without a ton of specialized mastery and on low-end PCs worked on the help menu, as well as recordings, into versions of Windows in the US.

Microsoft reported in 2007 the Microsoft Student Development Suite, a reasonable and solid programming bundle for state-run services buying and giving Windows-based laptops to essential and optional students for their utilization at home and schoolwork.

The education suite includes Windows XP Starter Edition, Microsoft Office Home and Student 2007, Microsoft Math 3.0, Learning Essentials 2.0 for Microsoft Office, and Windows Live Mail desktop.

Energy

Africa has some of the world's most expensive energy, and it is often unreliable (Bond 2016). The installed capacity is too low, and outages and blackouts are regular. Businesses and households are forced to rely on energy from backup generators, which is even more expensive than grid energy—an estimated $0.40 per kWh vs. $0.10–0.20 per kWh from grid-based energy (IFC 2019). Nigerian electricity users spend three times as much on backup generators as on grid energy (IFC 2019). Generators are

powered by burning diesel fuel, which emits emissions that are both a health hazard and a contributor to climate change. Grid electricity in Africa still depends heavily on fossil fuels, even though renewable sources like sun, wind, and hydro are abundant (IFC 2019).

Hydrogen Clean Steel

Hydrogen usage has been labelled a key component of the sustainable pathway to a renewable energy future and the global mining industry has been a first mover in taking on the hydrogen challenge in developing that sustainable pathway and preparing for its use in industry (Sandell-Hay, 2023). Fueling mining vehicles has for quite some time been distinguished as perhaps the clearest way that hydrogen can help mining activities representing things to come.

The potential benefits that hydrogen can provide were highlighted in late May when UK-headquartered Anglo-American provided a glimpse into how hydrogen technology can both benefit the mining sector and also help to improve the environment. That future was revealed to a global audience when Anglo-American unveiled a prototype of the world largest hydrogen-powered mine haul truck designed to operate in everyday mining conditions at its Mogalakwena PGMs mine in South Africa.

The 2MW hydrogen-battery half-and-half truck, creating more power than its diesel ancestor and equipped for conveying a 290-ton payload, is essential for Somewhat English American's nuGen™ Zero Discharge Haulage Solution (ZEHS).

nuGen™ gives a completely coordinated green hydrogen framework, comprising of a creation, fuelling, and haulage framework, with green hydrogen to be delivered at the mine site.

For the nuGen™ project, Old English American has worked with a portion of the world's driving inventive designing and innovation organizations, like ENGIE, First Mode, Ballard, and NPROXX.

This was necessary to design, build, and test a 1.2MWh battery pack as the haul truck system uses multiple fuel cells that deliver up to 800kW of power, combining to deliver a total of 2MW of power. The project also required the design and implementation of a software solution to safely manage power and energy between the fuel cells, batteries, and vehicle drivetrain.

The company also develops the power management and battery systems from the ground up, enabling it to tailor the system to each mine and improve overall efficiency by designing energy retrieval as the haul trucks travel downhill through regenerative braking. It was necessary to build a hydrogen production, storage, and refuelling complex at Mogalakwena that incorporates the largest electrolyser in Africa and a solar plant to support the operation of the haul truck.

Anglo-American has been attached to three other mining monsters - BHP, Fortescue, and Lid - in the development of a Green Hydrogen Consortium in Australia.

The consortium is part of a larger group formed with the Australian scientific think tank, the CSIRO.

CSIRO's Hydrogen Energy Systems Future Science Stage is a key exploration place dealing with new science and innovation that will permit industry - including the mining area - to decarbonize tasks, transport, and creation processes.

Nokero, Solar Light Bulb, USA

Early morning in Denver, Colorado, in January 2010, Steve Katsaros woke up with the idea of a solar light bulb that would provide light without any use of electricity.

He grabbed his sketchbook, and four days later a patent was filed for the technology that was to become the first solar light bulb of Nokero (short for "No Kerosene"). It took Katsaros five months to set up the company, and in June 2010, he and his team competed in a business plan competition in the US. Although they did not win the competition, it led to an interview with CNN by Ali Velshi that spread the news of the new solar light quickly and globally. A few days later, Katsaros received orders for the N180 solar light bulb from all over the world. (Katsaros, 2015)

On top of each light is a little level solar charger with minuscule bits of Maxeon Solar cells, which create more power from a more modest space than traditional cells, empowering Nokero to deliver the power-pressed lamps in such a little structure factor. The lights can be charged the entire day and utilized the entire evening - a solitary day's charge can give light for as long as 15 hours (on a low light setting).

With the electricity and cost constraints of developing and emerging markets in mind, Nokero developed a solar light bulb, a lantern-like LED lamp with four embedded solar panels, which are connected to a rechargeable battery. The battery is charged by the sun during the day and stores the energy to provide light at night. (Katsaros, 2015)

The battery lasts around 300-500 charges, and one charge lasts for 2-4 hours depending on the time charged. When the battery is not rechargeable anymore, the consumer can replace it for further use (CNN, 2010). For assembling, Katsaros went straightforwardly to China, where most solar light Products are made, essentially in view of the natural substance parts (battery, sun-powered light board, Drove parts, and a circuit board).

As the target consumer had a very limited budget to spend on a day-to-day basis, Nokero tried to push down production costs and delivered a USD15 solar light bulb. Compared with kerosene, the end consumer could reach the break-even point of lighting costs after five months. Thus, solar lighting lasts longer and costs less in the long term (Forbes, 2013).

In India, Nokero uses a distributor with 7,000 door-to-door salespeople (Forbes, 2013).

Huge clients of Nokero, other than developing business sector merchants, have been NPOs and NGOs that circulate solar lights to shoppers free of charge. For enormous wholesalers and NGOs, Nokero sells the item for USD6. (Washington Post, 2011) The

organization likewise launched one more item in 2013 that charges PDAs and battery-fueled gadgets through a USB port and gives light.

FPL-Formulated Polymer Limited – Nokero Partnership was formed in 2016, through an Indo-US collaboration of those two major technology Partners (formultedpolymers site).

FPL Nokero produces products such as LED bulbs, Tube lights, Street Lights, Panel Lights, Downlights, and High bay lights.

The N182 is an improvement upon the previous N180 model due to the higher quality LED, and also due to the smaller size to enable portability (Otieno, 2022).

In the wake of getting feedback from clients, Nokero consented to expand the brilliance and lessen the size for the most up-to-date line of lights. The N182 is currently pocket-sized so it could be utilized as a hanging light, a standing undertaking light, or an individual electric lamp. The PCB and on/off reverse are presently inside the light's globe to save creation costs and empower a more reasonable, higher quality product for consumers.

Nippon Bio-Fuel (NBF), Japan

NBF's adaptive micro-innovation ecosystem is a start-up firm that initiated its activity by providing sustainable energy sources to non-electrified rural villages in Mozambique via jetropha-based biodiesel combined with solar panels via contract farming. It utilized village kiosks to manage financial transactions with farmers and users of energy. Seeing the irregularity of bookkeeping at kiosks, where the payments for their services are collected, NBF introduced its cashless payment system for all the purchases at kiosks, a Point of Sale (POS) card system with the help of Partners, NEC, and JICA. Their cash cards became significant savings instruments for the local populace. This led to a new business opportunity in micro-financing for financial inclusion. Today NBF is conducting microfinance with full data of farmers' financial transactions. After NBF introduced a cashless payment system in kiosks, it was offered to implement the same model in Mozambique for a project of the FAO and the World Food Program (WFP). This led to an experimental project on digital cooperatives in Mozambique financed by WFP. Based on the learnings and experience, they developed an idea for a platform business, teaming up with additional ecosystem Partners, the Ministry of Agriculture, Forestry and Fisheries of Japan and the African Business Council and JICA, to establish a central platform for connecting suppliers and customers under an E-Agri Platform. (African Business council working group for Africa's agriculture, 2019).

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Husk Power Systems (HPS), USA

Husk Power Systems, established in 2008, is an organization situated in Post Collins, Colorado, US, that gives wipe energy services to off-network or frail matrix provincial networks in East Africa, West Africa, and South Asia, principally by building sustainability.

Husk Power Systems announced on 5 September 2023, that the "Africa Sunshot" initiative, to have 2,500 net-zero mini-grids operating in off-grid and weak-grid communities in the region within 5 years. Husk expects to mobilize $500 million in equity and debt to finance the Sunshot (huskpowersystems site).

The 5-year goals of the Africa Sunshot include: 2,500 operational mini-grids, 1 million new connections directly impacting 7.7 million people, 225,000 MSMEs connected, 150MW installed of rooftop solar commercial and industrial (C&I), and 2.1 megatons of CO_2 avoided through the displacement of diesel generation.

In the 33 least evolved nations (LDCs) in Africa, the charge rate is just 36%. As per the World Bank, driving 380 million individuals in Sub-Saharan Africa by 2030 will require the development of more than 160,000 minigrids at an all-out cost of $91 billion. At the ongoing speed, around 12,000 new mini-grids serving 46 million individuals will be assembled.

Under the Africa Sunshot, Husk illustrated country-explicit targets, incorporating 1,000 mini-grids in Nigeria multiplying Husk's past objective, 500 in the Popularity Republic of Congo (DRC) 250 each in four extra nations still to be distinguished.

HPS Partnering in 2020 with the Rural Electrification Agency (REA) and the Nigeria Electrification Project (NEP) and successfully brought reliable electricity to over 50,000 people through our mini-grids, with the potential to benefit over 2 million once we reach our target of 500 mini-grids.

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India:

India has a serious shortage of electricity, and people living in villages suffer the most. 125,000 villages lack grid power altogether, and even where the grid extends the supply is unreliable and does not reach all households (ashden site). While lattice proportioning happens, towns frequently get power solely after 12 pm when 'need' requests from urban communities and industry are low. This is of little use to Rural families and organizations.

The state of Bihar in North-East India has a very low rate of grid electrification and acute power shortages. Most families need to be involved in lamp fuel for lighting, and organizations go to diesel generators for power.

It is assessed that the lattice can fulfill just 10% of the need. The organizers behind HPS searched for reasonable ways of tending to this lack of power and recognized the potential for making maker gas from rice husk, a copious nearby asset, and involving the gas for power generation at the village level.

The first power plant that ran on 100% producer gas was commissioned in 2007. In 2008 HPS was registered as a for-profit company with a mission to provide renewable and affordable electricity to the rural populace around the world in a financially sustainable way. Three of its founders, Gyanesh Pandey, Ratnesh Yadav, and Manoj Sinha, come from Bihar, and Charles Ransler comes from the USA. Most have had education and professional careers in the USA.

The growth of HPS has been helped by substantial grant funding from the Shell Foundation, which has supported R&D, strategy, and training. US$1.65 million speculation from six social financial backers, Discernment Asset, Bamboo Money, Global Money Corp, Draper Fisher Jurvetson, LGT Charity, and CISCO, was gotten in December 2009.

In 2010 HPS had 270 employees. About 80% of its income comes from sales (mostly electricity, but also char products) and 20% from Government subsidies to new power plants (CISCO system, 2021).

Power plants are introduced where there is a dependable wellspring of rice husk and other biomass deposits within a distance of 10 km. HPS staff visit a town, at the greeting of town delegates, to survey its reasonableness for a plant and make sense of how the plan functions. Assuming at least 400 families focus on paying a month-to-month charge for power, HPS will introduce a plant (rice-husk gasifier, gas motor, generator, and 240 V power Distribution framework) and interface with the homes and independent companies that have attached. A town working group keeps up with and runs the framework, which supplies power each night for as long as eight hours.

Sackloads of rice husk or other biomass deposits are filled in the gasifier container every 30 to 45 minutes. The biomass consumes a limited supply of air to give energy-rich maker gas. The gas goes through a progression of channels that clean it, and it is then utilized as the fuel for a motor that drives the power generator. Power is appropriated to clients through the protected links.

The fundamental organisation furnishes a family with two 15 W minimized bright lights and smartphone charging all through the period every day that the plant approaches eight hours at night. Each plant serves around 500 clients.

The gasifiers were originally made by Ganesh Engineering. HPS upgraded the design significantly and now does much of the manufacturing itself. Gasifiers are optimised for rice husk but can also work with other types of agricultural residue or with wood. The engines are manufactured by an indigenous Partner who worked with HPS to develop an engine that could run on rice husk gas

In 2022, Husk signed a UN Energy Compact. It committed to building at least 5,000 mini-grids by 2030 which would impact 10 million people.

Transport

Roam Electric Transport, Sweden

Founded in 2017, Roam Electric began as a research project at a Swedish university (Doll, 2022). Five years on, the company is bringing affordable, electric transport to Kenya. The company builds electric motorcycles and buses tailored to the market with affordability and reliability at the forefront.

In harsh terrain, Wander has tried 160 models, raised more than $7.5 million, and run an effective experimental run program with M-Kopa, one of the biggest resource lenders on the landmass.

Presently the organization is ready to scale, with plans to create 150,000 bikes and 800 transports each year by 2026.

Because electricity is cheaper than petrol, Roam estimates drivers can cut running costs by 75% – an incentive that works for both people and the planet.

The Earthshot Prize is a global environmental prize that aims to discover and scale the best solutions to help repair our planet during this decisive decade (Kuhudzai, 2023).

Through this Earthshot program, Meander has now collaborated with worldwide innovation pioneer Hitachi to convey transport jolt across Africa. The organisation will attempt to make electric vehicles open in Africa.

Summer of 2023, ROAM launched its flagship Air electric motorcycle, complete with two swappable battery packs that combine 180 km (112 miles) of all-electric range and class-leading carrying capacity. Meander's bicycles assume a colossal part in its objective of facilitating mass reception of zero-emanation transport across Africa - especially in the body portion of cruiser taxis in East Africa (Doll, 2023).

Walk 2023, Meander shared plans to grow to another 10,000-square-meter (around 107,650-square-foot) office in Nairobi, Kenya, to stay aware of the interest and further develop creation efficiencies. The new office would be called Wander Park and would ultimately become home to the organization's new base camp in East Africa as well as lodging electric cruiser creation in addition to advancement and battery labs.

Finance

Elective credit scoring, on-request money, and information support are three regions where the best client needs are central to building and scaling a fruitful business (Cochrane, 2019). The accompanying organizations have effectively recognized the best requirements of their objective clients and have utilized these client trouble spots as a take-off point for their general business methodologies.

Alternative Credit Scoring

When it comes to understanding a customer's creditworthiness and risk profile, emerging markets are where we have seen the greatest innovation.

This is mainly due to the user needs being more acute in these geographies, due to the lack of reliable traditional data sources, and the sheer number of 'thin file' borrowers. Therefore, lenders have had to think creatively about how to build the risk profiles around their potential customers. As of late various organizations have arisen to help enormous banks fill this information hole.

While this item need was initially more intense in Emerging Markets, the addressable market opportunity is currently worldwide, so their extensive experience serving 'slight document' clients at scale will give them a benefit over European or American domestic players.

Mambu, USA, Ireland:

Mambu is a disrupting Core Banking Software through its market-leading, modern SaaS banking platform (Eqt Group). It gives fast-to-implement and simple-to-make due, adaptable, and current programming, which permits its clients to fabricate extraordinary financial encounters that their clients love. Counting banks, moneylenders, fintechs, and financial foundations as its clients, more than 50 million end-clients influence Mambu's innovation consistently.

With 700 employees globally, Mambu is investing in its people and the community.

Consumers and businesses alike increasingly demand frictionless digital banking experiences and as a result, the banking and securities enterprise software market – which is already over €100 billion in size – is experiencing double-digit annual growth. Mambu is the leading disruptive player in the market, catering to a large and global market segment, from fintechs to traditional financial institutions, over 65.

The Berlin-based fire-up services more than 150 banks, fintechs, and telecom organizations with north of 14 million end-clients. Mambu assists noticeable organizations with loving Santander, N26, and Orange to quickly configure, send off, and scale their computerized first banking and loaning services.

With a stage worked from the cloud upwards, Mambu's SaaS motor is a strong option in contrast to exorbitant and complex conventional center financial systems. Other than

its cloud approach, Mambu furnishes its clients with devices to fabricate, incorporate, and send off any loaning portfolio.

Mambu has been chosen by BancoEstado to further develop client access to computerized services (mambu site). This incorporates planning and making new Products for the Chilean bank, offering solid and natural financial services that fulfill the changing needs of its in excess of 13 million clients.

Mambu digitizes BancoEstado's conditional services through a total change, facilitating the bank's medium and long-haul methodology to turn into an area chief. These new capacities will situate BancoEstado as a cutting-edge and state-of-the-art financial trailblazer, both among traditional banks and new industry entrants.

Finastra Digital Banking, UK:

90 of the world's main 100 banks by resource size are attached forces with Finastra. With clients in 130 nations overall and one of the broadest solutions of financial programming solutions available, Finastra can serve all elements of a wide range of financial organizations.

Finastra has offices in the UK, Canada, the United States, Singapore, and the United Arab Emirates. By harnessing the stage's adaptable and open innovation, Finastra's clients can go from inheritance banking to straightforward, creative, and coordinated systems. With Finastra's secluded innovation stack, financial establishments can send off and convey new functionality rapidly with less risk.

Finastra, a global provider of financial software applications and marketplaces, and Modefin, a global fintech solution provider helping banks to thrive in the digital age announced in 2022 their Partnership to offer Finastra's Fusion Trade Innovation and Fusion Essence solutions to banks in Africa and numerous Indian subcontinent markets (CISION Pr Newswire, 2022). With Finastra's solutions, Modefin helps its customers embrace open finance today and future-proof their banking and global trade operations.

Modefin established in 2011 in Bangalore, India, currently serves over 65+ banks in more than 20 nations worldwide. Besides India, they have an on-ground presence and operations in the Philippines, Kenya, Ghana, and Dubai.

Finastra supports banks as they continue to adjust to changing market requirements and customer prospects – while futureproofing for tomorrow. Fusion Essence, the cloud-enabled next-generation core banking solution, combines sophisticated functionality and advanced technology to increase enterprise agility and operational efficiency while using AI to unlock data for smarter business decisions. The SaaS offering covers each phase of the client venture, empowering financial organizations to convey start-to-finish encounters for separation. Combination Exchange Development is Finastra's start-to-finish solution with industry-driving abilities for frictionless exchange and inventory network finance.

It utilizes straight-through handling, digitalization, and information investigation to empower clever exchange for development, with the capacity to advance with developing consistency, client, and competitive demands.

Mia-FinTech, Italy:

Mia-FinTech, the technology provider for banks and financial institutions based on the Mia-Platform technology has launched Payment Integration Hub (PIH), a new application that brings together all digital payment methods in a single console (Financial IT, 2023).

The PIH supports more than 10 payment providers including PayPal, Google Pay, Apple Pay, Satispay, Stripe, and UniCredit. Additionally, it provides APIs to easily connect several physical and digital POS via a simple configuration, making it probable to integrate external ERP frameworks. Mia-FinTech, the start-up that is enabling banking and financial institutions to evolve towards open finance, has announced its Partnership with the cloud banking platform Mambu (Methi, 2023).

Mia-Fintech goes about as a framework integrator, furnishing an organization layer to associate with different Partners in Italy and driving the reception of Mambu's cloud banking stage. The composable way to deal with banking is that Mia-FinTech and Mambu give guarantees that joint clients don't grow out of tech stacks and can consistently construct the computerized solutions that clients request.

Lenddo, Singapore:

Lenddo was established in 2011 to work on financial consideration for 1 billion individuals all over the planet, empowering financial specialist co-ops to access and serve new and underserved markets utilizing its disruptive innovation and utilizing new wellsprings of advanced information, like mobile social computerized impressions.

With workplaces in Manila, Bogota, Mexico City, and New York, Lenddo has helped in excess of 500,000 people in the Emerging Market since it was established.

Lenddo is a main business working across Southeast Asia and Latin America.

They collate alternative data sets such as mobile data, utility data, financial transaction data, social network data, and clickstream data to better understand a potential customer's credit risk profile, and then provide this aggregated information to traditional lending providers to help them make more informed credit decisions.

Lenddo's past loaning experience developed its licensed innovation and restrictive calculations which are presently being involved by driving financial establishments to give access to a huge number of shoppers and MSMEs all over the planet. It additionally empowers financial organizations to settle on more precise and faster choices across the client's lifecycle.

Clients utilizing Mambu and Lenddo together will want to enhance their advanced decision processes with new information sources to increment endorsement rates, decline defaults and decrease time to score and choice.

A mix of Lenddo to Mambu is simple through a Programming interface or SDK execution. Lenddo is an integral framework to that of the Mambu credit management framework. Lenddo will act as the beginning and front-end framework while Mambu will deal with your portfolio after the satisfaction of credit dispensing. The incorporation of Lenddo and Mambu systems offers a full web-based loaning solution, which will serve each level of your client lifecycle.

FirstAccess Platform, USA:

The first Access stage is adequately adaptable to work in all low-information conditions and simple for staff to learn (firstaccess site). First Access utilized numerous long periods of credit scoring experience in Africa to construct a digitization and credit beginning answer for the worldwide casual area. First Access empowers private ventures to apply online by means of their bank's site, transferring data and reports. Credits can be naturally checked for qualification, then steered to an advance official or call focus, a discretionary site visit by the credit official utilizing our versatile application, and all expected endorsements by chiefs. Credit processes are completely adaptable to every moneylender's inclinations.

Tanzania

Commercial banks and microfinance institutions in Tanzania use the First Access platform and web applications to collect data from customers, internal records, and credit bureaus. Low-risk loan applicants are scored and automatically approved, and credit committees review other loan evaluations according to their exceptional credit policies.

Philippines

In the Philippines, Rural bank clients are evaluated carefully utilizing the Primary Access stage, with disconnected information assortment and ongoing examination in branches by means of the Principal Access web application. Credit evaluations are synchronized progressively with branches, where experienced chiefs survey and endorse advances as indicated by their conventions for their extraordinary credit products.

Kenya

Asset financing organizations in Kenya utilize the Primary Access stage for ongoing computerized credit evaluations, giving advances for resources going from electronic gadgets to vehicles.

Incorporating multiple data sources into their credit decisions and tracking their +customer acquisition trends, the First Access platform helps them gain speed and control that help them grow faster.

Ethiopia

Microfinance institutions and SME loan specialists in Ethiopia utilize the Principal Access stage to gather rich information about their clients through site visits and individual collaborations, send this information continuously to branches for audit, and computerize more than 50 computations that were recently finished the hard way.

This provides lenders with a rich data set, operational and market insights, and faster approval times for their customers.

Nigeria

Mobile agents are pre-endorsed for float credits to guarantee that they will have satisfactory liquidity to serve popularity from their clients for withdrawals and stores. Pre-endorsements are handled in clumps at traditional spans to guarantee exact and modern appraisal of specialist execution and quality. The Primary Access stage joins quantitative and subjective information from different sources and gives extra permeability, soundness, and control for overseeing specialists, consolidating mechanization and human oversight for maximum growth.

Uganda

Microfinance (MFI) and microfinance store-taking (MDI), foundations in Uganda utilize First Access to gather information straightforwardly from clients, even disconnected, and to consolidate it with information from their interior records. Credit boards then survey the evaluations and endorse clients as per their exceptional credit strategies for an extensive variety of credit products.

CredoLab, Singapore:

Established in 2016, Credolab works with over 10+ languages spoken and employs more than 50 people. Headquartered in Singapore with offices in Kyiv, London, Miami, and Jakarta, Credolab targets a global market of 4 billion under-served consumers (credolab site). As of 2021, credolab has powered over $1 billion in loans to consumers in 30+ markets across Asia, Europe, Africa, Latin America, and most recently, North America in 2022.

Credolab pay-per-use solutions are accessible to banks and neobanks, computerized loan specialists and BNPL players, insurance agencies, and any industry at the crossing point with financial services (web-based business, ride-hailing applications, travel, and retailers).

Credolab's proprietary data modelling pipeline rooted in Machine Learning algorithms analyses over 70,000 privacy-consented data points from a smartphone device, converting customers' digital footprint into highly predictive scores tailor-made to each client.

Credolab utilizes AI calculations to distinguish in excess of 10 million personal conduct standards, like battery utilization and the most often downloaded application class.

CredoLab launched in Kenya is lined to drive financial inclusion by credit scoring more people, especially those who are new to bank and credit (Odhiambo, 2019). CredoLab announced that it is in negotiations with large financial institutions, digital banks, credit bureaus, consumer lenders, and retailers.

TrustingSocial, Singapore:

TrustingSocial is the largest provider of credit risk profiles in Asia, covering more than 1 billion consumers across India, Indonesia, Vietnam, and the Philippines. This gives financial institutions a unique opportunity to expand their services across new market segments, through unparalleled access to highly reliable risk profile information.

Vietnam and Singapore-based Trusting Social have successfully raised $65 million in its Series C funding round led by the Sherpa Company, a subsidiary of Masan Group (Asia Tech Daily, 2022). BDA Partners was the exclusive monetary advisor to Trusting Social on the transaction. Trusting Social drives financial inclusion by providing credit insights covering a billion consumers to 170 financial institutions across Vietnam, Indonesia, India, and the Philippines.

The essential coordinated effort between Believing Social and Masan means to foster a simulated intelligence-controlled buyer tech stage. This will offer altered retail and financial Products to 27 million families in Vietnam. It will give helpful access to customized fintech answers for buyers, consolidating Masan's disconnected-to-line vision with Confiding in Friendly's capacity to democratize finance.

The Partnership will also enable Masan to drive efficiencies in its core business by leveraging Trusting Social's AI capabilities in retail store selection, demand & supply planning, and product assortment & development.

SolarNow - a pay-as-you-go (PAYG) Model, Netherlands

SolarNow, a Netherlands-based social enterprise operating in Uganda, was launched in 2011 by Willem Nolens, an entrepreneur who brings 15 years of senior management experience in microfinance and renewable energy in Africa (gust site). SolarNow is a company that offers affordable cellular-connected solar equipment, energy, and services to remote, off-grid homes, farms, schools, health centres, and business locations across Uganda to answer the squeezing interest for reasonable great Solar home systems among 4 million off-matrix families and businesses visionaries in Uganda.

Through an IoT solution, SolarNow has developed an early warning system to communicate with clients if there is an issue with their IoT device that is connected to the solar equipment. It ensures that its customer's solar equipment is protected from disruptive, malicious, and costly service interruptions. Each device and its security are monitored centrally. Eseye collaborates with Solarnow and Amazon Web Services (AWS) to help bring solar energy to remote regions in East Africa.

Using an open SIM card, which gives coordination to the AWS cloud, grants SolarNow the to from a distance safely enact, solve, verify, and ensure sent gadgets over-the-air, in up to 190 nations. By utilizing the force of associated innovation SolarNow could address the neglected requirement for practical, quality solar energy through the solution of sun-based fueled gear, apparatuses, and services to remote or off-matrix homes, ranch, schools, health focus, and business areas. Also, IoT and M2M capacities further engaged SolarNow to turn out to be confident and secure in associating and dealing with its growing product portfolio.

Mobile Financial Services

Mobile financial services have expanded from savings and payment accounts into credit, insurance, and cross-border remittances—all of which help businesses to survive and, depending on scale, to employ workers. African banks lack information on the credit of individuals (Chironga et al. 2018). 4IR-enabled digital solutions can be used to improve credit risk models and operational risk and compliance and can reduce fixed costs by reducing the need for bank branches. Digital credit risk management, for example, uses automation, connectivity, and digital delivery and decision-making to allow for faster decisions and risk assessment that is superior to current manual processes (Signé 2022). Advanced analytics and machine learning can further increase the accuracy of credit risk models. In Kenya, IBM has broken down buy records from smartphones and afterward applied AI calculations to foresee financial soundness, giving banks the certainty, they expected to give $3 million in loans to small businesses. Studies have documented the positive impact of fintech services on the performance and growth of micro, small, and medium (MSM) enterprises throughout Africa (Signé 2022).

Vortex - solar ATM, India

The entrance of banks was very low in India. In numerous country regions, individuals need to the movement for about two hours to save money on services or ATMs are only accessible in urban zones (ibef, vortex sites).

In 2004, IIT Madras led an examination to enable banks to connect with a bigger populace. They moved toward Vortex Engineering and proposed to build up a country ATM. The test was to make a safe, reasonable, and solid system. As a pilot venture, Vortex introduced ATMs that keep running on solar power, in a couple of towns.

To guarantee security, ATMs are encased in thick steel compartments. The idea of a four-digit PIN influenced individuals to feel excessively helpless.

Biometric verification was the choice. To guarantee the better nature of money, the checking instrument demonstrated how individuals tally notes, utilizing a few fingers, it didn't devour more than 2 watts.

A conventional ATM dispenser expends 800 or 1,000 watts. The new ATM was expending about 5% energy thus less heat with lower working and upkeep costs. Batteries were energized at whatever point control was accessible, to manage the ATMs for longer timeframes.

A four-hour backup was incorporated with the ATMs as default, and in sectors that confronted a noteworthy power emergency, a small sun-based board was introduced for every one of the ATMs. Vortex was established in 2008 with the State Bank of India (SBI) in the Cuddalore area of Tamil Nadu, under a UNDP-supported task for MGNREGA (Mahatma Gandhi National Rural Employee Guarantee Act). About 3,000 Vortex ATMs are introduced crosswise over Asia and Africa (Nigeria, Sudan, Tanzania, and Madagascar).

In 2010, Vortex established the Gramateller Duo for the State Bank of India, the nation over, and in 2013, turned to Eco-teller Mini, the primary work area ATM in the Indian market. It offers the upsides of ordinary ATMs, computerization of money regulation) and smaller scale ATMs, portability. It is deployable in mobile money vans or shared spaces, for example, post-workplaces, weighs less, and is low on influence utilization (60W).

East Ventures (EV), Japan - Indonesia

East Ventures (EV) is a highly successful Japanese-Indonesian venture capital firm. EV began its operations in 2009 and today has several unicorns in its portfolio, including Tokopedia and Traveloka (Iizuka and Hane, 2021). In 2019, it raised US$75 million for its sixth fund (East Ventures, 2019). By September 2019, it had funded 300 founders, accelerated more than 160 startups, and attracted US$4 billion in follow-on funding from other investors.

When EV launched, it was a pioneer of venture capital in Indonesia. Indonesia today is known for having the highest number of unicorns among Southeast Asian countries.

Key elements of the ecosystem included management selection and training, financing for the growth of the companies, and links to customers and suppliers. The heads of Tokopedia and Traveloka were trained in US business schools or had work experience in the US. Even with this experience.

EV brought investors from Japan and invited entrepreneurs from Indonesia. These initially comprised CyberAgent and GREE Ventures.

The E-commerce platform Tokopedia created a valuable means of bringing ventures directly to customers, and EV worked with its portfolio firms to ensure that this platform was leveraged.

EV created a kiosk venture, Warung Pintar, which not only addressed disruptive change to a traditional business in innovation and development. Kiosks were traditionally operated by individuals with little capital, offering basic goods to passersby. EV had one such kiosk directly in front of its main entrance, run by an elderly lady. EV approached the lady and suggested making service improvements to expand her kiosk business. They added a digital payment capability and provided accounting support through their portfolio ventures. Within three years, they had established 2,000 kiosks across the country. US$30 million was also raised from several investors, including EV.

The venture keiretsu strategy both creates value and captures value. In addition to Kudo and Warung Pinter, CoHive offers shared space for startups, and WareSix offers logistics optimization. CoHive became a place where portfolio companies could also establish an office, with these spaces often located in the more accessible suburbs, while WareSix strengthened the supply chain operation for the EV venture keiretsu.

Healthcare

Embrace Nest, USA

Jane Chen is the co-founder of Embrace. She received her MBA from Stanford Graduate School of Business, and her Masters in Public Administration from Harvard Kennedy School of Government (Embrace Global site). Jonathan Cohen is a 30+ year serial entrepreneur, Co-Founder, and Board Member of Embrace Global.

Alanna Shaikh has twenty years of involvement with building and driving groups for fast reaction to compassionate crises and long-haul advancement of medical care systems in low-asset circumstances.

Embrace developed a low-cost and energy-efficient infant warmer, which addresses the key challenge of preventing hypothermia for infants with low birth weight in developing countries. The design looks like a miniature sleeping bag and incorporates phase change material, which maintains a constant, clinically ideal temperature for up to 6 hours. Unlike traditional incubators, it allows physical contact between mother and child, promoting the development of a strong maternal bond. It is an intuitive device that can be reused, sterilized, and repaired locally. The design of the device incorporates a wax-like phase change material (PCM) which, when heated for 25 minutes using an electric heater, ensures that the infant remains at a clinically approved temperature for up to 6 hours. The device is made of a durable, hypoallergenic, bio-compatible, medical-grade material that can be repaired easily in rural, resource-poor areas. The infant warmer is designed to complement Kangaroo Mother Care (practice of providing warmth with skin-to-skin contact) because it enables physical contact between mother and child. Notably, it allows mothers to breastfeed and give. Embrace has aided over 475,000 babies with our life-saving mobile incubators.

Sumitomo and A to Z Textile Mills, Insecticidal Bed Nets

A to Z Textile Mills Ltd is a Tanzanian family-owned organization that began with a solitary sewing machine in the 1960s (azpl website).

Through a joint wander with Sumitomo Chemical Co. Japan and a participation with the Africa Technical Research Center (ATRC), start to finish create the polyester and Long-Lasting Insecticidal Bed Nets (LLINS) keeping in mind the end goal to scuffle jungle fever. LLIN was suggested by the World Health Organization (WHO) in 2001.

The Challenge:

Nearly one million people in Africa die every year from malaria. At greatest risk are pregnant women and children under five. Those who cannot afford treatment or have limited access to health care are disproportionately affected.

Bednets are one of the most effective ways to prevent the transmission of malaria. Treated nets kill the mosquitoes on contact – but the cost of re-treating a conventional bednet with insecticide every few months is too heavy a burden for many people.

The Innovation:

A to Z's low-cost bednets treated with long-lasting insecticide (LLINs) are effective for up to five years, instead of the usual six months, and do not need to be re-treated. Acumen's initial investment in A to Z in 2003 catalyzed a public-private partnership between A to Z, Sumitomo Chemical, ExxonMobil, the World Health Organization (WHO) and the United Nations Children's Fund (UNICEF).

The Impact:

A to Z is now the largest manufacturer of LLINs in Africa, producing 29 million bednets each year and protecting millions of people from malaria. A to Z has found a way to reduce the production cost of a bednet from $7 to $5 and provide even greater access to the life-saving bednets. A to Z has also become one of Africa's largest employers. The company has provided jobs for more than 7,000 people, primarily women.

Essilor- Affordable Lenses:

Essilor gauges that 2.5 billion individuals overall need vision adjustment, and 95 percent of them live in developing business sector nations (Hadengue et al, 2017).

In 2013, Essilor motivated its 2.5 New Vision Generation technique to assist individuals with low wages who require vision redress.

Ready-to-Clip Lenses:

Rather than sitting tight for one to about fourteen days for central points to be surfaced and treated by their vision needs and after that edged to fit the edge, patients can be inspected, analyzed, and quickly furnished with glasses at an extremely sensible cost.

The casing plans are constrained, yet this inconvenience is counterbalanced by quick conveyance and moderateness.

Essilor upheld the advancement via preparing and preparing nearby businesspersons in target markets to begin their particular businesses by performing essential vision testing and apportioning Ready-to-Clip glasses.

Myopilux Lenses:

In Chinese urban locales, the pervasiveness of nearsightedness is 74 percent among 17- to 18-year-olds, contrasted with 41.6 percent for a similar age assemble in the United States (Yeo et al. 2015).

Essilor set up an early research motivation for its Asian R&D intensive on abating the movement of nearsightedness in youth. The organization's Asian R&D groups directed the greater part of the exploration with neighborhood researchers who were at that point chipping away at the subject.

This examination exertion brought about the Myopilux central point, which decreases accommodative slack amid the reading. The central point has appeared to moderate astigmatism movement by up to 62 percent (Yeo et al. 2015).

Vestegaard's Family

Vestergaard is a family-claimed worldwide health organization devoted to enhancing the strength of powerless individuals, a large portion of them live in developing nations (vestergaard website). Vestergaard is headquartered in Switzerland and has workplaces around the globe. Herewith is a portion of the tasks developed by this organisation.

PermaNet®, Slow Release by Vestegaard:

PermaNet®, the bed net of Vestergaard empowers the moderate arrival of the bug spray deltamethrin and avoids vector-borne infection, for example, jungle fever. To date, more than one billion individuals have profited from top-of-the-line PermaNet® bed nets. In October 2014, the World Health Organization's Vector Control Advisory Group distributed its yearly report which incorporated an assessment of the supporting proof for Vestegaard's item guarantee for PermaNet 3.0. The report noticed that PermaNet 3.0 is a "first in class" (malariaworld.org site).

ZeroFly®:

ZeroFly® is a progressed diminished buildup resistance against creepy crawly bugs for domesticated animals and yield insurance earlier, amid, and post-collect. ZeroFly® Screen is a bug spray fused screen that keeps animals solid and beneficial by lessening the effect of aggravation and gnawing flies, for instance, tsetse flies which are the vector of trypanosomiasis (Sleeping Sickness or nagana).

UV insurance is attached to expand durability and the bug spray utilized is the FAO and WHO-affirmed deltamethrin. The requirement for rehash mediation is decreased because the bug spray is ceaselessly revived at the surface of the yarns. ZeroFly® Storage Bag avoids damaging pest pervasions. It lessens the loss of seed or grains. Bug spray is consolidated into singular strands of the sacks, which gives an intense slaughtering activity against putaway item bugs before they can plague the grain or seed gathered taken care of.

CarePack®:

CarePack® is an adaptable bundle of various health mediations intended for incorporated and Cost-effective health programs. Each CarePack® can be adjusted to an assortment of health programming goals. CarePack® is perfect for HIV Programs, Integrated Prevention Campaigns, and Maternal Health. The total of what parts have been thoroughly tried to demonstrate health effects, and meet the most noteworthy regulatory guidelines for viability.

LifeStraw® Water Filters:

The advancement began in 1994 when the Carter Center moved toward LifeStraw's parent organization, Vestergaard, to build up a channel that could expel Guinea worm hatchlings from the water it was debasing (lifestraw.com site). Vestergaard planned a fabric channel yet then developed it into a more viable pipe frame in 1999.

LifeStraw® water channels change over polluted water into spotless, safe drinking water. Safe drinking water is particularly critical for powerless groups, for example, kids under five, pregnant ladies, and individuals living with HIV. LifeStraw® water channels likewise avert cryptosporidiosis, a noteworthy reason for diarrheal sickness in individuals living with HIV and kids under five.

The LifeStraw portfolio incorporates the high-volume LifeStraw Community purifier for institutional settings like schools and centers (presented in 2013), the LifeStraw Go refillable water bottle (2014), and LifeStraw Mission, a high-volume, collapsible pack perfect for campgrounds, amass climbs and endeavors motivated in 2015.

Today LifeStraw is utilized in water Products and ventures in more than 64 nations around the globe. The Life Straw, a water channel intended for individual utilization, gives consumable water without electrical power, batteries, new parts, running water, or a funnel in the water supply.

Jorge Odón - BD Odon Device™:

In 2006, Jorge Odón an auto workman living in Argentina thought to adjust the system of expelling a stopper stuck inside a container utilizing a plastic pack to pregnant ladies (Brownstone, 2014). The container is the uterus and the plug, is the child.

In 2008, Dr. Mario Merialdi at the World Health Organization (WHO) saw an exhibit of the device on a visit to Buenos Aires (Koh et al, 2016) and associated Jorge with Gary Cohen, an official VP at Becton Dickinson (BD). Jorge consented to a permit policy with BD enabling them to produce and disseminate the BD Odon Device™ and to clinical examinations to get to an agreement between the WHO and BD. Herewith are the consequences of the clinical test in 2018 (Schvartzman et al, 2018): Of the 49 ladies enlisted, the Odon device was embedded effectively in 46 (93%), and fruitful Odon device conveyance as characterized above was accomplished in 35 (71%) ladies. Vaginal, first and second-degree perineal tears happened in 29 (59%) ladies.

University of Manitoba, Canada, A Smartphone App to Detect Breast Cancer:

Breast malignancy affects around 500,000 ladies consistently, with just about 58% of these passing in developing nations (grandchallenges.ca website).

The American Cancer Society gave an account on Cancer in Africa (2011) stating that the five-year survival rate for breast growth is under half in Gambia and Uganda, contrasted with almost 90% in the United States.

Comparative inconsistencies in growth mortality are likewise found amongst provincial and urban focuses in developed nations. Early discovery of breast disease directly impacts the survival rates of ladies. College of Manitoba specialists in Winnipeg Canada, and Partners in China, Ireland, Nigeria, Portugal, and South Africa, upheld by Grand Challenges Canada and supported by the legislature of Canada, build up a mobile breast microwave detecting framework for low center pay nations and provincial networks in developed countries.

Microwave signals like those utilized by business cellphones are sent towards the breast by small-scale sensors working at a similar recurrence run as vast antennas however at a small amount of the size would cost altogether not as much as x-ray systems.

The South African Dr. Stephen Pistorius is the main specialist on this task. (uwinnipeg.ca website). In 1992 he immigrated to Canada where he went up against the obligations regarding Cancer Treatment Planning as a Senior Medical Physicist at CancerCare Manitoba.

The group effectively established a model of a compact breast growth recognition framework that could be utilized in remote networks by individuals with insignificant or no specialized preparation (grandchallenges.ca site). From a test on 135 ladies in Nigeria and South Africa, 91% trusted that they could work the framework without anyone else.

UE Life Sciences Breast Exam

UE Life Sciences established in 2009 by Unitus Seed Fund, Aarin Capital, Pennsylvania Department of Health, University City Science Center has fabricated and marketed a mobile scanner, iBreastExam that works with a smartphone.

It is a non-intrusive, compact radiation device. It has a material sensor that overviews changes in tissue versatility between sound tissue and a solid protuberance. Smaller scale sensors give concurrent input to the product and can distinguish peculiarities that are as small as three millimeters.

The iBreastExam creates filtering for up to 4 US$ per auditing contrasted with as much as 30 US$ for a mammogram in a private doctor's facility.

Brivo CT325/385, GE

The Brivo CT325 and 385 were developed in China for China. For the development of this scanner, GE aimed at creating a low-cost, but high-quality product that helps rural doctors with routine CT imaging needs. It has been developed to be a compact and easy-to-use CT scanner, at an affordable price, which makes it accessible to clinics and hospitals in rural areas. Being a client-centered organization, we are related to Circulating and providing a thorough collection of Brivo CT325 CT Sweep Machines from Ahmedabad, Gujarat, India. The Brivo CT325 CT Scan Machine is acquired from the vendors who build it using the finest quality raw materials and modern technology in sync with the set industry standards.

Registered in 2013, India Wipro GE Healthcare Pvt. Ltd. has gained expertise in supplying & trading of Medical equipment. This company located in Ahmedabad, Gujarat is supplying this product in India.

Fetal Heart Rate Monitor (FHM), Siemens, India

FHM is an example of inclusive innovation developed by Siemens India exclusively for the Indian market. FHM is a device that can monitor the heart rate of foetuses in the womb. The high-end market segment uses products based on ultrasound technology which can cost several thousands of dollars; FHM uses special acoustic microphones instead, making it significantly cheaper.

It was a global effort with joint efforts across research teams in India, Germany & USA. Robust and inexpensive medical devices like FHM help to improve the health care of people in rural areas and have huge potential.

Lullaby Baby Warmers, GE India

Universally, 139 Million births happen every year, of which roughly 4 Million children (under multi-months-old) bite the dust from generally preventable causes. At least 50% of global births occur in underserved settings where access to affordable technology remains limited. Twenty-five percent of the world's births occur in India.

Reducing child mortality progressively depends on tackling neonatal mortality. Globally, an estimated 37% of deaths among children under five occur in the first month of life, most in the first week.

During the birthing process, an infant's body temperature drops quickly once outside the controlled environment of the mother's womb. Without the physiological systems to ward off chilly, the accessibility of warmth is the main line to endurance for the infant. The child needs a gadget that can give sensitive warmth, imitating the mother's womb. The machine, which GE developed in Bangalore, and launched in 2009, costs $3,000 in India (GE, 2012).

For GE, the Children's song was only a beginning stage. The organization has since created the Cradlesong Driven phototherapy unit, which integrates Drove green innovation into the hotter, as well as the Vayu low-cost ventilator, likewise advanced in India, which can hold to 80 beds in an emergency unit its four-hour battery duration.

The machine's simple controls, pictogram buttons, and straightforward dials require negligible preparation and permit medical caretakers and specialists to center around the child, not reverse. It tends to be likewise associated with a battery to connect brownouts.

Pureit, Hindustan Unilever (HUL)

The Pureit purifier was launched in 2008 by Hindustan Unilever (HUL) in India. The filtration process is based on a gravity-driven "table-top" system that operates without electricity or running water. A four-stage purification process includes a microfiber mesh, a carbon filter, a chlorine dispenser "Germkill Kit" and a carbon polisher. These four main components allow for to decrease of a larger amount of particles, and certain protozoan parasites, sanitize water, and remove excess chlorine and chlorination by-products. The technologies used meet the strict international criteria of the U.S. Environmental Protection Agency (USEPA) for the elimination of harmful viruses and bacteria. Subsequent to launching its homegrown brand water purifier brand Pureit in Indonesia and Bangladesh in 2010, HUL has as of late taken it to enter markets in South Asia, Latin America, and Africa (Srinivasan, 2013). Pureit is at present sold in Sri Lanka, Brazil, Mexico, and Nigeria.

Becton, Dickinson (BD) Uniject[TM] USA

BD Uniject Auto-Disable Prefillable Injection System is a tool for vaccine combination product developers (bd site). Prefilled and ready to administer, the system is easy to use and produces less waste disposal than syringes. It is dose-sparing with no waste of unused multi-doses. Users perceived the system as less painful[4] and experienced no anxiety. The framework accompanies regulatory documentation and backing, specialized organization support. Accessible in 0.5 mL and 1 mL volumes.

We Care Solar Suitcase, USA

The Solar Bags are fabricated with the greatest parts to guarantee life span (wecaresolar site). Chief Assembling, situated in the US, fabricates the Solar Bag.

Dr. Laura Stachel was an obstetrician when an extreme back physical issue that happened during a conveyance in 2002 constrained her to surrender her training (Furio, 2023). Changing gears, she sought after a lifelong in general health, getting an expert's in 2006 and a doctorate in 2018 from UC Berkeley. In 2008, while doing an exploration at a Nigerian emergency clinic, Stachel saw the heartbreaking impacts that an absence of dependable lighting and power had on maternal and infant care. Since the emergency clinic had power for something like 12 hours every day, evening-time conveyances occurred close to obscurity.

Cesarean segments were in some cases directed by electric lamps. Of the medical clinic's 150 conveyances each month, three to eight ladies kicked the bucket because of inconveniences.

The point when she clarified the issue for her significant other, Hal Aronson, a solar energy teacher, he planned an independent solar electric framework that could fit in lightweight baggage, which might ultimately turn into the "Sun powered Bag," and immediately put it to utilize. Stachel and her better half established We Care Sun in 2010, whose mission is to further develop the health results for moms and babies in areas without solid power. In its starting points, the couple made the bags out of their Berkeley terrace, with the assistance of neighbors and Partners.

We Care's worldwide Light Every Birth Drive tries to destroy neediness in open maternal health places. The program is presently in Liberia, Nigeria, Uganda, Sierra Leone, and Zimbabwe and made a beeline for Malawi and Tanzania.

We Care Sun-based Suitcase® furnishes last-mile health offices with profoundly productive clinical lighting and power for versatile communication and little clinical gadgets. The We Care Sun-based Bag was intended to help ideal and effective crisis obstetrics. The framework incorporates a 12V, 20Ah lithium ferrous phosphate battery, four high-effectiveness Drove lights for clinical undertaking lighting, two 12V DC embellishment (lighter) attachments, two USB ports, and two development ports to take into consideration discretionary extras or extra lights. The Solar Bag incorporates two battery-powered headlamps, a fetal Doppler with battery-powered AA batteries, an infrared thermometer with battery-powered AAA batteries, and an AA/AAA battery-powered battery charger.

The last rendition (Form 3) accompanies further developed UI implies clinical experts can focus on medication, not observing a power gadget. Lithium Battery support permits work in precise battery fuel measuring. Lights with variable results permit splendid light when required, and power preservation when brilliant light isn't required. Bigger inside battery considers at least 240 watt-long stretches of energy storage, enough to run four lights on high for 12 hours, or on low for 60 hours.

Mobisante Mobile Ultrasound

The US Mobisante versatile ultrasound framework left organized exertion between Sailesh Chutani's past gathering at Microsoft Exploration, and David Zar's lab at

Washington College at St. Louis (mobisante website). WRF Capital put resources into the organization, Mobisante, in November 2010. The main item, the MobiUS SP1 framework, was cleared by the FDA in January 2011 and motivated in the USA market in October 2011.

The MobiUS SP1 framework likewise turned into the principal cellphone-based analytic system to be cleared by the FDA.

Mobisante has established a smartphone ultrasound test called Mobius (technologyreview.com, medecine website). It can deal with up to six ceaseless long periods of checking amongst taxes and can be utilized for fetal ultrasounds and imaging of organs like kidneys, irritate bladders, organs, and delicate tissue.

Conventional ultrasound machines cost $300,000 or more, while the MobiUS costs just $7,500 (Stylist). In any case, one organization has taken the value rivalry considerably further.

Phillips has offered their Lumify ultrasound test for just $199 multi-month, averaging $2,400 a year not considering the suggested $75 multi-month guarantee scope. Such rent bargains have put trend-setting technology and fresher gear inside the reach of individuals who probably won't have possessed the capacity to manage the cost of the upright expenses (trainchicagoheart.org site).

Medical Intellectual Ventures (IV's), Global Good Fund

In 2010, with financing from Bill Entryways and zeroed in on a common vision with Nathan Myhrvold, Worldwide Great was laid out to concoct advancements to address a portion of mankind's most overwhelming issues (Scholarly Endeavors, 2020).

With a group of probably awesome and brilliant personalities in science, designing, general health, and item improvement, Worldwide Great zeroed in its sights on concocting reasonable, open, and fitting innovations for low-asset settings and loaning its local IP to boost industry Partners to put up their Products for sale to the public.

Grounded in a profound multidisciplinary joint effort, Worldwide Great's creators, researchers, and architects worked untethered by the limits of a more traditional construction — and in uniquely planned work areas inside the IV Lab — to face challenges, flop quickly and adjust rapidly for more fast improvement of refined solutions.

From areas as, wide team members also made significant research contributions and published over 1,000 peer reviewer papers.

The Institute for Disease Modeling (IDM):

What started as a project focused on modeling malaria eradication, IDM has grown into one of the world's preeminent research organizations that supports global efforts to eradicate infectious diseases, what is more, accomplish long-lasting upgrades in health

by creating, utilizing, and sharing computational demonstrating apparatuses and advancing quantitative direction.

Global Good made a significant investment in creating and operating the Institute for Disease Modeling, which is one of the leading epidemiological modeling groups in the world. With predictive models based on stochastic methods, we can estimate the probability of certain outcomes and weigh the likely outcome of certain innovations vs. others to optimize impact and target product profiles as well as optimize implementation. These activities prove fundamental to selecting and understanding problems and identifying the best possible solutions.

A vital gap in clinical consideration in low-pay nations is the absence of trained professionals and clinical research facility foundations.

AI, combined with new developments in imaging, immunohistochemistry, materials science, and genomics can deliver radical clinical decision support systems that can make non-specialist clinicians, achieve or surpass the clinical effectiveness of the best specialists.

This is in a general sense significant for low-pay nations, where there are not many trained professionals and practically no clinical research centers. This is possibly likewise progressive for top-level salary nations since it can move medication out of costly tertiary consideration and into essential consideration, or now and again the home, driving down costs, while working on clinical results.

IDM deals with infection transmission elements for intestinal sickness, measles, polio, tuberculosis, HIV, pneumonia, typhoid, Coronavirus, and numerous different illnesses. Different areas of study incorporate maternal, infant, and youngster medical issues and mediations; health conveyance techniques; health framework access and viability; family arranging intercessions; genomic observation; microorganism advancement; drug resistance; and other health-related phenomena.

The Automated Visual Evaluation for Cervical Cancer:

The Robotized Visual Assessment for Cervical Malignant Growth is a falsely wise (computer-based intelligence) calculation that can modestly examine computerized pictures and precisely distinguish precancerous sores better than a human master.

National Cancer Institute (NCI) researchers plan to further train the algorithm on a sample of representative images and make it available for open-source use.

EasyScan GO:

EasyScan GO is a robotized magnifying lens that can look at test slides and give indicative precision that satisfies the guidelines of WHO Level-1 skill.

Commercialization Partner and global microscope manufacturer Motic, an AI- Chinese microscope company, is exploring additional applications including patient case management, drug effectiveness tracking, and drug and vaccine trials.

Arktek Passive Vaccine Storage Device:

The Arktek Uninvolved Immunization Storage Device is a super-insulated container optimized to safely store vaccines between 0 °C to 10 °C for 35 days or seriously utilizing just ice packs in hot zone conditions. An altered rendition of the Arktek that utilizations stage changes materials as opposed to the ice to keep a cool climate is presently the world's just refrigeration gadget equipped for keeping Ebola immunizations at the required - 80 degrees Celsius (- 112 degrees Fahrenheit) without power in far off regions for as long as 6 days.

MetaFridge and Indigo Cooler Vaccine Storage:

Global Good's vaccine storage research also resulted in the creation of advanced next-generation cold storage devices like the MetaFridge which provides highly reliable vaccine cold-chain support for environments with unreliable power.

Worldwide Great's vaccine storage research additionally brought about the making of cutting-edge cutting-edge cold capacity gadgets like the MetaFridge which gives exceptionally dependable immunization cold-chain support for conditions with disruptive power.

Another Worldwide Great innovation, the Indigo cooler, saves vaccines at the right temperature for somewhere around five days with no ice, no batteries, and no power expected during cooling.

AI Shield™ Cold Chain:

AI shield is a simple and proprietary cold chain solution that protects frozen bull semen from adverse temperature fluctuations, resulting in an increased likelihood of AI fertilisation success (The Citizen, 2016). The Worthington Enterprises and Worldwide Great planned the innovation to decrease the treatment disappointment in artificial intelligence administration conveyance by reducing the spread of venereal illnesses in animal keeping. Simulated intelligence Shield™ safeguards bull semen in transport from cold-chain breaks, and in this manner further develops origination rates. The man-made intelligence Safeguard gadget can likewise decrease evaporative misuse of costly fluid nitrogen.

AI-based Ultrasound Imaging:

Global Good is working on AI-based ultrasound imaging, in which a deep-learning ultrasound machine can automatically detect the onslaught of pneumonia, and its progression, or response to treatment, with better predictive value than current standards of care involving X-rays and human specialist interpretation.

M-TIBA, a "Mobile Health Wallet":

M-TIBA, launched in 2016, is taking advantage of the fact that almost 90% of the Kenyan populace has access to mobile phones, M-TIBA is now helping millions across the country put small sums aside for medical care when needed. With over a third of the populace in Kenya often having problems paying for healthcare, M-TIBA allows users to save money on their mobile phones to then be used to access medical services in any facility that accepts M-TIBA for payment (ITU News, 2018). M-TIBA is M for mobile and Tiba is treatment in Swahili, so mobile treatment. To date, almost 600 hospitals work with M-TIBA, providing healthcare services to those who need it most.

David Hojah, Pamela Capalad, Parrots Inc.:

Parrots Inc. harnesses the power of AI and machine learning to provide real-time solutions to people with advanced neurological disorders. Polly is Parrots' AI-enhanced assistive platform, which was inspired by Hojah David's aunt and two close friends who have been struggling with MS and ALS. Polly's clients gain a 360-degree field of clever vision, improved communication capacities, and new Telecare solutions — for a portion of the expense of current unwieldy furthermore, dehumanizing solutions.

Communication

Vodafone –Safaricom M-PESA

M-Pesa has developed a long way past its infrastructures facing individual exchanges (vodaphone website). The administration presently assumes an essential part in the more extensive economies of a few nations and money-related services to governments. MNC's global organisations and people. In 2011, Safaricom and Western Union achieved worldwide consent to permit M-Pesa clients to get global cash exchanges from 45 nations, including the US, Canada, Italy, and the UK. In 2014 Vodafone M-Pesa was motivated in Romania.

Siemens Smart Communication

Siemens SMART (Simple, Maintainable, Affordable, Reliable, Timely to market) activity thinks of practical frugal advancements (Agrawal et al, 2016, w3.siemens.com site).

Siemens delivers a touch board HMI Panel KTP 178 developed in Germany and sold in developed markets. Siemens conveyed it to China, however, it was not fruitful. (Agarwal and Brem, 2012).

Siemens group in China began the item conceptualization without any preparation and embraced the SMART policy of need ID, cost decrease, and blend and match. Siemens completed a full restriction of the value chain at Siemens Nanjing (nearby creation, neighborhood R&D group, and neighborhood item administration).

The framework accomplished a vast entrance of unique gear producers in China. It was all around acknowledged by clients as the item achieved the road cost with extra Siemens premium. As reverse advancement, the new framework enhanced the aggressiveness of Siemens in the developed nations.

Samurai Incubate Japan Africa

Samurai Incubate Africa was established in 2008 as an incubation program in Japan focusing on pre-seed stage ICT startups. The company expanded its activities to Africa in 2018. The countries of operation include Kenya, Nigeria, South Africa, Uganda, Rwanda, and Ghana. The value of the first fund for African startups was US $4.5 million but increased to approximately US$10 million in the second fund. They prioritize projects that focus on solving societal problems with the innovative application of technology and business models.

MPost:

MPost is one startup that Samurai Incubate Africa has invested in. This company creates virtual addresses in the mobile sphere to deliver postal mail in Kenya.

In Kenya, the majority of people do not have physical addresses for mail delivery. Those who need the service usually rent postal boxes at the post office, but these are sparse and difficult to access. In many cases, mail is either lost or delivered very late. By collaborating with the Postal Corporation of Kenya, Telkom Kenya, and Safari.com, MPost filled in missing links in the basic infrastructure to ensure the secure delivery of postal services. The company thus targeted a missing piece of infrastructure and used the existing delivery system to execute its business. Starting from the beginning of this assistance in June 2017, dynamic clients have expanded quickly, arriving at 42,000 in Walk 2019 (Jump Adventures 2019).

Fashpa and TalkLift:

The distributed manufacturing company, Fashpa, is served by an advertising company, sales are facilitated by an e-commerce company, and orders are managed by an order management company TalkLift. Mobile payments are organized by Xento, while logistics and distribution are supported by Sandy. Finally, delivery is strengthened by MPost. This collaborative network is a key factor in generating broader impacts, especially in places where there are few basic public services to meet the needs of potential users (Leapfrog Ventures 2019; Leapfrog Africa 2019).

Airtel Africa, Nxtra Centres

Pan-African operator Airtel Africa launched in Africa Nxtra, a data centres business (O'Grady, 2023a). Nxtra means to fabricate one of the biggest organizations of server

farms in Africa with high-limit server farms in significant urban communities found decisively across Airtel Africa's impression, supplementing its current edge destinations.

Nxtran data centre infrastructure is designed to host the next generation of computing while providing multi-MW capacity in a phased manner.

These offices meet severe worldwide security requirements and versatile incorporated answers for worldwide hyper scalers, enormous African ventures, new companies, SMEs, and legislatures.

Nxtra is empowering clients to meet information sway requirements and empowering more neighborhood cloud services to be presented in the nations where Airtel Africa works.

The first major Nxtra facility, in Lagos, Nigeria, delivers 34 MW of total power. It is intended to have high-thickness racks and incorporate the most recent best practice development to accomplish 1.3 power utilization viability (PUE).

African Innovation Platform, Qualcomm

Qualcomm launched 2022 its African Innovation Platform, a suite of mentorship, education, and training programmes created to support the development of Africa's emerging technology ecosystem (Jackson, 2022).

The platform provides resources and support for local universities, small-to-medium-sized startups, and grant participants, exposing them to Qualcomm's engineers and its state-of-the-art capabilities suite for mobile platforms and technologies, including 4G, 5G, IoT, artificial intelligence, and AI.

Qualcomm agents plan to draw in and team up with states, exchange affiliations, and other key Partners all through the mainland, including the ATU to send off the Africa Development Stage.

RuralStar Pro, Huawei, Malaysia

RuralStar Expert solution created by Huawei coordinates a baseband unit (BBU), a remote radio unit (RRU), and a hand-off gadget into a solitary module that can be sent by anybody in a town and somewhat designed by a designer. It's additionally very power-productive, utilizing under 120W. Then, at that point, there's the RuralLink solution, which uses microwave fronthaul innovation that empowers country locales to share the baseband assets of existing base stations, as opposed to conveying free BBUs.

Such rural solutions are designed to make wireless network deployment simpler, and lower TCO. Pro has been implemented in 60 countries.

Huawei has launched the RuralStar Pro network in 2022 in Bera, Pahang, Malaysia (Rozlan, 2022).

RuralStar Expert is Huawei's remote innovation that requires no "view" for organisations, making it appropriate for testing landscapes like deserts, hilly districts, and provincial valleys. As indicated by Huawei, the framework has an exceptionally low solution cost because of its straightforwardness, with a hub taking under seven days to be fabricated.

Each site additionally has low-energy utilization that requires under 120W, something like five lights. This implies that RuralStar Resourcefulness just requires two solar chargers to drive up the whole framework and give networks access to calls and the web. For this venture, Huawei collaborated with Celcom to give 4G LTE inclusion.

RuralStar can provide more online opportunities such as education, medicine, and employment to Malaysia's remote areas.

RuralStar Pro, Huawei-MTN, Ghana

MTN Group operates in 22 developing markets across Africa, Asia, and the Middle East. Since MTN entered Ghana in 2006, they launched 3G services in 2010 and six years later introduced 4G (Karlsson, 2019). MTN holds 89 percent of 4G connections in Ghana's increasingly competitive mobile market. As part of MTN's efforts to extend fast and reliable mobile telephony connectivity in rural areas, they are an integral Partner of the Ghanaian government's Rural Telephony project, together with the National Communications Authority, Ghana Investment Fund for Electronic Communications (GIFEC), and Huawei Technologies Limited. Under this Partnership, MTN is rolling out new sites in rural areas utilising Huawei's RuralStar solution. To date, they have commissioned c. 300 new RuralStar sites and are committed to increasing the project further in Ghana.

Industry

Line Human Machine Interface [HMI], Siemens

HMI panel is a vital factor in the world of automation and has numerous applications in various industries. Siemens develops human-machine interface technology to meet the increasingly complex processes of today's machines and systems. It is highly optimized to meet specific human-machine interface needs using open and standardized interfaces in hardware and software, which allow efficient integration into the systems.

Siemens team in China started the product conceptualization from scratch and adopted the SMART approach of need identification, cost reduction, and mix and match. The new SMART product was launched into the Chinese market and was very well received by customers in China,

Siemens SMART Line HMI Panel is used for direct machine or plant visualization tasks. All-in-one Panel PC devices integrate an industrial PC and an operating unit and then offer a combination of ruggedness, performance, and brilliant display. It provides close-to-machine operation and monitors control, data processing, and motion control

tasks. They are ideal for production processes in harsh industrial environments and always include an easy touch screen or membrane keyboard operation.

Mice, Logitech

The populace densities in Chinese cities are extremely high (Priyanka, 2013).

Resistance from a mouse in the following loft could inadvertently jam your mouse signals, easing back or halting its activity.

 Consequently, robust shielding wasn't a luxury option in urban settings; it was a necessity. Another distinctive characteristic of the Chinese market is that consumers favour free internet video content over cable television.

Logitech is one of the worldwide forerunners in PC peripherals, with a worldwide upper hand in consoles and mice, yet until 2009 they neglected to prevail upon Chinese purchasers.

Logitech was grounded in a Western perspective. Therefore, these were simple contrasts to disregard. Albeit Chinese purchasers, anxious to get the least conceivable cost, could eagerly involved in specific elements of execution, they required a "superior" remote chip to get adequate reach and safeguarding.

The explanation for the absence of progress was a nearby Chinese organization called Rapoo, which held by far most of the portion of the overall industry.

Rapoo had an advantage in the local market because it understood the needs of Chinese consumers, which were different from consumers in the rest of the world. The Chinese consumer had two particularities that needed to be addressed.

First and foremost, the Chinese associated the PC with the TV to act as video diversion because of the exorbitant cost of satellite TV and because of the thickness of the populace, impedances between two separate mice are entirely conceivable.

Hence, requiring at least 2.4 GHz and safeguarding for the Chinese purchaser. Rapoo had the option to defeature the item, giving just the 2.4 GHz without different highlights, and in that way keeping the cost reasonable for the Chinese market.

Logitech realized that although most consumers in the developing world weren't connecting their computers to the television to watch entertainment, it would probably change due to the development of the computer as a multi-purpose entertainment device. Logitech created a mouse with the features necessary for Chinese consumers at only $19.99. The new mouse was very successful in China and it was the first product to break 10 million in sales in the first year.

After considerable research, Logitech settled on a price of $19.99; it is a more modest premium over the competitor's price but it nonetheless increased margins and placated the reluctant sales staff.

In less than a year, the company had shipped more than 4.5 million units of the new mouse. Of all the Logitech new product launches, this was the first product to break $ 10 million in sales in China within just twelve months.

Coca-Cola – eKOCool

Hindustan Coca-Cola Refreshments, an auxiliary of Coca-Cola situated in India, has presented eKOCool, a solar-controlled chest cooler equipped for saving to four dozen 300 ml glass bottles. The development likewise charges mobile and sun-based lights (citytempac1 site). Coca-Cola is thinking about testing the innovation in different urban areas across India before getting it to different nations in the district.

The first eKoCool coolers were given for free to twenty female retailers in the Agra region of north India in 2011. The program was immediately successful with retailers reporting five times as much sales as before the acquisition of the coolers. Parekh credited the coolers for aiding create a market in areas where Coke was not present at all. The eKoCool unit's ability to also charge mobile phones and light up homes creates additional benefits to retailers. Their customer base has grown with people often coming to charge up their mobile phones, and the eKoCool's lighting ability allows stores to stay open by night.

Retailers that use the eKoCool units have reported significant increases in sales and the social program has positively impacted communities. In addition to expanding the eKoCool program in India, Coca-Cola has developed a program and product that has garnered interest around the world. The technology of eKoCool not only delivers a bottle of Coca-Cola but also the light of a lantern by which a young boy or girl can study.

Initiatives of Firms from Developing Countries

Basic Needs

Sanavita, to Reduce Anemia, Tanzania

Tanzania is suffering from a high rate of malnutrition (stunting 32%) where micronutrient deficiency which causes the death of children and women is a major challenge (sanavita site). Sanavita is committed to bio-strengthened crops with Vitamin A, Zinc, and Press to diminish the lack of vitamin A and Paleness among youngsters and ladies.

Iron deficiency is 58% for children under the age of 5; and 45% for women aged 15 – 49 years; Vitamin A deficiency for children aged 6 – 59 months is 33%.

Jolenta Joseph, Overseeing Chief and Pioneer behind Sanavita began her drive in 2018, during which farmers were battling with gaining access to markets for their Products.

She started by buying fresh produce from the farmers and selling it to the market.

She began drying the yams and in no time, she was bundling her Products and that is how Sanavita started in Walk 2019.

The business extended to wheat products, milling porridge flour from sweet potatoes, pumpkin seeds, and rice, proVitamin A maize, and cassava which is for the thick porridge (ugali). Sanavita is creating awareness in clinics, on social media, and in local media to reach out to all the people both in town and rural areas. This is finished in a joint effort with the locale health office and Tanzania Food and Sustenance Center. Likewise, town legislatures are the coordinators of the gathering and preparation phases.

Technology for Tomorrow Limited (T4T), Uganda

T4T has its underlying foundations in innovative work at Makerere College. The MD, Specialist Dr. Moses Kizza Musaazi, has an energy for Proper Innovations particularly for the monetarily distraught.

The ultimate goal is to emancipate them from their beginning circumstances to being self-sustaining and economically empowered. T4T has many products designed to promote health and safety for urban as well as rural areas in Africa. It also has people dedicated to ensuring the proper and sustainable application of the Appropriate Technologies.

Many of the products work with the culture and behaviors of the people which allows the technologies to be easily assimilated into communities.

MakaPads Sanitary Pads:

MAKA' signifies 'home' and is an abbreviation for Period Organization Information Reasonableness. The venture has arrived at north of 700 young ladies with their items.

 About 55,000 MakaPads have been sold to date (empowering-people site)

MakaPads are clean cushions produced using papyrus and paper squander. The normally spongy material has a high limit (one cushion can be utilized for 8 to 10 hours).

They are assembled with a moisture barrier and mesh covering and can be purchased with or without an adhesive. The dried and pulverised papyrus fibres are processed into a thick paste with paper and water. This is dried in the sun, smoothed, squeezed, and sliced to measure into spongy additions with precisely worked machines.

The pads are sealed in packs of ten and are then exposed to ultraviolet light to kill off all bacteria or germs. Because the sanitary napkins are made of natural material and do not contain any chemical additives, they are almost 100% biodegradable and do not cause any intolerances. MakaPads protect women from health problems and discrimination and can help to reduce the high rate of early school leavers among girls.

As the production of MakaPads does not require any special knowledge, they can be manufactured by people without training. This creates jobs for those who would otherwise have no chance of getting gainful employment. Technology for Tomorrow Limited employs mainly women from a refugee camp in Uganda for the production of MakaPads and provides them with a source of income. Being produced from local materials, the producers are independent of imports or contributions to establish their businesses.

Mak Bulk Load Incinerator:

The MAK Mass Burden incinerator has been intended to answer the requirement for an affordable however ecologically more secure method for arranging off Medical services Squander (HCW).

Toxic and particulate emissions are drastically reduced. HCW is a by-product of health care that includes sharps, non-sharps, blood, body parts, chemicals, pharmaceuticals, medical devices, and radioactive materials. Poor management of HCW exposes health workers, waste handlers, and the community to infectious, toxic effects and injuries.

MAK Bulk Load incinerator is pre-heated and burned down with locally available paper waste or cardboard from the pharmacy department. Sorting of HCW is the key to the above success. Waste is loaded in the primary chamber according to the moisture content. When pre-warmed, the incinerator utilizes the caloric worth of the burned waste to keep up with a high temperature of over 900 C, subsequently significantly limiting the working expense of the framework compared with diesel/electric/biomass-helped ignition processes.

Interlocking Stabilized Soil Block (ISSB):

Eng. Dr. Moses Musaazi developed the ISSB innovation to moderate significant expenses of development and simultaneously relieve environmental change because of deforestation brought about by fire-consumed blocks.

ISSB entails the use of sandy soil to produce blocks that are chemically stabilized, commonly with cement or lime, and then compressed manually or by motor-driven machines. Soil stabilization refers to the application of additional supplements or forces to the soil to make it waterproof and stronger. The nature of the block relies upon the properties and blend of soil types, how much power is applied for compaction, and the expansion of substance Products to additionally settle and reinforce the blocks.

Compared to alternatives such as red-fired bricks or cement blocks, it offers lower construction costs with comparable quality in terms of structural and isolation performance speed of construction, and easy-to-learn technique.

Today ISSB is being used to build hospitals, schools, and homes across the country, as well as shelter for refugees in settlements. The versatile technology has been well adopted in the housing sector with the construction of bungalows, storied apartments, and the most affordable housing options.

The Maka Stove:

The Maka stove is a cheaper solution, a more energy-efficient, time-saving device for cooking (t4tafrica site). Different sizes can be built from as small as 0.5-meter diameter to larger diameters depending on the size of the saucepan or pot. The stoves are easy to assemble, affordable, and are installed in homes as well as institutions. They reduce the amount of fuel needed for cooking by as much as 50%.

MakaStove was made to work on the nature of Stoves, with better eco-friendliness and, in particular, make it reasonable. It is accessible in two sizes, standard and huge. Making it ideal for family use as well with respect to organizations or schools.

Heated blocks retain heat for hours, heat is not lost as in an open fire, heat retention and the contained flame mean less fuel required and less time collecting fuel. The fuel type is wood or charcoal. It reduces forest & swamp loss, land erosion, CO_2 emissions, and fuel usage means less smoke inhalation and eye irritation.

Greenrev GR, Fortified Fresh Fruits and Vegetables, Uganda

Levels of stunted growth among children remain high, at 38% in Rwanda, 34% in Uganda, 34% in Tanzania, 29% in Kenya, and 37% in Malawi.

Joseph Niyomukiza couldn't quit considering the amount of more cost-effective food fortress is to immunizations in forestalling or battling sickness (tonyelumelufoundation site). The thought was established in the improvement of his nation, Rwanda. However, it was only after the Tony Elumelu Business Venture Program, where he got vesting situation and support, that he had the option to control his vision.

His company, Greenrev GR, is an agribusiness enterprise with an interest in reducing horticultural harvest losses, as perishable crops and fighting against malnutrition by adding micro-nutrients, to improve livelihoods through diversified nutrient-rich diets, including vegetables and cereals from seed to processing.

The company has provided fortified fresh fruits and vegetables to over 2.5 million customers. More than 6 million people have tried their fortified cereals and have reached around 65 cooperatives. Moreover, 421 farmers have been influenced through learning systems on deals, supply, and innovation.

The solution strengthens its ties with the community by creating jobs and working closely with small businesses through knowledge-sharing.

Environment

Upcycle Africa, Uganda

Up-cycle Africa promotes an innovative mindset while empowering youth through up-cycling plastic bottles (Sustainable Development Solutions Network – Youth, 2020). The solution trains nearby networks, particularly the distraught youth to safeguard the climate. Bottles supplant earth-threatening blocks, which are scorched for a long time

advancing deforestation. Bottles are gathered and compacted with soil, making the houses extremely practical and reasonable. Besides, the structure's areas of strength are, heat, and are tremor safe. This solution additionally prepares nearby individuals and gives them the ability to transform plastic into eco-blocks as well as build their own homes from plastic waste.

Upcycle Africa has taught an expected 20,800 students in 52 distinct schools and has recuperated more than 3,000,000 plastic Bottles. North of 100 tons of plastic has been economically reused. They have fabricated 117 houses for families including 11 from underestimated networks.

Quantum Polychemics, Bangladesh

Zahin Rohan Razeen of Bangladesh is the founder of Quantum Polychemics Biotechnology which converts perishable waste destined for landfill into valuable materials through biological processes. It has the vision of tackling plastic pollution and creating environment-friendly bioplastics for the packaging industry, food supplies, agriculture, textiles, etc (Deepto, 2020). Involved in the same project is the scientific advisor of Bangladesh Jute Mills Corporation, Mobarak Ahmed Khan, who invented the biodegradable jute polybags.

Quantum Polychemicals has developed exceptional IP that offers a completely new and unique solution to plastic pollution. Polychemics biological processes convert organic renewable waste destined for landfills into valuable materials. Quantum Polychemic's natural product jute biopolymer platform creates a wide range of polymers with tunable properties and practical applications to meet the growing demand for sustainable plastics.

The materials are an environmentally friendly alternative to petroleum-based jute-based bioplastics. The exclusive polymer has the properties of expanding the richness of the dirt as it breaks up in the water in under 10 minutes and debases in the soil in under a month making the whole cycle eco-friendly.

100% of the jute waste is being used in making bio-cellulose for the production of polybags. 70% of the mendicants near the factories have been uplifted from unemployment since the commercialization has taken place. Furthermore, the economic status of over 200 jute farmers has been enhanced.

GREENfluidics, Mexico

At only 23 years of age, Adan Ramirez Sanchez, a business visionary has stood out for his creative item: A Smart sun-based biopanel made with algae.

His idea arose when he was studying at the Faculty of Sciences of the Autonomous University of the State of Mexico (greenfluidics site). Adán started Greenfluidics thanks to the support of his professor Miguel Mayorga.

They imagined Keen Solar Biopanels made of microalgae and carbon nanoparticles which create two processes.

The first is carried out by microalgae, which function like a plant that photosynthesizes, that is, they capture carbon dioxide from the atmosphere and they generate oxygen. The second is made by carbon nanoparticles, which carry solar radiation to high temperatures and generate energy. Along these lines, energy is made while oxygen is made and carbon dioxide is retained.

GREENfluidics technology is called "Smart Solar Biopanel". This technology has each square meter capable of absorbing one ton of carbon dioxide and generating one ton of oxygen dioxide as well as generating 160 W / h.

GREENfluidics technology captures CO2 from the chimneys of a coal-fired power plant before it enters the atmosphere, transporting the CO2 through a pipeline, and injecting the CO2 deep into a suitable and carefully selected underground geological formation, such as a nearby abandoned oil field, where it can be safely stored.

Feel Good Eco Nurture, India

Feel Good Eco Nurture intends to give another life to plastic waste and development trash to diminish squandering going to landfills (feelgoodeco site).

Sharang Sunil Ambadkar and Varad Tole have developed a process where a composite material is produced from mixed plastic waste and construction and demolition debris, developed a Technology to reuse level 7 or Diverse Plastics purported 'Non-recyclable' and other modern Development waste to concoct a 100 percent infusion Mouldable material into development-based Products like Paver Tiles and Timbers a substitute for normal wood.

The solution could mitigate 1000 Kg of CO2 per ton of production. This composite material, Multi-Layered Plastic (MLP), can be molded into any shape or form leading to an endless possibility of product range like roof tiles, paver blocks, dividers, and lumbers.

Robert Luo, Mi Terro, China

Robert Luo co-founded Mi Terro in 2018 with Dr. Shengfu Chen (boss science official), a teacher in the division of synthetic and biochemical design at Zheijang College in Hangzhou, China. Mi Terro started by making duffle sacks out of plugs and sea plastic.

The newest product in the green fashion lineup is a t-shirt made from spoiled milk (docdroid site).

Robert was inspired to start Mi Terro when visiting his uncle's dairy farm in China and seeing buckets of spoiled milk. He intended to involve horticultural waste for good and at last established Mi Terro, the world's initially exceptional material organization that makes adaptable bundling materials that are produced using

agricultural waste and are ocean degradable and home compostable (starternoise site). Through Mi Terro, Robert is utilizing accuracy aging to arrive at his objective of finishing the utilization of microplastics and petrochemical textile fibers.

Mi Terro is now tapping waste streams from potato peelings to brewers' spent grains to create cost-effective replacements for polyvinyl alcohol (PVA), a petrochemical-derived film used in laundry and dishwasher pods (Watson, 2023).

Mi Terro got connected with, a brewing giant. AB InBev in China, where launched a paid pilot to create a label for their beer bottles made using the brewer's spent grains.

Mi Terro launched another paid pilot with Unilever making water-soluble flexible films that it could test on detergent pods and laundry pods.

They extracted the protein and fiber from the spent grains and then modified them into resins using existing manufacturing equipment via a patented process. They believe that working with polysaccharides from potato peelings and cellulose from the byproduct of paper production is a cheaper approach.

As indicated by Luo, Mi Terro's patent-forthcoming creation process is more energy-effective than regular PVA creation.

They use existing plastic equipment such as a twin-screwed extruder and a blown film machine to make resins and films. The process is primarily chemical. The film can be at price parity with PVA film when we reach 600 tons of annual production. The company, which has raised around $1.5 million in seed funding, has small teams in China and Los Angeles.

Mukuru Clean Stoves (MCS), Kenya

Experiencing childhood in Mukuru, one of Nairobi's biggest ghettos, for quite a long time Charlot Magayi sold charcoal for fuel. That charcoal was the reason for standard respiratory diseases for herself as well as her neighbors (top40.businessdailyafrica site; Onyando, 2022). Then, at that point, in 2012, her girl was seriously singed by a charcoal-consuming oven. Looking for an improved solution, in 2017 she established Mukuru Clean Stoves (MCS).

Instead of consuming hazardous strong fills, Mukuru Clean Stoves utilize handled biomass produced using charcoal, wood, and sugarcane. This consumes cleaner, making 90% less contamination than an open fire and 70 percent under a conventional cookstove. They are less expensive as well, costing just $10 and splitting continuous fuel costs.

Since 2017, MCS has sold over 250,000 clean cookstoves in Kenya, enabling families to make savings of over $20 Million in fuel costs while impacting the lives of over 1,200,000 people who now benefit from cleaner air within their homes while avoiding over 500,000 tons of CO_2 emissions.

Agriculture

Ground Penetrating Radar (GPR), Argentina

GPR technology can be used to map and determine the depth of water tables. Even without rainwater, water can be provided for crops, if the roots come into contact with the water table zone (studiogyd site). GPR is used as a non-destructive technique for low-depth subsoil investigation, which produces excellent results in terms of soil profile mapping. It consists of an electromagnetic wave unit and a second digital recording system unit. Wave reflection time delays and wave speed in the material containing the antennae are used to deduce the depth at which the reflector unit (pipe) is located. The georadar creates a dirt picture with a high horizontal and vertical goal which recognizes explicit Products, yet additionally describes the region.

The depth of penetration and the resolution depends on which type of antenna is used. In high-resolution urban areas shielded antennas are used because they are better equipped to control noise and air reflections with high-quality imaging and a depth range of up to 10m. Estudio G&D (estudiogyd site) uses existing technology in a new context.

The innovation is a compact, small-scale device, easy to transport. Big areas can be analyzed without costly and labor-intensive drilling. Deeper soil and groundwater levels can also be detected. The problem of water shortage in developing regions does not only affect clean drinking water. Water consumption by households and businesses only constitutes one-fifth of the entire water use – the lion's share is used for the production of food.

The Georadar can boost crop yields at locations with underground water tables. When the location and distribution of water tables are known, hybrids and fertilizers can be selected according to the amount of water that is available. Thereby, crop yields are maximized and the water is used more efficiently.

This knowledge could also give useful information for soil preparation such as quantifying the supply of soil conditioner in the form of compost, adapted fertilizer utilization, etc. Due to the relatively high purchase costs, the service should be provided on the regional or local (village, cooperatives) levels, or by big farms.

Agriculture:

GPR sees use in high-value crop management such as vineyards. The primary focus is on managing soil water content to provide optimal growing conditions (sensoft site).

A culmination center is around soil conditions, design, and character that influence water stream and seepage. While brilliant cultivating is an essential area of purpose, sporting facilities, for example, fairway greens are another focus.

Applications: Agricultural Drainage Tiles; Metal Soil Water

Forestry:

Utilizing GPR to look at the inside of trees and inferred wood Products and designs is a developing area of GPR applications. Involves range from analyzing varieties in water content to searching for illness and decay. Ongoing worries about the development of carbon dioxide in the environment have seen GPR used to further develop information about tree root zones. Another normal application includes looking at the condition of utility poles.

Applications: Tree Roots; Wooden Poles & Trees

Environment:

Surveying conditions near earthy-colored field destinations is a region that sees significant GPR utilization. Applications range from finding covered frameworks like barrels, lines, and old establishments however finding changes in soil fill conditions to discovering contaminant plumes.

Applications: Underground Storage Tanks; Septic Systems; Contaminant Delineation; Contaminant Remediation

Project Pollen, Fourth Line Limited, Zambia

Half of Zambia's populace is employed by the agriculture sector, but it makes up only 8.2% of our GDP (Sustainable Development Solutions Network – Youth, 2020). Despite having an abundance of open land, fertile soil, and access to water, more than 2.5 million Zambians experience food shortages and a majority of Zambian farmers still live in poverty.

Fourth Line Limited is an African social enterprise helping small-scale farmers in Zambia create ecosystems for prosperity. More than 800 bee farmers in rural Zambia have been positively impacted by this project. Fourth Line has designed innovative low-cost beehives made from unwanted wood waste and offcuts whose yields have increased productivity from 15kg to 70kg per season. They offer a detectable social financial impression to a huge number of Rural honey out-cultivators and little-holder farmers by drawing in them to deliver high-worth honey for commodities to worldwide markets.

The project aims at empowering 2500 farmers with tangible income and access to the market (40% women & 80% youth), enabling farmers to grow and sell more as they will have access to credit, allowing them to reach prosperity.

Since 2019 Fourth Line Limited increased productivity by 80% for 500 smallholder farmers (67%) through the adoption of climate-smart farming systems for food and cash crops. They increased access to farming inputs for 1200 smallholder farmers (60% women) and increased access to market, distribution networks, and finance for 800 farmers. They also created employment opportunities for 30 young people (50% young women).

NovFeed Limited, Tanzania

Tanzania holds great potential for aquaculture production. Its climate is ideal for farming indigenous fish species, including tilapia and African catfish - the favored fish for Tanzania's lower- and middle-income classes. Market demand for fish is growing quickly due to populace growth and increasing incomes. However, supply from wild catch is dwindling as natural water bodies are overfished, and enforcement of regulations on fishing is limited at best. This situation has resulted in an estimated fish demand deficit of 480,000 tons annually in Tanzania.

Diana Orembe, CEO and Founder, of NovFeed in 2018 realized that the current fish feeds available in Tanzania and South Africa in general are mostly imported from other countries such as the Netherlands, Vietnam, and China (genafrica site).

The imported and local fish feeds are made from soybeans and fish meal as the main protein ingredient. These two fixings are extravagant and represent more than 70% of the all-out feed creation costs which thus makes the feeds exorbitant. Diana came up with a bacteria-based protein as the best substitute.

NovFeed *has developed a proprietary chemical-free biotechnological platform where organic waste is converted into a natural, traceable, and safe non-animal and non-GMO protein source to be used in* aquaculture (novfeed site). The organization utilizes normal microorganisms and modern biotech that transform natural waste into a profoundly thought protein item with an emphasis on making nutritious, adjustable contributions to the food framework, hence empowering meat and aquaculture sectors to get food Products.

The platform relies on *a proprietary fermentation process in which a selected group of bacterial strains produce a nutritious, high-protein feed that has the following features: release of 80% less CO2 in the production compared to traditional processes; the final product is free of toxins or feed inhibitors; the process is highly scalable; and the final product is high in protein content, which allows better nutrition while being 30% cheaper than traditional sources.*

The stage permits to supplanting of the creation of unreasonable protein fixings, as fishmeal and soy protein focus that are widely utilized in aquaculture feeds worldwide.

NovFeed produces, processes, and formulates new cost-effective fish feeds based on indigenous, locally produced, and sustainable ingredients such as maggots. Black soldier flies in their larval stage feed on organic matter and can eat a wide variety of organic wastes, from different sources such as slaughtering houses. As the hatchlings mature, they consume this natural waste eagerly for 2-3 weeks before coming to the pre-pupae stage, so, all in all, they are an ideal nutritional substance and can be harvested.

They are then dried and ground into a fine protein-rich flour which then is mixed with other ingredients to produce fish feed pellets. These pellets are then sold to fish feed distributors that will sell to the fish farmers. NovFeed's superior product will increase

yields for farmers, helping to decrease the cost of production by 30% while supplying the food insecure in the region with healthier animal protein.

NovFeed protein is a group of regular, practical, and detectable feed elements for fish and animals that are being created to assist with fulfilling the developing worldwide need for protein. Created through a characteristic maturation, it is non-GMO, serious with existing wellsprings of protein, and delivered to the quality standards. Complete protein source with 70% crude protein and 97% fish survival rate, highly digestible and palatable, gut health, and low *Feed conversion ratio* (*FCR*).

MaxGrow is a microbial liquid left over at the end of our process. High in nitrogen, phosphorus, and potassium (N-P-K), it is a valuable, organic soil conditioner.

MaxGrow has demonstrated to expand yield and soundness of vegetable and natural products trees, has bio-energizer properties, works with plant supplement assimilation, and further develops generally soil microflora.

ProSect Feed Protein, Ghana

ProSect Feed established in 2019, is to deliver bug-based creature care for poultry, fish, and pigs.

The protein feeds have up to 58% crude protein nutrients and are cheaper than what is available in the Ghanaian market.

ProSect Feed works with smallholder farmers in Ghana to provide them with nutritious and cost-efficient alternative sources of animal feed thereby decreasing their production cost and yet not compromising on quality. This insect-based protein feed provides a cheaper, locally produced option that is high in crude protein. This allows smallholder farmers to make higher profits and gives them a competitive advantage.

The current facility can produce close to 10-14 tons of organic fertilizer every month as well as 2-3 tons of poultry and fish protein feed. They employed 6 full-time staff and rely on technical backstops from some of our experts, so that makes 10 employees. Ghana spends more than $200 million every year bringing in poultry Products that are likewise delivered locally.

As fly hatchlings are a characteristic part of the eating regimen of fish, chicken, and pig, PROteINSECT is zeroing in on raising two types of fly and directing taking care of preliminaries with these animals.

Fly hatchlings developed on a scope of natural squanders can lessen the volume of that loss by up to 60%, giving an extra advantage to squander the executives and the environment.
PROteINSECT is bringing together expertise from China, Africa, and Europe to encourage and enable the adoption of fly larvae protein into animal feed around the world. The project has 12 Partners from 7 countries and is co-ordinated by the Food and Environmental Research Agency (FERA) in the United Kingdom.

Agro Online Platform, Zimbabwe

Over 6.1 million smallholder farmers in Zimbabwe are residing in neediness, across Africa that number is 250 million, and universally there are north of 500 million smallholder farming households.

Zimbabwe smallholder farmers produce 20 million tons of food and a third of that produce is wasted before it reaches consumers. In the meantime, in the same country, 7.7 million people are hungry according to WFP. Across Africa, almost 50% of the food produced is wasted - that is enough food to feed 300 million people on the continent.

Agro has created an online platform to give smallholder farmers empowerment and sustainability in their entire production and supply chain through a 4 tier system. Agro gives farmers access to debt-free financing to reduce price risk through their service 'Agro-Contracts'. This service also provides crowdfunding through loans and an opportunity for farm produce processors to get a regular supply of high-quality produce at lower costs since all middlemen are eliminated. This also guarantees complete traceability of all produce.

'AgroHow' gives farmers custom-made information about cultivating, access to Smart homestead innovation through local area leasing, and access to consistent updates on farm infections.

'AgroCart' is another service offered by Agro, which allows farmers to sell their produce and buy inputs directly from and to manufacturers. This takes out waste and increments inventory network proficiency, while additionally eliminating the agent to expand the farmer's benefit and bringing down the costs for buyers.

As of now, Agro is still in the prototyping and advancement stage, however, they have still figured out how to get subsidizing for 50 farmers in the town of Norton.

The solution has also managed to sell off 10 tons of grains for farmers and 500 kgs of broccoli and cabbage. Agro has been able to get 100 farmers access to speak to an agronomist through WhatsApp chat-bots. Agro has a network of 200 farmers to whom they currently send pest outbreak alerts and information.

Bio Solution, Fertilizers, Rwanda

Rwanda's economy is dominated by agriculture where more than 90% of people depend on it. While the populace increases and the food needs increase, the farming land never increases. On the contrary, production decreases which forces farmers to use chemical fertilizers and pesticides to increase productivity. Due to the populace growth and the improvement of living standards, there is a growing concern associated with waste generation in Kigali city and secondary cities.

All gathered waste goes to only one landfill in Kigali as same as optional urban communities, and the waste piece is overwhelmed by the natural misuse of up to 68%. Firmly established fires, methane blasts, avalanches, and leachates compromising

waterways and groundwater are a portion of the normal issues brought into the world by dumpsite mismanagement.

More than 50% of the waste that goes to landfills is of good quality for composting, such as waste from purely residential neighborhoods, and waste from special generators such as markets, restaurants, and slaughterhouses.

Since its creation by Elie Ntirenganya, an Entomologist and entrepreneur

in 2015, Rwanda's Bio Solution produced more than 500 megatons of fertilizers, more than 200 farmers and farmers cooperatives, employed more than 25 workers, especially youth and women, partnered with one district and one TVET school, and involved more than 30,000 USD funds.

What is common is chemical fertilizer which is expensive (due to importation) and harmful to crops and the environment. The company uses environmentally friendly effective microorganisms (EM) to produce and sell organic fertilizers. Waste is collected from Kigali City and Bugesera secondary city landfills and deposited into working sites. The waste is then mixed with the EM solution and special fresh plants to control the minerals. The final product is ready to use within two months. The company is also able to sell this fertilizer at a low and affordable price to the community, thus contributing to lowering annual farming expenses. Around 16 tons of waste are deposited in their dumpsters for sorting and managing. 120 farms are now using the product.

Plantheus, Diagnose Plant Diseases, Nigeria

Plantheus Nigeria is a plant off-line diagnostic application that requires no internet access to run diagnostic analyses on the condition of plants. The AI algorithm that will be used in the application will be adept enough to learn about new crop diseases.

Plantheus is a mobile application that uses AI to diagnose plant diseases and suggest solutions to farmers and Agric extension workers. An AI algorithm that can be used to train new crop diseases.

Drones are also being used in a battle against yield-robbing pests (insects, weeds, diseases). Yet, drones are likewise an approach to decisively build the capacity to follow the development of yields and distinguish supplement lacks. This data can then direct key homestead management choices.

Animal Identification Management System, Nigeria

In 2017 MTN, in Partnership with the Katsina State government, officially launched the Animal Identification Management Solution (AIMS) at the Runka Game Reserve, Katsina State (Business Day, 2017).

The MTN Points solution uses microprocessors, about the size of a grain of rice, implanted in every animal.

These chips use passive RFID (Radio Frequency Identification) technology, allowing law enforcement agents, veterinarians, owners, sellers, transporters, and other relevant parties to easily determine the ownership and origins of animals using handheld scanners and a short code.

This has multiple uses including point-of-sales validation of animal ownership and the identification of owners of lost or stolen pets and livestock, which will discourage cattle rustling. Additionally, it will work with illness reconnaissance and control, as well as animal recognizable proof, which is expected for global beef export.

In 2018 the Nigerian Agricultural Quarantine Services (NAQS) and MTN Telecommunication, Nigeria embarked on a Partnership through the MTN AIMS to properly identify animals for import and export purposes (tribuneonlineng, site).

Four Years After (2021) rustling of cattle, sheep, goats, and other domestic animals in the state by marauding bandits remained a daily occurrence (This Day Liv, 2021).

Examination further uncovered that both the MTN, security offices, creature proprietors, and the Katsina state government can't follow even a solitary stirred dairy cattle or other domestic animals carted away by bandits with the device within the period under review despite billions of naira reportedly expended on the execution of the project in the state.

Femi Kayode, System for Livestock Health, Nigeria

In Nigeria, livestock accounts for one-third of the country's GDP providing revenue to the government as well as income and social security to farmers, especially in rural areas (ashoka site). Animals uphold farmers' vocations however the best limitation to animal creation is animal infections.

Farmers need data about biosecurity and illness counteraction, there is an absence of information accessible to the government about the quantity of animal's farmers and the quantity of animals in the country.

There is a disconnection between rural farmers, especially cattle herders, and veterinary doctors. There is a lack of database on animal health care services in the country and veterinarians do not understand their role in animal disease prevention.

The animal illness reconnaissance in Nigeria has flopped horribly in light of the fact that veterinarians are not associated with country farmers to get continuous data about sickness episodes, veterinarians don't comprehend their job in infection announcing, and data about illness flare-ups barely escapes networks until a huge number of animals have been lost endangering general health.

Creature sickness reconnaissance is a successful procedure for forestalling and controlling illnesses. Generally, the episode of sickness flare-up doesn't pull out before it happens and can occur across the boundaries of a few nations. These sicknesses are probably going to fan out like quickly when they happen bringing about high bleakness with subsequent financial effects. Fostering a compelling and productive sickness observation framework permits will empower the country to distinguish illness flare-

ups early sufficient that will provoke early mediation to forestall mortality and horribleness that might result from these zoonotic infections.

Femi Kayode is the principal in Nigeria to construct a framework for domesticated animals' health and illness to counteraction. He is doing that by building a local veterinarian and farmers' local area and including state and central legislatures. He spearheads a global positioning framework for animals and boundless infections.

He is likewise spearheading and fostering a public information base of enlisted animals and collaborating with existing systems for the following and spread of infections and quick counteraction. This is additionally influencing human health which is jeopardized by consuming unfortunate animals.

To construct a framework for infection expectation and counteraction, Femi believed that the essential solution was to interface farmers with one another and associate veterinarians with farmers to empower him to attract examples to conjecture and foresee sicknesses.

To empower the sickness following and avoidance, Femi developed a simple oversee application through which the data is being transferred and early admonitions of impending illness are appropriated.

He additionally believed that this communication framework ought to include veterinarians, so his application associate's veterinarians and farmers. This application is free for farmers, which prompts them to effectively partake particularly that Femi is going to these farmers with schooling and preparing. In Femi's framework, farmers have a lot higher pay due to the diminished animal death rate, he feels that in the long haul, it will impact the financial development for example through animal commodities.

The new framework that Femi has created permits the moment Distribution of antibodies in jeopardized regions saving not just domesticated animals but human lives since certain illnesses that are contaminated by animals influence human beings.

Zenvus, Nigeria

Zenvus looks to further develop decision-production for farmers by giving experiences into crop status in view of information gathered from sensors and different means (IoT).

The data is stored in the cloud and can be accessed by the farmer irrespective of their location. This allows farmers to use fertilizers and irrigation more precisely, increasing farming efficiency (borgenproject site).

Zenvus is an intelligent solution for farms that uses proprietary electronics sensors to collect soil data like moisture, nutrients, and acidity plus also provides farmers with the ability to track everything that is happening in their fields, such as a water pipe leak, irrigation, and efficient fertilizer application. It then sends the collected data to a cloud server via GSM, satellite, or Wi-Fi. Algorithms in the server analyse the data and advice farmers on the best farming techniques. As the harvests develop, the framework conveys extraordinary cameras to construct vegetative health to assist discovery of dry

spells with pushing, nuisances, and infections. Zenvus gives clear visibility to accurate farming by checking out information in the dirt and the harvest vegetation.

The data generated is aggregated, anonymised, and made available via subscription for agro-lending, agro-insurance, and commodity trading to banks, insurers, and investors (Ekekwe, 2017). With this AgTech IoT development, organizations like MTN, Airtel, Etisalat, and Glo can give a ton of horticulture information to farmers, banks, guarantors, and others across the pecking order. Telecom administrators will plan to work on the network of sensors and different information-catching gadgets on the ranch to assist farmers with transforming this information into significant bits of knowledge through the Zenvus programming platform.

Zenvus Boundary helps farmers map the boundaries of farms. They can utilize the output to independently obtain farmland titles from governments. Zenvus team can do this for co-operatives or governments or farmers can use Zenvus technology to do the mapping.

Zenvus Fusion – Zenvus Combination is an assistance for states and improvement organisations which is intended to assist with building a Soil Fruitfulness Guide in voting demographics across Africa

Zenvus Bits of knowledge: This assists farmers with understanding the dirt states of their farmlands through sensors that convey suitable information to their telephones or PCs. With this, farmers can successfully oversee manure application, and water system and every day remove the mystery from cultivating. The investigation is essential for the Zenvus accuracy cultivating sensors provided.

Orbital Solutions, Nigeria

Orbital Solutions Global Services Limited is a company that started operations in Nigeria in 2014 and applies technology to optimize agricultural production and facilitate the aggregation of farmers by using smartphones and drone technology in farming processes (Ojoye, 2019). Orbital Solutions Global Services Limited's headquarters is in Lagos, Nigeria.

Track Your Build, Nigeria

Track Your Build offers remote sensing services for construction and infrastructure management as well as a project management & construction jobs cloud.

The service provided is a combination of professional engineering services enhanced by using drone, satellite, and ground sensor data to create documents, drawings, and advisory for projects, assets, and field service management.

Track Your Build uses drones to collect data on vegetation, plant counting and yield prediction, plant health, height and field performance, nitrogen content, and many other

data streams to maximise field productivity while reducing environmental impact (trackyourbuild site).

Binkabi, Trading Platform, Nigeria

Binkabi is a Blockchain-enabled agriculture trading platform in cooperation with Sterling Bank that allows farmers to deposit crops in warehouses and to be issued with a tokenised asset receipt (binkabi site). This gives them the option of more flexible trading times and to borrow against their receipts.

They can then use this token as an asset to borrow money against, allowing them to invest in their farms and to sell at the optimal time in terms of crop price rather than immediately after harvest as the loans they can receive thanks to the token allow them to wait for optimal prices.

Described as the 'Uber for grain' project model, the technology is leveraged to make agriculture commodity trading fairer and more profitable. The more commodities are traded, the more discounts are earned. Farmers obtain instant rewards as their goods are sold through an online wallet which is decentralized.

Hello Tractor Nigeria

Nigerian start-up is Hello Tractor, which offers technology for smarter, better maintained, and more profitable tractors using an AI solution from IBM (hellotractor site). The company sells its brand of tractors and uses AI to automate complex decisions for the purchaser of the tractor and the bank issuing credit. It assists the farmer in selecting the best tractor for his or her needs while simultaneously providing the bank with information that will inform their loan decision. The tractors include sensors that are used to monitor their condition (IoT) after their purchase.

The platform employs contract tractor drivers and generates business for tractor mechanics, bringing the efficiency of mechanization to African SHF. The company had already served up to 22,500 customers and reported yield increases of 200 percent for its clients by 2015; it has grown substantially since then and expanded into other countries (Theunissen 2015).

Jaguza, Livestock Management System, Uganda

Jaguza Tech started in 2017 aims to transform the livestock farming sector by solving three major problems plaguing this sector (ikeasocial site). These problems are the extensive loss of livestock to common diseases, livestock rustling, and the lack of proper livestock tracking and management systems. The enterprise transforms the sector through the development and deployment of a livestock management system that uses the Internet of Things, Data Science, and bi-data to solve the problems above to strengthen food security while improving livestock production.

As of Walk 2021, the Jaguza Animals executive's framework has enlisted more than 18,000 clients, around 80% of whom are dynamic clients, habitually counseling the application consistently. They have 8,000+ ranches enrolled across 13 nations.

MUIIS (Market-led, User owned ICT4Ag-enabled Information Service), Uganda

MUIIS offers accurate satellite weather information, agricultural advice, trend analysis for soil, water evapotranspiration records, insurance data, and market information for farmers (muiis.cta.int site). Tips and instructions are sent to mobile devices and can be as specific as 'spread fertilizer between 5pm and 7pm' or 'winds expected at 3pm.' Farmers have reported that this type of intervention has helped increase crop yields and contributed to improving food security.

Carico Café Connoisseur Blockchain, Uganda

Coffee is one of the main money crops in Uganda. The Uganda Coffee Advancement Authority (UCDA) gauges that roughly 500,000 families rely upon Coffee creation. Because of the idea of restricted handling limits in Uganda, by far most of its Coffee trades should be as raw beans.

This makes it difficult for the end buyer to ascertain where the beans originated. There is a global trend to incorporate fair trade principles in coffee supply chains. Some estimate that the growth of fair-trade products results in a 24.5% increase in coffee sales. Blockchain can facilitate the verification of fair-trade supply chains.

Carico Café Connoisseur, a Ugandan firm, has started using Blockchain to trace the origin of coffee beans. The firm claims that coffee bean purchasers are ready to pay a higher price if they can trace the origin of the coffee through Blockchain. Using Blockchain as a tool for origin verification and traceability offers several advantages, such as immutability of records, transparency, and data security. Using Blockchain, Ugandan farmers will be able to digitally integrate an immutable certification. Consumers can verify the authenticity of the certification by scanning a QR (Quick Response) code with their smartphone. They will also have access to transparent data regarding where and when the beans were grown and what quality was assigned to the beans throughout the process. Using blockchain puts an immutable time stamp on every step that the shipment makes, such as regulatory inspections, distribution warehouses, and cross-sea shipments. This procedure empowers local coffee suppliers to charge more and pay the local farmers higher wages (Pepi, 2019). Carico Bistro Specialist has previously finished its most memorable pilot shipment, containing numerous lots of the Ugandan Coffee brand Bugisu Blue. The shipment effectively advanced toward South Africa in December 2018.

CARICO Coffee has worked on predictable quality and has been evaluated for the fifth year straight as Specialty level (Cup-Score north of 80, two of them more than 85) on the SCAA (Specially prepared Coffee Relationship of America) scale by two

autonomous confirmed specialists in Switzerland and America. Green Beans and Simmered Coffee are exchanged straightforwardly with 1.700 Smallholder Farmers through the global Carico-Group (carico. coffee site).

FarmDrive, Financial Services, Kenya

FarmDrive, Kenya is opening access to financial services for more than 50 million smallholder farmers in Africa (wsa-worldwide site). Utilizing straightforward smartphone innovation, elective informational indexes, and modern information examination, FarmDrive is shutting the basic data hole that holds smallholder farmers back from getting credits that would permit them to develop and expand their organizations.

Possibly financially sound smallholder farmers are many times denied advances since they miss the mark on traditional credit profiles that moneylenders depend on to assess borrowers.

FarmDrive spans the subsidizing hole between smallholder farmers and financial establishments in two ways.

The initial step is to unite different surges of information to make yield-prescient agronomic calculations intended for each cultivating vertical and geographical locale.

FarmDrive then creates credit profiles for farmers by combining the agronomic algorithm with behavioral data.

AllGreen, Diagnosing Crop Diseases, Cameron

AllGreen Cameroon is developing intelligent modules to identify diseases in plants. ROSALIE module diagnoses in real time and accurately diseases of crops and also notifies the owners of good practices to adopt to eradicate them. AllGreen technology is incorporated into drones deployed at various plantations.

Drone Applications for Precision Agriculture in Uganda

In Uganda, drones are used in the Technical Centre for Agricultural and Rural Co-operation CTA's 'Eyes in the Sky' project at the Igara Tea Factory. The drones assist smallholder farmers in the provision of crop inventory and management advice. This helps farmers calculate yields and their seed and fertiliser needs. Over 4,000 digitalised profiles of smallholder farmers were created with their location, size, and productivity. Based on the data gathered by drones, farmers can apply for credit since the collected information can serve as collateral.

This project started as a pilot in 2017 and operates in coffee plantations, carrying out a census of coffee farms as well as obtaining a geo-reference inventory of coffee farms. A total of 30 youth-led enterprises were selected across 17 counties via competitive processes to participate in the project and this number is growing. Over 16,000 farmers

benefited in 2019 and a total of 58 institutions have sought advice and input from consortium members.

Beatdrone, Spray Pesticides, Nigeria

Beatdrone helps farmers spray pesticides on their farms (spraying a hectare with a drone takes about 15 minutes compared to the 10 hours that farmers cover through subsistence farming), engage in crop supervision, and map farmlands. Farmers can request drones schedule a date for drone deployment and then make their payment. At the moment, they are covering over 30,000 hectares of land in Nigeria (Technopolis Group, 2019).

Arifu, Education Technology Company, Kenya

Arifu is an education technology company established in 2015 in Kenya (arifu site). They offer a content marketplace that brings together subject matter experts who wish to earn money by creating licensable courses, and organizations that wish to improve their performance by efficiently delivering these courses to their customers. The low-cost platform works with omnichannel conveyance of schooling and data in drawing in chatbot-style configuration to a main interest group regardless of access to mobile internet.

Arifu is also a digital advisor whose training content can be accessed freely on SMS, WhatsApp, Telegram, and Facebook Messenger. Arifu's mission is to provide information and opportunities for all.

A global agribusiness maintained that a reasonable and versatile way should prepare farmers, increment deals and further develop item utilization.

Arifu digitized the agribusiness's traditional in-person training and product information Distribution which reduced their cost of delivery from $20 to $1 per farmer. Are involved 250,000 farmers over interactive SMS to help improve their good agricultural practices.

In the first pilot with 5000 Kenyan farmers, Arifu helped farmers improve behavior related to good agricultural practices. They increased farmer yield by 55%, and income by acre by $187. Arifu digitized the agribusiness's traditional in-person training and product information Distribution which reduced their cost of delivery from $20 to $1 per farmer. 250,000 farmers are involved over interactive SMS to help improve their good agricultural practices.

Proximity Designs, Myanmar

Proximity Designs is a design NGO company that operates as a social enterprise. It was launched in Myanmar in 2004 to help farmers and agricultural workers access better technology, based on a perception that this need was not being met by the public and private sectors, or by humanitarian aid work. Proximity Designs develops affordable

products for rural workers, involving them in the design process to make sure they meet user needs. The organisation has three business units: farm technology, farm advisory services (FAS), and Proximity Finance, which develops loan products for farmers. Proximity's R&D focus is on irrigation, aiming to address the challenge of water management in Myanmar where percentages of irrigated farmland are amongst the lowest in Asia.

During the developing season, Myanmar's Irrawaddy Delta is an energetic green interwoven of rice fields (medium site). In any case, two times every year, after the gathering, these 2,000,000 sections of land are consumed with blazes, which heat the soil and send tufts of thick, dark smoke surging very high.

Open-field burning is a centuries-old tradition, made necessary by the narrow window of time that farmers have to clear their land of crop residues before planting for the next season. Consuming the intense, well-established straw stubble abandoned after gathering has various disadvantages. As well as making the air disagreeable to inhale, causing boundless medical issues, and adding to environmental change, it likewise attacks the dirt, denying it supplements and making it hard and truly challenging to work. This implies farmers should apply more compost, and frequently need to lease hardware, additional work, or both to work the heated topsoil.

The agronomists, designers, and frontline teams worked alongside farmers for three crop cycles during the research phase.

The result of the research and design process is a microorganism-based formula that can be spread across fields to speed up the decomposition of the rice straw, in under two weeks without the need for burning. It is made from a mixture of Effective Microorganisms (EM), a type of biological soil amendment made up of beneficial microbes, rice bran, a byproduct from rice mills, and nitrogen fertilizer.

With most regenerative practices, it requires a long investment to receive the financial rewards, which is the reason reception is frequently sluggish. With our No-consume Rice cultivation practice, farmers can see the profit from their speculation within one season.

As a matter of fact, they can recuperate the expense of the definition — around USD 25 for each section of land — in something like thirty days on the grounds that no-consume cultivating requires less plowing and manure prior to planting.

It also returns nutrients to the soil, leading to more rich, biodiverse land and improved crop yields at the next harvest. Based on our initial impact study with 350 farmers, they experienced a 10% increase in yields from applied acres and USD 500–1,000 in net farm income increases, equivalent to about 14% of their annual household incomes.

Farmers can also see and feel the improvement of their land. The farmers say they step on the soil and they can tell it's rich. It's also more pliable. This helps farmers to roughly halve the costs of hiring workers to till the land before sowing, buying diesel, and renting machinery.

The No-burn Rice Farming practice has clear and immediate benefits. Since the pilot launch in May last year more than 15,000 farmers have purchased our branded-EM bottles to adopt the practice, abandoning the century-long practice of open field burning.

Industry

End-to-end Haulage Operations, Kobo 360, Nigeria

Kobo360 was established in 2018 to settle the failures in Africa's store network, by making a stage that associates producers and freight proprietors with truck administrators, to move their merchandise consistently across the landmass.

Kobo360 uses data analytics and artificial intelligence to reduce inefficiencies in last-mile delivery, provide transparency and visibility, reduce communication gaps within the entire ecosystem, optimize pick-ups and deliveries, and improve routes in real time. Kobo360 has a physical presence in 7 African countries; Nigeria, Benin, Ghana, Uganda, Kenya, Côte d'Ivoire, and Burkina Faso.

According to the World Food Programme, one-third of food produced by human consumption is lost or wasted globally (Oluwaseun, 2022). Foods such as fruits and vegetables, ice cream, poultry, seafood, dairy products, and beverages require maintenance at predefined temperatures and are exposed to atmospheric conditions. Moving goods in temperature-controlled trucks – is vital for agriculture and agribusiness as well as pharmaceuticals. Yet, temperature-controlled logistics (TCL) is virtually non-existent in most of the African countries. Every year, losses between 40 to 50% are a trend across Africa. The lack of cold storage accounts for at least a quarter of post-harvest losses.

In 2020, in an organisation with the Worldwide Money Company (IFC), KOBO started to concentrate on strong virus chain capacity in Nigeria with an emphasis on reasonably cooled TCL.

In 2021, KOBO, the IFC, and the UK Department for Business, Energy & Industrial Strategy (BEIS) asked innovators around the world for climate-smart, TCL solutions that can help Nigeria tackle its food wastage, and support its health sector.

KOBO is getting to work with some of the most innovative cold chain storage technology in the world to deploy solutions in Nigeria.

ChillTech is one of them. ChillTech has developed proprietary absorption chilling technology that turns the waste heat from the toxic gasses of diesel engines and gas micro-turbines into cool air and water. The technology is used to cool anything from storage units containing perishable food to air conditioning for homes and offices. Engineers at the company have also designed a novel mobile unit that uses absorption chilling to provide refrigeration for perishable foods and medicines. With a 7 kW unit mounted on a truck, a 40-foot container can be cooled for the duration of a trip, powered solely by the heat from the exhaust of the truck. Câm Dairies is already using a PCM-enabled rechargeable mobile chilling system developed by Tessol and Gricd, two of

our innovation Partners. After a single charge, a Câm Dairies truck can maintain ambient temperature for 15 hours without a direct power source.

KoboCare offers enlisted truck proprietors and drivers on Kobo360 with truck funding, limits on diesel, and quality tire buys.

Kobo360 through its services reduces transporters' expenses by over 40% on truck maintenance.

A robust insurance policy covers Goods-in-Transit for every trip on the Kobo360 platform. Monthly vehicle inspection and Auto-servicing. Inclusive insurance package protecting vehicles/trucks from fire, accidents, and third-party damages. Tyre and Oil replacement. Payfasta offers customers access to credit in multiple countries.

Payfasta gives complete visibility overpayment requests, invoice due dates, and completed payments.

The Additive Manufacturing (AM) Strategy, South Africa

The AM Strategy was introduced by South Africa's Department of Science and Technology (DST) and is aimed at positioning South Africa as a global competitor for 3D printing technologies through the identification of future market and product opportunities (Tess, 2016). The AM program upheld by the DST centers around propelling 3D printing advancements in the field of titanium clinical inserts and aviation parts, as well as polymer AM for design.

Among the institutions participating in the collaborative AM programme are the Vaal University of Technology, which has a particular focus on the tooling and casting sectors, Stellenbosch University, and Bloemfontein's

Central University of Technology (CUT) Place for Quick Prototyping and Assembling, which works with the clinical area and on the advancement of plastic and metal 3D printing materials.

3D4AgDev Project:

The 3D4AgDev project is funded by the Bill and Melinda Gates Foundation, GIZ, and supported by the University of Galloway. The task utilizes 3D printing to give ladies smallholder farmers the capacity to foster their work-saving agrarian instruments that are tailor-made for their way of life, soils, and trimming systems (Naudé, 2017).

The tools can provide routes out of poverty by improving the labour productivity of smallholders' agricultural systems. Tools may save labour, lead to higher yields and incomes, reduction of child labour, and more time for other activities. The project enables user-led innovation where end users are involved in the research and design of an innovative product or process. The use of 3D printers enables rapid prototyping of their ideas. Female smallholders who lack formal education can design agricultural hand tools and household food processing equipment that meets their own needs. Plastic

prototypes can be copied by local tool manufacturers, developing their modifications to ensure that the agricultural tools are suited to the purchasing power and needs of smallholder farmers.

The project is run by a research team that consists of an interdisciplinary group from the University of Galway. Participating organisations are the International Centre for Tropical Agriculture (CIAT), Client Relationship Specialist (CRS), Concern Worldwide, and MakerBot.

Hyrak Machine:

South Africa also has the world's biggest 3D printer, the Hyrak, which uses titanium powder to print customised parts (Campbell, 2021).

The printer was designed and built as part of a collaboration between Aerosud Innovation Centre, a private supplier of aero structure & aircraft interior components, and the Council for Scientific and Industrial Research's National Laser Centre, a public research organisation. It was funded by the South African Department of Science and Technology. The 3D printer already has clients in industry, notably in aeronautics, allowing the country to supply South African parts from South African machines to South African aircraft (Wild, 2018).

The Hyrax uses the form of AM known as laser-based powder bed fusion. This technique uses powdered material (originally mainly polymers but now also metals). The powdered material is melted (usually by lasers or electron beams) into the desired shape, again layer upon layer.

The Hyrax can build objects with a volume of up to 200 mm diameter by 250 mm, in nonreactive materials, such as stainless steels, maraging steel, cobalt chrome, and Inconel, and reactive materials such as aluminium and titanium.

Its 400 W laser is a solitary mode Yb fiber instrument and its optical framework is a post-objective galvo scanner (both laser and scanner are imported from Germany).

It has a focus diameter of between 80 micrometres and 5 400 micrometres and can produce layers with a minimum thickness of 30 micrometres. The inert gas it uses in the process chamber is argon or nitrogen. Even with imported key components, the Hyrax is much cheaper than an equivalent machine imported into the country.

The Shoe Manufacturing Industry:

The cooperation between Val University and the shoe manufacturing industry has resulted in the conceptualization of entirely new products, especially to molding of shoe lasts and soles. Through research collaboration between Val University and the shoe manufacturing industry, the printing of shoes is shaping the use of acrylic plastic powder and colored chemical binder. As of now, Nike and New Equilibrium offer top-of-the-line football and track shoes with projection plates that are made by AM.

Additive Manufacturing in the Aerospace Industry:

South Africa's added substance production is utilizing titanium to supplant different metals utilized in assembling aerodynamic and military parts because of its solidarity to weight proportion. A model is a coordinated effort between the Centre for Quick Prototyping and Assembling (CRPM) of CUT and the Aeroswift project facilitated at the CSIR Public Laser Place, which brought about the printing of 3D titanium airplane parts produced for both Boeing and Airbus (Williams et al, 2007)

Lightweight structures are critical from techno-economic and cost management perspectives (Klenam et al, 2022). Materials used in the design of typical aerospace components are metals, polymers, composites, and ceramics. Metallic components are produced from Al-based, Ti-based, specialty steels (stainless steels), Cu-based, refractory-based, Ni-based, Co-based, and Fe-based superalloys. Composites include carbon fibre-reinforced polymer composites.

Additive Manufacturing in Emerging Energy and Electronic Devices:

The world is in a massive state of energy crisis coupled with increasing use of fossil fuels with global climate implications.

The use of petroleum derivatives has multiplied starting around 1974 as per the Global Energy Organization (IEA).

Using the 3D printing approach, the usable life of these batteries and supercapacitors can be increased while using low-cost materials instead of catalysts and electrolysers from expensive platinum group metals, especially with the advent of current water-splitting technologies.

Additive manufacturing has been used to fabricate turbine blades for various energy-harvesting applications. Selective laser melting was used to design graded lattice structures to replace the internal solid volume of turbine blades. Through the 3D printing process, there was ~33.41% to 40.32% reduction in the weight of the turbine blade, a stress rate of 25.52% to 48.55%, and ~7.35% to 19.58% deformation rate.

Additive Manufacturing in Building and Construction:

The conventional construction methods relied on replica models to design and construct structures. These models are in two aspects and are being progressed to 3D models driven by the structure data displaying (BIM) devices. The application of AM in the construction industry is synonymous with using architectural design tools to produce small and megastructures, walls, and façades of buildings. This transition to 3D BIM tools is due to the recent drive towards automation, reducing cost overruns and overhead costs, and reduction in completion time. For instance, the cost of printing a house is the same as printing a concrete block.

Drones, Kumba Iron ore, South Africa, Skyriders

Unlike the old technologies – the pneumatic drills, which were once the regular machine for drilling at Kumba Iron Ore, one of the largest mining companies in the world, drones are now being used (espace, angloamericankumba sites).

Miners used to be on the pneumatic for over 8 hours to make drilling holes to place explosives (ropeaccess site). Now, the story has changed. With South African AfirSkyriders drones, workers can be in the comfort of their offices and automatically use drones to drill.

Drones outfitted with cameras and scanners can provide data on operations and current conditions in the mine, increasing worker safety, and efficiency and up-skilling workers who manage the drone fleet.

Kumba has seen such a return on its investment in drone technology that it has worked through a complex two-year legal process to earn an operating license to fly its drones, with its staff licensed as drone pilots.

Anglo-American subsidiary Kumba Iron Ore is using a small fleet of drones to optimise the surveying processes at its famous Sishen mine in South Africa (african decisions site; Arnoldi, 2018).

Kumba's permit to work its robots - with its pilots, and at levels of up to 1,000 ft over the ground - is the aftereffect of a determined foundation and a huge number of rands worth of investment.

Five staff have been trained to pilot the drones, and they are licensed by the South African Civil Aviation Authority to use the technology.

Somewhat English Americans have additionally settled new working practices, like booking flights, flight routes, and art support. As abilities sets go, these are new to the Somewhat English American gathering, and the organization is anticipating growing further new abilities as robot innovation advances.

Tolaram, Nigeria

Tolaram is a Singaporean organization that started tasks selling materials in Nigeria during the 1970s (van Bever and Ojomo, 2016).

Executives and brothers, Haresh and Sajesh Aswani, however, saw an opportunity to create an instant noodle market in the country. In 1988, they began importing Indomie noodles. In any case, to focus on the nearby market, Tolaram chose to construct assembling and conveyance capacities in Nigeria when the traditional way of thinking exhorted against it. Tolaram has grown to almost $1 billion in turnover, built and operates 13 manufacturing plants in Nigeria, and runs a 1,000+ plus truck Logistics Company.

Indomie Noodles:

At the point when Haresh Aswani chose to begin bringing Indomie Noodles into Nigeria in 1988, the odds were not good for his organization, Tolaram (Ojomo, 2016). Nigeria was ruled by a military government, GDP per capita was only $256, and 78% of people lived on less than $2 per day. But Aswani began importing noodles into Nigeria and since then, has built 11 factories that manufacture many of the inputs for the noodles. The company directly employs approximately 10,000 people and hundreds of thousands indirectly. A packet of Indomie Noodles costs roughly 18 cents, a product affordable by the majority of Nigerians. Tolaram has started development plans for other African nations. Where many see snags, the organization sees an open door.

Addmie:

Multi-national conglomerate, Tolaram Group has launched a new mixed additional seasonings range, "Addmie", produced for indigenous, international, and continental cuisine (thisdaylive site).

Addmie is an innovative all-regular 3 out of 1 mix made with painstakingly chosen blended vegetables, proteins like Crawfish and Chicken pieces, and preparing powder.

The new products were in line with the group's commitment to not just simplify the cooking process but also make everyday meals more nutritious for all families. With Addmie, they want to make the process of adding vegetables and proteins to the meals easy and convenient.

Tata Low-technology Water Filter

Affordable products for low-income consumers in the global South Starting with the needs of resource-constrained consumers in developing countries, some companies are adapting products to their preferences and pockets. Tata Consultancy Services developed a low-innovation water channel that filters water with rice husks, a typical byproduct in India. Tata Chemicals, the maker of the device, produced this mobile, robust device for an initial cost of 24 dollars and 4 dollars for the replacement filter.

Godrej – Chotukool Refrigerator, India

In February 2010, Godrej Group's appliances division, Godrej & Boyce Manufacturing Co Ltd, test-marketed a low-cost refrigerator (called the world's cheapest model at Rs 3,250) aimed primarily at rural areas and impoverished customers in India. The product is powered by batteries and uses cooling chips. To promote product expansion and adoption, the company has devised a unique financing scheme for buyers.

The Chotukool refrigerator is an example of reverse innovation because it was designed to meet the needs of consumers in developing countries, rather than developed countries. It is a low-cost alternative to more expensive refrigerators and meets the specific needs of these markets.

The problem was that after initial market success, sales of the ChotuKool quickly declined and after two years only 15,000 had been sold. Chotukool served a necessity that did not exist in the eyes of the consumer.

Haier Mini Magical Child Washing Machine, China

Mini Magical Child" launched in 1998 by Haier is based on the concentric washing technology allowed to increase efficiency, reduce noise, and save water.

Haier read the market and analyzed that summer was a slack season for washing machine sales in China as most families do not prefer using washing machines in the summer (Zeschky et al., 2011). Haier decided to attract consumers by offering new products i.e. washing machines with low, medium, and high-water levels that can wash just one pair of socks or underwear. The "Mini Magic Child" saved electricity, water and & space. It got an excellent response from the consumers, they embraced the change. The success encouraged Haier to continue its series and it exported its product to 68 countries in Europe, Asia, Africa, and America. Although Haier was a large company, however, its flexibility, observation, and readiness to create new value for its customers encouraged it to experiment with disruptive ideas. Thus, generating profit as well as changing the lives of its consumers.

India - Aakash Tablet - Raja Singh Tuli and Suneet Singh Tuli

In 2010, the Indian government announced the improvement of the Aakash tablet to give ease computers to the nation's developing student population (grassrootstechnology and akashtablet sites).

It doled out the Indian Institute of Technology (IIT) Rajasthan the undertaking of developing the initial 100,000 tablets at the US$35 value point. IIT Rajasthan took after an open offer process and chose the most minimal bidder (DataWind) among all offers regarded as qualified.

The Aakash tablet can be credited to the careful endeavors on the part of Raja Singh Tuli and Suneet Singh Tuli siblings.

In mid-2011, the organization in like manner proclaimed that there would be two variations of the tablet: Aakash computers, supported by the governing body and flowed to students at US$35, and the Ubi Record 7, monetarily open at US$60. Kept testing of the Aakash tablets by students featured the requirement for a few changes, for example, longer battery life and a speedier processor. In November 2012, the device was sold at US$21 for students of design universities, with the administration financing the other portion of the cost.

Datwind is a pioneer in minimal effort web availability and gives web communication services (datawind website). Datawind web conveyance Platform offers minimal effort Internet network policy by packaging a moderate figuring device with an economical one-year prepaid web reading administration plan.

Energy

UpOwa SAS, Cameroon

As of the end of 2018, upOwa SAS had installed more than 4,500 systems mainly across two central regions of the country, connecting over 20,000 people to clean energy (REPP site). A successful EUR 3m capital raise in 2019 – including EUR 1.3m equity financing from the Renewable Energy Performance Platform (REPP) enabled the company to embark on a rapid expansion phase.

REPP was established in 2015 to catalyze the development of sub-Saharan Africa's environmentally friendly power area by assisting engineers with overcoming hindrances to finance.

This has resulted in over 26,000 installations by 31 March 2022, connecting nearly 130,000 people, as well as 374 micro-businesses and nearly 100 critical services such as schools, clinics, hospitals, and water pumping stations.

UpOwa makes available systems to off-grid households using a lease-to-own model. Customers pay a deposit and then make monthly payments on a mobile phone money platform with targeted repayment periods of 18-24 months. Clients can pick either a 6Wp lights or telephone charging-just framework, a 10Wp framework with a radio, or a 40Wp to 50Wp framework that gives extra capacity to different machines, for example, televisions with variable screen sizes.

In October 2020, REPP expanded its interest in upOwa with an EUR 500,000 convertible credit, bringing the all-out resolved to date to EUR 1.8 million.

Different financial backers behind the task incorporate French family-possessed influence venture organization Colam Effect, which has made both a value speculation and a convertible credit. The organization got obligations from ElectriFI, Lendahand, BPI, and most as of late, a mezzanine office from the Energy Entrepreneurs Growth Fund (EEGF).

Drone Applications for Energy, Nigeria

Beatdrone is a multi-sector drone service provider primarily functioning in oil and gas (beatdrone site). It provides detailed optical imagery in case of flare stack head inspections without the need to shut down the facility as well as early detection of weak pipelines while providing real-time security surveillance. Specifically, in the oil and gas sector as a sensitive sector, where companies lose millions of dollars every day, they use drones for detailed optical imagery in case of flare stack head inspections without the need to shut down the facility as well as early detection of weak pipelines while providing real-time security surveillance. A normal inspection of a flare stack takes about 1-2 weeks for an offshore rig, and hundreds of thousands of barrels are drilled per day, so the company loses millions when it is shut down. However, with drones, they do not need to shut it down.

Beatdrone also uses their technology, which can go down to the seabed and collect data by mapping the sea floor and be used for the analysis of equipment used for drilling. This limits the time that divers spend under the water to do this, saving time and increasing the value for money.

Concerning the infrastructure sector, it can carry out topography mapping for construction companies, map and identify dump/mining sites for mining companies, do mast structural integrity inspections for telcos, and inspect large solar installations for renewable energy projects.

Azuri, M-Kopa, and Mobisol, Kisumu County, Kenya

Azuri delivers affordable solar home systems on a commercial scale to customers in 12 countries in sub-Saharan Africa.

The company has sold more than 150,000 systems to more than 750,000 beneficiaries and customers spanning three East African countries - Kenya, Uganda, and Tanzania. Established in 2011, M-Kopa combines the power of digital micropayments with Internet of Things (IoT) connectivity to enable access to funds in the provision of solar systems. The services offered by M-Kopa include access to solar lighting, energy-efficient televisions and fridges, smartphones, and cash loans.

Mobisol was established in 2010 to improve access to affordable energy systems and services to its customers in rural communities. Mobisol installed over 800,000 SHSs for households and small businesses to improve lives and stimulate economic activities in underserved, off-grid rural communities in sub-Saharan Africa.

These three companies have operated in Kenya for almost a decade providing various renewable energy products and packages for low-income households, and underserved and remote communities.

M-Kopa pioneered and kick-started the wider pay-as-you-go (PAYG) solar market; they use a combination of pay-as-you-go and flexible payment schemes, particularly for households who cannot afford an upfront, lump-sum payment.

M-Kopa's core innovation lies in the business model that's been developed to make it affordable for its customers. "Kopa" means "to borrow" in Swahili, and each system the company sells is in effect a loan of about $165 (£123). Clients pay $35 (£26) upfront and agree to make a daily payment of $0.45 (£0.34) for a year, after which they own the system.

Azuri's Quad Solar Home System provides a complete household lighting package for as little as $0.50 (£0.37) per day.

The Mobisol Solar home system (SHS) is a large integrated home and business-level energy system with a solar panel, battery, power electronics, appliances, and pay-as-you-go functionality. The monthly installment fee in Kenya is between $18 (£13) to approximately $54 (£40), depending on the system configuration purchased. The

system supports payments through multiple mobile money platforms in the target countries, including M-Pesa, Tigo Pesa, Airtel Money, and MTN Mobile Money.

M-Kopa provides this solution by providing households with access to SHS, lighting systems, and charging points for mobile devices. The SHS comes with a control box that contains the battery and a SIM card that can communicate with M-Kopa headquarters in Nairobi. When a customer makes a payment via a mobile phone, the SIM card sends a signal to activate the batteries. The company also offers customers energy-efficient appliances and an opportunity to build a credit record that improves long-term socio-economic status.

Azuri's product comes with four powerful LED lights, a rechargeable radio, a torch, and a mobile phone charging point. Once service providers fully recover the costs of the SHS, all the energy generated is free. Additionally, for customers who wish to upgrade their SHS, AzuriTV provides a 24-inch super slim LED TV, which comes with over 100 satellite TV and radio channels. Azuri (SHS) features HomeSmart, ensuring customers have 'light all night' by monitoring climatic conditions that adapt to customers' lighting and usage needs.

KopaGas, Tanzania

The project has deployed next-generation Liquid Petroleum Gas (LPG) canister meters. This framework is furnished with machine-to-machine (M2M) innovation, empowering medium and low-pay families to reverse away from grimy and costly charcoal.

The business model eliminates upfront costs and allows households to pre-pay for gas quantities that fit their budget, improving households' financial planning. The Pay-as-you-Cook (PAYC) referred to in this pilot, has improved access to clean cooking fuel.

The GSMA Mobile for Development Utilities Programme awarded an Innovation Fund grant to KopaGas to design a low-cost meter for LPG canisters and test a Pay-As-You-Go (PAYG) cooking gas service, which inspired the KopaGas PAYC service. KopaGas subsequently partnered with Oryx Energies, a leading LPG distributor in sub-Saharan Africa, to source and distribute gas canisters in Dar es Salaam.

The project began with 5 customers as a trial in December 2016 and rolled out the service to 148 households and 2 businesses by August 2017. Only 5% of Tanzanian households use LPG consistently. About $60 to $100 is required to invest in a gas cylinder, stove, and accessories, which is roughly equivalent to 20 to 30 days of income for a household living on less than $3.10 per person per day. The refilling costs for a full cylinder represent an additional seven to 15 days of income. For the PAYC service, KopaGas designed a smart meter on household gas cylinders.

KopaGas aimed to deploy a PAYC service model for customers who cannot meet the upfront expense and refilling costs so that they can afford clean cooking gas for as little as $0.45 per day. The PAYC service included cylinder delivery to the customer's home. KopaGas recruited PAYC customer households for the pilot project from a women's savings and credit cooperative (SACCO). The SACCO served as an avenue to mobilise women and create awareness of the system through demonstrations and seminars.

Households paid $4.50 to register and an optional $9.00 for a stove sold on commission by the SACCO. The smart meter, gas cylinder, and unsold portion of gas remained the property of KopaGas, while customers had access to the LPG content.

The PAYC service uses mobile money and GSM machine-to-machine (M2M) connectivity. Households pay via mobile money, specifically Vodacom's M-Pesa, for gas purchases. Payment information from the mobile money platform to the KopaGas cloud servers then updates the smart meter in real time using GSM M2M connectivity.

The meters periodically relay information on gas consumption, cylinder usage, and battery levels and have an anti-tampering safety functionality. When a cylinder is nearly empty (as measured by the meter), the meter generates a message prompting KopaGas staff to deliver a full cylinder.

An update of credit information is given via mobile money payment. The meter display shows the time, gas remaining (GR), credit available (CR), battery level (BL), and volume of gas used (VU).

Gaz Lite, the Philippines

Gaz Lite is a liquefied petroleum gas (LPG) canister developed by Filipino firm PR Gaz to solve the problem of indoor air pollution from the use of solid fuels such as wood and charcoal in the home. Benefits are multi-faceted: better health, shorter cooking times, lower household expenses, and micro-entrepreneurship opportunities. PR Gaz has set up over 800 community stores as canister retailers.

Brenton International Venture Manufacturing Corp. (BIVMC), the leader in liquefied petroleum gas (LPG) serving commercial and industrial clients since 1992 and a member of the Brent Group of Companies, has lately acquired the assets and operations of PR Gaz in 2003 (brentgas site).

Transportation

SafariSeat Wheelchairs, Kenya

The story began in Kilifi, Kenya, when Janna set out to develop SafariSeat in 2016 (tai.ngo site). He attached forces with Cara, Bertie, and James and collectively they founded, crowdfunded, and launched the SafariSeat venture. With the help of an ever-expanding team, Janna's original dream has evolved and grown into The Accessible Institute (TAI), an international organisation whose impact has reached hundreds of people in Africa.

It is a new wheelchair design that can navigate rough terrain found in African countries and other developing countries. It works via a lever system, where the person can pump hand levers to regulate the wheelchair's speed and power. SafariSeat's goal is to implement an open-source toolkit in developing countries where the blueprints are free

and the resources necessary to build these wheelchairs come from bicycle components at a low cost for local workshops.

An open-source toolkit has three components that contribute to its success: the use of diagrams for building purposes, a communication network, and a design portal where people can submit ideas for improvement.

Tata Ace, Chota Haathi, India

The downturn in the business vehicle area that started in 1998/99 was drawn out and profound. Toward the finish of 2000 four groups essentially studied four portions - halfway business vehicles, light business vehicles, medium business vehicles or more, and the sub-four-ton market.

In early 2001 the tams learned that there was a need for an affordable four-wheeled truck with more stability, safety, comfort, all-weather protection, and one that could carry more load. A truck half the size of a Tata 407, a 2.25 tonner was planned for the bottom of the pyramid, Tata Ace.

In 2005 Tata Ace came into existence. The Tata Ace was powered by a small 700cc diesel engine capable of producing 16hp of power and a peak torque of 37.5Nm. The motor is matched to a 5-speed synchromesh transmission. Albeit the motor was little, the body on outline suspension provided it with plenty of choices. Goodbye Expert turned into a tremendous achievement. Independent ventures began involving it for the lightweight freight carriage and Goodbye Pro became famous across India under the name, 'Chota Haathi'.

 In 2007 Tata Ace Magic launched a four-wheeled passenger carrier. Tata Ace compressed natural gas (CNG) was launched in 2008. Tata Motors had to set up a committed plant at Pantnagar to meet the increased demands.

The truck was a huge hit in the market as nobody thought of a four-wheeled truck until then (Vipparthi, 2020).

A smaller engine-powered Tata Magic Iris was launched in 2011 and it was aimed to compete with autorickshaws. The 600cc engine was capable of producing 11hp of power and 31Nm of torque. The top speed was a mere 34kmph. The fuel efficiency was around 15kmpl which proved to be a vital point for sales. Within 2 years i.e., by 2012, another 500,000 units were sold by Tata. A total of 1 million Tata Ace was sold.

In 2022 Tata power up a Tata Ace mini-truck with a Tesla Power USA Battery (Tesla Power USA, 2022).

Tesla Power USA business vehicle batteries rush to re-energize, have low upkeep, and are ready to adapt to the changing Indian environment and high cap temperatures in the vehicles.

Tata Nano

Tata Nano was the next project after launching Tata Ace which was intended to be an affordable passenger vehicle. All the non-essential features of a car were removed which brought down the price of the car to a great extent. Parts such as the passenger's side wing mirror, one wiper blade, and other interior parts were removed. The size is approximately 10 feet long which is unconventional to the other four-wheelers on the road in India. It is a compact car that is low-cost, fuel-efficient, and can easily manoeuvre on the busy road lanes in India. Tata suggests that the car has been designed to address the needs of a middle-class Indian family.

Tata Motors introduced its affordable car 'Nano' (meaning "small one" in Hindi and Gujarati) in 2009 (Ehsan, 2021). The Tata Nano is a rear-wheel drive, four-door car with a petrol engine that seats up to five people. It has a length of just over three meters.

The Nano was designed for India's congested cities, which would ease traffic congestion and pollution by bringing more people onto the roads.

However, the sales of the car subsequently dropped during the later months after its launch. The car's production ended in 2018 and hence did not reach the depths of the Indian economy. One of the issues associated with the decline in sales was in terms of delivery expectations of the customers.

The Nano could have a potentially disruptive impact on the 84 European automotive market (Aschmoneit Di Janevska, 2013). In addition, the criteria determining whether we have a case of reverse innovation such as the origin of the idea for the Nano, the place of its development, and its market introduction (both primary and secondary), are all clearly related to India and other emerging/Emerging Market (Sri Lanka and Nepal).

The car might have too few features to be appealing to consumers, even the ones from the middle and lower classes, and it might not offer a satisfactory purchase. There is an ongoing debate about the safety of the Nano and its compliance with various automotive standards which could be the result of the Nano's overemphasized frugality.

Irrespective of how the car turned out in the automobile sector, it is important to understand that Tata Nano was responsible for a new market creation (Singh and Srivastava, 2012). This market tapped the bottom of the pyramid by providing diversity in the four-wheeler segment (Singh and Srivastava 2012). Even after the car did not reach the interiors of the towns and small cities, the Tata group had set up access points in interiors for test drives. They also established 'F' class showrooms, which had only one car in the showroom, and hired additional men to man the showrooms (Singh and Srivastava 2012).

Finance

Alternative Credit Scoring

Kwara, Kenya:

Kwara gives secure, basic, and reasonable on the web and versatile banking for SACCOs, otherwise called credit organisations and local area banks. In 2018, the

Nairobi-and Berlin-based business set off to enable money cooperatives in the Emerging Market to address their issues immediately and assist them with staying away from costly savage other options.

Timo, Vietnam:

Since its send-off in 2015, Vietnam's most memorable computerized bank, Timo, has quickly advanced into one of the nation's most granted banks, named both 'Quickest Developing Advanced Bank' and 'Most Innovative Computerized Bank' at the 2020 Worldwide Financial Matters Grants.

Laid out in 2015, Timo was quick to offer an expense-free, simple, and helpful computerized financial involvement with Vietnam. From that point forward, Timo has sought to set the benchmark for current banking, in Vietnam and then some.

Timo has taken the innovative step of Partnering with high-profile retail brands including McDonald's and 7-Eleven, setting up kiosks – known as 'hangouts' – in high-traffic retail outlets to empower clients to join to turn into Timo clients rapidly and helpfully. This approach has assisted with expanding Timo's memorability and permitted the bank to interface straightforwardly with clients, especially the more youthful age.

TymeBank, South Africa:

South Africa's unbanked and underbanked populace is estimated at 11 million. Given its objective to strive for financial inclusion, TymeBank has made it a priority to increase banking access and simplify the process. Meeting a test of this scale would have been very difficult as sending off another bank while having the option to consent to severe South African financial guidelines is a huge endeavor.

As another contestant, TymeBank realizes that offering continuous financial encounters that are one-of-a-kind, customized, and instinctive alongside brilliant client care, will be essential to progress. Cooperating with store chains 'Pick n Pay' and 'Fighter' gave TymeBank access to 800 stores and permitted them to introduce ongoing biometric acknowledgment stands that clients could visit to open a financial balance. With simply their character number and no extra desk work, the client is given a customized, initiated Visa charge card in five minutes or less.

Following a delicate send-off in December 2018, when TymeBank went to inhabit 20 'Pick n Pay' and 'Fighter' stores the nation over, the bank developed to 50,000 clients in just shy of 90 days.

When the bank decided to refresh its core banking system, it selected Mambu's cloud-native banking platform because it offered infinite scalability and quick time to market. The execution required a half year and during that time TymeBank moved 85% of its foundation to the Amazon Web Services (AWS) stage, a shift that permitted TymeBank to divide their functional expenses.

GoTyme Bank, The Philippines:

'Born straight in the cloud', GoTyme Bank is using Mambu's SaaS cloud-native, API-first banking platform to scale efficiently, improving access to financial services to millions of Filipinos who can now open an account and get a debit card in under five minutes.

GoTyme Bank offers computerized financial services by means of stands set up in retail outlets having a place with Robinsons Retail Property Inc. under the Gokongwei Gathering.

GoTyme Bank will have in excess of 500 booths in activity toward the finish of 2023. These GoTyme stands, which will be opened right the nation over, will empower access to get, advantageous and excellent financial services to the large numbers of Filipinos who are at present prohibited from the conventional financial framework.

Products and services on a proposition to clients by means of GoTyme Bank at send-off incorporate a free Visa charge card for face-to-face and online buys, bank moves through the mobile application, and an important prizes program.

Ualá Argentina:

Ualá is an Argentina fintech organization that Launched in 2017 giving paid ahead of time Mastercard records to clients managing financial exchanges both locally and abroad.

A 100% digital offering, Ualá quickly became successful after it saw an opportunity: an imbalance in Argentina where mobile phone penetration stood at 92% while banking penetration lagged at 50%. In 2019, in the wake of deciding there was worth tracking down in addressing an absence of access to credit notwithstanding more than adequate smartphone accessibility, Ualá extended by adding buyer advances to its item advertising.

Investors have taken note of the company's early success. Because of numerous rounds of weighty support from heavyweights like SoftBank Latin America Asset and Tencent, Ualá today depends on the financial muscle that supplements its mechanical spryness and vision.

Take, for example, Mexico, where it recently announced plans to acquire ABC Capital. Not halting there, Ualá likewise launched its financier services in late 2021 and later ventured into the Colombian market in January 2022.

Home-owners Planning Home, Mexico:

Property holders arranging home improvement projects are offered credit through their workers for hire by means of a smartphone. Data about the clients and their development projects is gathered continuously, handled by extraordinary qualification measures and mechanized investigation, and endorsed for dispensing.

On-Demand Finance

Cash-In, Cash-Out (CICO), Kenya:

CICO is how money enters and exits a digital ecosystem. This is significant predominantly on the grounds that this functionality permits disconnected (cash-based) and on-the-web (computerized) economies to cooperate really (something that has not been addressed in many markets worldwide).

Kenya is a center-pay country with a north of 47 million individuals. In Kenya, CICO development is occurring around the metropolitan groups, development of CICO in provincial and remote groups is essentially slower. Northern and western pieces of Kenya do have not many specialist outlets by virtue of restricted financial movement; the absence of a fundamental foundation; and climatic and segment subtleties. The key occasions that prompted financial records and specialist network development include the send-off of M-Pesa in 2008, Organization Banking guidelines in 2010, Public installment systems guidelines, and the nullification of specialist selectiveness in 2014.

Gojek's 'On-Demand Everything', Indonesia:

Gojek is Southeast Asia's leading on-demand, multi-service tech platform providing access to a wide range of services including transport, payments, food delivery, logistics, and many more (gojek site). Established in 2010 to give answers to Jakarta's consistently present traffic issues as a top priority, Gojek began as a call place with an armada of just 20 cruiser cabbies (ojek).

With the standard of utilizing innovation to work on the existences of clients, the Gojek application was Launched in January 2015 for clients in Indonesia to give motorbike ride-sharing (GoRide), conveyance (GoSend), and shopping (GoMart) services. Today, Gojek has changed into a "Super Application": a one-stop stage that interfaces clients with north of 2 million enlisted driver-partners and 500,000 GoFood shippers.

The app has also been downloaded over 170 million times across the region. By giving incalculable encounters across different areas, Gojek has helped - and keeps on aiding - make more incentives for society by further developing proficiency, efficiency, and financial consideration.

Go-Jek is currently likewise hoping to expand on to this by settling the money-out functionality by means of their obtaining of Mapan, an Online to Offline (O2O) startup that gives a local area-based reserve funds and credit stage that counts north of 1,000,000 families across 100 urban communities in Indonesia as individuals.

It would turn into an organization of drivers and shipper specialists giving money in focus to a wallet connected to a menu of O2O services in addition to the capacity to arrive at last-mile clients and their spending information.

The main two e-installment players in Indonesia Go-Jek and Tcash, exploit the way that a bigger number of Indonesians own smartphones than ledgers (Maulia, 2018).

In April 2016, Go-Jek wandered into financial innovation with the send-off of Go-Pay. The comfort of paying and tipping drivers with an e-wallet made a huge, developing client base: a big part of Go-Jek's 100 million month-to-month exchanges are handled through Go-Pay.

Tcash, meanwhile, rides on the vast network of its parent company, state-owned Telekomunikasi Selular, or Telkomsel. Indonesia's biggest mobile administrator bragged 178 million supporters as of June.

With 97% of Indonesia's mobile supporters on prepaid plans, Telkomsel has long-laid-out organisations with few telecom booths dissipated the nation that sells its broadcast appointment and data packages.

Tcash recruits these kiosks as its agents -- offering people a new way to pay monthly bills, make motorcycle installments, and transfer money, among other services.

Gojek and Tokopedia, Indonesia's two greatest new businesses, have consented to a consolidation that will make an $18bn food conveyance, ride-hailing, and online business group arrive across Southeast Asia (Ruehl, 2021). The blended organization, which will be renamed GoTo, will start planning for a double posting in Indonesia. Different financial backers that have supported the solution incorporate Alibaba, Facebook, Visa, and Google.

Rappi, Columbia:

Born in Bogota Rappi is a Columbian company and the first SuperApp in the region. It was founded in 2015 by Simón Borrero, Sebastian Mejía, and Felipe Villamarin and today is present in Brazil, Argentina, Chile, Colombia, Mexico, Peru, and Uruguay.

Rappi was an early mover in building the region's vast network of couriers and last-mile logistics (Inclusive Money, 2023). The organization was the first in Colombia with its armada of bikes and cruisers, and later outfit the different organizations across the district, changing what was initially an on-request conveyance application into a multi-industry computerized commercial center.

Over the most recent six years, Rappi has launched various new verticals, like Rappi Travel or Rappi Diversion.

From a financial incorporation point of view, the most intriguing vertical is without uncertainty Rappi Money, a choice that permits clients to carry money to the client any place they need it. The organization understood the requirement for clients to have cash readily available, so they actuated an ATM administration to get cash from any site.

The biggest contribution to Rappi happened in March 2019, with $1 billion from SoftBank, the largest investment received by a Latin American startup to date. Last August, Rappi raised a little over $500 million in a funding round, taking its value to $5.25 billion.

Rappi, the SoftBank-upheld Colombian conveyance application, is permitted to offer computerized financial services following endorsement from the Andean country's financial controller (Labs and Reuters, 2022).

Colombia's financial guard dog cleared RappiPay, a joint endeavor between Rappi and bank Banco Davivienda, to work as a computerized bank.

RappiPay began operating in Colombia as a digital wallet, using the Daviplata platform for customers to make payments, transfers, and purchases. With the authorization to operate as a digital bank, Rappi will be able to offer deposit and savings services through its platform.

Up to this point, RappiPay has offered a Mastercard and an online store account, as well as other financial services in Colombia, Mexico, Brazil, Peru, and Chile - contingent upon neighborhood guidelines - yet without offering the full services of an internet-based bank.

In Colombia, RappiPay as of now has nearly 800,000 clients and has given around 200,000 charge cards.

RappiPay boss Gabriel Migowski told last November that Rappi and Davivienda had agreed to invest $100 million in the financial platform.

In June 2022, following first talks throughout 2021, Colombia's Financial Authorities granted authorization to RappiPay, a joint venture between Rappi and bank Banco Davivienda, to operate as a financial entity in the country.

In the wake of accepting its financial permit, RappiPay presently offers a full set-up of financial services, giving full cash control and overseeing answers for its clients, without requiring any paperwork.

Through the 100% digital app, RappiPay users can send and collect money, transfer funds to any bank across the country, pay utilities and bills, withdraw cash at any Davivienda ATM in Colombia, and perform other services, all without any costs or commissions. Moreover, the RappiPay card empowers frictionless and quick installments for in-store shopping.

As a trailblazer in financial consideration, RappiPay is in the main line to give financial Products and answers for underbanked and underserved Colombians, helping the country's digitisation program and driving financial consideration simultaneously.

RappiPay has proactively given in excess of 215,000 Visas in the country, through which it has given nearly USD 4 million in cashback, featuring that for over 40% of clients, this is their most memorable Mastercard. Hence, in a little more than a year, in excess of 80,000 new clients have entered the financial framework with a RappiPay item.

From Mexico to Chile, the key is making a Cross-Boundary organisation.

In 2019, Rappi made a Partnership with Visa to release its debit card in the country. In 2020, it was the financial group **Banorte** that crossed paths with Rappi Mexico: the two

firms have struck a Partnership to become co-owners of a digital financial services venture in the country.

In 2021 Itaú Corpbanca, the fifth-biggest confidential bank in Chile, and Rappi were cooperating to carry more prominent financial consideration to Chile. One more essential organization was endorsed with Chubb, the world's biggest public property and loss safety net provider, to co-make redid advanced protection contributions for Rappi's great many clients across the district.

Data Crowdsourcing

Crowdsourcing involves obtaining work, information, or opinions from a large group of people who submit their data via the Internet, social media, and smartphone apps (investopedia site). Publicly supporting work permits organizations to set aside time and cash while taking advantage of individuals with various abilities or contemplations from everywhere in the world.

As an option in contrast to traditional supporting choices, publicly supporting takes advantage of the common interest of a gathering, bypassing the traditional guards and middle people expected to raise capital.

Publicly supporting ordinarily includes taking a huge work and breaking it into numerous more modest positions that a horde of individuals can deal with independently.

SafetiPin, India:

SafetiPin is a crowdsourced application and online platform that provides safety information in public places. It was established in India in 2013 and its essential capabilities incorporate a security scoring of public spaces, a GPS following capability for clients, and a protected course arranging choice. Clients share data by finishing health reviews. SafetiPin then examinations and alters gathered information and gives conservative security data to all clients as well with respect to city arranging.

There are nine parameters used to assess the security of public spaces: Lighting, visibility, openness, crowd, and diversity of people, nearby public transport, availability of walkways, presence of security personnel, and the associated feeling. By leveraging these nine parameters, an algorithm calculates a safety score for public spaces. Pins on the city map display the safety data and the safety score of each location. Ongoing audits of users ensure up-to-date data.

This crowdsourced data can in turn be fed into Google Maps. Google Maps shows alternative routes, including safety information, so that users can easily select the safest route. If the app is open, it directly alerts the users when a location, rated as unsafe by others, is entered. The user can invite family and friends to track their location until the user reaches their destination.

Currently, SafetiPin is collecting data in 28 cities across 10 countries, such as India, Indonesia, the Philippines, Colombia, and Kenya, and is available in five languages — English, Hindi, Spanish, Mandarin, and Bahasa.

Watch Over Me and WhereIsMyTrasport, South Africa:

Look after me situated in Singapore and WhereIsMyTrasport working out of Cape Town, are both comparative organizations looking to publicly support information to tackle health and versatility issues in creating markets.

The application can inform the development of business models in more mature markets.

So here we have multiple examples of solutions built for local needs but now have the opportunity to solve similar pain points in a variety of global markets.

Aavishkaar Capital, India

Aavishkaar Capital is a pioneer social impact fund located in India. Aavishkaar, which means 'invention' in Hindi, invests in social entrepreneurs with a vision to bridge the opportunity gap for the world's emerging three billion people.

By 2019, Aavishkaar Capital had over US$4.2 billion under management. This was invested in 70 early-stage businesses, half of which successfully exited, generating US$105 million in profits (Nikkei Shimbun 2019). The company estimates that by 2018, it had helped to create 150,000 jobs and improved the lives of 100 million people. Aavishkaar Capital also operates in Sri Lanka and Bangladesh and is starting investments in East and West Africa in 2020 (Aavishkaar 2018).

Aavishkaar Capital created a management consultancy firm in 2002 called Intellecap (Intellectual Capital Advisory Services) to provide know-how to entrepreneurs. The work of guiding entrepreneurs is carried out by the project managers. One strategy was targeting universally applicable and scalable projects that met local challenges, such as waste management and supplying agricultural inputs and products. Another strategy was the formation of a financial conglomerate to support different levels of financial needs so that invested companies can be appropriately financed as they grow.

Aavishkaar Capital is a piece of the bigger Aavishkaar Gathering, which comprises four free gatherings of organizations - Aavishkaar Capital, Intellecap, Arohan, and Ashvi (Aavishkaar Gathering, 2021).

Each offers different functions that are complementary in serving the founders' vision. Intellecap deals with consultation and business advice to entrepreneurs. Arohan engages in microfinance and gives credit to microbusinesses with loans ranging from US $100 to US$1500 (Maximum US$3000). Ashvi invests in small to medium enterprises (SMEs) with entrepreneurial intentions, ranging from US$3000 to US$1.5 million.

Tigo and DCB Bank, India Tanzania

Operator Tigo Tanzania has partnered with DCB Bank (India) to expand financial inclusion for the unbanked through a service Partnership that will enable customers to access the bank's services through mobile payment service Tigo Pesa's network of mobile money agents (O'Grady, 2023b).

DCB plans to leverage Tigo Pesa mobile money agents to mobilise deposits and offers customers enhanced options for fund withdrawals.

DCB has been managing a robust agent network for more than a decade, creating livelihoods for more than 200,000 agents.

To consistently store or pull out assets from financial balances through chosen Tigo Pesa Wakalas (or specialists), all clients need is a Tigo SIM.

E-commerce Platform

Alibaba has helped many family businesses in China connect to the vast domestic and international market by reducing customer discovery and transaction costs (Glennie et al, 2020). Transportation stages have made the course of ride-hailing — provided by casual area drivers of vehicles or cruisers — more effective, offering greatly improved support for clients and more secure working circumstances for drivers.

The expansion of e-commerce in Africa has created a demand for informal bicycle, motorcycle, and taxi drivers to provide on-demand delivery services for vendors, including food service vendors, creating more and better informal sector jobs in the process. Numerous studies in Kenya have also documented the effect of mobile money on non-farm informal business profits and SHF access to credit, as well as positive effects on women's economic empowerment. As well as archiving the neediness-lessening effects of the versatile cash administration M-pesa's rollout in Kenya, Suri and Jack (2016) additionally showed that access to M-pesa accounts, by expanding and safeguarding ladies' reserve funds, permitted ladies to move out of resource agribusiness and begin new non-ranch organizations.

Women owners of informal businesses in Tanzania who received training on the use of an MFI linked to M-pesa saved almost four times more than the control group used for measuring project impact and were 16 percent more likely to receive a loan (World Bank, 2019). In Niger, ladies who were given access to mobile cash bank accounts expanded their profit from their financial exercises and their haggling power in the family (Ahmad et al., 2020).

The adoption of uniform national identity systems, often through biometric identification has helped improve system security and functioning and has enabled the system to receive international payments and remittances. Access to mobile money platforms is not equal across Africa. Countries with nimble and enabling regulatory

systems such as those in East Africa have seen rapid growth in accounts and clear benefits. Kenya leads all other nations in SSA in mobile money accounts per capita.

The expansion of e-commerce in Africa has created a demand for informal bicycle, motorcycle, and taxi drivers to provide on-demand delivery services for vendors, including food service vendors, creating more and better informal sector jobs in the process.

Kudi.ai, Nigeria

In Nigeria, Kudi.ai uses AI to facilitate financial transactions and payments on chat platforms like Facebook Messenger, Slack, and Telegram (Kudi, 2019). The start-up has developed a chatbot that allows users to make payments and send money to friends and family in Nigeria through messages. It uses AI to understand user requests, drive conversations, understand their spending habits, and prevent fraud. The chatbot can be used to transfer money, facilitate cash withdrawals, pay TV subscriptions, electricity bills, data subscriptions, and airtime. The start-up is working with banks and telecommunication companies to try working on a larger scale.

Healthcare

Aravind Eye Hospital- Aurolab, India

The Aravind Eye Hospital began in 1976 with an 11-bed hospital and has evolved into a large healthcare system (Venkatesh and Shukla, 2021).

Aravind contains different focuses that give changing degrees of care, with 15,000 short-term facility visits and 2000 medical techniques on an ordinary day.

The work process at Aravind considers all assessment and testing to be performed around the same time, including subspecialty discussions. Moreover, treatment choices, for example, laser fringe iridotomy, laser and infusions for diabetic retinopathy, and scene planning are presented as same-day strategies, while waterfall medical procedure is presented as a following-day strategy.

One surgeon operates on two tables with the help of two scrub nurses and performs six to eight surgeries per hour, leading to an average of 2000 cases per surgeon per year. Surgical materials are thoughtfully reused and recycled.

Instruments, for example, needles and careful cannulas are streaked in the middle among cases and go through a full autoclave cycle by the day's end.

The solar plant at Aravind-Pondicherry produces 60% of the energy required at the site.

The '5R Practice' laid out at Aravind incorporates Decreasing how much waste is created, reusing materials, reusing waste at the source, Fixing and performing preventive upkeep, and Reconsidering current practices.

Aravind Eye Hospital performs cataract surgery for only $30 whereas in western economies it costs about $3000. Their first hospital overseas was established in 2018 in Nigeria by Partnering with the Chanrai Group.

Aravind Eye Hospitals is currently undertaking projects and collaborating with firms in the West.

AI NIMCURE Project in Healthcare, Nigeria

Annually, 245,000 Nigerians die from tuberculosis (TB). It is considered one of the most major infectious diseases across developing countries by the World Health Organization. TB is curable but there has been an increase in the number of drug-resistant cases of TB, which points to a lack of adherence to treatment by patients. The NIMCURE project is a collective project between the Co-Creation Hub and the Nigerian Institute of Medical Research (NIMR). The NIMCURE project is being implemented by the Lagos-based Co-Creation Hub in conjunction with the Nigerian Institute of Medical Research. The project aims to leverage AI to improve surveillance and detection of outbreaks of TB around the country and to improve adherence to TB treatment. This is achieved by building a system that continuously collects, analyses, and interprets health data to predict and plan for outbreaks and epidemics earlier in their course. The system consists of a digital public health intelligence platform.

AI is used to recognize patterns in the data collected (disease case reports) and identify and report on any anomalies and patterns indicative of possible outbreaks early on to healthcare organizations, facilities, and the public. The system also draws on a wider range of data to identify anomalies, including healthcare product purchases, absences from work or school, presenting symptoms to a healthcare provider, or presenting laboratory test results.

NIMCURE promotes adherence to TB treatment using a digital care tool helping patients and caregivers to better manage the treatment process remotely and on the go. This draws on video-observed therapy. NIMCURE was carried out as a pilot project in April 2018 and March 2019.

Cerviscan, Cameroon

Innovation designed by youthful specialist Conrad Tankou has made cervical and breast disease screening more straightforward in rural areas of Bamenda in northwestern Cameroon (Bonny, 2020).

Cervical cancer is second with an age-explicit proportion of 1,993 new cases for every 100,000 women each year.

95% of cancer patients in Cameroon are analyzed at a high level or terminal phase of the sickness, while therapy choices are scant and the visualization is not extremely hopeful. Yet, evaluating methods for certain cancer growths are concentrated and challenging to access for individuals in distant regions. Called Gicmed, Conrad's

innovation project was developed to address these problems. It is based on the use of a unique and atypical device. In particular, a telemedicine and pathology reading platform. It allows a trained doctor to collect data from patients after screening. The data is then sent to a specialist based anywhere for confirmation of a diagnosis without having to travel long distances.

According to the promoter, its impact is positive. He reported that more than 4,000 women have benefited since its launch.

Conrad's goals remain the same. It is to improve remote diagnosis for people in remote areas and to raise awareness of the importance of screening for certain chronic diseases. It will be a similar technology but more developed in diagnosing other diseases easily. It is a question of upgrading the software and hardware to cover other pathologies that require microscopic diagnosis. Thus, to collect enough data to build applications that will use artificial intelligence.

Powerfree Education Technology (PET), South Africa

PET is an organisation that mitigates the Healthcare conveyance hole by creating innovative technological devices and education apparatuses that assist in improving maternal survival and healthcare of newly born and unborn babies in developing counties (Chutukuta. furthermore, Grobbelaar, 2016). The company lobbies for the development of low-cost, power-free, and robust medical devices and learning materials that help in making life-saving decisions. They offer distant analytic instrument devices, for example, the Foetal heart rate monitor, and the Pulse Oximeter. PET operates not for profit however health facilities pay for the medical devices to ensure that the project is sustainable. Donors fund between fifty to sixty percent of the overall cost of the technological devices. The Grand Challenges Canada, Bill & Melinda Gates Foundation, and Save the Children are also involved. PET has made relationships with healthcare experts from Wales and India who manufacture their equipment. They also have a Partnership with Philips Healthcare that seeks to facilitate the expansion of its distribution to other countries as well as in commercializing the innovative Foetal Heart rate monitor. The Partnership is also considered to lower production costs whilst maintaining high product quality. This will enable the devices to reach disadvantaged communities across Africa (Alan, 2014).

Medical Diagnostech, South Africa

Medical Diagnostech Medical Diagnostech is a Cape Town-based manufacturer of low-cost, quality, high-sensitivity diagnostic kits for pregnancy, drug abuse, and malaria (Chutukuta. and Grobbelaar, 2016). The devices are intended to be sustainable, simple to utilize open for low-income communities that are confronted with jungle fever or chronic drug use. Different units are utilized for pregnancy, HIV, and fertility tests. The company operates on a for-profit basis, thus its revenue is made from sales. Malaria test kits are sold through distributors both locally and in 25 countries. For more than five

years Medical Diagnostech has been effectively giving institutions quality products. The use of innovative technologies has operated with the prevalence in awareness, explicitness, and solidness of the testing packs contrasted with different units that are still being used. Some of the company's Partners include the Small Enterprise Development Agency (SEDA) which helped it to facilitate the accreditation of the company and assisted the company to expand. The company has managed to scale through increasing the number of products distributed and also through a network of distributors.

Cervisafe, Malaysia

Cervisafe set of set-tapping test apparatuses for individuals for starter screening of cervical cancer growth. Cervisafe is manufactured by LaDIY Healthcare Sdn Bhd in a joint effort with the Universiti Putra Malaysia Cancer Resource & Education Centre (CaRE) (astroawani site).

LaDIY plans to be a perceived worldwide leader in conveying quality and complete Healthcare and Medical solutions, to fundamentally improve quality of life (ata-plus site).

This device is distributed free of charge to women to help them detect cervical cancer at an early stage in about 10 locations nationwide in stages and Melaka is the sixth location and four other locations include Kota Bharu and Johor.

Early recognition and screening can reduce the risk of getting cancer by 70%. The current techniques for detection are the Papanicolaou (Pap) tests and the more unambiguous Human Papillomavirus (HPV) tests that are led in clinics and hospitals.

Cervisafe is a 'DIY' Pack that caters to 'Privacy and Convenience - use at home', to test for both Pap and HPV. The device separates cell tests for both Pap and HPV tests in the accommodation and privacy of the user's home. In the future, the test unit will provide an initial prognosis of conditions that can be followed up with a more detailed analysis at clinics or hospitals.

WinSenga Matibabu, Uganda

In 2011, Makerere University students developed WinSenga, which is a foetal heart rate monitor using a smartphone. WinSenga is a handheld device that can scan a pregnant woman's womb and report foetal weight, position, breathing patterns, gestational age, and heart rate. The information is transmitted to a smartphone and onto the mobile app, which plays the part of the nurse's ear and recommends a course of action. Analysis and recommendations are uploaded to the cloud and can be retrieved by a doctor anywhere to track development at any time.

Elsewhere, the mobile application Matibabu was also developed by Makerere University students to perform a non-invasive malaria test. This test can diagnose malaria patients without a prick on their skin and shows them where the available

treatment centre is located. It uses smartphone technology accompanied by custom-made hardware to test for the presence of plasmodium in human blood.

AI SOPHiA health care in Cameroon

Since 2017, the Bonassama District Hospital in Douala has integrated SOPHiA developed by Sophia Genetics, a multinational company, into the clinical workflow to advance patients' care. By using this AI solution, the hospital now forms part of a larger network of 260 hospitals in 46 countries that share clinical insights using big data analytics across patient cases, feeding a knowledge base of biomedical findings to accelerate diagnostics and care. This allows the hospital to rapidly analyse genomic data and decide on the most effective care.

DataREACH Healthcare, Cameroon

College of California, Los Angeles (UCLA) Stamps Researcher Vikash Singh plans to join his interests for enormous information, man-made reasoning, and registering with assisting emerging nations with carrying out state-of-the-art pipelines for AI and progressed examination (Steinkopf-Straightforward, 2017)

Vikash Singh was born at the Ronald Reagan UCLA Medical Center and "kind of grew up at the school," because his parents are cancer researchers at UCLA.

In secondary school, he directed bosom disease research on the potential medical advantages of the Vernonia Amygdalina spice and had his turnout distributed interestingly. He was keen on this exploration for its positive effects on society and medical services.

He concentrated on cardiovascular sickness and improving techniques to assess AI models. This experience developed his advantage in computational science, his school major since it consolidated his interests in math, medication, and health.

He has been involved with UCLA's Stamps Scholars Society, planning service projects including volunteering at a homeless shelter and a food bank.

His research, still at Cedars-Sinai, is now focused on the application of deep learning algorithms to diagnose cardiovascular diseases based on nuclear imaging data.

It's essentially a PC assisting with the determination or forecast of specific illnesses, finding designs and numerical connections in the information not straightforwardly clear to people.

Currently, he is finishing a machine learning paper about optimizing evaluation models for diagnosing cardiovascular diseases.

Beyond school, he fabricated the first prescient examination pipeline for a startup called Recuperate, an "Uber for specialists" application that plans to change medical care utilizing an on-request administration model.

In the summer of 2015, he used his Stamps enrichment fund to build Project DataREACH, which implements cutting-edge techniques in machine learning and artificial intelligence in developing countries' medical systems. He traveled to Guyana to give presentations on the project, including to the Minister of Health and National Cancer Institute.

He has of late developed DataREACH to Cameroon through a coordinated effort with Songhai Labs, which associates pioneers in friendly business with chances to have an effect in emerging countries.

Songhai Labs is working on the DataREACH project in Partnership with the World Health Organization (WHO) in Cameroon and his start-up from UCLA, California. Within this project, the HSPC polyclinic in Kumba, a private hospital in southwest Cameroon, was provided with a digital application that helps it compile data on patients for epidemiological surveillance via AI.

Lara.ng, Nigeria

Lara.ng is a Whatsapp-styled chatbot that offers turn-by-turn directions and fare estimates for transportation within Lagos. It uses AI to offer conversational-style directions for public transport, tricycles, and other transportation modes in Lagos (Lara, 2019). The first version of the platform was launched in 2014 and followed up by Lara.ng in 2017. The app offers public transit directions complete with price estimates – with an option to share with others or use a rideshare service. A user only needs to type a query like 'From Obalende, Lagos to Ajah Bus Stop' and Lara will provide step-by-step directions and price estimates. Apart from this, the app can be used by the company to gather information on how often a user uses a particular route, how much they spend on average and what are their most visited places. Currently, Lara has around 100,000 users, of which 12,000 are monthly active. The most challenging aspect for the company has been hiring new staff. It has been very difficult for the start-up to find good people that fulfil their requirements. They have noticed a lack of capable technology talent in the Nigerian labour market (Okunola, 2018).

Gautham Pasupuleti, Biodesign Innovation Labs, India

Gautham Pasupuleti is the CEO & Managing Director, and Chairman of Biodesign Innovation Labs.

Biodesign Innovation Labs is a medical device and healthcare company based in Bangalore supported by the Department of Biotechnology BIRAC- Government of India, Government of Karnataka, Qualcomm, CAMTech Global Health — Mass General Hospital, CCAMP, IKP, IIT Bombay and Department of Science and Technology, Govt of India.

Gautham drives a group of specialists, scientists, specialists, originators, space specialists, and general health experts as a component of the improvement of innovative

and reasonable serious consideration/basic consideration clinical gadgets that can save lives for patients with respiratory sicknesses.

Biodesign Development Labs' RespirAID clinical gadget assists with diminishing the elevated degrees of bleakness brought about by a lack of ventilators in low-asset settings.

It is an affordable, mobile ventilator that provides a means for stabilizing the patient to maintain their blood oxygen saturation levels. If there is cardiac arrest or respiratory arrest you have to stabilize them.

There's only a limited number of sophisticated ventilators in India. At the other end of the spectrum, there's a bag-valve-mask ventilator which paramedics use for manually ventilating the patient for just a few minutes.

Biodesign Development Labs overcomes this issue between not having any ventilators and having a smidgen of manual ventilation.

RespirAID stabilizes the patients provides positive pressure inflation with all the respiratory parameters and is very easy to use.

The Pandemic Response Prize was awarded in 2021 to Biodesign Innovation Labs for responding to COVID-19 and future pandemic crises through the development of RespirAID, a safe, reliable, affordable alternative for prolonged manual ventilation.

3D Printing Medical, South Africa

Added substance production has improved the printing of manufactured inserts and different prosthetics, as well as bioprinting and tissue designing, which has subsequently decreased the normal of five years of holding up among most state-subsidized medical clinics for prostheses to three years (Thywill et al, 2022).

The Department of Higher Education, Science, and Innovation officially launched the Medical Device Additive Manufacturing Technology Demonstrator Project (MedAdd) on 8 April 2022 at the Central University of Technology (CUT), Free State (cut site).

The undertaking that the division reserves has brought private ventures and the college's Centre for Fast Prototyping and Assembling to make clinical gadgets fully intent on diminishing South Africa's dependence on exorbitant imported clinical gadgets that numerous emergency clinics can't manage.

Patient-specific X-ray shielding masks, customized manufacture of medical prosthetics, elbow implants, and cranial implants produced directly from titanium alloys using Selective Laser Melting are some examples of products developed.

The dental field has likewise benefited incredibly from research and modern organisations since new compounds have been developed that have given the most Cost-effective dental answers for dental patients.

MedAdd is accessible for small organizations to industrialize new Products, de-risking their innovative improvement before completely fledged commercialisation.

In addition, through MedAdd students, researchers and industry personnel will be able to develop the required skills to develop this new technology and new industry.

DSI offered financial help of R 97 million through the Innovation Advancement Organization (TIA) to the college, which houses the Item Improvement Innovation Station (PDTS), to offer specialized help to SMEs concerning answers for services and preparation.

The station makes use of first-class engineering expertise from the Central University of Technology (CUT), as well as specialized prototyping equipment from the Centre for Rapid Prototyping and Manufacturing (CRPM).

Vulcan Augmetics, Viet Nam

Founded in 2018, Vulcan Augmetics is a prosthetics company that creates affordable and adaptable prosthetics. This is targeted towards the community of people with disabilities, especially in developing countries (wearevulcan site). Vulcan Augmetics uses ML-powered wireless EMG sensors with deep learning networks.

The Vulcan Multi-grip Myoelectric Hand offers 6 main grips with 360-degree wrist rotation, a smart sensor system a very fast fitting process, and a robust and fast grip with loading weight up to 12kg

Vulcan app calibrates sensor band to customer's biosignal, adjusts opening & closing speed, onboards patients after fitting with guided exercises, and troubleshoots and requests technical support the cost is around 1000$

Tata – Swach – World's Cheapest Water Purifier

The term Swach means "clean" in Hindi. Goodbye developed the water purifier - the world's least expensive at the hour of its delivery in India - to serve the Rural area. It doesn't need running water, power, or in any event, bubbling.

Tata water filter called 'Swach' uses nanotechnology to purify water (cscindia site). Goodbye, Exploration, Improvement, and Configuration Center (TRDDC) and Goodbye Chemicals have mutually developed the center innovation. Swach is a high-level variant of Sujal, launched around 2001-02 as a piece of corporate social obligation regarding Wave-impacted regions.

Swach uses Rice Husk Ash (RHA) impregnated with nano (1 x 10-9) silver particles for safe and clean water.

Sujal additionally involved RHA in the mix with rocks and concrete. RHA, delivered from a warming rice husk, contains actuated silica and carbon. Initiated silica can lessen the turbidity of the water entering the channel and give a more drawn-out run for the framework. Then again, enacted carbon has the property to tie with non-polar materials

while polar materials stay in a fluid solution. Most pesticides are natural and firmly nonpolar and subsequently show a liking for adsorption on the carbon surface. The enacted carbon has an impediment in eliminating microbial pollutants.

WHO thus recommends coupling charcoal treatment with chemicals (iodine, chlorine, etc) or UV disinfection to remove microbial pathogens. Actuated carbon additionally can't eliminate lithium, alcohols, and smelling, serious areas of strength for salts and bases, and inorganic substances like sodium, lead, iron, arsenic, and nitrates.

Community Aid & Sponsorship Programme (CASP), conducted laboratory tests to find out that the filtered water shows a reduction of 96 % diarrhea and other gastrointestinal infection-causing bacteria. Objections are against the sturdiness of the model and the small size of the storage tank.

Silver restrains microbe's augmentation by responding with sulydryl (- SH) groups in the bacterial cells, creating primary changes in bacterial cell layers and collaborating with nucleic acids. The nano-measured particles help in expanding the surface region so the microscopic organisms get sufficient response time. Porous ceramic filters made from baked clay that includes rice husk, with colloidal silver are effective against waterborne bacterial pathogens, but not effective against viruses such as poliovirus, rotavirus, norovirus, and viral agents giving Hepatitis A and Hepatitis. E. The 560 mm tall Swach filter contains two parts.

The upper part contains a repository where the untreated water enters, and the lower centerpiece has a bulb to which the cartridge can be connected. One more repository is put at the lower end, which gathers clear water. Contingent upon the nature of water around 3000 liters can be separated after which the cartridge can be supplanted. The stream pace of the channel is 3-4 liters each hour. It is a low-cost alternative to more expensive water purifiers and meets the specific needs of these markets. The filter did not succeed in entering the US or European market.

Zembrin®

The Sceletium plant, local to South Africa may have an impact on the central sensory system (Emboden, 1980). In 1995, Dr. Gericke connected South Africa's driving addictionologist, Dr. Greg McCarthy, to visit two networks in Namaqualand where the plant was still being used (zembrin website). In 2006, a potential investor, Hall Investments, put resources into the examination, shaping HG&H Pharmaceuticals.

In February 2008 groups to the agreement were the San people groups of South Africa, through the South African San Council (SASC), and HG&H Pharmaceuticals.

In September 2012, a product containing Zembrin®, the brand name of the institutionalized and portrayed business concentrate of Sceletium tortuosum developed by HG&H Pharmaceuticals, was motivated in the South African market. In March 2013, the main Products containing Zembrin® were motivated in the US market.

In March 2015, HG&H was granted their third US patent on Sceletium, and at this point, approximately 26 signed dietary supplement Products containing Zembrin® were on the US market. Likewise, Zembrin® had been formally endorsed as available to be purchased by Health Canada as a nonprescription health item.

Forus Health - Retinal Eye Imaging

Chandrasekhar first found out about preventable visual deficiency when an authority from the Aravind Eye Hospital chain visited Philips India, in 2006, where he was the executive of the methodology for the organization's Transistor unit, NXP Transistors. After four years, in January 2010 he quit his activity and began Forus Health in Bangalore, India, to construct a mobile eye scanner (Arakali, 2016).

Shyam Vasudev, who was Chandrasekhar's Partner and Partner at Philips India, additionally went along with him as a fellow benefactor. The speculators are IDG Ventures, Accel Partners, and Asian Health Fund.

3Nethra, the principal screener display dispatch in 2011 is sufficiently mobile for a pillion rider on a bicycle to convey it. The pictures from the screener can be sent to an ophthalmologist in an advanced policy for a survey on his or her smartphone or PC.

The eye scanner itself has been introduced in 1,100 healing facilities and in addition diagnostics labs, diabetic treatment centers—as diabetes-related visual deficiency is a vital factor—and the Aravind Eye Hospitals.

Reverse Innovation (RI)

We characterize reverse advancement as a worldwide advancement that, at some stage during the development interaction, is portrayed by an inversion of the progression of development from a non-industrial nation to a high-level nation's market.

Ideation/concept development, new product development, and first market introduction are key reverse innovation phases.

RI Definition

RI is a disruptive inclusive innovation in the emerging economy that is adapted to customer segments in developed countries seeking good enough products at a lower price than existing ones (Govindarajan , 2013; Malodia et al, 2022).

The concept of RI, coined by Immelt et al. (2009), was first introduced as antithetical to the concept of glocalization (Hadengue et al, 2017) and a tool to pre-empt possible competition from emerging market competitors in developed markets. With an expansion in the stock of innovation and abilities required for developments, domestic firms in Emerging Market are probably going to represent an extreme danger to MNCs from developed markets and hence would force MNCs to localize their R&D process to remain competitive (Corsi and Di Minin, 2014; Govindarajan and Ramamurti 2011). Using examples from GE Healthcare, Immelt et al. (2009) provided anecdotal evidence highlighting the significance of factors such as investing in localized R&D centers, country-specific organizational structure, and financial autonomy. RIs coming out of GE's Indian and Chinese subsidiaries were not only disruptive for the local market but were also disruptive in developed markets.

Govindarajan and Trimble (2012a, b) explained that RIs are first adopted in emerging markets and later flow back to developed markets.

Von Zedtwitz et al. (2015) extended the discussion and argued that reversal may happen at any stage during the innovation process, i.e., ideation, development, and diffusion, and further presented a typology of innovation flow.

One of the precursors to the conceptualization of the market potential in emerging markets was Prahalad (2004). He suggested that firms had to understand the dynamics of this potential market, as well as the process of innovation therein to benefit from it (Prahalad, 2012). Building on the bottom of the pyramid concept, Prahalad introduced trickle-up innovation. Trickle-up innovation refers to any innovation developed for the bottom of the pyramid that subsequently trickles up to high-income countries (Prahalad, 2004).

Brown and Hagel (2005) proposed the concept of blowback innovation to underline the importance of DMMEs not simply adapting their products to emerging market needs but rethinking their ways of doing business in those markets. They explained why it is important for DMMEs to reshape business and management practices to gain access to

emerging markets and avoid being displaced by emerging countries' multinational enterprises (EMMEs). These ideas are taken up by RI and the fathers of the concept have often recalled that this innovation strategy was a prerequisite if DMMEs wanted to survive the rise of emerging markets and their local firms.

Trying to improve the positioning of the concept, Burger-Helmchen et al. (2013) have described RI as a way to contest the dominant technology-push innovation model put forward by Schumpeter (1911, 2003). The demand-pull vision (Schmookler, 1966), the concept of lead-users (von Hippel, 1986), the reverse multinational perspective (Kogut and Zander, 1993), and the creative economy (UNCTAD, 2010) likewise endeavored to conceptualize a type of RI (Burger-Helmchen et al., 2013).

RI Dynamic Factors

External Factors

The government innovation fund supports high-tech entrepreneurial effective means to become regional innovation level and economic development of the main driving force (Guifeng et al, 2017).

The government should continue to strengthen and improve, including a property rights system, a market-oriented incentive system, sound financial policy, guaranteed financial payment, and other effective policy supplies.

The government should cultivate innovative talents, establish a creative team, and use a good policy environment to attract innovative talents, constantly improve the development of innovative talents mechanism, and strive to maintain the region's economic development and the vitality of innovation.

Consumers and market demand is to promote a major driving force for reverse innovation. This requires the needs of consumers and the changes in the entire market research. Endeavors ought to watch out for the progressions in market improvement, convenient logical change, and redesigning, and accordingly keep on upgrading the center seriousness of ventures.

Internal Factors

Enterprise innovation culture is an important driving force for enterprise innovation work. This culture guides enterprise employees to continue to achieve the goal of the enterprise and work in the long term.

Technical staff leaders as the unit and the enterprise managers and organizers, directly affect the enterprise and enterprise employees' awareness of innovation. Leaders should have a solid basic theoretical knowledge and scientific and cultural knowledge, learn to look at the world, analyse the development of the times changes, grasp the trend of development of the times, and innovation to lead the development of enterprises.

The enterprise management model should focus on the transition from entrepreneurial management to professional manager management, from the traditional single enterprise management mode to the group management mode.

Diffusion of Innovation from Emerging to Developed Markets.

Reasons Behind Reverse Innovation

Customers in developed markets who cannot afford products at standard prices may look for alternatives at lower prices (Hang et al., 2010). Subsequently, advancements in low-cost clinical consideration, lodging, or banking Products and services might engage clients living in ghetto or rural regions of the developed nations.

Products that have been developed at a low cost for emerging markets can expand whole market demand in developed markets. The demand would be expanded because of the price elasticity effect when new versions are launched in developed markets at low cost.

Augmenting products for emerging markets requires the addition of new functionalities, like ease-of-use or portability which can also create new applications in developed markets. For example, optimizing home appliances in terms of portability can appeal to at-home customers in developed markets.

Consequently, improving existing products for emerging markets can boost sales in developed markets (Banerjee et al., 2015; Govindarajan and Trimble, 2012).

Some scholars contend that the technology of low-cost products may be enhanced over time until these products satisfy the high-end applications in developed markets (Christensen and Bower, 1996).

Customer and Firm-Related Factors

Tangible Outcomes

The developed market customers are looking for RIs since these markets have a growing segment of customers similar to the emerging market in terms of their affordability constraints. The micro-credit concept in the banking service industry has achieved a significant foothold in developed markets (Govindarajan and Trimble 2012b). RIs with their intrinsic super-esteem and mechanically progressed credits give MNCs an upper hand in the worldwide commercial center.

Firm performance is characterized as the accomplishment of the expressed business objectives estimated as far as productivity, piece of the pie, and investor esteem (Hult et al. 2004). The positive effect of innovation competencies on firm performance has been archived unequivocally in the writing and is planned to convey unrivaled firm performance (Damanpour 1991; Hult et al. 2004). Other than the piece of the pie, by embracing the standards of RI, firms likewise foster unique abilities that lift firm performance by rebuilding the company's assets, functional schedules, and innovation

competencies which convey substantial advantages concerning better financial execution (Helfat and Raubitschek 2000).

Intangible Outcomes

Making RI throughout some undefined time frame conveys upgraded firm learnings and assists firms with working on their activities through a superior comprehension of new experiences, the need for new designs in organisations, the production of new systems and cycles, and new activities focus (Fiol and Lyles 1985). RIs fundamentally influence the efficiency of organizations by adding to the most common way of growing new item improvement abilities, achieving cross-practical reconciliations, and utilizing existing advances in making super-esteem Products. It additionally improves the organisation's ability to figure out the idle and expressed needs of the clients and the nearby climate.

Demand for Customization

Created market clients' interest in customization and utilization of refined innovation in the given worthwhile advancement (Corsi and Di Minin 2014; Hart 1995; Zeschky et al. 2014). Firms are expected to distinguish and comprehend the requirement for highlighting upgrade winning in the created market sections and consolidate the innovative plan to achieve better functionality and improve the apparent worth of the given RIs.

John Deere changed its farm truck, at first intended for the Indian market, by adding more power, refined elements like GPS, and a cooled lodge designated to the created market clients. With these upgraded highlights, the farm trucks demonstrated fruitful in the USA.

In the year 2010, almost 50% of tractors manufactured by John Deere India were sold in developed markets (Govindarajan and Euchner, 2012).

Latent Needs

The presence of dormant requirements gives an open door to the organizations by setting their advancements in these heterogeneous client fragments by offering the numerous uses of the given RI. This permits firms to situate the innovative products in the shifted portions serving the various requirements and further work with the dispersion of RI in the created markets, achieving a higher worth result.

With a market share of approximately 35% in the USA ultrasound market, GE was sceptical of cannibalizing its own high-end ECG machine market when it planned to launch the low-cost MAC 800 in the US market. However, they realized that there was a huge opportunity in terms of addressing latent needs. MAC 800 opened up completely

new market opportunities for us such as serving primary care doctors, rural clinics, emergency rooms, ambulances, and accident sites.

Ingersoll Rand (India) Ltd innovated a battery-operated refrigeration unit for small-sized vehicles in emerging markets, especially for small-size trucks and vans in India.

Such vehicles have little motors and thus can't uphold motor-fueled refrigeration units. Later Ingersoll Rand effectively inverted this item to create markets where the RI was embraced by eatery proprietors and providing food firms. Since the refrigeration unit was not difficult to introduce and didn't need motor power, these clients introduced the unit in their conveyance vehicles to keep the food new for little conveyances. In this manner, recognizing the idle requirement for their development not only assisted Ingersoll Rand with acquiring an upper hand yet in addition worked on their benefit.

The essential use of any child hotter is in neonatal serious consideration units (NICU) in emergency clinics to brood untimely children.

However, GE positioned one of its RIs, the 'Lullaby Warmer,' in US hospitals as an additional facility within the mothers' private rooms. The size of the hardware and convenience made this new application for the Cradlesong Hotter, subsequently opening significant interest for such child warmers in the USA market and providing a significant competitive edge.

RI process

Harman International, the U.S.-based business, owned by Samsung today, known for ultrasophisticated dashboard audiovisual systems designed by German engineers, developed a radically simpler and cheaper way to create products in emerging markets and applied the Saras ("adaptable" in Sanskrit) method to its product-development centers in the West (Govindarajan, 2012). Herewith are the stages in the RI process.

Executing Radical Change

The team consisted of a software group in India and a smaller hardware group in China. The headcount was kept low to ensure flexibility and inspire the members to take initiative.

A new engineering culture and approach to innovation challenge the team members to think aggressively. The team accepted several other principles, including simplicity, modularity, and third-party solutions.

Overcoming Resistance

Saras soon met with internal suspicion. In certain sides of the organization, the thought spread that its Products were mediocre, implied exclusively for India and China, and not realistically complex enough for Western markets.

After Toyota acknowledged Saras, these worries softened away, and at last, the deals staff perceived that lower costs didn't be guaranteed to mean more modest commissions. With a higher net benefit for each unit and a lot bigger volume base, deal commissions remained to rise, as well.

Change from Below and Above

Harman's management of reverse innovation shows that the two-part approach—with local teams generating radical change from below and CEOs orchestrating companywide changes from above, helps organizations bypass traditional thinking and integrate new logic into product offerings. This approach ultimately enabled Harman to offer an unprecedented range of products along a continuum of markets, from low-end to luxury. Ideally, the parent company gives the local growth team the freedom to function with all the energy and imagination of a start-up and encourages it to establish radical goals.

Establish Radical Goals

"All the features at half the price and one-third the cost." Harman's traditional R&D methods could never have achieved such an objective, but aggressive goals and the daunting constraints they imply can spark novel ways of succeeding.

Practice Clean-Slate Organizational Design

Saras's whole-function approach to design not only helped shatter the dominant logic in the project's early days but also showed the rest of the division that its new organizational structure was as good as or better than the company's traditional siloed one.

Leverage Global Resources

Innovation teams in emerging markets make full use of multinationals' extensive assets and continue to interact with legacy units. By recruiting several of Harman's German engineers to join his team, Hartman was able to tap into Harman's global expertise in navigation technology. The German designers, albeit at first impervious to the undertaking's way of thinking, in the end, saw its worth and aided form extensions to the conventional engineering group. They became change agents.

Choose Team Leaders Without Conflicting Interests

The team should be led by an executive whose highest, if not only, priority is the project. Generally, the task will be harmed by traditional reasoning, which lines up with the organization's prevailing income stream.

Rebranding the Company's Future

You cannot change the dominant logic without changing the people and the hierarchy. To help initiate Saras, Hartman hired two high-profile executives, one from Bosch and one from Philips, and put them into newly created positions overseeing sales, marketing, and distribution for India and China. Hartman shifted the engineering function's center of gravity from Germany and the United States to key emerging markets, where local carmakers' needs were apparent every day.

As part of the integration of the Saras approach, Hartman created Phoenix, a cross-organizational engineering team to bridge the divide between the old guard and the upstarts. It will probably join the learning accomplished through Saras and the profound experience and capability of the inheritance group to accomplish a solitary lucid methodology and innovation platform.

Hartman cultivated curiosity about and increased knowledge of emerging markets by including leaders with deep experience in the developing world on boards of directors and top management teams. Harman allocates key administrators to two-year spells in the Emerging Market for individual and expert development, cultivating the sharing of ability between heritage units and Saras. Hartman ensures that legacy businesses continue to thrive and calms fears of product cannibalization. Managing glocalization and reverse innovation within a single enterprise and resolving the resulting conflicts are central organizational challenges. Harman continues to serve the luxury market, and the German engineering team continues to add features and functionality to serve luxury customers.

The company sets annual performance targets and financial incentives to enhance strategic alignment and reduce friction between the Saras team and the legacy units.

RI Triggers, Enablers, Barriers, And Drivers

RI is the result of triggers, enablers, barriers, and drivers.

Triggers

Triggers are a set of factors that cause MNCs to think divergently and innovate because of market saturation in developed markets (Govindarajan and Trimble 2012b; Leavy 2011; Li et al. 2013). Inflating cost imperatives in both arising and created markets (Judge et al. 2015), asset cum framework imperatives (Furue and Washida 2014; Govindarajan and Trimble, 2012a, b; Judge et al. 2015; Zeschky et al. 2014), or social contrasts (Govindarajan and Trimble, 2012a, b).

Enablers

Enablers are factors that have contributed to the design and development of RIs. The flow writing talks about empowering agents like the internationalization of innovative

work (Govindarajan and Euchner 2012; Govindarajan and Trimble 2012b), enabling nearby development groups (Corsi and Di Minin 2014; Govindarajan and Euchner, 2012; Immelt et al. 2009), and building neighborhood organizations and joint efforts (Govindarajan and Ramamurti, 2011).

Barriers

There are many barriers to adopting RI in high-income countries (HICs). First is the difficulty in obtaining clearance from regulatory and insurance authorities along with manufacturers' aversions to make cost-effective products for fear of financial losses. Second is the difficulty in identifying inventions for adoption.

Inherent conscious or unconscious geographic bias against Low- or Middle-Income Country (LMIC) s' innovations, wrongly perceived differences in respective needs and deep-rooted cognitive organisation of high-quality research with HICs hinder an objective learning process and prevent widespread diffusion of RI from LMICs to HICs.

The barriers discussed in the RI literature comprise factors such as centralized organizational structure (Wan et al. 2015), fear of cannibalization (Furue and Washida 2014), and quality perception based on country of origin among developed market customers (von Zedtwitz et al. 2015).

Many studies have shown examples of reverse innovation, but there is little understanding of reverse innovation drivers (Hussler and Burger-Helmchen, 2020).

Enterprising direction assists firms with turning out to be more responsive and coordinated while taking care of arising client needs, bringing about advancements they can commodity to developed nations. Developed market consumers are looking for super-efficient and low-cost products.

Economic Drivers

Poverty is an economic factor because it has been considered that poverty reduction can serve as a driver of the RI approach.

The aging populace includes both the economic factors of innovation such as affordability, quality over functionality, and social development and economic factors of the country, such as poverty reduction (Simula et al., 2015).

'Leapfrogging to frontier technologies' can be seen as a driver in some cases where there is a need for new technologies in the market because other countries have already reached or are using advanced technologies. Govindarajan and Ramamurti (2011) mention the importance of leapfrogging for RI and cite the example of reversing from no telephones to wireless technologies for communication in African countries. For 'product adaptation ability', Von Janda et al. (2018), explain the importance of firms' potential to adapt to earlier innovations, according to market requirements for RI to prosper.

Social Drivers

There are 5 social-embeddedness drivers of RI. 'Identify customer needs', 'Trust with customers', 'Cost awareness', 'Global community networks', 'Commitment to a local market'. All these factors mention the firm's relationships with its customers as a whole.

Business Drivers

Factors such as 'strong external stakeholders', 'product-pricing', 'positive FDI spillovers', 'new salesforce settings', 'build new core competencies', and 'marketing' have all been considered as attributes of a RI business- model (Zott et al., 2011).

'Old organisational structures', 'risk of cannibalization', 'attracting tough audience', and 'static industry capabilities' are directly and indirectly attributed to the RI business model (Zott et al., 2011). These barriers are related to costs such as operational costs, labour costs, and other factors related to the economic situation of the firm and its customers.

RI Five Paths

There are five gaps identified between developing economies and advanced countries that can reveal to companies the most promising areas where they should innovate. These gaps trigger the emergence of reverse innovation since they cannot be closed by mere adaptation of current products for emerging markets. Govindarajan and Trimble (2012b) list the following five gaps: performance gap, infrastructure gap, sustainability gap, regulatory gap, and preferences gap.

The Performance Gap

Creating world clients can't bear the cost of top execution, yet you can't simply send out cut-down rich world Products and services. An entirely new price-performance curve is needed. In terms of the performance gap, Govindarajan and Trimble (2012) highlight that developing nations are most eager for breakthrough new technologies that deliver decent performance at an ultralow cost. (Terrio, 2014).

To achieve this, Soni (2013) and Trimble (2012) believe that developed world businesses need to start from scratch and build completely new offerings.

The Infrastructure Gap

Rich nations have exceptionally evolved foundations - streets, telecoms organizations, influence plants, schools, colleges, emergency clinics, banks, financial exchanges, and so on. There is significantly less such foundation in agricultural nations.

In an Emerging Market where there is a lack of infrastructure, circumstances may prove advantageous. Soni (2013) concurs by sharing that the foundation hole takes into consideration the advancement mechanical developments.

Unfortunately, nations are on an alternate improvement way than the rich world - they don't have to go through similar periods of improvement. Rather some are jumping the rich world in advances like mobile communications.

MPesa mobile financial services in Africa turn your mobile phone into your virtual bank.

The Sustainability Gap

Griffith-Jones (2014) states that new infrastructure should be developed innovatively in developing countries to encourage sustainability. For instance, infrastructure that utilizes renewable energy would prove very beneficial to developing countries.

There is an ongoing conflict between economic activity and the environment. One model is outrageous air contamination in Beijing. Despite their standing for consuming coal to create power, the Chinese are making enormous interests in supmobile innovation. BYD (Construct Your Fantasies www.byd.com) is an organization situated in Shenzhen who have developed a scope of module electric vehicles with Li-particle iron phosphate batteries. Their Polestar vehicle was hailed by Top Stuff Magazine as "Quite possibly of the absolute most complete electric vehicle cash can purchase. BYD is likewise dynamic in solar energy and Drove lighting. They have taken their solutions worldwide.

The Regulatory Gap

The regulatory gap addresses the fact that regulations in developing nations tend to not be as strict or developed as in advanced countries. Such tight regulations in developed countries tend to interfere with the innovation process. Therefore, fewer regulatory systems may prove supportive of innovation. (Trimble 2012; Soni 2013).

Regulatory systems are a blade that cuts both ways. Guidelines are in many cases important to forestall or address misuse however they can develop into boundaries to advancement. There are fewer guidelines in the creating scene, which might prompt less organization and quicker progress, however can likewise prompt threats to representatives and the general populace.

In the created world, routine checking of liver capability for patients on antiretroviral drugs and numerous different meds is the acknowledged norm of care. Checking for liver poisonousness in the creating scene, be that as it may, is seriously restricted by cost and access to present-day instrumentation. Due to these resistances, many creating world patients get negligible or no checking during treatment.

Diagnostics for All (dfa.org) is a not-for-benefit organization established at Harvard College in 2007 by a gathering of researchers and business visionaries with a common obligation to save lives and lightening sickness in emerging nations and other asset unfortunate settings through low-cost, creative, down to earth-symptomatic gadgets. They developed a low-cost, designed paper-based, liver compound demonstrative test that can give an evaluation of liver health from a solitary drop of blood in around 15 minutes. This was tried in Vietnam, where less severe guidelines worked with quicker testing and arranged the organization to meet more rigid US FDA guidelines.

Diagnostics for All was subsequently awarded a grant by the Bill & Melinda Gates Foundation to develop a low-cost, rapid diagnostic test for immune markers of successful vaccination against tetanus and measles. The improvement of a basic, mark-of-care resistance evaluation will quickly affect the ebb and flow of worldwide endeavors to control immunization-preventable infections. The organization has created other low-cost, basic, and fast analytic tests for use in medical care and horticulture.

The Preference Gap

The preference gap addresses the immense range of cultures throughout the developing countries of the world. Different preferences may open up opportunities for companies to explore completely new offerings. As preferences will not only vary between countries but also within countries there is a great amount of opportunity to explore (Soni 2013).

Consumers have different preferences in different cultures. Pepsico developed lentil-based snacks in India to meet local demand. In 2003 Procter and Bet presented VickMiel, another over-the-counter hack medication for low-pay purchasers in Mexico. This pre-owned regular honey, as opposed to fake flavors.

After a couple of years, P&G brought this product to developed countries, at a lower price than its Vicks product, with considerable success.

RI Dimensions

Reverse innovation can be conceptualized according to its three dimensions: clean slate, super value, and technologically advanced products (Malodia et al., 2020).

Clean Slate Dimension

Reverse innovations are clean slate in nature because they follow a bottom-up approach to design and develop a product to solve existing problems (Govindarajan and Trimble, 2012; Leavy, 2011). The characteristic of a clean slate is well-supported by the value innovation theory that requires firms to make a fresh start by looking beyond their existing capabilities and assets (Kim and Mauborgne, 1997, 1999).

The RI Embrace baby warmer was designed as a blanket using a wax-like substance that can retain heat for a longer duration compared to a conventional photo-therapy bassinet, which was based on lighting technology to keep infants warm. RIs that show a fresh start thinking past the current creation stages accessible to MNCs and which are planned without any preparation are probably going to make more noteworthy progress regarding reception and dispersion (Borini et al.2012; Leavy, 2011). Fresh Start likewise gives a potential chance to make an answer for unserved or underserved markets taking on complete innovation or another use of existing innovation

(Ali 1994; Lee and Na 1994). Such innovations being clean slate emerge as ideal solutions to emerging markets and may later appear as RIs (Govindarajan and Ramamurti, 2011; Leavy 2012).

Super Value Dimension

Reverse innovations are considered super-value products because these products provide superior benefits at a low cost. In the Emerging Market, clients like and require reasonable Products that are sufficient to meet their fundamental requirements (Nook and Christensen, 1995). As per Chan Kim and Mauborgne (2005), turnaround advancements can bring down client functional expenses, offer more prominent functionality, or supplant consumables with reusable parts.

GE India's $500 ECG machine offers a scan at less than 10 cents without compromising on the clinical efficacy that a $10,000 ECG machine would achieve at a much higher operating cost and has been accepted favorably worldwide.

Technologically Advanced Products

Reverse developments are mechanically exceptional in light of the fact that they influence state-of-the-art innovation to make top-notch things at a less expensive expense than existing other options (Zeschky et al., 2014).

Turnaround advancements are initially expected for the Emerging Market, pushing usability and activity. Most existing reverse advancements depend on disruptive or radical innovations (Archibugi and Filippetti, 2015). Moreover, turnaround developments create curiosity by creating progressed, reasonable, and normalized particular plans.

The Discovery IQ PET/CT scanner has a modular design and is 40% cheaper, with increased efficiency in scanning technology, lower radioactive material exposure to the patient, and a reduced operating cost.

Hence, RIs, unlike other cost innovations, are superior in the manifestation of advanced technology to come up with an innovative solution serving the needs of both emerging and developed markets.

RI Typology

We use the four innovation phases, ideation, development, primary market introduction, and secondary market introduction by denoting advanced countries with "A" and developing countries with "D". We determine 16 possible global flows of innovation.

We thus define reverse innovation in the strong sense as a reverse innovation that has at least two of its key innovation phases taking place in a developing country (von Zedtwitz and Soberg, 2014). This definition contrasts with a reverse innovation in the weak sense, which has only one of its key innovation phases taking place in a developing country.

The following five types of reverse innovation flows are cases of reverse innovation in the strong sense: ADDA Developing Country Spillover, DADA Double Reverse Innovation, DDAD Advanced Country–Targeted Innovation, DDAA Developing Country Innovation, DDDA Reversed PLC.

The following five types of reverse innovation flows are cases of reverse innovation in the weak sense: AADA Spillback Innovation, ADAA Cost/Capacity Innovation

ADAD Reverse Spillover, DAAA Front-End Reverse Innovation, DAAD Developing Country–Inspired PLC.

The activity of a company from an advanced country in a developing country will be defined as D also. A cooperation between a company in an advanced country and a company from and developing country will be defined as AD.

The Traditional Global Innovation Flows starts with advanced countries and end with developing countries: AAAA Advanced Country–Only Innovation, AAAD Vernon's Product Life Cycle, AADD Developing Country–Targeted Innovation,

ADDD Advanced Country–Inspired Innovation, DADD Advanced Country–Based Localization, DDDD Developing Country–Only Innovation. Herewith we present case studies of the different types initiated by (DMMEs) and (EMMEs).

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Cases of Developed Markets Multinational Enterprises (DMMEs)

DMNEs are mainly focused on health and industry systems that could be adapted at a low cost for suitable segments of the market in developed countries and food applications for customers who are seeking special cultural tastes in developed countries. The initiative is taken in common between the CEO and local representatives in developing countries. Herewith selected successful products.

Health

DDDA Strong Type. MAC 400 Electrocardiogram (ECG), GE India

In 2005, engineers in the Bangalore R&D centre started the development of a mobile electrocardiogram (ECG) machine that could be used in rural areas and be affordable for the populace in these areas (GE Healthcare, 2011; Govindarajan & Trimble, 2012; Hoekman, 2018).

GE's Mac 400 was fully conceptualized, designed, sourced, and manufactured in India according to the requirements of local customers.

Considering the Indian market, the Macintosh 400 is estimated at 33% that of imported ECG systems of comparative quality.

The Macintosh 400 - with just four buttons - is sufficiently minimal to fit inside a rucksack, and at under 800 dollars (rather than $2,000) can regulate ECG tests at one dollar for every patient.

To manage blackouts in many pieces of India and an intense deficiency of medical care experts, the Macintosh 400 is battery-worked and expected to be not difficult to utilize.

Clients in the medical services field maintained that the machine should be versatile so they could arrive at additional patients; thus, it is lightweight. To guarantee simple functionality (particularly in far-off regions) and to bring down costs, it accompanies economically accessible parts rather than modified and restrictive parts.

By developing the MAC 400 ECG machine for rural India which accounts for circa 70 percent of the population, GE has not only managed to expand in India but also ended up developing a product whose advantages were acknowledged by U.S. private customers as well, private clinics and ambulances (Bandyopadhyay, 2012). With a fairly expensive and robust product, previously GE could not penetrate the lower tiers of the Indian market and thus risked being exposed to the attacks of local healthcare companies that think frugal. The MAC 400 changed its competitive position but also opened up new segments of the U.S. market that embraced the product and put it to use in a different environment. The product is truly frugal by nature: it is only a fraction of the price and size of a standard ECG: it runs on batteries to account for the electricity shortages in rural areas, it is very easy to use and overall, it gives doctors great flexibility in attending patients in remote areas (TEDxTalks, 2012). Most importantly, this ECG is nowadays sold in 225 countries (Northeastern, 2013), becoming a very successful example of reverse innovation.

The variant of the ECG machine called the MAC i ("i" stands for India) was at half the price of the MAC 400. By consolidating the Marquette 12SL examination program, which is standard in GE's superior ECG gadgets, GE has alleviated any quality worries. The Macintosh 400 and the Macintosh I consolidate the examination program that is standard in GE's all the more very good quality ECG gadgets and incorporates underlying programming that deciphers the ECG

 in English like any pathological test, a feature that previously was available only in GE's very high-end ECG machines. Besides being sold in India the product was also sold in Europe, a DDDA type.

DDDA Strong Type. MAC 800, GE China

As in Bangalore, a GE Medical services LGT arranged in China needed to foster an ECG gadget that was fit to the Chinese market. Building upon the accumulated knowledge of the Bangalore LGT the Chinese team developed the MAC 800 ECG (Singh, 2011).

The MAC 800 was a modification of the original, commercially successful MAC 400, developed by GE as an alternative to the more expensive but foldable Lite ECG (Ehsan, 2021).

The MAC 800 was a compact device, weighing only about 240 grams and with dimensions of 37.0 cmX19.0cmX11.0cm. The machine is designed to be used in field conditions with limited or no technical support and can generate an ECG in less than a minute. MAC 800 ECG device is sold in the United States or Canada (Govindarajan & Trimble, 2012).

(AD)DDA Strong Type Vscan, GE China

In 2010 GE introduced the Vscan, a hand-held mobile ultrasound device (General Electric, n.d.d) that was derived from an earlier model developed for rural China in 2002, known as the Logiq Book (Govindarajan & Trimble, 2012; Zeschky et al., 2014).

For the development of the Vscan LGT was set up in China, with full autonomy, to develop the technology to meet local needs, and to provide care solutions in rural and county areas (General Electric, 2014e; Hilton, et al., 2013). In the end, the development of the Vscan was a collaborative effort, using the design specification that came from India, drawing on telematics from Norway and the user interface from France, and system integration from the USA and manufacturing expertise from China (Hilton, et al., 2013). The Vscan was developed for antenatal care in Emerging Markets, where it could also be used in rural areas by making it lightweight, and solar-charged (Karti, 2014). Its plan empowers medical care suppliers to head out to the far-off local area centers (General Electric Organization, 2013), and it has been made simply being used, with the goal that paraprofessionals can likewise utilize this gadget (Karti, 2014).

To date, the Vscan has become commercially available not only in China and India but also in North America and Europe (GE, 2012). The device has received FDA clearance, a Medical Device License from Health Canada, and the CE Mark by the European Union. To date, the device has now been rolled out in over 100 countries.

DDDA Type. Ultrasound Machine, Philips, China

ElastPQ Hepatitis B virus (HBV) infection is a major public health problem in China. Approximately 7.18% out of 1.3 billion Chinese are HBV carriers. Additionally, approximately 25% of these patients later develop chronic hepatitis B (CHB), which in turn results in cirrhosis, causing liver cancer in 3%–10% of these patients.

Around 500,000 Chinese people kick the bucket because of cirrhosis and liver malignant growth consistently. The best way to conclude liver malignant growth was liver biopsy, which is a difficult and costly way to find this infection.

The Philips China Healthcare R&D team in Shanghai developed the ElastPQ ultrasound technology launched in 2012. This is a shear wave-based elastography strategy that can quantify the solidness of liver tissues communicated in kPa and can be utilized to track down irregularity, as a sign of liver sickness.

To ensure better assessment, Philips is working in collaboration with several hospitals in China to collect biopsy data. These data are fed into the ultrasound machine database, thus performing simple, accurate, non-invasive, and single-step imaging of liver tissues that is affordable and painless for patients. Currently, only 20% of patients in China have access to this technology, but many hospitals in Western China have been increasingly adopting this technology. In the EU, governments endorse that hospitals use elastography to diagnose liver diseases.

DDDA Type. Multix Select DR, Siemens, China

Multix Select DR machine, a digital X-ray product is another example of a SMART product which also illustrates the reverse innovation concept associated with these frugal products. This product was developed not only for emerging markets but was also designed to address the global markets.

The Multix Select DR is an entry-level system that facilitates cost-effective access to X-rays, at a price that is around one-third below comparable predecessor products of Siemens.

Multix Select DR is alluring to small and medium-sized clinics in recently industrializing nations as well as to small clinics and doctors' centers in industrialized nations.

The cost of this system is around 30% less than the existing high-end products within Siemens but in terms of quality to a large extent adheres to the standards used in the Western world. This product is also used in the Western world as a backup machine. Siemens also reduced the dose requirements of the system by 50%, making it safer for the patients & doctors. Select DR is being developed in China and marketed globally. The sales numbers for the product have been growing considerably and show a promising future.

DDDA Type. Vicks Honey Cough, Procter and Gamble (P&G), Venezuela

Honey Cough originated in 2003 in P&G's labs in Caracas, Venezuela, which creates products for all of Latin America. Market researchers found that Latin American shoppers tended to prefer homeopathic remedies for coughs and colds (Jana, 2009; 1library.net, site). So, they set out to create a medicine using natural honey rather than artificial flavors typically used. P&G introduced the syrup in Mexico first, under the label VickMiel, and then in other Latin American markets such as Brazil.

P&G wagered that the product could appeal to parts of the U.S. that have large Hispanic populations. In 2005, the organization rebranded it as Vicks Casero available to be purchased in California and Texas, at a cost somewhat not exactly Vicks' pillar item, Vicks Formula. P&G won't release sales figures, but within the first year of its release the Cincinnati company boosted distribution to 27% more outlets.

Figuring that natural ingredients could appeal to even wider groups, P&G took the product to other markets where research indicated that homeopathic cold medicines are popular. In the past two years, the company has been marketing the product in Britain, France, Germany, and Italy, as well as Switzerland.

ADDA Type. Automotive Air Purifiers (GoPure), Philips, China

Deteriorating air quality in China has led to the introduction of automotive air purifiers (Shan and Miqdad, 2016). A main threat comes from high concentrations of particulate

matter in the air such as PM 2.5 and PM 10, as these pollutants can cause life-threatening diseases such as cancer, asthma, and in certain cases even a heart attack. This problem was further intensified by the fact that particulate matter was accompanied by volatile organic compounds (VOCs). The deadly combination of particulate matter and VOCs mainly affects people who are suffering from respiratory issues, pregnant women, the elderly, and children. These groups became the early adopters of in-car air purifiers. Everything began in 2008 when an auto extra review uncovered that Chinese drivers are worried about poor in-vehicle air quality. Therefore, in 2010, Philips devised its first universal model of air purifiers for cars with the help of a local mobility R&D team based in Shanghai. Today, onboard air purifiers are a source of pride for Philips. Currently, Philips is the market leader in terms of market share, followed by VOSSON, 3M, and Midea. In the last five years, this company saw massive year-to-year growth for its air purifiers.

Philips recognizes the key pretended by neighborhood Chinese architects in the advancement of its air purifiers. "China is a main country in numerous perspectives. A decade prior, a ton of center developments were created in Europe. Significant worldwide and nearby players like Panasonic, Hisense, Lenovo, and Haier have additionally entered the air purifier market. Up until this point, the fundamental benefit of Philips is that it offers a productive answer for guaranteeing unadulterated air in the vehicle lodges by utilizing HESA in addition to HEPA filtration, as this innovation affects human health and eliminates 99.9% of unsafe substances. Car air purifiers are becoming famous in Japan for security against sensitivities and asthma as well as to guarantee sterilization.

These automotive air purifiers produced in China are being exported to the American as well as European markets.

DDDA Type. Kurkure, Aliva and Nimooz, Pepsico, India

Kurkure is a brand of spiced crunchy puffcorn snacks made up of rice, lentils, and corn, owned by PepsiCo. It was launched in 1999 in India. The snack is currently being manufactured and sold in India, Pakistan, and Bangladesh.

PepsiCo is adapting its Indian innovation Kurkure for Western markets. Kurkure is currently available across the globe wherever there is a large ethnic Indian populace.

PepsiCo India's prepared wafers brand Aliva and lemon-seasoned drink Nimbooz are a portion of the organization's different developments out of India that stand out worldwide and are at present being adjusted to suit nearby preferences for abroad markets.

DDDA Type. Maggi Masala Noodles, Nestle SA, India

Nestle SA has taken its Indian brand, Maggi Masala Noodles, to many markets across the globe including the UK with Tesco, Sainsbury's, and Morrisson until Walmart in

the United States. Moreover, the organization wants to take its zest marks explicitly produced for Indians, like Maggi Pulao Masala (in sachets) and Maggi Masala Sorcery, to different markets. The organization likewise wants to take its Indian brands Maggi Noodle Atta and Maggi pasta soups outside India.

DDDA Type. Noodle Maker/Pasta Maker, Philips, China

The idea for the noodle/pasta maker came from the Kitchen Appliances Innovation & Development Team (KAIND), which is based in Shanghai, China. The primary knowledge was to assist Chinese individuals with keeping up with their traditional craft of noodle making, which reaches back millennia, particularly in Northern China, where noodles are a staple food alongside rice. The machine is intended to work with another age of Chinese individuals to take part in DIY (Do-It-Yourself) noodles, an expertise that had been rapidly blurring.

In 2014, noodle producer machines entered the US and Australian markets as pasta creators. The thought was again to guarantee sanitation and thrilling pasta-making encounters at home.

The pasta creator was presented in the European market as well as in the South American countries of Argentina and Uruguay. 40,000 noodle creator units were sold in China, while 200,000 units were sold in the remainder of the world (Column), with North America being the biggest market.

DDDA Type. Kurkure snack, Aliva, Pepsico, India

Pepsico's Kurkure is a spicy and crunchy, puffed corn "nosh" made up of rice, lentils, and corn that comes in various flavors and spiciness (Oates, 2023). The Kurkure nibble started in India and was launched in 1999. Pepsico's Kurkure showed amazing development in under a decade. PepsiCo's taste creation is distributed in certain markets, including West Asia. Aliva is another creation of PepsiCo. (avilanaturalle site). Product enhancement and a strong marketing approach are credited to its success.

In tune with its plans to repeat the success of Kurkure, PepsiCo has announced the launch of its snacks under the brand name Aliva and plans a large-scale advertising campaign to promote the product (Bruce, 2009). Aliva is one more achievement in Frito-Lay India's excursion to change its portfolio to address the developing buyer center around health and fixings.

ADDA Type. Gatorade PepsiCo, Bangladesh

The inspiration for Gatorade, the Godzilla of sports drinks, dates back to the 1960s when Western doctors who went to Bangladesh to help address a cholera outbreak discovered that the locals were using a drink made of carrot juice, rice water, bananas, and carob flour – a mixture of carbohydrates and sugar – to rehydrate those suffering

from diarrhea (Kaul, 2018). A doctor at the University of Florida read about the traditional treatment and concluded that something similar might help dehydrated football players.

At the time, a Western medical opinion held that putting carbohydrates in the stomachs of patients suffering from diarrhoea would cause cholera bacteria to multiply and the disease to worsen. Yet, the local treatment worked. As Dr Mehmood Khan, boss logical official of PepsiCo (which currently claims Gatorade) puts it, by giving carbs and sugar in the solution with salt, take-up was speedier, and patients rehydrated quicker. The outcome of the therapy was shrouded in the English clinical diary Lancet, and it advanced toward a specialist at the College of Florida. The specialist saw a typical issue in the requirement for quick rehydration. In the event that such a treatment functioned admirably for cholera patients, it would most likely work for sound football players.

Around that time, the University of Florida athletics department was looking for ways to get their football players quickly rehydrated. The research labs of the University of Florida came up with a concoction of water, glucose, sodium, potassium, and flavorings. The tasty cocktail sped the replenishment of the electrolytes and carbohydrates just as was the case with diarrhoea patients in Bangladesh that players lost through sweat and exertion. Gatorade took its name from the Florida Gators, the football team of the University of Florida.

The Gatorade story was unusual for its era. It ran counter to the dominant innovation pattern. Inventions typically originated in rich countries and later flowed downhill to the developing world. Gatorade, by contrast, swam against the tide. It was a reverse innovation.

AADA Type. Naturella, Procter & Gamble, Mexico

Naturella was launched by Procter & Gamble in Mexico as the first line of feminine products made with natural ingredients like cotton fibers and chamomile after discovering that Always, was losing market share to rivals there.

Fast-forward to 2017. When purchasers are more mindful of the quality and beginning of the Products they pick and more young ladies are selecting natural and earth-cognizant female Products, Naturella seized the opportunity to freshen up its relevancy and differentiation.

(DA)DDA Type. Dashboard Audiovisual Systems for Cars, Hartman Case, India and China

The automobile-infotainment division of Harman International known for ultra-sophisticated dashboard audiovisual systems designed by German engineers, developed a radically simpler and cheaper way to create products in emerging markets and applied that method to its product-development centers in the West (Govindarajan, 2012).

Harman did this utilizing a two-part approach: radical change from below combined with astute leadership from above. A small team based in India and China created a new organizational structure and adopted new design methods.

This approach ultimately enabled Harman to offer an unprecedented range of products along a continuum of markets, from low-end to luxury. The company deliberately placed the initiative, named Saras ("adaptable" in Sanskrit), within emerging markets. The team consisted of a software group in India and a smaller hardware group in China. The head count was kept low to ensure flexibility and encourage the members to take initiative.

The project was run by people who were both familiar with emerging markets and deeply rooted in the company culture. To maintain connections with the division's traditional product development centers, the team included three engineers from Germany and three from the United States.

After a successful demonstration to management in 2009, the project entered the commercialization phase. Aiming for entry-level and midrange cars, Harman approached customers in India and China. But it also approached high-end customers.

Some of them at first showed hesitance. Despite the fact that they had squeezed for changes to the inheritance stage, they were surprised by how far Saras had withdrawn from what they'd become used to, and they were worried about the quality.

Only after Hartman invited customers to visit the development centers for presentations and demos were they reassured that the new approach was solid.

The company then began to market the new products to developed-world carmakers whose need for simplicity and low cost was similar to that of manufacturers in emerging markets.

After Toyota accepted Saras, the concerns melted away, and ultimately the sales staff recognized that lower prices didn't necessarily mean smaller commissions. With a higher net benefit for every unit and a lot bigger volume base, deal commissions continued to rise, as well.

A year and a half after send-off, Saras had produced more than $3 billion in new business — a decent piece of its five-year focus of $5 billion — during one of history's most hellacious financial periods. Harman's portion cost rose almost fourfold from 2009 to 2011.

Having innovated for automakers in emerging markets and then offered Saras products to developed-world manufacturers of mid-priced cars, Harman has entered the third stage of its reverse-innovation initiative: Its new secluded and adaptable plan and creation strategies are moving into conventional extravagance markets.

The original Logan was planned at Renault's Technocentre close to Paris, being the consequence of four years of improvement of the X90 project, reported by Renault in 1999, after the acquisition of Dacia around the same time.

During a visit to Russia by French CEO Jacques Chirac, Louis Schweitzer noted that at Lada and Renault dealerships, the €6,000 Ladas were selling very well while the €12,000 Renaults stayed in the showroom. The cheapest version of the car is €5,900.

It was officially launched in 2004. Renault originally had no plans to sell the Logan in Western Europe, but in June 2005, began importing a more expensive version of the car, starting at around €7,500. It was a surprising success with people wanting an inexpensive, no-frills car they could repair themselves.

Case Studies of Emerging Market Multinational Enterprises (EMMEs)

EMMEs lead global innovations by adopting frontier technologies to leave behind legacy technologies mainly in the internet, energy, healthcare, and transportation (Surdu and Narula, 2021).

Internet

DDDA Type. Microblogging website Sina Weibo, China

"Weibo" (微博) means "micro-blog" in Chinese. Launched by Sina Corporation on 14 August 2009, Sina Weibo is a microblogging website and app that compares to Twitter and Instagram.

In contrast with WeChat, Sina Weibo is for the most part utilized by a more youthful populace. It offers a more enlightening and moving substance. In like manner, Weibo permits organizations to set up official and confirmed records to speak with their devotees and publicize their Products and services.

In Walk 2014, Sina Company reported a side project of Sina Weibo as a different element called essentially "Weibo", and documented an Initial public offering under the image WB. (Hidustan Times. 2014) Sina carved out 11% of Weibo in the IPO, with Alibaba owning 32% post-IPO.

Sina Weibo is obtainable in both simplified and traditional Chinese characters. The site also has versions that cater to users from Hong Kong and Taiwan. In 2011, Weibo developed a global version in English and different dialects.

As of September 2021, Sina Weibo had 523 million dynamic month-to-month clients, with 3 of every 7 of those utilizing the site day to day. Sina Weibo has attracted feedback over censoring its users (chinagravy site).

DDDA Type. Mobile Text and Voice Messaging Communication, Wechat, Tencent, China

Tencent, a Chinese Internet giant, introduced a new innovative mobile messaging app which is now the hottest mobile phone app across the world. WeChat (which is called

Weixin in the Chinese language) is a versatile text and voice-informing communication administration Launched on January 21, 2011.

Currently, it has 279 million active users with 78 million (Shan and Khan, 2014).

This app is available for download on the Apple app store, Google Play, BlackBerry App World, and marketplace for Windows phones. Concerning the services for smartphones, the application gives message informing, hold-to-talk voice informing, video calling, broadcast informing, area sharing, and video/photograph sharing highlights. The assistance is given in excess of 15 dialects. This large number of elements has made WeChat the fifth most downloaded application after Google Maps, Facebook Courier, YouTube, and Google in addition to. Tencent opened its delegate workplaces in the USA in 2014, for its person-to-person communication program and has declared that it has gone into concurrence with the Tech monster Google for its advancement in the USA.

Presently, the vast majority of the clients in the US are Chinese living in the US or individuals who have someone to contact inside China, like family or Partners.

DDDA type. Capsule Collections, Baoshop Mr Bags, China

Tao Liang, nicknamed "Mr bags", is a graduate of the University of Southern California and Columbia University. Although he is only 26 years old, he has already become one of the most successful digital influencers in China, in terms of the ability to drive sales (Retail News, 2019).

He has chipped away at container assortments with various extravagance brands, for example, Givenchy, Longchamp, and Montblanc, bragging about a colossal following on WeChat and Weibo, which are two of the biggest virtual entertainment networks in China.

He also knows how to sell them to his over 3.5 million readers on China's biggest social media platform Weibo and more than 850,000 followers on WeChat, a microblogging messaging app.

In 2012, the graduate of both the College of California, Los Angeles (UCLA) and Columbia College began his Weibo account, Mr. Packs; today he's collected practically 3.5 million Weibo supporters and endless fans on his WeChat account and has been tapped by extravagance brands like Dior, Fendi, Chloé and Tod's for joint efforts.

Tao launched a mini-program on WeChat called the BaoShop, dedicated to designer collaborations and offering products exclusively to his WeChat followers (Chen, 2018).

Tao's vision for Baoshop is to create exclusive pop-ups that are dedicated to limited-edition offerings as well as bespoke Products. As a matter of some importance, it's an elite spring-up idea. The unique assortments are quite often sold out in minutes. Bags priced from 5,000 yuan (US$770) to 30,000 yuan perform especially well on our platform.

On 9 April 2013, Alibaba Gathering declared that it would secure 18% of Sina Weibo for US$586 million, with the choice to purchase up to 30% later on. Alibaba practiced this choice when Weibo was recorded on NASDAQ in April 2014.

Healthcare

DDDA Type. Temporary Abdominal Wound Closure, Bogotá bag, Columbia

The unique contribution of Oswaldo A. Borraez Gaona, MD, of Bogota, Colombia, was the utilization of a plastic pack over the open midsection in harmed patients. The pack takes into consideration quick access for a relaparotomy and covers and safeguards the viscera until edema, as well as contamination, settles. The Bogota sack is a development in harm control as a medical procedure. This insignificant expense strategy serves to quickly cover the open mid-region and forestall destruction. It permits simple access to the mid-region. It very well may be supplanted with a new one at an insignificant expense. Tragically, be that as it may, it experiences a few disservices: It doesn't protect skin or sash from harm. It doesn't forestall the aggregation of intra-stomach liquid wealth in cytokines.

It does not help control intra-abdominal pressure (IAP) or prevent intra-abdominal hypertension (IAH).

The open mid-region is utilized when the stomach entry point can't be shut, when an early reoperation is important, to forestall a stomach compartment condition, for the treatment of optional or tertiary peritonitis, for the treatment of omphaloceles in neonates, and the treatment of missing portions of the abdominal wall (Dhananjaya and Cotton, 2021; Tran V.T. and Ravaud, 2016).

Bogotá bag is a temporary abdominal wound closure, Kangaroo mother care for premature infants, the orthopaedic external fixator for complex fractures, shunt valve for normal pressure hydrocephalus, mosquito net mesh for inguinal hernia repair, and manual small incision cataract surgery.

D(DA)DA. Aurolad, Intraocular Lens, India

Aurolab is Aravind's eye hospital manufacturing arm. Aurolab's intraocular lens (IOL) division was set up in the year 1992 with only 10 production staff to manufacture three-piece PMMA intraocular lenses with technology transfer from the USA (aurolab site). The fantasy about making the IOLs accessible at a cost reasonable for Rural patients was accomplished when Aurolab conveyed great IOLs at Rs.270/ - per lens.

Aurolab invested in and launched single-piece PMMA IOLs in 1994.

In the year 1998, the IOL division got an ISO certificate and in 1999 got CE confirmation for its Products.

In 2002 Aurolab introduced its hydrophilic acrylic IOL and in 2007 its Hydrophobic acrylic IOL, Aurovue.

Today this division manufactures a wide range of IOLs including premium, new technology IOLs. Aurolab Lenses are exported to over 120 countries worldwide including Canada, Denmark, and Israel, though not the U.S.

Transport

DDDA type. Two-wheel Drive Tractor, Mahindra & Mahindra Limited (M&M), India

The history of Mahindra and Mahindra began in 1954 with M&M becoming a manufacturing Partner of the Willys Overland Corporation, US (Thomke and Luthra, 2009). Willys is best known for its design and production of military and civilian jeeps. With the initiative of two brothers K.C. Mahindra and J.C. Mahindra, the jeeps were licensed to be manufactured in India as the Mahindra brothers perceived the value of Willy jeeps suitable for India's emergent road infrastructure. Later on, M&M formed collaborative Partnerships with several global automobile manufacturers such as Renault, Ford, Peugeot, Mitsubishi/Samcor, Ugine Kuhlmann, and International Harvester Company (Thomke and Luthra, 2009).

Keshub Mahindra attached management of the firm in 1948 and was elected chairman in 1963. With the leadership of Keshub Mahindra, in 1990 real reform was initiated in M&M to become competitive in India (Mahindra, 2014).

He emphasized that innovation in all spheres of product development and process management would enable M&M to become the topmost player in the Indian automobile market.

He supported an engineer named Sandesh Dahanukar who came up with the idea of developing a tubular chassis for several vehicles. Sandesh observed the fact that conventional chassis were not suitable for automotive vehicles since the chassis were prone to frequent breakdowns due to the massive pressure of the vehicles. He thus came up with the idea of an affordable tubular chassis to support load bearing (Thomke and Luthra, 2009). Anand described Sandesh as a "maverick" engineer who thinks out of the box and does not always go by the routine processes and protocols (Thomke and Luthra, 2009). To expedite the prototype development of the tubular chassis, Anand Mahindra arranged a budget of 600,000 INR (US$9,643) and arranged for Sandesh to work on the project without being affected by the corporate bureaucracy. With direct assistance from Anand, this effort paid off and in a few years, a fully functional tubular chassis was crafted, saving more than 300 million INR for M&M (Thomke and Luthra, 2009).

Another M&M engineer, named K.J. Davasia, who possessed deep knowledge about the Indian tractor market observed that Indian farmers not only use tractors for farming but also personal and commercial transportation for spawning extra household income. Based on his observation, Davasia came up with the idea of the affordable "Sactor", which is a combination of tractor and hybrid transporter for low-income Indian farmers (Thomke and Luthra, 2009). Davasia, who is now the CEO of M&M's farm equipment

sector (FES), approached R.N. Nayak who was leading the R&D for the FES. With less than one million INR budget (US$16,130), a concept prototype was developed, using the frugal engineering approach. In 2003 the "Sactor" project underwent initial testing phases. Mahindra tractors, over time, became very popular in India.

They were inexpensively priced and fuel-efficient, two qualities highly valued by frugal Indian farmers. The machine was appropriately sized for the small Indian farms with its small turning circle. Additionally, when not on the farms the tractors did double duty to ferry loads from the city, not only for farmers and their families but also on hire for others. Sometimes it would also be used as a passenger vehicle for the family and also on hire. Mahindra USA entered the US tractor market in 1994 (Mishra, 2013). The company has established itself as a successful niche player using innovative marketing and sales strategies.

Instead of trying to develop a product that could compete with bigger brands, Mahindra USA targeted a smaller agricultural niche - hobby farmers, landscapers, and building contractors. It coupled this strategy with personalised service, building close relationships with dealers, customers, and the community at large. Through reverse innovation, Mahindra USA launched a two-wheel drive tractor in the market. Competitors and analysts did not expect it to succeed but today they have almost 90 percent share of that market segment. The company is now expanding beyond the US market. It recently opened a distribution centre in Canada followed by another in Mexico. It has acquired a distributor in Brazil. Brazil will become the central point of our operations in South America.

DDDA type. Yadea Green E-bikes in China

Yadea is a worldwide forerunner in creating and fabricating electric two-wheeled vehicles including electric bikes, electric mopeds, electric bikes, and electric kick bikes.

To date, Yadea has sold products to 70 million users in over 90 countries and has a network of 40,000+ retailers worldwide. With a mission to help people "Electrify Your Life", Yadea continues to invest in R&D, production, and global expansion to build a shared and sustainable future for mankind. Yadea has forever been focused on providing practical and green electric transportation, answering the public call for carbon nonpartisanship, and taking energy saving and emanation decrease as the center objective of the organization's free commitment.

After 20 years of development, Yadea has sold more than 70 million electric two-wheelers including in the United States and Australia.

Materials

DDDA Type. Construction Materials, Cemex, Mexico

CEMEX is a construction materials company that produces, distributes, and sells concrete, clinker, aggregates, and construction products such as asphalt tiles, cement

blocks, etc (cemex site). CEMEX offers solutions for housing, pavement, and commercial development projects. CEMEX's Products incorporate prepared blend concrete, oil-well concrete, mixed concrete, rock, black-top, sand, substantial lines for sewer systems, design Products, and others.

CEMEX is recognized for its technological capabilities, customer service, and branding expertise. The company has transformed undifferentiated commodities into value-added, premium-priced products under three broad categories. cement (Portland grey and white, mortar, pozzolana, oil well), ready mix (Ready-to-pour mixtures of cement, sand, gravel, and water), and related products (Crushed stone, sand, gravel, paint, lumber, and electrical supplies).

The company's social innovation is reflected in the "Patrimonio Hoy" (PH) project that was originally launched in Mexico as a Do It Yourself (DIY) construction process and has since expanded to several other low-income communities in Latin American countries. Within this scheme, emigrants in the United States can send their remittances directly to a CEMEX retail shop, and families receive construction materials instead of cash. In the developed world the company uses its innovative experience by developing materials adapted to the local conditions such as in the UK, with VIATEX, VIABASE, VIADRIVE, and VIASHADE materials (babourproducts search site).

VIATEX® VIATEX® 07 is a thin surface course asphalt developed by CEMEX to meet the specific needs of the UK market. Due to its stable aggregate skeleton, it can provide significant benefits to the road user, the surfacing contractor, and the highways specifying authority.

VIABASE® is an innovative Stone Mastic Black-top (SMA) cover course that gives a Cost-effective, execution-driven answer for present-day street upkeep methodologies. As flimsy surfacing systems have become more boundless in their utilization, support systems have gone through an unobtrusive change.

The surface dressing has declined significantly in the UK and with local authorities having to take on an increased burden of highway management and maintenance, new, more cost-effective approaches are being adopted

VIADRIVE® is a surfacing framework explicitly created to give a solid and stylishly satisfying surface for carports and access streets. Conventional surfacing materials have traditionally provided a low-maintenance and cost-effective solution for driveways, access areas, and parking zones

VIASHADE® A true "coloured" Asphalt is an extremely important element in modern construction and landscaping. Shaded bituminous surfaces can be utilized either simply tastefully or to satisfy explicit practical or plan measures. They can successfully outline specific regions, like leaving coves, cycle, and transport paths, and through courses and upgrade health guidelines on bequest streets by underlining their private use.

CEMEX has established a network including people from CEMEX as well as from national and international universities and specialist institutes from countries such as Holland, Austria, and the USA (Torres and Jasso, 2016). They created a Technical

Support System (TSS) operating through data technologies. This system consists of a series of tools that allow the collaboration and sharing of technical knowledge between people from different subsidiaries (Torres, 2004). A principal job of the CEMEX R&D group during the multinationalization process has been to carry out the modernization of the plants in acquired firms. This includes optimization of the equipment, systems and operations, maintenance, and materials. By 2001 the company founded the CEMEX Research Group (CRG).

It was created to exercise leadership in the development and management of R&D of CEMEX initiatives and to manage the intellectual property (IP) portfolio, as the owner of it, in the business units and activities of CEMEX worldwide. CRG is deliberately located in Switzerland, is one of the most innovative centers in the world. CRG is integrated by a multidisciplinary group that includes research scientists, engineers, and experts in business and marketing, from 23 nationalities. From one perspective CGR joins the best specialists of CEMEX's tasks in his group, and then again it completes Partnerships with driving establishments in exploration and colleges in Switzerland and the remainder of the world.

Industry

DDDA Type. Galanz Affordable Microwaves, China

In September 1978, Galanz was founded, originally as Guizhou Down Products Factory, located near Hong Kong in the district of Shenzhen, southern China It began to manufacture water-washed down feathers including goose, duck, and chicken feathers (Bolmsjö Heller, 2015).

In 1991, the textile industry became very competitive as increasing factories entered the Chinese market. After one year of managers' market research and with inspiration from Japan, Galanz decided to enter the Chinese microwave oven market in 1992.

In 1992, Galanz bought its first microwave oven assembly line together with associated equipment from Toshiba to start production and design (Ge & Ding, 2007). These excessive R&D and external knowledge-seeking efforts resulted in a high-quality product with improved features and close to the developed-market quality offered at an emerging-market price (Hang et al., 2010). In 1993, the first microwave oven was successfully launched in China, and by 1996, three years later, Galanz' market share in China reached 50% (Ge & Ding, 2007).

By 2000, Galanz had a 70% market share in China. By 2005, more than 50% of Galanz's microwave Stoves were manufactured for international export under its brand. Because of its Chinese roots, it was the innovator for microwave features such as stir-frying, deep-frying, and steam cooking, which made the microwave oven a broader cooking device, not only in Chinese consumers' kitchens but worldwide. Galanz made a global mark with its innovative small and cheap microwaves, perfect for middle-class families and small households in developed countries. (Hang et al., 2010). Due to the success of Galanz's microwave Stove international competitors started to move their

production to Galanz's factories. Galanz worked with the price of the microwave compressors, the key component of microwave Stoves, to win contracts. Due to its scale, it was able to offer manufacture microwave compressors to its international competitors for about USD7.5 (compared to USD30 from Europe and Japan). Both the European and Japanese firms outsourced their production facilities to Galanz, resulting in greater economies of scale, lower product prices, and greater R&D achievements for Galanz. In 2007, Galanz produced every third of every new microwave produced in the world, and the microwave compressor made by Galanz was charged around USD4.

DDDA Type. Maintenance Management Practice, Bharat Forge, India

Bharat Forge associated with the automotive industries, power, oil and gas, marine, and aerospace industries has developed a maintenance management practice. This maintenance management practice is designed to minimize downtime during machine maintenance plus has an advanced information system for problem predictions. The average downtime is less than 10 percent for all its global platforms (Casestudyinc, 2010). The company eventually secured its presence in various parts of the world such as Sweden, the U.S.A., and Germany.

Energy

D(DA)DA Type. Wind Power Provider, Suzlon, India

Suzlon Energy is a provider of renewable energy solutions (Deva, 2023). The company is a producer of wind turbines. It offers a scope of sun-based energy solutions, for example, solar irradiance evaluation, land obtaining and endorsements, framework, and power departure, production network, establishment and commission, and life cycle resource management.

Tulsi Tanti, a mechanical engineer, was keeping an eye on his family material business in Surat, Gujarat.

The business was not in the best of health, mainly due to high operating costs caused by expensive electricity and frequent power outages. In 1994, he purchased two wind turbines and produced his electricity (suzlon site). Mr Tanti exits the textile business and enters into the energy sector with Suzlon. In 1995, Suzlon was shaped by providing clients with a total bundle of wind energy services. (Mehra and Munroe, 2011).

He established a technical collaboration with the German wind energy leader Südwind Energy GmbH, to strengthen and build its expertise in designing Wind Turbine Generators (WTGs). This mechanical mastery gave the basic push that assisted Suzlon with setting up WTGs across India from 1995 to 2000. During this period Suzlon commissioned its first 0.27MW WTG for Indian Petrochemicals Ltd(IPCL) in Gujarat. It also commissioned WTGs in the state of Maharashtra and Tamil Nadu (Pradhan, 2012). The rising organization of WTGs likewise prompted a proportionate expansion in the introduced limit with the organization crossing the 100MW introduced limit mark

in this period. Suzlon likewise charged its first 1MW WTG for the then Goodbye Gathering Organization, Niskalp Interests in the year 2000.

After a series of challenges, the first export was in the year 2003 to the United States of America, then Brazil, Germany, Netherlands, Australia, Asia, Europe, Africa, and. It has a reach of 32 countries with more than 10,000 wind turbines. The company has also powered electricity for a populace of 50 million people in the last 20 years, which is about 9000 MW in total. The company's website shows that they have 17,000 MW of wind power deployed globally as of today. The expansion scheme was well planned and well timed as mentioned by several senior officials in the press and media. The company's first acquisition was with Senvion and the latter was with Hansen Transmissions.

Suzlon is considering setting up a manufacturing plant in South Africa, which has recently opened up its wind energy market (Mehra and Munroe, 2011). It is now building a plant in Brazil.

Suzlon has a 33 percent piece of the pie in India's total wind energy establishments.

The organization has tasks and support services across 191 destinations that depend on more than 9,600 wind turbines.

DDDA Type. Wind Permanent Magnet Direct-Drive (PMDD) Technology, Vensys, Germany, Goldwind, China

Wu Gang a 1983 graduate of Urumqi's Xinjiang Engineering Institute, was born in 1958 (Clifford, 2015).

Wu's excursion toward Goldwind began while he was instructing at a specialized school in his old neighborhood of Urumqi.

Xinjiang Wind Energy, one of China's spearheading wind organizations and Goldwind's ancestor, was established by utilizing a $3.2 million Danish award. The organization was driven by Wang Wenqi, an obstinate man who accepted that wind could be bridled for electrical power.

In December 1987, together, Wang, Wu, and their group persevered in their vision of wind power and assembled China's most memorable wind ranch at Dabancheng.

Dabancheng wind ranch, opened in 1989, comprised of the thirteen little, 150 kilowatts, wind turbines made by Danish turbine producer, Reward Energy.

Goldwind was established by Wu Posse as a component of the Chinese government's 863 Program and was supported by the state. The subsidizing assisted Goldwind with opening its most memorable get-together plant in Urumqi and consent to innovation move solution with a German turbine maker Vensys. In 2008, Goldwind bought its super durable magnet direct-drive (PMDD) innovation from Vensys.

VENSYS Elektrotechnik, Germany, main business line is the manufacture of full inverter systems up to 6 MW for wind energy and solar parks.

Full inverters guarantee that the produced power is taken care of in the matrix with reliable voltage and incremental recurrence. A further fundamental item is the production of pitch systems - purported rotor cutting-edge change systems for wind turbines.

Goldwind spearheaded the Chinese wind market by becoming quite possibly the earliest organization to investigate the capability of wind power.

Today, Goldwind is a leader in the global wind industry with mature manufacturing capabilities, innovative permanent magnet direct-drive (PMDD) technology, and a proven track record.

2007 – Goldwind becomes a publically listed company on the Shenzhen Stock Exchange. Goldwind's first 1.5MW turbines begin to operate.

2008 – Goldwind Science & Technology acquires a 70% stake in the German company Vensys AG, and completes construction of R&D centers in Beijing, Xinjiang, and Germany.

In 2009 – Goldwind successfully launched an independently-developed 2.5 and 3MW turbine series. Goldwind installs its 1.5MW wind turbines at Uilk Wind Farm in Pipestone, Minnesota, USA marking a major step forward in the company's international expansion.

In 2012 – Goldwind connected its first large-scale wind power project in the US, the 109.5MW Shady Oaks Wind Farm, to the grid and completed the sale of the project to a power generation arm of a foremost Canadian utility in the same year.

DDDA Type, Regional Jet, Embraer Aircraft, Brazil

In August 1969, the government of Brazil made a choice to put resources into the flight fabricating industry and established an organization under the name of Empresa Brasileira de Aeronáutica (Embraer).

Embraer was at first considered to change into designing and modern limit, the science and innovation created by Brazilian Centro Técnico de Aeronáutica (CTA) as well as the Instituto Tecnológico de Aeronáutica (ITA). The company was required to develop civilian projects as well as work on military contracts (Chaudhary, 2019).

In 1994, Embraer was privatized and turned into the greatest exporter of high-innovation results in the Southern Half of the globe and the third-biggest maker of business airplanes on the planet.

The 15-21 seater Embraer EMB 110 Bandeirante was Embraer's first aircraft. EMB 110 is used by the government or even commercial businesses to serve small settlements around Brazil, suiting the regional passenger market as well as military transportation. The manufacturer remained domestic until 1975 when its first internationally acknowledged aircraft, the Embraer EMB 120 Brasilia was released.

The company continued its successive trail in Europe when it slid into the jet range with its Embraer Regional Jet (ERJ) family. Having 30-50 seats, ERJ130/5 and ERJ140/5 airplanes acquired fame with provincial carriers and saw north of 1,200 ERJs being constructed. With ERJ145, exhibited in 1989, Embraer cleared a path into the provincial carrier market too.

Under the cloak of achievement gifted by the ERJs, in 2002 Embraer chose to enroll in the bigger airplane market presented its newly planned E-Fly family, and invited worldwide endorsement once more. Offering financial, quick, and dependable trips on short courses, the E170/175 and E190/195 became ideal for carriers working between urban communities in Europe and North America.

Uncovered in 2013, the E-jets were then renovated into the E-Fly E2 territory. E2 treatment was given to the E175, E190, and E195 comprising uprated motors, a further developed wing plan, new aeronautics, and a refreshed lodge. This checked one more effective tryst with provincial carriers.

With a capacity of around 80 passengers, the E175-E2 was the smallest one while the E190-E2 had around 96 seat capacity.

As of late, Embraer has uncovered its most memorable completely electric airplane. Presently, a work in progress, it is a demonstrator project containing 100% electric impetus innovation. For the rudimentary assessment of the zap innovation, the little, single-motor airplane in view of the EMB-203 Ipanema farming airplane will be introduced with the innovation to be tried.

Ipanema, the agricultural aircraft provided the basis for the electric prototype. The principal trip of this airplane is planned in 2020, up to that point the demonstrator airplane will keep on going through tests.

EmbraerX carried out its new objectives for the improvement of eVTOLs, their air traffic guidelines, and the production of an armada skeptic flying services network at the Uber Lift Highest point 2019. The air taxi with an eight-rotor framework, plans to enhance the metropolitan climate and spotlight on high unwavering quality, low working expenses, and low commotion impression.

In the same year that Embraer celebrates its 50th anniversary, the company also undergoes major changes. One of them is its essential joint endeavor with Boeing in the business flight region and the multi-mission airplane KC-390.

Last year, Boeing and Embraer announced a strategic partnership that positions both companies to accelerate growth in global aerospace markets. Under the details of the solution, Boeing will hold an 80 percent proprietorship stake in the joint endeavor and Embraer will possess the excess 20% stake.

The proposed organization has accepted investors' endorsement, approval by the directorate, and authorization by the Government of Brazil this year.

DDDA type. Rechargeable Lithium Batteries, Contemporary Amperex Technology Co., Limited (CATL) and BYD, China

BYD and CATL have made significant contributions to the development of EV technology,

Established in 1995, BYD, Build Your Dreams, has grown to become one of the largest EV manufacturers in the world.

BYD's batteries are known for their high energy density, which allows for longer driving ranges and improved performance. They utilize lithium iron phosphate (LiFePO4) chemistry, which offers enhanced safety and longevity compared to other lithium-ion battery types.

Founded in 2011 CATL has quickly gained recognition for its cutting-edge battery technology. CATL batteries are known for their high energy density and fast charging capabilities. They primarily use lithium nickel cobalt manganese oxide (NCM) chemistry, which offers a balance between energy density and cost-effectiveness.

The main difference between BYD and CATL batteries lies in their chemistry. BYD utilizes lithium iron phosphate (LiFePO4), while CATL predominantly uses lithium nickel cobalt manganese oxide (NCM). LiFePO4 batteries are recognized for their safety, long cycle life, and thermal stability. On the other hand, NCM batteries offer higher energy density, allowing for longer driving ranges and faster charging times.

Multinationals from Advanced Countries Supporting Reverse Innovation

Herewith is the list cited in this chapter

GE

MAC 400 Electrocardiogram (ECG), India

MAC 800, China

Vscan, China

Philips

Ultrasound Machine, Philips, China

Noodle Maker/Pasta Maker, Philips, China

Siemens

Multix Select DR, Siemens, China

Procter and Gamble (P&G)

Vicks Honey Cough, Procter and Gamble (P&G), Venezuela

Naturella, Procter & Gamble, Mexico

Pepsico

Kurkure, Aliva and Nimooz, Pepsico, India

Kurkure snack, Aliva, Pepsico, India

Gatorade PepsiCo, Bangladesh

Nestlé

Maggi Masala Noodles, Nestlé SA, India

Hartman

Dashboard audiovisual systems for cars, Hartman, India, and China

VENSYS, Germany, Goldwind China

Wind permanent magnet direct-drive (PMDD)

Countries and Companies from Developing Countries Supporting Reverse Innovation

Herewith is the list cited in this chapter

China

Sina Weibo

Microblogging website, Sina Weibo

Wechat, Tencent

Mobile text and voice messaging communication, WeChat, Tencent

Baoshop

Capsule collections, Baoshop Mr bags

Yadea Green

Yadea Green E-bikes

Galanz
Galanz Affordable microwaves

Contemporary Amperex Technology Co., Limited (CATL) and BYD
Rechargeable lithium batteries

India
Aurolad
Intraocular lens

Mahindra & Mahindra Limited (M&M)
Two-wheel drive tractor

Bharat Forge
Maintenance management practice

Suzlon
Wind power

Columbia
Bogotá bag
Temporary abdominal wound closure

Mexico
Cemex
Construction Materials

Brazil
Embraer aircraft

Education and Research Platforms Using and Supporting Innovation

MNCs, universities, and education professionals propose educational platforms focused on creativity and the capacity to implement innovation in different domains. The selected MNCs organisations and programs are LEGO, Oando Petroleum, Nestlé, Pricewaterhouse Coopers (PwC), Hess Corporation, Microsoft, Tata Center for Technology and Design, Organization for Environmental Education and Protection (OpEPA), Dream a Dream, Massive Open Online Courses (MOOCs), Learning Network, Cohort learning, Learning Management Systems (LMS) and Educational communities.

Introduction

The traditional education system was introduced, ushering in the industrial age. Educating and learning were molded into a one-size-fits-all model for giving fundamental numeracy and proficiency abilities during this time. Schools were ranked, and students were sorted to determine who would be eligible for higher education and would enter factory or farm work immediately.

Race, culture, geography, and gender are no longer impediments to learning. Schools are ensuring that all students thrive in and out of the classroom. This is not to say that all students will achieve the same outcomes at the same performance levels. Nonetheless, we expect a system in which students can flourish as they uncover their full potential.

In many ways, one-size-fits-all approaches fail to meet that expectation. They ignore the fact that students bring a diverse set of knowledge, skills, and experiences to the classroom. Providing personalized learning, a teaching approach to address students' individual educational needs, is one promising way to improve outcomes.

Universities, education professionals, and MNCs propose innovative educational programs focused on creativity and the capacity to implement it in different domains. Those initiatives are adapted to the conditions and the needs of both sides, educators, students, and companies and organizations hiring their services. Some of the initiatives are implemented in developing countries, improving their education system and their capability to grow.

Massive Open Online Courses (MOOCs)

In 2001, MIT pioneered the OpenCourseWare (OCW) initiative, which allowed everyone access to course materials on the web while licensing the use, modification, and redistribution of these materials (ocw.mit. ed. site). The open-access model was critical in the evolution and direction of MOOCs. The first MOOC, "Connectivism and

Connective Knowledge (CCK08)," was taught by George Siemens and Stephen Downes at the University of Manitoba in 2008, and it drew 2200 students from all over the world.

However, completion rates have remained contentious since MOOCs entered the mainstream in 2012.

Proprietary learning portals like edX, Coursera, and Udacity first started offering standardized online training programs. They concentrated on imparting lower-level, day-to-day skills.

edX

Was established in May 2012 by researchers from MIT and Harvard. Gerry Sussman, Anant Agarwal, Chris Terman, and Piotr Mitros showed the principal edX seminar on circuits and gad-derives at MIT, drawing 155,000 students from 162 nations. In 2013 they attached forces with Stanford and in June 2013 they arrived at 1 million students. edx.org released as open source, creating Open edX (web.archive.org site).

Coursera Inc. (COUR)

COUR is an internet-based schooling supplier that offers students access to courses, specializations, and degrees (Eckstein, 2022). Established in 2012 by Stanford software engineering teachers Andrew Ng and Daphne Koller, Coursera doesn't make instructive substance.

Rather, the company Partners with universities and other organizations to provide them with an online platform that students pay to access.

Coursera

Coursera initially started working with a couple of schools (Stanford, Princeton, College of Michigan, and the College of Pennsylvania) to bring a portion of their famous courses to the web. Today, Coursera additionally cooperates with organizations, legislatures, and not-for-profit organisations. As of May 2021, Coursera cooperates with in excess of 200 foundations all over the planet and offers more than 3,000 courses, authentications, tasks, and specialty fields to a huge number of students.

In 2023 more than 275+ universities and companies offer more than 4,000 courses through Coursera.

Udacity

Udacity started when Stanford teachers Sebastian Thrun and Peter Norvig had a progressive plan to offer a "First experience with computerized reasoning" course on the web — to anybody, free of charge (udacity website). North of 160,000 students in

excess of 190 nations enlisted, requesting a better approach to convey training. A surprising disclosure arose, the best 400 students weren't from Stanford. This disclosure ignited a mission to make deep-rooted learning more impartial and inclusive. Udacity has been extending amazing opportunities from that point forward.

The loss of favor and popularity of MOOCs has led to the development of numerous variants, with Partner-based learning gaining the most acceptance.

Learning Network

Personal Learning Network" (PeLN)

Back in 1998 when the internet was in its infancy, Tobin (1998) wrote an article about the term PeLN). This term was used to describe a network of people and resources that support ongoing learning (teacherchallenge site).

The PeLN consists of relationships between individuals where the goal is the enhancement of mutual learning. The currency of the PeLN is learning in the form of feedback, insights, documentation, new contacts, or new business opportunities. It depends on communication and a degree of trust that each party is effectively looking for esteem-added data for the other.

Professional Learning Network (PrLN)

The term has evolved and is now sometimes referred to as a PrLN, taking into account professional growth and interaction.

Like in many other industries, educators have access to people from all corners of the globe 24/7. This may to a great extent be through virtual entertainment yet different stages too, like websites, online networks, and news destinations.

Many barriers have been removed, geography, culture, language, time zones, travel, costs, and logistics.

PrLNs represent any group that engages in collaborative learning with others outside of their everyday community of practice, with the ultimate aim of improving outcomes for children (Brown & Poortman, 2018).

The PrLNs, aim to bring together scholars, practitioners, and policymakers with the common goal of better understanding and supporting networks for learning of educators with the ultimate goal of improving student learning.

Networks of educators, from different schools such as teacher design teams, research learning networks, data teams, and lesson study teams appear to provide such promising forms of teacher development.

Although teachers working and learning together in PrLNs is considered one way to support teachers, at scale, to rethink their practice, there is still a lot to learn about this process of professional collaboration and the conditions that influence and sustain it.

Herewith PrLNs are relevant to developing countries. Herewith educational networks supporting innovation.

World Bank's Africa Centers of Excellence Project (ACEP)

The Africa Centers of Excellence Project (ACEP), launched by the World Bank in 2014 to improve research and teaching capacity in the area, is one such excellence project (ace.aau site). The stages and subsidizing sums are Pro I ($165 million in West and Central Africa), Pro II ($148 million in Eastern and Southern Africa), and Expert Advancement Effect ($274 million in West and Central Africa).

The ACE 1 undertaking objective was to: cultivate territorial particular information between taking part grounds in regions that attention on unambiguous common provincial advancement resistances; improve these advanced education establishments' abilities to convey world-class preparing and research strategies; and also, to meet the demand for skills required for Africa's development, such as the extractive sector.

 At the end of the ACE 1 project period, 30,730 African students and 3,583 faculty have been trained, 2,593 research publications have resulted from their work, 9,070 practical internships have been undertaken, and over US $50 million has been raised through external revenue generation.

Herewith the centers of excellence (CE) established by ACE I and ACE II mainly in health, agriculture, ICT, mines, oilfields, material, food, Sustainable Cities, climate, change, water management, railway, aquaculture and fishing, textiles, mathematics, herbal and traditional medicines, nanotechnology, rodent pest management & biosensor technology development and energy.

Nigeria

African Central Point of Greatness for Genomics of Irresistible Infections (ACEGID). Savior's College, Ede

African Central Point of Greatness for Disregarded Tropical Illness and Criminological Biotechnology. Ahmadu Bello College, Zaria

African Central point of Greatness in Phytomedicine Innovative work (ACEPRD). College of Jos

OAU ICT- Driven Knowledge Park (OAK-Park). University of Obafemi Awolowo,

Pan African Materials Institute. African University of Science and Technology

Center of Excellence in Oilfield Chemicals Research (CEFOR). University of Port Harcourt.

Center for Agricultural Development and Sustainable Environment (CEADESE). Federal University of Agriculture, Abeokuta.

Center for Food Technology and Research (CEFTER). Benue State University, Makurdi.

Center in Dryland Agriculture (CDA). Bayero University, Kano.

Center of Excellence in Reproductive Health Innovation (CERHI). University of Benin, Nigeria.

Cote d'Ivoire

Centre d'Excellence Africain Mines et Environnement Minier (CEA MEM). Insitut National Polytechnique Felix Houphouet-Boigny

Center of Excellence for Climate Change, Biodiversity and Agriculture (CEA-CCBAD) Felix Houphouët-Boigny University.

Togo

Centre of Excellence in Sustainable Cities in Africa (CERViDA - DOUNEDON) University of Lomé.

Niger

Centre of Excellence in Innovative Teaching / Learning of Mathematics and Sciences for Sub-Saharan Africa (CEA / IEA-MS4SSA) Niamey.

Ethiopia

African Centre of Excellence for Climate Smart Agriculture and Biodiversity Conservation (Climate SABC). Haramaya University.

Centre for Innovative Drug Development & Therapeutic Trials for Africa (CDT-Africa). Addis Ababa University

Africa Center of Excellence for Water Management (ACEWM). Addis Ababa University

Africa Railway Center of Excellence (ARCE). Addis Ababa University.

Kenya

Centre of Excellence in Sustainable Agriculture & Agribusiness Management (CESAAM). Egerton University.

Sustainable Use of Insects as Food and Feeds (INSEFOODS). Jaramogi Odinga Oginga University of Science & Technology.

Centre of Excellence in Phytochemicals Textiles and Renewable Energy (PTRE). Moi University.

Malawi

Centre of Excellence for Aquaculture and Fisheries Science (Aquafish). Lilongwe University of Agriculture & Natural Resources (LUANAR)

Africa Centre of Excellence for Public Health and Herbal Medicine (ACEPHEM). University of Malawi – Malawi College of Medicine

Regional Centre of Excellence in Agricultural Policy Analysis (APA). Lilongwe University of Agriculture and Natural Resources (LUANAR)

Centre of Excellence in Transformative Agriculture Commercialization and Entrepreneurship (TACE). Lilongwe University of Agriculture and Natural Resources (LUANAR)

Centre for Resilient Agri-food Systems (CRAFS). University of Malawi

African Centre of Excellence in Underutilised and Neglected Biodiversity (ACENUB). Mzuzu University.

Mozambique

Center of Studies in Oil and Gas Engineering and Technology (CS-OGET). Universidade Eduardo Mondlane

Africa Center of Excellence for Food Agricultural Policy and Programs. Universidade Eduardo Mondlane

Rwanda

African Centre of Excellence in Energy for Sustainable Development (ACEESD). University of Rwanda – College of Science & Technology

African Centre of Excellence in Internet of Things (ACEIoT). University of Rwanda – College of Science & Technology

African Center of Excellence for Teaching and Learning Mathematics and Science (ACEITLMS). University of Rwanda College of Education

African Centre of Excellence for Data Sciences (ACE-DS). University of Rwanda – College of Business & Economics

Tanzania

African Centre of Excellence for Innovative Rodent Pest Management & Biosensor Technology Development (IRPM&BTD). Sokoine University of Agriculture.

Southern African Centre for Infectious Disease Surveillance (SACIDS). Sokoine University of Agriculture

Water Infrastructure & Sustainable Energy Centre for the Futures (WISE FUTURES). Nelson Mandela African Institution of Science & Technology

Collaborating Centre for Research, Evidence, Agricultural Advancement & Teaching Excellence & Sustainability (CREATES). Nelson Mandela African Institution of Science & Technology

Uganda

Makerere University Regional Centre for Crop Improvement (MaRCCI). Makerere University

Centre of Materials, Product Development & Nanotechnology (MAPRONANO). Makerere University

African Centre for Agro-ecology & Livelihood Systems (ACALISE). Uganda Martyrs University

Pharm-Biotechnology & Traditional Medicine Centre (PHARMBIOTRAC). Mbarara University of Science & Technology

Zambia

Africa Centre of Excellence in Infectious Diseases of Humans and Animals (ACEIDHA). University of Zambia

The Copperbelt University Africa Centre of Excellence for Sustainable Mining. Copperbelt University

Burkina Faso

ACE in the Education and Research with Water, Energy, and Environment Sciences and Technologies. Institut International d'Ingénierie de l'Eau et de l'Environnement 2ie.

Cameroun

Centre d'Excellence Africain en Technologies de l'Information et de la Communication (CETIC). University of Yaounde.

Republic of Benin

Centre d'Excellence Africain en Sciences mathematiques et Applications (CEA-SMA). Universite d'Abomey-Calavi,

Togo

Centre d'Excellence Regional sur les Sciences Aviaires (CERSA). University of Lome.

Ghana

Regional Water and Environmental Sanitation Centre Kumasi (RWESCK).

Kwame Nkrumah University of Science and Technology.

West African Centre for Cell Biology of Infectious Pathogens (WACCBIP). University of Ghana, Legon.

African Center of Excellence for Training Plant Breeders, Seed Scientists and Technologists (WACCI). University of Ghana, Legon.

Senegal

Africa Center of Excellence in Mathematics, Informatics, and ICT

University of Gaston Berger.

CEA-SAMEF in Maternal and Child Health Université Cheikh Anta Diop.

Africa Voices Dialogue (AVD)

AVD provides a space for the voices of Africa's educators, learners, and communities to be seen, heard, and loved (africavoicesdialogue site).

Through sharing African experiences of education, learning, and innovation regionally, continentally, and globally, AVD believes that a proudly African, contextually apt approach to education on our continent can be developed.

Herewith dialogues organized by AVC:

Research for Africa's education – think tank on the creation of an AVD research hub; a dialogue on climate and learning; the power of play – 2nd-anniversary celebration, Ubuntu leadership – Africa's gift to the sdg's, regional collaboration for education, alternative education models for Africa; education in conflict; storytelling under the stars; fostering entrepreneurial mindset; teacher health; empowered beyond school; inclusive and collective leadership; and workshops initiated by AVD: parental engagement in education,1, 2, 3, 4; peacebuilding and passion and purpose workshops.

Learning Network on Nutrition Surveillance (LeNNS), South Africa

The Intergovernmental Expert on Improvement (IGAD) and East, Central, and Southern African-Health People group (ECSA-HC), with help from USAID Propelling Nourishment, held a specialized studio from February 21-23, 2023 — the second in a progression of quarterly meetings met by the LeNNS. The subject of the second LeNNS specialized studio was "Developments in Food and Sustenance Observation: Worldwide and Territorial Viewpoints" and conversations zeroed in on trading data among members to address the manners by which food and nourishment information is gathered, examined, and spread.

More than 120 members from Uganda, Rwanda, Tanzania, Kenya, Somalia, and Djibouti are attached to the studio.

Representatives from development Partners such as the World Health Organization (WHO), UNICEF-East and Southern Africa Regional Office (ESARO), the Bill & Melinda Gates Foundation, and the US Centers for Disease Control (CDC) added to conversations on making and upholding compelling nourishment strategy.

Members found out about creative and supmobile strategies to advance dietary and wholesome observation in East and Central Africa. Three Technical Working Groups (TWGs) had conversations on early advance notice, routine information, and micronutrients.

Africa Research, Implementation Science and Education (ARISE) Network, USA

ARISE is a network for collaborative education and research activities in Africa established by Harvard T.H. Chan School of Public Health in Partnership with AAPH and leading institutions and organizations across the African region (aaph site). In June 2014, a foundational meeting was held in Boston, MA with all Partners from education and research institutions from nine countries in Africa (Botswana, Burkina Faso, Ethiopia, Ghana, Nigeria, Rwanda, South Africa, Tanzania, and Uganda) to discuss advancing coordinated and collaborative education and research activities to address critical gaps in populace health.

The meeting allowed the establishment of a network that builds upon the numerous ongoing training and research activities among participating institutions - the ARISE Network. Network exercises incorporate conversations to focus on and outline plans to progress intentional and cooperative general health-building endeavors with an emphasis on execution science.

The Network provides training opportunities to advance mastery of both new knowledge (implementation of health systems interventions, health service quality, health systems financing, and human resources for health) and methods (implementation science, program, and impact evaluations, biostatistics and epidemiology, and health economics).

Through rigorous coursework, participatory seminars, case studies, intensive mentorship, and training in translational research, trainees will have the opportunity to interact extensively with Network faculty, fellow trainees, and other professional mentors. The main research domains covered by ARISE are epidemiology studies; newborn screening and inclusive care; laboratory diagnostics and quality assurance systems; sickle cell disease complications; community training and implementation science; eHealth technologies; genomics and genetics of sickle cell disease; treatments for sickle cell disease and ethics and regulations.

Preferred Reporting Products for Systematic Reviews and Meta-Analyses (PRISMA), South Africa

Alain Chuard is the founder and CEO of Prisma, a learning network that intends to replace traditional education (Ohiri, 2022). Prisma introduced the first Connected Learning Network (CLN) in the world, a brand-new category in education.

PRISMA 's learning model is a locally-based, globally connected at-home learning network that provides kids with the skills they need. The team of educators, business people, and technologists have created a charter school from the bottom up, redefined education, taught hundreds of children, and created prosperous technology firms.

Playing video games teaches vital life skills like problem-solving, critical thinking, social awareness, teamwork, and collaboration. Behind game-based learning is that it assists students with learning all the more actually when they are making progress toward specific targets. Gamified training draws in students in cooperation and agreeable rivalry. Play has benefits for grown-ups as well as small kids.

PRISMA Training Solutions holds a prominent position as a leading professional training provider in Africa, specialising in the mining sector with full Mining Qualification Authority (MQA) accreditation (South Africa Business Integrator, 2023). With an effective history of preparing more than 40,000 students in mining, group, and manager improvement, PRISMA is certified for capabilities, abilities programs, and north of 400 Unit Norms by the MQA. Their joint effort with Barrick Gold is centered on conveying custom-fitted and manageable schooling and preparing solutions in Tanzania, driven by Jacques Rancher, Overseeing Chief at PRISMA. The organization plans to upgrade efficiency, proficiency, and health.

Bright Little Labs, UK

Founded in 2015, backed by Warner Bros, Discovery and Bethnal Green Ventures, Bright Little Labs focuses on inclusive role models and learning-inspired stories to teach digital skills, like computer science, coding, and critical thinking (bright little labs; press.wbd.com sites). Bright Little Labs is a children's media firm founded by Sophie Deen that creates ethically produced, educationally beneficial children's books, apps, and games.

Their lead story is about Criminal investigator Spot, a tech whizz who is on a perilous mission from the Children's Intelligence Agency (CIA). The company provides a lo-fi and accessible route into coding, with kids joining the CIA to complete STEM-focused 'missions' on and offline which complement the UK Computing Curriculum. Beginning on Kickstarter in 2016, Brilliant Little Labs was essential for the Bureau Office-supported, tech-for-good gas pedal Bethnal Green Endeavors. They now have users in over 30 countries and are widely recognized for their story-led approach to 21st-century skills.

Turner International's Digital Ventures & Innovation (DV&I) group 2018 announced an equity investment in Bright Little Labs (BLL), a UK-based early-stage company that creates and distributes edutainment content for kids (press.wbd site).

Turner's kids' portfolio includes the Cartoon Network, Boomerang, Boing, Toonami, and Cartoonito channels, websites, and YouTube channels as well as extensive content production licensing, and merchandising operations.

Turner operates more than 175 channels showcasing 48 brands in 34 languages in over 200 countries. Turner International is a Time Warner company.

Bright Little Labs has reached over 9,500 kids in 35 nations. 61% of users believe that neither boys nor girls are better than the other at science, and 47% of users are extremely confident in their ability to code. Ever since November 8,100 children have had a Detective Dot lesson thanks to our free curriculum packs. Over 90% of teachers say they would recommend the material to someone else.

Bridging Innovation and Learning in TVET (BILT), Asia, Africa

The BILT project is focused on what makes TVET agile and responsive to the rapid speed of change: new qualifications and competencies (unevoc. unesco site).

The BILT project gives a stage to investigate the most common way of distinguishing new capabilities and skills effectively, coordinating them into engaging educational programs preparing guidelines, and executing them through innovative pedagogical approaches. BILT Innovation and Learning Practices offer a new approach that makes TVET more relevant to the needs of the economy, society, and the environment while addressing challenges related to global TVET trends in Africa, Asia, the Pacific, and Europe.

I-hubs practices are aggregated as a team with 'Abilities for development center points' task Partners and depend on the idea of advancement as illustrated in UNESCO-UNEVOC's Development Structure. TVET practices from around the world have been carried out to address arising difficulties and to further develop TVET education and learning inclusively.

MilleaLab, Indonesia

MilleaLab is an across-management programming stage to make 3D and augmented reality-based instructive Products. The cloud-based stage offers instructors many layouts and 3D models to make tweaked virtual acquiring offers without coding abilities.

MilleaLab endeavors to make instructing and learning exercises more joyful, creative, and innovative. The stage was launched in 2019 and has empowered access to virtual learning offers for 1500 schools and in excess of 16000 dynamic clients in Indonesia. MilleaLab likewise prepared and guaranteed 5200 instructors and supports educators

to become VR envoys to drive learning advancement through the improvement of VR-based learning media.

Technical Education and Skills Development Authority (TESDA) Online Programme, the Philippines

TESDA has utilized the capability of data and communication innovation (ICT) to build the absorptive limit with regards to TVET conveyance, shape future educational programs concerning social turn of events and manageability, and introduce new policies addressing inclusivity.

Department of Higher Education and Training (DHET) Partnership with CISCO, South Africa

TVET educational programs are grown midway at the public level. With the results and guidelines previously settled, educational plan planning adds new mechanical advancements to existing educational programs without the requirement for enormous scope changes. By working with a laid-out ICT organization in a public-private organisation, changes to content and evaluation guidelines are simple, cutting-edge, and significant for students.

PSET CLOUD, South Africa

PSET CLOUD establishes a computerized climate that fortifies, incorporates, facilitates, further develops effectiveness, and settles difficulties in the administration and the executives of the post-school instruction and preparing framework in South Africa to empower residents to go with informed training and work market choices prompting expanded employability.

This stage will assist businesses with tracking down reasonable and skilled competitors, and it will assist the general populace with understanding what work opportunities are accessible, what the formal and non-formal learning requirements are for these work valuable opportunities, also as where these capabilities can be procured and to direct people on their vocation pathways.

Ad Astra Academy, South Africa

Elon Musk is known for many things. From starting Tesla to taking over Mars and his erratic tweets, they have earned him a spot as the most love-hated billionaire today (Study international, 2021). Less popular to people in general is his job in Promotion Astra ("to the stars" in Latin), a non-public school by South African business person and teacher Joshua Dahn.

Musk's aims for this in-person school were to make age-based learning obsolete and focus on problem-solving and gamification. At this school, children learn soft

skills more naturally in a multicultural and innovative environment — innovation is key.

Dahn close by Chrisman Honest, a designer from edtech startup ClassDojo, cooperated to carry this idea to the majority. Enter Synthesis, an online games-based academy. Ad Astra Academy is an education, outreach, and development project that brings the excitement of exploration to students in some of the most underserved regions of the world. Curiosity is one of the most essential human traits - a constant need to understand the world around us through uncertain tinkering and wandering journeys (adastra. world site). The inaugural Ad Astra Academy took place in Brazil's City of God, in Partnership with the Instituto Presbiteriano Álvaro Reis (INPAR). The main seven-day stretch of the educational plan presented the logical strategy and zeroed in on issues of livability, environment preservation, astrobiology, and planetary group science. A field outing to a nearby island gave an open door to independent investigation and true comprehension of homeroom standards.

Armed with an understanding of habitability and Martian geology, students conducted a live video conference with HiRISE mission control, recommending specific, scientifically valuable sites on the surface of Mars for imaging. Ad Astra programs are customized for each community and can range from several hours to several months. In all cases, members partake in a unique educational program that creates proof puts together thinking abilities, and underwrites with respect to every student's sense to investigate.

Tweaked educational plans highlight field trips and intuitive illustrations on natural, space, and life sciences.

Eventually, students join driving researchers from around the world on the bleeding edges of investigation, focusing on Mars for imaging by a NASA shuttle, or working with remote ocean voyagers to work robots great many meters underneath the waves.

The synthesis program is currently an online, once-a-week enrichment programme that teaches the Ad Astra concept of problem-solving. It acknowledges applications from students (six to 14 years of age) from everywhere in the world. It guarantees invigorating courses and encounters through reproductions; contextual investigations; labs; creation and configuration projects; and corporate coordinated effort.

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Environmental and Space Science, Nigeria

Nigeria is Africa's most populous country, yet public investment in education lags behind the growing number of promising students. In an organisation with the Nigerian organisation Earthspace, the Promotion Astra Foundation directed fourteen day-long projects of vivid field-put together science and hands-with respect to projects revolved around ecological and space science. In Lagos, students from a few nearby schools figured out how to get clarification on some pressing issues and gather information through decisive reasoning activities; they visited a neighborhood ocean side to find

out about contamination and scene development. In Port Harcourt, the Central point of the Nigerian oil industry, a different Partner of students found out about the district's geographical history and ongoing changes to the scene noticeable through satellite symbolism.

Landscape-forming Forces of Rio de Janeiro with those on Mars, Brazil: July 2018 - April 2019

To build a sustainable culture of exploration and knowledge-seeking, Ad Astra Academy returned to the City of God and the Instituto Presbiteriano Alvaro Reis. With help from 2015 alumni, participants compared the landscape-forming forces of Rio de Janeiro with those on Mars and constructed model rovers to handle terrain challenges. With a scientifically informed view of how to search for clues of past habitability on Mars, student's video conferenced with Mars Science Laboratory mission planners in California to share their proposed exploration strategies.

Scientific Discovery, Bangladesh: December 2017 - May 2018

Southeastern Bangladesh is characterized by water: old streams constructed and cut its rich slopes, a thick organization of waterways back and forth movement with occasional downpours, and the Indian Sea laps at the sandy shore. But, most youngsters nearby - especially young ladies in rural networks whose schooling is often undermined by financial difficulties - miss the mark on apparatuses or foundations to see the value in the normal cycles at work and completely perceive how they might impact day-to-day existence. Throughout a while, the Promotion Astra Institute worked in organization with the Osel Establishment and Public Geographic Training with a class of young ladies at a school close to Cox's Bazar, Bangladesh to share the energy of logical disclosure and give the devices to an eventual fate of scholarly freedom and instructive progression.

The students acquired new images of Mars from NASA's HiRISE camera and explored nearby waterfalls, beaches, and rivers; ultimately, they presented their findings to hundreds of community and religious leaders, sharing their newfound knowledge and emphatically showcasing the enormous potential of female students.

Afrorack

Founded in 2016 by Aaron Guice, Afrorack seeks to empower children and young adults of colour via workshops and education programmes centred on music technology and sound design.

Aaron Guice was a Los Angeles-based business sound originator. Utilizing different apparatuses available to him, including mouthpieces and electronic instruments, he made sounds for TV notices and music recordings, including one for the 2011 Jennifer Lopez and Fiat's 500 Cabrio vehicle crusade. However, when his dad's ailment took

Guice back to Chicago in 2012, he wound up entering a different universe of sound: measured blend.

The initiative seeks to empower youths via workshops and education programmes centred on music technology and sound design (Koe, 2022).

Guice attached forces with the Old Town School of Folk Music, which has a long history of teaching music. People think of Old Town and they think they're teaching ukulele or something like that, but they created this outlet called Music Moves, which allows people to go out into the community and do workshops and presentations for kids and adults. That was a group that helped connect Guice with the community center in Englewood called iGrow.

In spring 2018 Bryan Bamanya began looking in Kamapala's repair shops for the pieces that would allow him to build the first African modular synthesizer. To do so, Bamanya relied on tutorials and circuit diagrams found on the Internet. Thanks to his impressive resourcefulness, he managed to beget the Afrorack. His success didn't stop there, the young inventor went on to perform at the Atlas Electronic Festival in Marrakech, Morocco, and at the Nyege Nyege Festival in Jinja, Uganda.

Behind the Afrorack is a need to break with America and Europe and reconnect with his African roots. He believes *that the next electronic music revolution will take place in Africa*. Indeed, the current synthesizers sold on the market are mostly American or German. Besides their exorbitant price and their scarcity in Uganda, Bamyana rejects industrial tools.

In 2019, Brian Bamanya's Afrorack, Africa's first DIY modular synthesizer inventor, released his first album named after his creation via the Ugandan label Hakuna Kulala (*Pan African Music*, 2022).

Bamanya introduced polyrhythmic structures found in some African musical traditions thanks to his synth sequencer. It is especially obvious in "African Drum Machine". Different layers of sounds can be distinguished, between the oscillators and the drums, to give shape to hypnotic new rhythms. It unquestionably is the consequence of Bamanya's work on algorithmic music and Euclidean rhythms he previously referenced back in 2019. In "Osc", this equivalent frantic cadenced force normal to East Africa's sounds can be found.

Cohort Learning

Cohort learning is a new phase for online schools, just as the professionals who rely on them are transforming themselves for the digital age.

Partner-based learning is a teaching and learning model that is collaborative, community-inspired and strength-based. Courses are controlled by Partners through computerized stages, and students travel through the material at a similar speed while being intuitively regulated by a coach or a teacher.

Cohort learning is vital because groups, not individuals, are modern society's primary learning unit.

The 2020s were a watershed year for the Cohort learning development, which is currently saturating all schooling textures. Partners are centered on three primary facilitators: instructors/mentors, students, and learning tools (courses and platforms). This model's three pillars are also learning, reflection, and action.

The shared goal is to achieve excellence for all students, regardless of background, socioeconomic status, or geographical location. That core value should guide where we keep our current systems and innovate to create more effective and equitable education for all.

Herewith selected international Partner-based learning platforms specialized in different domains and Partner-based learning platforms in developing countries. (Ohiri, 2022).

International Cohort Learning Platforms

Teachfloor

Teachfloor supports unlimited learning activities, depending on the subscription plan. The course has landing pages and duplication so you can repurpose learning content and other course materials. Bulk invitations are onto the platform, as well as to learning events within the Partner-based course, that adhere to the learner's unique timezone. Zoom is integrated to host and record classes.

Main features: Provides a virtual social integration feature that allows educators to have an interactive community; It allows corporate trainers to have analytical reports of their business. The platform allows practitioners to establish Bootcamp while accounting for each learner.

Disco

Co-founders Candice Faktor and Chris Sukornyk are long-time friends and serial entrepreneurs passionate about community, learning, and building world-class platforms.

Before helping to establish Disco, Candice scaled Wattpad to 80 MM clients, making it the world's biggest stage for makers to share their accounts (sold in January 2021, for US $660MM). Furthermore, Chris established six other endeavors supporting new businesses, most as of late Chango (obtained in 2015).

Disco supports the building, operating, monetizing, and scaling of all kinds of learning experiences, especially Partner-based courses (disco site). All that you want to make and adapt your Partner course and local area in addition to helping the student venture is natural to the Disco stage.

A clean user interface makes it easy for you to customize the end-to-end experience, and even easier for your learners to navigate.

From massive open online courses to small businesses, Disco put course creators in the driver's seat to create their own learning experiences and run their educational programs the way they want.

EducateMe

EducateMe is one of the most powerful learning systems for small businesses that use the Cohort learning model. The platform aims to help you create a successful Partner program by giving you an easy-to-use interface and a solid foundation on which to develop.

The Collaborative approach promotes group collaboration on activities or educational objectives with a sizable enough group, so everyone has a chance to contribute. Students in a group could each take on a special responsibility that contributes to the whole, or they might all work on the same thing.

EducateMe is a hub for those who deliver training and guidance for learners. The participants can create homework for your students, specify due dates, and easily add relevant resources. EducateMe integrates a set of useful technologies that facilitate learning. For example, these include Zoom: for live sessions; Calendar: for reminders and to schedule classes; Meeting recordings; Messaging, and In-app notifications: which send reminders about scheduled activities.

Main features of EducateMe: Automated meeting record; Messenger to enable easy and live communication; Kanban board assignment tracker; Analysis and performance tracking dashboards; Self-servicing software system for instructors to sign in and design their courses.

Maven

Maven is a partner courses platform for single experts. Wes Kao is one of Maven's co-founders, a Partner-based education platform (maven site). She's helping Maven develop a platform to assist anyone in creating Partner-based courses and delivering a top-notch student experience at scale.

The stage integrates both live and nonconcurrent components to draw in students as opposed to depending simply on unoriginal, little gathering studios or generic, mass online courses, which would require more teachers and backing staff.

As of now, numerous specialists and makers miss the mark on assets (staff, cash, and time) important to deliver a Partner based course of the greatest type.

In this manner, Expert is making a stage that gives the top educators access to the world and makes considerably more captivating, intuitive courses than MOOCs.

Trending courses are in AI, Product, Marketing, Business, Leadership, Design, Engineering, Investing, Productivity, Writing, Data and Sales. The Expert stage is best reasonable for content makers who are deeply rooted in their fields and have an extremely impressive online entertainment followership.

Features of Maven: Time-based group learning settings; Design syllabus and monitor project submissions; Self-paced classes with defined goals; Track instructors and student performance in Partner-based courses.

Expert deals with promoting your substance for you, consequently assisting you with building your image as an idea chief in the schooling area.

Eduflow

Eduflow is a Cohort learning platform for instructional designers. The stage permits teachers to make and tweak their course frame plans without forfeiting client experience. The stage was established by David Kofoed Wind, Malthe Jørgensen, and Simon Lind in 2015.

Due to the acquisition by Multiverse, Eduflow no longer accepts new signups. Main features: Self-servicing software system for instructors to sign in and design their courses*;* Powerful editor tools for course designing*;* Professional Learning Management Systems that offer trainees personalized learning experiences.

Fresh Learn

FreshLearn is a platform for mixed programs that allows instructors to create, modify, and sell digital courses while handling things like landing pages and payment processing. Main features: Supports self-paced learning; Supports multiple languages; Provides information about student progress.

Early Childhood Education and Care (ECEC) Network

The Early Childhood network focuses on children's initial engagement in out-of-home learning activities offered by the public or private sector as ECEC activities. The network was launched in 2009 with the intent of creating a platform for ECEC practitioners, researchers, and policymakers around the world to share knowledge and experiences from their own or other people's professional work in the ECEC sector.

In the 2019 congress, the ECEC network focused on children's agency and participation. The aim was to create a discussion based on examples of how children's perspectives can scaffold adult learning about how to increase the quality of an ECEC setting.

Cooperative learning is currently quite possibly the main way students learn and develop. Albeit individual work can be an incredible method for dominating substance, cooperative work engages and empowers a student to develop specific flexibility.

Collaborative learning is based on a small group of active student participation over passive lecture-based teaching.

According to the ecosystem model for IECE, there are five primary processes through which children are involved in the everyday life of the setting as follows: positive interaction, involvement in daily activities, a child-centered approach, personalized assessment for learning and accommodations, and adaptations and support (Hau et al, 2023). The dimensions are as follows: Overall welcoming atmosphere; Inclusive social environment; Child-centered approach; Child-friendly physical environment; Materials for all children; Opportunities for communication for all; Inclusive teaching and learning and Family-friendly environment.

Cohort Learning Platforms in Developing Countries

Teneo Online School, The South African Inclusive Assessment Institute (SACAI)

Teneo Online Pre-Primary School is a mix of live classroom lessons and some offline activities that we ask parents to facilitate (teneoschool site). Live illustrations are recorded and can be played once more assuming the youngster needs it. This approach is significant for Pre-Essential students, who are as yet mastering the primary abilities they need to advance through proper tutoring. Classes are 30 minutes long, with a 30-minute break incorporated into the school day to guarantee little personalities don't get excessively worn out.

Teneo Online Primary School is set up to help children move on in their formal education, developing their skills and knowledge with an approach that's aligned with the IEB (Independent Examinations Board).

Teneo Secondary School's definitive objective is to assist your youngster with getting better Matric results. Our certified educators are subject experts with experience in showing Matric classes on the web. A considerable lot of our educators are likewise markers for the last year-end assessments who know how to get ready students for their tests.

eTrade for Women, UNCTAD and MIDEVA, Africa

The program was specially organized for women digital entrepreneurs to enable them to leverage the design thinking approach to design better environments for themselves and their communities, as well as drive their business growth and impact.

The participants can use the design thinking approach to produce innovative and industry-leading ideas and compete with other digital businesses.

The program builds communities of women digital entrepreneurs established in developing countries and economies in transition and committed to making a difference. As a component of their obligation to help ladies' business people convey more effect, eTrade for Ladies is giving Masterclasses.

eTrade for Ladies drew in MIDEVA Labs to plan and work with virtual and in-person studios for ladies' business visionaries situated in Africa, Asia, and Latin America fully intent on empowering them to use the plan to figure ways to deal with the configuration of better conditions for them as well as their networks, as well as driving their business development.

MIDEVA is a social-influence examination, plan, and development consultancy aggregate that works across Africa.

The organization leverages behavioural, human-centered design and community-powered approaches to support teams and organizations to tackle complex challenges to create lasting impact.

MIDEVA Labs was to plan an internet preparing module for the lady's computerized business visionaries recipients of the drive with an emphasis on applying the plan figuring strategy to tackle issues with inventive business solutions that can be increased and have an effect to speed up the SDGs.

Graphy

Graphy's website claims that over 150,000 creators have built Partner-based courses on their platform, using their suite of solutions to create, market, and sell their course offerings (graphy site). The stage supports live, lecture-led courses as well as "drip" courses that can be completed asynchronously.

Graphy's main objective is to make the end-to-end process of building, marketing, and selling a Partner-based course as seamless as possible to give founders and operators a revenue stream for selling their experiences.

Abhijit Chavda, #AskAbhijit Show, India:

Abhijit is a member of the consultative group to the Principal Scientific Advisor to the Government of India. He is the creator and host of the immensely popular #AskAbhijit Show on YouTube, the Abhijit Chavda Podcast, and the Indian Interest Podcast. In June 2022, he got the 2022 Maharshi Narad Grant for services to the Indic cause from his excellency the respectable Legislative leader of Maharashtra, Shri Bhagat Singh Koshyari at Raj Bhavan, Mumbai.

Rahul Devkar:

He helps Creators & Entrepreneurs grow their Businesses online using Online Courses & Social Media.

Sur Siddhi:

Sur Siddhi Music Therapy is based on methodologies of Sur Sanjeevan Music Therapy principles. We incorporate Ancient and Original Indian Classical Music + Ayurveda

(the Veda of Life) + Modern Neuro Sound Technology (Brain Entrainment / Binaural Beats) in our therapies.

Laurel's Learning Lab:

Experience true native American English Training with Laurel. Learn American English and pronunciations online with me in interactive and creative courses. You will be able to reverse in English without any hesitation with our online English Classes.

Getfunded Africa

GetFundedAfrica is a tech-enabled marketplace at Abeokuta, Ogun State, Nigeria which matches start-ups, investors (VCs & Angels), corporates & governments to improve and strengthen the African start-up ecosystem. It is one of only a handful of exceptional non-gas pedals on this rundown (media.getfundedafrica site).

Launched in February 2020, it utilizes training, raising support, and innovation services to empower African new businesses to develop and scale. The Partner-based program is one of its instructive services.

The Baobab Network (TBN), Senegal

The Baobab Network is a Kenyan technology accelerator that is investing in the next crop of African tech entrepreneurs and, for the last six years, has continued to empower early-stage tech start-ups in Africa. The Baobab Organization runs an elite gas pedal program supporting Africa's trendsetters to scale local solutions.

Telecel Group Africa is a Start-up Initiative Program (ASIP) Accelerator Program in Senegal that is supporting and adding value to young start-ups making an impact in their communities and contributing to the growth of the African continent. It was launched in 2017.

Grindstone Accelerator Program, Africa

Jointly owned by Knife Capital and Thinkroom Consulting, and supported by the SA SME Fund, Grindstone assists high-growth, innovation-driven tech South African start-ups to become more investable, sustainable, and exit-ready. It helps grow the start-up ecosystem and the economy at large.

Adanian Labs Venture Building Program, Africa

Adanian Labs Adventure Building Project was established in January 2020 and alluded to as the "fire up that forms new companies." It is a first-of-its-sort adventure studio in Africa, on a mission

to build 300 impact-driven tech start-ups from Zambia, Tanzania, South Africa, Nigeria & Kenya that are commercially viable and positioned to accelerate the growth of African economies.

Keep Kenya Learning

Keep Kenya Learning is a collaborative effort by EdTech East Africa, Metis Collective, and the Regional Education Learning Initiative (RELI) to support parents and caregivers to lead learning at home (hundred site). The goal is to provide a vision of what great learning at home looks like and access to digital and non-digital resources to support that learning.

Working in Partnership with local community-based organisations (CBOs) who already serve caregivers and have their trust, the program has engaged over 300 rural and urban low/lower-middle caregivers.

The Africa Early Childhood Network (AfECN)

AfECN is an enrolled non-benefit, laid out in 2015 to act as a stage to support greatness and joint effort in safeguarding youngsters' privileges, impact strategy and practice, reinforce organizations, and offer experiences and knowledge in ECD on the African continent (afecn site).

The organization includes organisations from common society, the scholarly community, the government, and the confidential area at the public and local levels.

AfECN attempts to help African researchers working at the convergence of examination, practice, and strategy to progress youth advancement in the area. The researchers work to additional both fundamental exploration of culture, setting, and kid advancement, as well as on program and strategy assessment research. AfECN likewise works with a territorial examination network that connects deep-rooted worldwide ECD researchers from the inside and outside the district to improve information age, management, and spread.

Webinars have been launched generating cooperation between organisations in countries members in the following subjects: playful parenting, childcare, GISP Africa regional convening, Access to quality WG, Global series on ECD & climate change, Africa and Asia Pacific IECD services, Fifth session of AU CESA and ECED cluster.

Kurios, Latin America

Kurios, founded in 2019 by Carlos Lau and Luis Ubillas Door, located in Lima, Peru, is a Partner based online course for professionals in Latin America (kurios site). The instructors are professionals coming out of tech companies like Google, Amazon, Stripe, and more. The course completion rate is 90% and the annual customer retention rate is 100%.

A few clients: Walmart Mexico, Banorte (second bank in Mexico), Mercado Libre, BCP (#1 bank in Peru), Alicorp (driving CPG in Latam), and Sura (driving benefits store).

Learning Management Systems (LMS)

International LMS

Docebo

Docebo was designed to merge formal and informal training, emphasizing proactive training and individual mentoring for businesses of all sizes. A smooth LMS functions admirably on smartphones and empowers development with execution checking quicker course rollouts, and game-like difficulties. Docebo allows you to integrate with services like SF.com and Single Sign-On (SSO) using SAML, OKTA, and Webex to enhance your educational offerings.

TalentLMS

TalentLMS may be used on iOS and Android and supports different languages. They have both paid and free membership levels, with the paid levels being estimated seriously.

TalentLMS is among the main 5 LMS for independent ventures on the grounds that its idea is more about the show than design.

But it does have the potential to work with a wide variety of learning technologies, such as SCORM and Tin Can (xAPI), push notifications, and video conferencing. TalentLMS simplifies creating, marketing, and tracking an online course by providing an inclusive set of tools. Because it generates detailed reports based on assessment outcomes, this program is particularly useful for monitoring participants' development over time.

iSpring Learn LMS

iSpring Learn LMS makes it easy to create courses, quizzes, video lectures, and simulations. Notwithstanding basic substance creation and clear transferring, it likewise allows continuous online classes, integrates gamification, and executes complex detailing and assessments.

iSpring Learn LMS provides access to expert support engineers around the clock. Whenever you have more questions about the product, they even arrange webinars inside the program to assist you.

SAP Litmos

Over 11,000,000 people have benefited from SAP Litmos, making it the most popular cloud-based LMS in the world.

Course creation, execution observing, studies, cautions, and customized learning pathways are a few elements presented by this set-up of programming devices.SAP Litmos provides an extensive off-the-shelf content library where you can acquire brand-new training materials at no additional cost, in addition to its top-notch security features, powerful reporting instruments, and award-winning customer service.

Moodle - Best Open Source & Free Cloud

With Moodle, instructors can make their dynamic courses available to students worldwide without spending a dime on a cloud-based or commercially supported LMS.

This program features easy plugin administration and mass course building in addition to its other useful features, including file management tools, custom site design choices, language support, and secure authentication.

Moodle gives an easy-to-use, versatile dashboard that rundowns all courses and undertakings in one helpful area. It includes a calendar, text editor, auto alert tools, progress monitoring solutions, and collaboration capabilities, and it's available on desktop and mobile platforms.

Moodle allows users to have discussions in various tongues, provides access to free educational materials, and archives posts from people all around the globe.

LearnWorlds - Best

The application's user-friendliness stems from the fact that many pre-made templates may be modified extensively without the need for coding or design expertise.

Learners may annotate their papers in a variety of ways. Moreover, it includes transcripts, responsive e-books, and interactive movies.

360Learning - Best

360Learning positions top LMS for private companies in light of its underlying help for group-based schooling. The platform is adaptable to mobile use and may work in tandem with a wide range of enterprise software.

The framework effectively requests feedback from students and records their evaluations and reactions to each course. The system then creates reports in real-time, allowing teachers to evaluate a class's effectiveness instantly.

LMS in Developing Countries

Oliver Karstel (Pty) Ltd, South Africa

Founded in 2012, Oliver Karstel (Pty) Ltd is a South African specialised business-to-business content production and video production agency (oliverkarstel site).

With roots in photography and video production, and through interest combined with market demand, we progressed into all areas of inbound and outbound content marketing, including Graphic Design, Web Development, E-Commerce Development, and SEO. As the computerized market kept on advancing, we started to represent considerable authority in specialty fields, for example, Movement, 3D Demonstrating, Augmented Reality, and E-learning Advancement. With our generalist approach, we've developed an arsenal of tools that we use to assist our clients in acquiring and retaining customers.

Synrgise, South Africa

Synrgise is a South African innovative technology company specifically focused on learning, talent, and performance solutions for the workplace (synrgise site).

Synrgise is a blended learning management and delivery platform.

It takes into account the administration and organization of all study halls, eLearning, and distance preparation.

Mixed learning is a conventional schooling program in which a student learns, in some measure to a limited extent, through the conveyance of instructive substance and guidance by means of computerized and online media with some element of student control over time, place, path, or pace. While still attending a "brick and mortar" school structure, face-to-face classroom methods are combined with computer-mediated activities.

Paradiso Solutions, Nigeria

Paradiso Solutions in Nigeria supports account management, content management, employee management, training management, time tracking, gamification, and social learning.

The product displays various e-learning abilities that make web-based learning fun, useful, and viable. Features such as gamification, custom course builder, blended learning, social learning, and multiple language support provide teachers and trainers the tools they need to create and implement effective courses that connect with students and students and drive them to add up to capability and complete abilities acquisitions and maintenance.

Paradiso LMS is advanced for the versatile stage, empowering the two coaches and students to get to the framework utilizing their smartphone or tablet. Students or educators can without much of a stretch investigate their timetables, dole out errands, alter their courses, and track the advancement of their students in only a couple of snaps. Students, then again, can take a gander at their errands, view their courses and progress, perform tasks, and speak with their mentors and individual students inside a similar stage.

Paradiso LMS Features: Instructor-Led Training (ILT) Management; Interactive Video Training (IVT); Gamification; Resource/Trainer Booking.

The University of Jos LMS, Nigeria

The University of Jos LMS Nigeria provides an engaging learning environment for students. It permits distance learning on a few courses in certain divisions of colleges. It is overseen and worked by the College of Jos in Level State. In addition, this learning management framework in Nigeria urges mobile figuring out how to get to courses whenever and anyplace.

Educe, Nigeria

Educe is among the top Nigeria LMS organizations gaining practical experience in carrying out new learning advances. It likewise creates mixed and inventive learning solutions that offer intelligent learning content for eye-to-eye and virtual homeroom exercises.

Moreover, it also provides custom eLearning solutions by delivering tailored content as per your business requirements.

M-Shule, Kenya

Made in 2016, in Nairobi, by Claire Mongeau, a training proficient, and Julie Otieno, a processing researcher, the startup M-Shule is the primary adaptative and mobile overseeing stage considered to cultivate the exhibitions of rudimentary schoolers in sub-Saharan Africa. It targets halting school disappointment, which concerns in excess of 149 million kids. The Kenyan startup makes a scholastic help application accessible to scholarly organizations, students, and guardians through the web and by means of SMS to sidestep the Web access bother. The program M-Shule can adjust to the learning pace, the troubles, and the effectiveness of each and anybody while utilizing individual information, computerized reasoning, neurosciences, and mental brain research. Reports composed by the application are shipped off to the guardians and the schools profiting from it to illuminate the students' advancement and make an information base to assist different foundations with adjusting and improving their development.

First tested for six months by 400 learners split into 15 schools in Nairobi in 2017, M-Shule was officially launched in January 2018.

The primary beneficiaries of the programme are refugees from the Democratic Republic of the Congo, Rwanda, Ethiopia, Somalia, and Uganda who presently live in Kenya. Of these 35 percent (approx. 8,000) are aged 15 or over, while the remaining 65 percent are primary school children aged 6–11. Gender representation is almost equal, with slightly fewer female learners.

Learners can use M-Shule in both Swahili and English. Students can take more than each course in turn. Until this point in time, the stage has major areas of strength for conveyed across in excess of 20,000 families from 30 Kenyan regions, Uganda, and Tanzania in excess of 6 ability advancement spaces and 7 dialects, including Dholuo, English, Kamba, Kikuyu, Kiswahili, Ng'aturkana, Lugabara, Baganda, and Somali.

Tuteria, Nigeria

Godwin Benson, CEO, and Abiola Oyeniyi, CTO, launched Tuteria, an edtech company, in 2014 to make learning accessible to learners who want to reach their learning potential (v2tuteria site). This Nigerian platform is a tool connecting people willing to develop skills with coaches who already own those targeted skills, in their close neighborhood.

This platform allows for a personalized approach given the needs of each learner. The most followed courses are those of programming and web conception. The company has tutors in all 36 states of the country and the Federal Capital Territory, Abuja (Fakya, 2021).

Yoruba, French, Igbo, Hausa, Arabic, German, Spanish, Chinese, and Ibibio are used by this program.

Tuteria covers some subjects and courses taught in primary, secondary, and tertiary institutions, with tutors available for international exams such as the IELTS and GRE. Additionally, the organization covers abilities and callings, for example, make-up, dance, photography, swimming, coding, music, and public talking.

Coaches are relegated in light of their nearness to the area of the students. In May 2021, Tuteria Launched Tuteria 2.0, a redesigned variant of its site, to keep on making "the educational experience more consistent, viable, and reasonable. With the redesigned variant, guardians or students can present a solicitation by depicting what they are searching for in a guide and giving data about their youngster or themselves.

Pre-appraisal tests are likewise given to kids face-to-face after coaches have been allocated to decide on pain points.

Tuteria's estimating framework depends on an hourly rate for every student, with mentors allowed to set their rates for each subject. The updated stage assists clients with paying straightforwardly on the site and starting contact with their chosen coach right away.

There is no fixed fee. Every tutor on the platform determines their fee. Also, the number of days and hours spent learning determines the cost of learning. Tuteria takes a 15% to 30% cut of the total cost.

3,000 tutors serve over 50,000 learners and can offer full home-schooling, support in addition to school, or any combination of these, in any location worldwide.

The Sampark Smart Shala™ Mobile Application, India

144 million children in India's government schools where 6 out of 10 cannot read grade-2 text and 8 out of 10 cannot do simple math sums (Sampark Foundation site).

This brought forth Sampark Smart Shala with 5 inventive components incorporating a Sound box with a voice mascot called "Sampark Didi" an empowered versatile Application that works without web combined with extensive teacher training and rigorous real-time monitoring.

The Sampark Smart Shala™ mobile application is a free learning stage with over 200K educators as dynamic clients that gives straightforward and drawing satisfaction that makes learning fun in schools.

Sampark Smart Shala mobile application was presented for educators with example plans, mock showing recordings and question banks planned to Jharkhand Course books to assist instructors with showing in the right grouping and in the correct way.

Using the existing education infrastructure and personnel, the program incorporates regular monitoring of schools. Month-to-month execution reports are shipped off to school overseers by means of the Sampark Brilliant Shala™ application, an Android-based application.

Annually, the programme is evaluated by a third party with focused learning outcome assessments.

In light of the well-known KBC design, a gamified Al-driven evaluation called Sampark Didi Ke Sawaal was brought to the study hall, to remove the feeling of dread toward tests and make appraisals fun.

Al-driven Communicate in English program where all Jharkhand course readings were vivified with a special button for the youngster to record and test their elocutions.

This innovation aimed at enhancing teachers' ability to teach English and a child's ability to speak and comprehend English.

Sampark TV transforms a dumb TV into a smart classroom enabling teachers to teach and engage children through interactive learning that has energized the classroom with excitement.

Shule Direct, Tanzania

Shule Direct provides versatile learning opportunities via accessible technologies. Their team has created the first locally-based e-learning platform in Tanzania based on the national curriculum by the Ministry of Education (shule site).

Right now, Shule Direct disperses its excellent advanced instruction content to students through an online entryway, mobile applications, an SMS-based versatile application (Makini SMS), and a disconnected learning management framework

(LMS) that offers user-friendly dashboards for students and teachers.

Shule Direct is a social and strong organization that furnishes optional school students of Tanzania with computerized examination devices. The organization works with qualified educators to make digitized notes, instructional exercises, tests, web recordings, or recordings, and foster mechanical answers for students all through the nation and the landmass.

The casing of reference depends on the Cloud innovation with a substance that is coordinated and adjusted to neighborhood concentrates on programs.

It consists of an API (Application Programmer Interface) that provides a unified interface allowing the extraction of appropriate content towards different peripherals and platforms.

This platform serves over 2 million students and 23,637 teachers in Tanzania, Uganda, and Kenya.

Passuneb, Uganda

Launched in 2014, Passuneb is an eLearning stage that gives free instructive assets to students in essential and optional schools (passuneb site). The site offers online individual tests, an online library where clients can get to digital books, Virtual Labs for augmented reality fun science investigations, and vocation direction.

The services offered are:

- *Online Selftest*: Access hundreds of revision questions with their answers which you can choose to attempt or download at any time and revise at your convenience.
  E-library: A collection of e-books on various subjects online or downloaded to read at any time, anywhere.

- *Virtual Lab:* A playground with virtual reality fun science experiments.

- *Career Guidance*: Career guidance and counseling programs aim to help students make more informed and better educational and career choices.

- **Wolox:** Students' lifestyle and leisure, co-curricular activities, UNEB news, and students' talent.

Schoolap, DRC

Created in 2018 Schoolap is an online platform offering web applications for schools, students, educators, and parents of students (schoolap site). Schoolap is an instructive stage that proposes in English and French, a wide assortment of organized educational substances for pre-essential, essential, optional, and specialized levels. The stage covers the whole school system and offers proficient courses educated via coaches through virtual study halls. With north of 21,000 educational Products accessible, an organization of more than 6,000 schools, 1.9 million students, 105,000 educators, 6 regions in the DRC, 7 Products and services.

Snapplify, South Africa

Launched in 2011, Snapplify is a cloud-based edtech platform for the distribution of digital content to schools, corporates, and individual readers (home.snapplify site).

Snapplify is at the front line of edtech solutions in Africa and has practical experience in empowering computerized learning for people and establishments through the biggest advanced instructive commercial center in Africa.

A large number of schools, universities, and colleges use Snapplify consistently to instruct, learn, and access instructive substances. Snapplify is the computerized content Partner on one of the largest arriving at advanced mediations in Africa - a venture that conveys innovation and e-figuring out how to government-funded schools in South Africa's Gauteng territory.

As a socially-disapproved organization, Snapplify is focused on supporting others and making reasonable change, internationally, through joint effort and development. Snapplify runs influence programs through the Snapplify Establishment, and enables, moves, and elevates educators by means of Teacha, the biggest local area of educators in Africa.

Beginning around 2011, Snapplify has developed and ventured into new markets in Africa and the US, with workplaces across South Africa, as well as in Nairobi, Amsterdam, and New Jersey. Snapplify is upheld by AngelHub Adventures, a funding organization supported by previous First Public Bank Chief Michael Jordaan and the Harris family, as well as global investors.

DigiClass, Burkina Faso

Launched in 2017, in Burkina Faso, Digiclass is a platform for learning, revisions, and online tutoring in French for students in grades 6 to 12 as well as teachers and parents of students who want to regularly monitor the performance of their children (digitalclass site).

Rwanda Education Board (REB)_e_learning

The ongoing global issue of the COVID-19 pandemic has affected all sectors and resulted in the closing of schools in Rwanda to avoid the spread of the disease (reb.gov.rw site; e-learning.reb.rw site). The REB has established an online learning platform to help students continue with their studies. While at home students keep learning and are supported by their teachers and parents using the REB eLearning platform.

The stage is open on workstations, work areas, tablets, and smartphones. Two choices are accessible, site and mobile application. It is possible to access the content without registration, however, there is no interaction with the teacher or tutor nor accomplishment of activities and assessments.

Student Support Programme (SSP), Mauritius

Students have more ownership of their learning which helps them to become free learners. The SSP brings digital learning to the fingertips of everyone (sspmoe site).

SSP is a drive of the Service of Schooling and HR, Tertiary Training and Logical Exploration as a team with the Open College of Mauritius (OU), Mauritius Establishment of Instruction (MIE), and Mahatma Gandhi Foundation (MGI). The site offers showing materials for Grade 7 students and has quite recently begun with Grade 8 and is intended to guarantee that the educational plan is regarded.

This Student Backing Project was set up as a feature of the Nine-Year Ceaseless Fundamental Training, (NYCBE) expecting to help students in this Coronavirus flare-up by creating various video illustrations for Lower Optional students in grades 7-9.

Moringa School, Kenya

The Moringa School Kenya is one of the top coding schools in Africa. It is a full-time coding school. The company selected 12 students who were interested in a tech-related degree and provided them with a four-month intensive boot camp where they will learn the skills needed to become the next generation of techies (Brook, 2022)**.** The reason for the program is to show students different programming dialects with the goal that they can work on their specialized abilities. In addition to academic excellence, presentation skills, and business basics are additional modules to ensure that the learners are well-prepared upon graduation from school.

Moringa School has introduced an inclusive array of training courses in Artificial Intelligence (weetracker.com site). The new addition expands upon its already diverse range of offerings, which includes Full Stack Software Engineering, Data Science, UI/UX Product Design, Cybersecurity, DevOps, and more. Presently, students and experts the same can exploit Moringa School's state-of-the-art assets to dig into the interesting universe of simulated intelligence.

The recently unveiled courses stem from Moringa School's strategic collaboration 500 companies with top-notch training. Moringa's AI offerings encompass a diverse range of programs, ranging from an in-depth Masterclass titled Introduction to Prompt Engineering to a condensed 1.5-day training session focusing on AI Strategy for Business Pioneers and finishing in an exhaustive 1-week short course committed to Building and Sending computer-based Intelligence Applications.

Sara Potler Lahayne, Move This World, Columbia

In 2007, traveled to Bogota, Columbia as a Fulbright Scholar. Ideas like sympathy and compromise were being instructed from reading material without a cycle for viable application. They were just words on a page, and students weren't locked in. Sara started coming to an obvious conclusion from her background and training to envision a program that would show students close-to-home abilities for deep-rooted influence.

As a dancer, Sara understood the authenticity of conveying emotion through creative i (CASEL). They have created a platform for embracing different types of learning, but more importantly, acknowledging that we all learn differently. Move This World tackles education accessibility around the globe while encompassing the emotional component of learning that is lacking in many typical school systems.

Tonee Ndungu, Kytabu (Girls for Girls), Kenya

Growing up in Kenya and going through the public education system was a challenge for Tonee's family on two fronts. First, it was very expensive, even for a middle-class family in the capital city of Nairobi. Second, he was a dyslexic student in a system that had no structures for students who did not learn at the same pace as the rest of the class. 15 years after Tonee's not exactly helpful secondary school encounters, Kytabu is a reaction to the expense and construction of data scattering to students in Kenya.

Kytabu gives educators and students access to required course books and learning assets for the Kenyan school system through a computerized stage on a versatile application. #SomaNasi, Swahili for 'Learn with Me', is part of Kytabu Inc.'s Girls-for-Girls program that equips female students with 4,500 videos and 15,000 assessment questions that cover the entire 12-year Kenyan education curriculum while Partnering them with virtual study-Partners around them in a virtual study group (solvemit.edu site).

#SomaNasi sends a mix of Kytabu's Learning Management Framework (LMS), mobile application, and SMS message solution. The LMS acts both as a learning content storehouse and a virtual study hall maker that openings young ladies in comparative geo-labeled areas that register to be in a comparable grade into one gathering.

The virtual classroom then exists for a month to 3 months with all the girls set on achieving specific goals, unlocking badges, getting credits, and going up learning levels by watching videos, doing assignments, and working on problems together every day.

#SomaNasi focuses on young ladies and ladies of school-going age in the public school system in East Africa. These directly include girls in all social and economic classes (low-income, middle-income, and upper-income), special groups (LGBTQI+), and marginalised groups (refugees, internally displaced, out-of-school) that would be using the Kytabu app or SMS short-code to join the Girls-for-Girls #SomaNasi program. Because the application is mobile and does not require physical interaction, social and economic barriers would not limit the girls' interactions and would not hamper the learning experience the girls would have.

Organizations and NGO's

Organization for Environmental Education and Protection (OpEPA), Columbia

Luis Alberto Camargo is the founder and director of the OpEPA, a non-profit devoted to the advancement of nature-based and regenerative education, heritage interpretation,

and weaving in Bogota and Columbia (Wise, 2022). He is also a co-founder of The Weaving Lab, which aims to create thriving learning ecosystems by helping change leaders to become more aligned, collaborative, and systemic (projectwet site).

OpEPA provides tools to public and private schools for the articulation, strengthening, visibility, and implementation of School Environmental Projects or other educational projects aimed at the conservation, appropriation, and sustainable use of the ecosystem services that each area -where the project is implemented- provides (IUCN, 2023). Notwithstanding their instructive endeavors, OpEPA likewise attempts to propel the shift towards recovery in people, organizations, and the public approach.

This incorporates drives like the reasonable and regenerative travel industry, progressing to regenerative societies, and tending to planetary limits difficulties, for example, environmental change, biodiversity misfortune, biological systems, soil quality, and water management.

The "Road to Carbon Neutral"

The "Road to Carbon Neutral " project attempts to engage neighborhood government authorities, business people, writers, and local area stakeholders to construct a drawn-out vision for low-carbon pathways in energy and transport adjusted with Colombia's 2050 strategy. It will enhance the capacity of Colombian departments and municipal government officials to implement solutions that contribute to the country's low-carbon ambition (ukpact site).

The OpEPA programme has so far benefited over 140,000 in Columbia with a geographical reach in Columbia, the US, Peru, Costa Rica, and Chile.

Weaving Lab

In 1915, the College of Wisconsin had a winding-around Research facility where students took in the art of winding in the home financial matters division (weavinglab site). A century later, *Weaving Lab: Plain Cloth Productions,* as a public-facing site of textile production, explored the creation of cloth in relationship with inquiries around time, labor, process, rhythm, production, meditation, and math-based patterns. The lab ran for the summers of 2016 and 2017 at the Wisconsin Foundation for Revelation in Madison, Wisconsin.

Winding around Lab Computerized Residency welcomes craftsmen to interpret their work into woven fabric utilizing the particular innovation of the TC-2 Jacquard loom. The residency energizes new talk, exploration, and development by broadening communication with the type of jacquard winding around and the cutting-edge loom as a prototyping instrument. Winding around Lab drives length the fields of craftsmanship, plan, and social work, looking to diagram new material and applied regions, to enhance the solution-based plan, and encourage new methods of social creation.

Project Water Education Today (WET), USA

Project Water Schooling Today (WET) firmly accepts that eye-to-eye connections give an important preparation experience to instructors, everything being equal. However, we recognize that this is not always possible due to distance, scheduling conflicts, health concerns, and convenience. WET has several options for online or virtual training for formal and non-formal educators as well as corporate Partners and employees. Pre-K-12 formal or non-formal educators, we encourage can talk to local Project WET Partners as they may be offering live virtual training or other local online training.

WET Online Training:

It is a digital interactive workshop for educators who are unable to attend an in-person Project WET workshop. The Online Training gives educators information about Project WET and leads them through activities from Guide 2.0. It also includes required workshop components such as practice teaching, information on educational standards related to Guide 2.0, and internet resources, all in a self-paced, interactive format. After the Online Training, educators will receive a print copy of the Project WET Curriculum and Activity Guide 2.0 and certification as a Project WET educator. This training is only available through your local Project WET partner.

The Clean and Conserve Education Program:

The Project WET Establishment and Ecolab have cooperated to make the Clean and Save Training System. Starting around 2014, Clean and Moderate has contacted very nearly 7 million individuals in 72 nations, determined to save water and make the world a better spot. Beneath, you can download clean and save schooling materials, participate in web-based preparing modules, and access the WaterStar acknowledgment program.

The suite of materials that the program offers includes lessons that focus on sanitation and water conservation (in addition to a KIDS booklet, an early childhood activity storybook, and a high school project guide on the same topics). Each activity has its online training to guarantee educators are comfortable teaching the topics and activities.

Dream a Dream, India

Indian Dream a Dream helps underprivileged youth of Bangalore and other Indian regions to develop existential skills for life-long thriving (dreamdream site). For over 20 years, Dream has been devoted to helping marginalized youth live better lives through learning life skills.

Dream a Fantasy works straightforwardly with 10,000 youngsters every year through our two development labs - After School Fundamental Abilities Program and Vocation Interface Program (hundred site).

In these innovation labs, new approaches to life skills development are introduced, demonstrated, documented, and fed back into the larger framework to re-imagine learning for young people in India.

Dream a Dream provides innovative, non-traditional educational opportunities through sports and arts to allow children to build important life skills such as teamwork, decision-making, problem-solving, and critical thinking. The organization Partners with 20 schools in Bangalore work with students from grades 4-10 and run two centers in under-resourced neighbourhoods for 15-23-year-olds to help develop the life skills necessary to make a healthy transition from adolescence to adulthood. Here the programmes in Computer Education, Spoken English, Communication Skills, Money Management, and Workplace Readiness are integrated with a high-impact life skills approach that prepares them for the job market and creates versatility, certainty, and flexibility expected to answer the quick difference in pace in their general surroundings.

The program was launched in July 2018. It creates transformative experiences for teachers/educators to re-imagine their role, demonstrate empathy, expand their creativity, develop listening and validation skills, and facilitate safe learning spaces in their classrooms.

Recognizing that children spend the majority of their time in the classroom, Dream a Dream expanded its work to train teachers in ways to create safe, engaging, and joyful learning environments. Until this point, they have prepared more than 9800 educators who thusly have worked with north of 245,000 students.

The Training Service of Delhi welcomed Dream a Fantasy to collaborate with them to foster another social/profound program called the Happiness Curriculum.

The big breakthrough was the Delhi schools' willingness to devote 40 minutes of curriculum time each morning to social/emotional learning that develops life skills. The program, itself, includes stories, mindfulness practices, and creative activities from Dream a Dream all focused on the health of children and how they can find true happiness. When the program was planned, dream a Fantasy's errand was to prepare 18,000 educators in 1,024 government schools.

Partner Youth Empowerment's (PYE), US

PYE began with a single youth gathering called Power of Hope in 1996 on Whidbey Island, near Seattle, Washington, US. Charlie Murphy and Peggy Taylor then established a non-benefit organisation called Force of Trust: Youth Strengthening through Human Expression. In 2008, worldwide finance manager Ian Watson attached Peggy and Charlie to establish Partners for Youth Strengthening to take the work to a worldwide crowd.

A quarter century after the fact, camps in light of Force of Trust's Innovative Strengthening Model have occurred in Canada, English Columbia First Countries, the

US (Washington State, Oregon, and California), Jamaica, Brazil, South Africa, Uganda, the UK, and India. PYE and its Partners train a great many youth laborers, educators, and social assistance experts every year in the Innovative Strengthening Model. This thus influences the existence of more than 220,000 youth every year.

PYE's mission is to unleash the creative potential of young people (Partnersforyouth site). For quite a long time, directed by this mission, PYE has been attempting to move the field of youth work to answer the more profound requirements of youngsters for importance, reason, inventiveness, and organisation.

PYE does this by training individuals, schools, and organizations in our Creative Empowerment Mode (CEM), a combination of experiential education, group facilitation, and the arts, which together foster key life skills that help youth thrive in a fast-changing   world.
The CEM combines experiential learning, Group facilitation, and Arts-based practice into a framework for designing and leading transformative programs for youth and adults. Through program exercises, members foster self-assurance, inspiration, social and close-to-home capability, and administration-demonstrated indicators of health.

Today, through a train-the-trainer model and with our circle of global Partners, we train over 6,000 practitioners in 40+ countries annually. Through an online learning network, are regularly engage 5,000+ practitioners around the world with free resources and peer education opportunities. These practitioners, in turn, reach over 300,000 youth each year with programs that ignite purpose, power, and possibility in youth.

Design Cuts's, UK

Tom Ross is Design Cuts's founder and chief executive officer, a community of 750,000 creatives (designcuts site). He is a showcasing master who helps entrepreneurs (and innovative business people like us) in building connections with networks. Course categories provided are Business & Marketing; Drawing & Painting; Graphic; Design; Illustration; Photography; Lettering & Typography.

African Dream Collection

African Dream collection is all about African art and crafts.

This collection includes hand-drawn vector patterns and brushes. Background for branding projects, fabrics, packaging, fashion apparel, posters, wrapping paper, and printable graphics.

Introducing the "Africa" collection. Created with love for you. All the characters, elements, and details are carefully chosen to create the image of a real sultry Africa. Bright paint and gradient colors, elaborated details generate a stunning flavor of the collection. Many elements, backgrounds, frames and textures, seamless patterns allow you to create thousands of your ideas and designs. Ideal for pattern making, clothing and interior design, and social media design.

Tribal Patterns

Introducing a unique collection of 40 Tribal Patterns inspired by African mud cloth.

Mathematical plans have a hand-tailored feeling that makes them remarkable. Albeit the method involved with making mud fabric traces back to the twelfth hundred years, these ancestral themes are as yet pertinent today. These examples would be perfect for an expansion to a brand, for dazzling bundling plans, writing material, and in any event, for web foundations and header pictures. The extra brushes likewise make it simple to add some extra.

African Mudcloth Patterns

This collection of African Mudcloth Patterns are all hand-drawn patterns inspired by the techniques used by Malian ethnic groups to dye fabrics using mud. The Bogolanfini (as they are known) were made with complex themes and images that used to recount stories and have more profound implications.

The patterns are fully editable (through Adobe Illustrator) we can easily change the colors and shapes to suit all your projects! Use them as foundations for textures, marking projects, bundling, design attire, banners, and printables, or simply attempt them as web foundations with extraordinary outcomes!

Tribal-art Collection "Africa"

The tribal art collection incorporates hand-drawn African veils, a beautiful letter set, additional Product components, and highly contrasting surfaces. You can make unique shirt prints, music banners, touristic handouts, and strange summer plans. Additionally, you can embellish the bistro or your home in the African style.

The silhouettes of the collection work great for photo overlays. The decorative alphabet is perfectly combined with illustrations. The textures of this set are appropriate for fabrics and wrapping paper.

Web20 Classroom LLC, US

A former teacher, Steven W. Anderson is a father, learning evangelist, author, speaker, and public speaker. Steven now works as the director of instructional technology and as a consultant with educators globally after having a fruitful career in public education (Web20Classroom site).

He has experience coordinating instructive innovation, using virtual entertainment for learning and encouraging solid self-teach organisations. He is an expert learning specialist, creator, and co-founder/CEO of Web20Classroom LLC.

Shaelynn Farnsworth is a leader in the convergence between literacy and technology. She is the COO of Web20Classroom. She has a Master's Degree in English from the

University of Northern Iowa along with a Bachelor's of Liberal Arts Degree in Education.

Her primary focus is on technology, literacy and authentic instruction, Data Collection, Professional Development, School Improvement Plans, and Walk-through development.

HundrED, Finland

A serial entrepreneur, novelist, and public speaker, Saku Tuominen founded HundrED, a non-profit organization that seeks and disseminates innovative educational ideas to improve K–12 education worldwide (hundred site).

His expertise is creativity and innovation. He was educated at Aalto College in Helsinki. HundrED is a worldwide organisation with an unmistakable target of tracking down compelling and versatile instructive developments, advancing their reception, and assisting with getting them going.

HundrED concerns about climate change, resource depletion, and ecological degradation intensify, and so does the urgent need for a sustainable future. (Heslop, 2023).

Education for Sustainable Development (ESD), UK

Stephen Sterling is an Emeritus Professor of Sustainability at the University of Plymouth (sustainableeducation site). He is the founder of the Education for Sustainability programme at London South Bank University.

Sustainability education, often referred to as ESD, is a proactive strategy that equips students with the knowledge and skills necessary to confront pressing global issues like climate change, inequality, and biodiversity loss head-on. ESD embraces an all-encompassing methodology that considers both the student-instructor elements and the learning climate.

Stephen Authentic classifies ESD along four aspects: supmobile, legitimate, solid, and sturdy. Maintainable training supports individuals, networks, and environments.

Education for Sustainable Development (ESD), UNESCO

ESD is UNESCO's education sector response to the urgent and dramatic challenges the planet faces (UNESCO site).

Going about as a worldwide backer and planning to reinforce limits of legislatures to give quality Environmental Change Training (CCE), UNESCO creates and shares information, gives strategy direction and specialized help to its Part States, and carries out projects on the ground. UNESCO energizes inventive methodologies and improves

non-formal training programs through media, systems administration, and organizations.

Part States are urged to create and carry out a 'country drive' to standard ESD in the country's endeavors made for seeking after a feasible turn of events.

In this way, a country drive will be considered as an umbrella drive that commonly incorporates whatever number of ongoing ESD exercises in the nation as could reasonably be expected and a few new exercises, to encourage collaborations.

The Global Schools Program, UN Sustainable Development Solutions Network, UN

The organisation is the initiative of the UN Sustainable Development Solutions Network.

The Global Schools Policy Program was born out of an 18-month pilot program in Morocco, Ghana, and Turkey, where a team of 50+ researchers in 3 universities worked closely with ministries of education and/or other institutions to analyze how sustainable development education is integrated into national education priorities and curriculum (Global Schools Program, 2023). The program was advised by leading education experts from Monash, Harvard, and Columbia universities. The pilots were conducted in 4 separate languages and involved 80+ stakeholders, including representatives from various teacher unions, government agencies, local councils, civil society organizations, universities, and businesses

The Worldwide Schools Program developed a free half-year instructor preparing program called the Worldwide Schools Backer program, including in excess of 30 talks, sound web recordings, unique readings, conversation prompts, and evaluations

(globalschoolsprogram site).

Global Schools Advocate

The Worldwide Schools Program developed a free half-year educator preparing program called the Worldwide Schools Supporter program, involving in excess of 30 talks, sound digital recordings, unique readings, conversation prompts, and evaluations administered on Edx Edge and WhatsApp. WhatsApp enables access in low-data formats, particularly for educators living in resource-constrained settings. (globalschoolsprogram site).

Mentoring Program

Mentors promote networking and cross-collaboration between schools and Advocates, provide platforms for brainstorming on Education for Sustainable Development (ESD) activities and school-wide strategies, encourage classroom-to-classroom collaboration on SDG-related activities that are relevant to each school, and increase

engagement and retention of Advocates in the program by connecting them more actively to peers. In 2022, due to a new partnership with the Masters in Development Practice Program, Mentors also participated in the Global Classrooms project. This is an innovative professional development course that meets for 14 weeks during live webinars with prestigious speakers who are sustainable development experts.

Virtual Student Symposium

On June 10th and June 11th, 2022, the Global Schools Program held a virtual Student Symposium. The symposium was an opportunity for talented students to present their sustainable development ideas and projects on a global stage. Over 200+ participants from around the world attended the Symposium. The two-day high-influence virtual meeting associated students with experts from assorted sustainability vocations, who talked about their expert and individual excursion with the SDGs, manageability, and environment activity.

Khan Academy, US

Khan Academy is an American non-profit educational organization created in 2006 by Sal Khan (support. khanacademy site).

Its objective is to make a group of online instruments that assist with instructing students. Its site likewise incorporates valuable practice activities and materials for instructors. It has delivered north of 8,000 video illustrations showing a wide range of scholarly subjects, initially zeroing in on math and sciences. All assets are accessible for nothing to clients of the site and application.

As of 2018, over 70 million people use Khan Academy, out of which 2.3 million students use it to prepare for the SAT.

As of August 2023, the Khan Institute channel on YouTube has 7.98 million endorsers and Khan Foundation recordings have been seen more than 2 billion times.

Enhancing conventional homeroom training with the innovation being created by his Foundation can expand the adequacy of educators by liberating them from traditional talks and permitting them to commit additional opportunities to individualized guidance for every student.

The institute flaunts an independent-directed growth opportunity with more than 100,000 practice questions and 5,000 informative movies covering everything from rudimentary math to school-level physical science and financial matters.

In India, the courses are in English, Hinglish, Hindi, Gujarati, Assamese, Marathi, Punjabi, and Kannada.

With more than 300 million courses provided and more than a billion exercises completed, it is the most popular library of educational lessons worldwide; more than

1.8 billion people have watched his online educational videos. Each month, over 10 million unique students use it.

Additionally, Khan Academy is being used by over 200,000 educators worldwide to help students become more knowledgeable about a variety of subjects and to free up class time for engaging in project-based learning.

Websites exist also in Arabic, Dari, Hebrew, Malay, Persian, Swahili, Telugu, Thai

Ukrainian, Urdu, Xhosa, and Zulu (support.khanacademy site).

Jelmer Evers, the Netherlands

Jelmer is an author, a history teacher, and a two-time Global Teacher Prize nominee. He turned into a reformer of the Dutch schooling system and had been laying out an overall instructor initiative organization to give his students balanced training.

His method of site instruction encourages students to take responsibility for their education and helps them establish a unique learning environment.

Thousands of pupils across the globe have used his assessment tools, resulting in a highly networked K12 MOOC. Jelmer uses social media and gamification extensively in his history lessons, focusing mostly on interdisciplinary issues where students learn subject material and skills while investigating real-world problems. Herewith three of the innovative programs launched by him (ei-ie site):

Global Response to Commercialization and Privatization of Education in Nigeria Further create awareness on the impact of privatization and commercialization of education at the regional level in the West Regional Bloc which comprises Delta, Edo, Ekiti, Kwara, Lagos, Ogun, Ondo, Osun, and Oyo States.

Book Development and Promotion of Literacy in Underprivileged Schools

Sierra Leone, Burkina Faso, Burundi, Gambia, Benin, Swaziland

Train teachers to produce culturally relevant teaching and learning materials to be used for the promotion of literacy in underprivileged schools. Elevating social exchange to annihilate kid work and reinforce quality training solutions in Zimbabwe

Following the fruitful execution of a venture against kid work in Chipinge (Manicaland territory) in 2015-2020, ZIMTA and PTUZ are fostering a kid work-free zone in the Muzabani region (Mashonaland Central region). Improvement of a kid work-free zone in wards 13 and 14 of the Muzabani locale (Mashonaland Central territory).

YouCubed, UK

More than 400 million students have benefited from Jo Boaler Mooc's approach to mathematics.

Co-founder of YouCubed and Stanford University Professor of Mathematics Education, Dr. Jo Boaler, is a pioneer in the field. Her books significantly enhanced teaching for a lot of math instructors. Alongside being the maker of the primary MOOC on math education and learning, she likewise fills in as an examiner for the OECD's PISA trying system.

As a scientist, teacher, and evangelist, Boaler is a main defender of an in a general sense different way to deal with schooling. The method involved with showing up at a response can be similarly basically as huge as the solution.

Her method is one where grasping the connections between math facts is more important than memorization of the facts themselves. She has stood firm on footings as the Marie Curie Teacher of Math Training in Britain, a science educator in London complete schools, and a speaker and scientist at Ruler's School, London, among others.

The Organisation of International Schools in Africa (AISA)

The AISA School Exchange Programme provides support for two full-member schools wishing to collaborate, share specialist expertise, and exchange learnings (aisa site). The program supports the full circle transport costs for a meeting overseer or instructor from one AISA part school to head out to another, subsequently encouraging more prominent cooperation and joint advancement inside our community. AISA likewise upholds the virtual school trade.

Blended Learning

Blended learning helps teachers offer a more individualised and inclusive approach to teaching and learning to prepare our students for the future.

Bended learning transforms student learning through personalisation and increased agency.

It provides for myriad opportunities such as active learning where students have more responsibilities, the promotion of best practices by improving teachers' pedagogical approach, improved technological standards for both technology and other subject areas, individualised learning by creating space for teachers to dedicate more time to small groups and individuals and improving school emergency readiness by enabling teachers, students, and parents to move to a fully virtual learning platform in case of emergency closures.

AISA Affinity Group

The motivation behind an AISA Fondness Gathering is to give an online place of refuge to AISA individuals who share a shared characteristic or personality. The purpose of affinity groups is to foster a sense of connection and belonging, where people can come together to share experiences, challenges, and ideas. Proclivity group individuals meet

on the web and examine issues and subjects chosen by the gathering. Membership of AISA Affinity Groups is open to any member of staff at an AISA member school.

AISA Partnership with Edmentum

AISA has collaborated with Edmentum to bring their computerized educational plan assets and on the web, remote instructing choices to our schools when interest for both is expanding dramatically. Edmentum has many years of expertise in providing virtual teaching for schools that do not have resources for teachers in every subject with every qualification, thus allowing students in AISA schools admittance options that would not otherwise be available to them

Edmentum is part of Edmentum Inc. which has over 400 employees. Edmentum Inc. is based in the US with offices in Minneapolis, Minnesota, and Dallas, Texas. We operate from inside the UK are the industry leaders in educational technology and have been pioneering educational resources for the past 60 years.

Programs for students aged K-12 are used in over 100 countries within schools, school groups, and governments. They have more than 370,000 educators utilizing our solutions, and we are engaging over 5 million students worldwide.

AISA Partnership with the International Centre for Missing and Exploited Children (ICMEC)

AISA has partnered with ICMEC to empower our community with resources and training around child protection, health, and health to create a safer world for children. The ICMEC Worldwide Teacher Community for Greatness and the Global Team on Youngster Insurance have united to give assets on the most proficient method to forestall and answer child abuse, disregard, and sexual abuse to guarantee no kid remains solitary.

AISA Partnership with the Academy for International School Heads (AISH):

AISA has attached forces with AISH to bring their excellent expert learning and local area fabricating course to our individuals at particular rates. AISH has driven Profound Jumps at past AISA gatherings and we suggest their expert advancing course for yearning and serving Heads of School.

It is AISH's objective to give rich expert advancement potential opportunities to Worldwide School Heads and to be on the bleeding edge of driving and learning. The Initiative Series does precisely that as it coordinates customized proficient improvement with your advancing requirements as a pioneer.

AISH Leadership Series Online Program was created with this ethos in mind, as the courses are taught by experienced International School Heads with a focus on the real-time needs of the current or aspiring international school leader. The Leadership Series

Online Program includes six total online classes. Courses were developed and are taught by experienced International School Heads. They are designed for flexibility and for participants to adapt learning experiences and meet course expectations at their own pace.

AISA Partnership with International School Board Training (ISBT)

AISA has partnered with ISBT to provide the schools with access to the Management Essentials series. This online series is designed with school boards in mind, allowing convenient access to the entire board so that everyone is working from a common ground.

Save the Children, Emergent Literacy and Maths (ELM) programme

ELM programme raises awareness of emergent literacy and maths skills and how they develop through play and joyful learning, trains early childhood care and development (ECCD) teachers on how best to support them, and mobilises communities to promote these skills at school and home to ensure school readiness.

The programme is being implemented by Save the Children (SC) in Bangladesh, Ethiopia, and Rwanda (Bethell, 2016). The evaluation report for Bangladesh suggests that the programme's multi-faceted approach including health and nutrition produced significant gains in the general readiness of children to attend school. Specifically, by presenting youngsters with early math ideas, for example, shapes and numbers, their availability to begin arithmetic in schools was altogether improved (SC, 2012). In Ethiopia, the program zeroed in on the utilization of an ELM 'tool compartment' with facilitators of early childhood care and development (ECCD) fixates being prepared on the utilization of program materials and play-based methods.

Early mathematics concepts included: number and quality identification; counting; and concepts of time, direction, space, and shapes.

Teacher Education in Sub-Saharan Africa (TESSA)

TESSA initiative The Open University, UK is in close collaboration with international Partners and supported by funding from philanthropic organisations.

The program operates through a network of teacher educators and teachers working to improve the quality of classroom practice across SSA by supporting school-based teacher education by providing unrestricted access, through the internet, to a large bank of Open Educational Resources (OER) including general teaching resources; subject-specific resources including teaching packs; audio clips; and, handbooks for teachers and teacher educators.

The materials, prepared and/or adapted by African authors, are designed to enhance the training of teachers both pre-service and in-service. They are currently available in four languages - English, French, Kiswahili (Tanzania), and Arabic (Sudan).

Where possible the OER promotes active learning and constructivist approaches to teaching mathematical concepts. Wolfenden et al. (2010) report that within two years of their completion, at least some TESSA OER had been formally incorporated into 19 teacher education programmes from the certificate level to B.Ed. level across nine Partner countries. One of the critical qualities of the TESSA approach is the adaptability presented by utilizing OER which can be utilized as they are or changed to address explicit issues as well as country-explicit settings.

Ministries of education, Higher Education Institutions, and TTIs can join the TESSA network for support or they can simply 'plunder' the available resources to build or enhance their teacher training modules. The Mauritius Institute of Education has used OER as the basis of a 'Creative Pedagogy' module and the Ministry of Education in Togo has adapted TESSA's freely available materials to meet local needs.

Nokia Mobile Mathematics Application (MoMath)

UNESCO and Nokia have carried out drives to assemble the limit of essential educators in Mexico, Nigeria, Pakistan, and Senegal using versatile advancements. In Senegal, the initiative launched in 2012 focuses on student learning in Mathematics and Science.

In particular, the MoMath has been adapted to match the national curriculum. This allows students to master mathematical concepts in a dynamic digital environment that can be accessed from any internet-enabled mobile phone" (UNESCO, 2013). Students can therefore practice problems at home or school at any time.

The system also stores information about the progress of students on remote servers making this immediately available to teachers. UNESCO and Nokia worked with local Partners RESAFAD (Réseau Africain de Formation à Distance - Sénégal) and CRFPE (Centre Régionale de Formation de Personnels de l'Education de Dakar) to train 100 teachers from 50 schools on using the application to gain deeper insights into the learning needs of their students and constructively respond to these needs.

Digital School in a Box, Uganda

UNICEF is setting up 60 'Digital Schools in a Box' to reach the most marginalised groups (in Uganda). These digital schools, serving 100 to 200 children each, are set up in schools and health centres in rural communities where children spend most of their time so that they have access to quality educational content 24/7 and are more prone to learning collaboratively. Each computerized school is worked around a solar-fueled PC with Web network, a projector, a speaker and a report camera" (UNICEF, 2013).

The BrightBox, Simbi Foundation, Canada

Simbi Foundation is a Canadian research-led non-profit organization enhancing access to education for the next 3.5 million learners in remote and refugee communities in India and Uganda, including in Bidibidi Refugee Settlement (simbifoundation.org/brightbox site).

The BrightBox is a remote, unsupported, solar-controlled gaining lab reused from a steel trailer. Put on the grounds of a current school, BrightBox gives access to education assets to a local area of 6,000 concurrent students through a restricted, significant educational program Intranet which can be accessed from any place in the school. It likewise makes a center for the age of force which can be disseminated to the encompassing school blocks, raising their ability.

The BrightBox incorporates the Raspberry Pi Microcomputer stacked with the Simbi Learn Cloud educational program and Simbi Disconnected, a projector and screen, and extraordinarily planned work areas and seats to expand the space for learning.

Once introduced, the BrightBox goes about as a miniature matrix for an entire school local area, permitting clean energy to be dispersed to encompassing school homerooms to control lighting and projectors. The BrightBox is fitted with a unique roof for optimal water catchment and solar power generation.

MathCloud e-learning, Sri Lanka

MathCloud is an e-learning platform developed by the for-profit company MPDA73 in Korea. The product is versatile in that as a student advances through a module, the framework utilizes the responses to demonstrative tests to distinguish qualities and shortcomings and, consequently, to convey a program custom-fitted to the student's particular requirements. Student progress is followed in the product and the educator approaches various devices intended to make the entire class and customized showing more effective (MPDA, n.d.). The ADB's testing e-learning as Learning Project funded the customisation of MathCloud materials to match the national curriculum for mathematics, including translation to Sinhala. In the pilot phase, students in selected schools used MathCloud for two hours per week (out of five hours of mathematics tuition in total) for a year. An assessment of the effect of the mediation detailed that the treatment group made measurably huge additions when contrasted and the benchmark group (Jawline, 2012). The impact size, assessed from the assessment information, is around 0.25. Whilst this may be considered to be 'small', it is comparable to reported effect sizes for other CAI interventions (Fletcher-Flinn and Gravatt, 1995, Cheung and Slavin, 2011).

CyberSmart Digital Learning Platform, SmartSenegal

SmartSenegal is a profoundly creative information-building stage planned explicitly to address instructor proficiency requirements by working on their capacity to access and

share learning content and team up inside a sympathetic and moving climate (profuturo africa site). Vital utilization of man-made reasoning aides educators find and applying the best educational assets and doing what they are now doing — just quicker and more straightforward.

Teachers are already heavy users of social networks but existing networks are not uniquely designed for teachers. We are adding features that teachers have told us will make their jobs and their lives easier.

The USAID Proof-of-Concept successfully demonstrated how The CyberSmart Digital Learning Platform effectively delivers previously unavailable instructional materials. Additionally, educators acquired valuable study hall educational time since they no longer needed to duplicate examples onto the chalkboard. The CyberSmart Digital Learning Platform is specifically designed to address these challenges, delivering instructional materials — maps, photos, videos, and up-to-date quality content — into classrooms with few books and 40-75 students.

iMango, Kenya

In seven years, iMlango has improved the mathematics, literacy, and life skills outcomes of nearly 300,000 children in Kenya, including 68,000 marginalised girls, in 245 schools (profuturo kenya site).

In seven years, iMlango has improved the mathematics, literacy, and life skills outcomes of nearly 300,000 children in Kenya (Kajiado, Kilifi, Makueni, and Uasin Gishu), including 68,000 marginalised girls, in 245 schools.

The - Cloud Enabled Internet Connection (C3) Micro-clouds for Education as a Solution for e-learning, Kenya

The C3 miniature cloud, otherwise called a cloud-empowered web administration, establishes a rich learning climate that offers a neighborhood content storehouse and strong e-learning instruments. Teachers and students connect to the local microcloud via Wi-Fi and have access to a fully cloud-based learning environment. It provides an excellent foundation for delivering e-learning, including content, rich media, and lessons that do not require constant internet access. With this solution, students and teachers across the region have access to cloud-based LMS, curriculum, content, and resources, even in situations where the school has no connectivity or power supply.

In a micro-cloud-enabled scenario, the school's micro-cloud platform hosts the learning infrastructure as well as the curriculum, content, and resources. The Kenyan education sector program is implementing cloud-enabled e-learning.

In the pilot stage, the outcomes show that the miniature cloud advances joint effort among students and educators in conditions without a web organisation. In this review, students had the option to examine different points and help each other concentrate in a place of refuge made by educators.

The miniature cloud worked on the nature of schooling for 110 students at St. Aloysius Gonzaga Auxiliary School in Nairobi, Kenya. For these students, illustrations are not generally founded on obsolete course readings. Books are currently only one of numerous other instructive assets accessible to students, supplemented by recordings, webcasts, games, sites, and so forth. The miniature cloud has been enormously useful in the multiplication of showing services and advancements that improve students' reasoning and composing abilities and the capacity to tackle complex issues.

E-Education Sites Operating in Africa (do4africa Site)

Petach Robotics, Kenya

There is a lack of skills in science and technology among youth in Kenya. The points shown in school are not adequate for the students to be urged to seek after vocations inside STEM and tackle designing issues. Additionally, technology is critical for innovation, yet schools struggle to get students interested in this area. This can only be addressed by starting to teach all subjects connected to STEM from an early age.

Peter Ochieng the founder of Petach Robotics, currently works at the Department of Computing at Taita Taveta University, Kenya (researchgate.net/profile/Peter-Ochieng-site).

Peter explores Normal Language Handling, biomedical ontologies, and Man-made consciousness.

Through a progression of contests beginning essentially on the web and up close and personal, students practice their inventive critical thinking abilities and take on certifiable plan issues. With a zero-cost, zero-setup, and online environment that uses the latest web technologies, Petach Robotics provides students worldwide with a testbed to carry out research.

Petach Mechanical Technology has coordinated nearly 100 contests that have tested the students and given learning in decisive reasoning and STEM. In general, the work of Petach Robotics has drastically improved the skills of hundreds of students who have received training in STEM subjects such as robotics and coding. The Dawa app is a medical app that facilitates telemedicine appointments. The company has partnered with numerous organizations, such as Safaricom, which has ensured the quality of their classes.

Eneza Education, Kenya

Eneza Education is a Kenyan-based platform led by Wambura Kimunyu that aims to connect learners across Africa through learning modules, video tutorials, live classes, and interactive courses. (Brook, 2022). As well as giving its without clients learning devices, Eneza is attempting to give training answers for the provincial and semi-country networks in Kenya, Rwanda, and Tanzania. Eneza permits students to get to every one of their assets through versatile.

Eneza has shown that an inventive model utilizing the most straightforward of the innovations (e.g., fundamental digitization of the course book content) and devices (simply 2G remote telephones) can deliver the most intelligent response (carbonegroup site). 10 million+ learners across three countries (Kenya, Ghana, and Côte d'Ivoire) 8 million+ questions answered, and double-digit improvement in academic performance. Eneza goes after every one of the critical resistances by first changing over every single scholastic reading material (from grade four through auxiliary schooling) into digitized scholarly substance and afterward breaking them into exceptionally organized scaled-down miniature modules, which are then conveyed over the remote organizations of the nearby telecom specialist co-op to the end-clients with extremely fundamental 2G telephones with just message informing abilities.

This approach conquers every one of the key hindrances - the absence of incremental Web organisations, the absence of most recent (3G/4G/5G) telephones which are unreasonably expensive for a major area of Rural inhabitants, the absence of course books for youngsters to peruse or overhaul after they get back from school)

Eneza's solution is accessible and affordable to every kid no matter where they are. A centralized cloud-based technology infrastructure that combines one-time investment with almost limitless scale and delivery, along with a super-efficient subscription & collection system, very affordable price points, and almost few pennies per student per day, supports attractive profitability and growth.

The platform is designed to support two-way interactions so that the students can complete in-the-context questions and receive feedback and scores from their teachers who can be anywhere and do that in their own time asynchronously.

Eneza's model works with components (cloud framework, telecom organizations, and remote telephones) that are as of now there in the objective populaces of African landmass and many nations across Asia, South, and Central America. It works across every scholarly subject and dialect, as well as concerning grade levels from essential to auxiliary schooling.

E-Universities Platforms

E-higher Education, Cameroon

In the education sector, in 2015 the government of Cameroon established a strategy for higher education based on more funding and digitalisation of higher education. Based on this, the e-higher education vision programme was established with plans to enhance e-learning, e-administration, and the construction and equipment of nine digital centres in each of the state universities and in one inter-state university; plus, 500,000 laptops have been distributed to university students (32GB SSD with 2GB RAM) since then, with the objective being to connect the laptops to a cloud service and interconnect the universities with common services.

African Virtual University (AVU), African Development Bank

African Virtual University (AVU) is Africa's first pan-African online institution. Launched in 1997, AVU provides students and scholars with affordable, accessible, and relevant quality education and research in an environment that encourages critical thinking and promotes innovation (Brook, 2022)

AVU offers a wider selection of quality online courses and enables students to choose from a variety of flexible delivery options – not just traditional onsite delivery.

The university offers courses on a range of subjects to both domestic and international students. Today, it offers distance learning courses across a broad spectrum of disciplines to more than 43,000 students in over 30 African countries in English, French, and Portuguese.

Kenyetta Digital School of Learning (KDSL), Kenya

Founded in 2014, *KDSL* is a leading online learning platform serving learners across the African continent. They have developed a content strategy designed to enhance the digital literacy of young people (Brook, 2022).

KDSL offers a wide range of free online courses on topics including leadership, financial literacy, career preparation, and more. The platform combines online teaching tools, technology, and innovative teaching methodologies to ensure that learners are engaged, motivated, and fully prepared. Today, it offers distance learning courses across a broad spectrum of disciplines to more than 43,000 students in over 30 African countries. The Digital School has centers in various parts of Kenya including Nairobi, Mombasa, Kisumu, Nakuru, Kakamega, Kericho, Nyeri, Embu, Garissa, and Marsabit.

Meltwater Entrepreneurial School of Technology (MEST), Ghana

Established in Ghana in 2008, MEST gives basic abilities for preparing, financing, and backing in programming advancement, business, and communications to hopeful tech business people.

Past tech and enterprising abilities preparing, MEST Africa gives a true benefit to business people through financing, business brooding, and access to a worldwide tech organization. MEST has launched various effective new businesses that have proceeded to get follow-on subsidizing and admission to the world's top tech gas pedals, has facilitated visitor teachers from Fortune 100 organizations, and counts Mastercard Establishment, Microsoft, and 500 new companies among its Partners.

The program teaches entrepreneurs how to build tech businesses. There are computer programming, software development, product management, finance, marketing, sales, and leadership courses (Brook, 2022).

MEST upholds beginning phase programming business people, focused on building solutions that address the landmass' most appropriate difficulties while making abundance and work.

The internal seed fund invests between $50k to $250k+ in funding to help launch and scale early-stage companies. As well as financing, MEST offers an 18 to two-year hatching period and access to a powerful worldwide tech local area.

University of Africa (UA), Zambia

This is an online university founded in 2012 that offers free online courses on entrepreneurship. Its vision is to teach more individuals about the valuable opportunities presented in business and business ventures, particularly among Africans. The main objective of this online platform is to offer free online courses to students and other learners who are interested in business and entrepreneurship (Brook, 2022; theuniversityofafrica site).

The College of Africa offers free online courses, testaments, confirmations, Degree, and Ph.D. degrees. Students can choose from a wide range of degree programs including the Bachelor of Business Management (BBM) and Bachelor of Business, computing, education, mass communication, psychology, and LLM Laws.

The university offers a scholarship program as well. It has more than 2000 students from Zambia, Zimbabwe, Uganda, South Africa, and the Democratic Republic of the Congo.

Unicaf University, Zambia

The College has laid out best-in-class grounds in Malawi, Zambia, and Uganda Unicaf College is an authorized college in Malawi and Zambia and is likewise endorsed to select students in Kenya.

Unicaf College in Malawi is certified by the Public Committee for Advanced Education (NCHE) and Unicaf College in Zambia is authorized by the Advanced Education Authority (HEA).

Unicaf College grounds in Zambia and Malawi are likewise certified by the English Certification Board (BAC) as an Autonomous Advanced education Supplier. The Unicaf University platform provides students with flexible learning options, including the ability to study anywhere, anytime, on any device, and at any pace (Brook, 2022).

Unicaf University has been created to help students overcome the challenges of a lack of academic resources, especially in sub-Saharan Africa, where 80% of people cannot afford secondary school. According to its founder, Unicaf University is focused on three key areas: teaching and learning, research and development, and innovation.

Diplomas provided by this university are in Arts in Tourism and Hospitality Management, Science in Business Accounting and Financial Management.

Partnering with *South Wales, Marymount California University, the University of Nicosia, and Unicaf University, it gives Undergraduate and postgraduate programs both offline and online.* In Africa, the college has grounds and learning focuses in Malawi, Nigeria, Somalia, Zimbabwe, Mauritius, Zambia, and Ghana.

Wits University of South Africa, Wits Plus

Wits+ is an innovative and innovative e-learning platform that provides a convenient and cost-effective solution for learners in South Africa. The platform is part of the Wits University of South Africa (Brook, 2022; Wits site).

It aims to help learners who are considering gaining the right skills and qualifications to make their dreams come true. To achieve this goal, Wits+ has made its learner's experience a hassle-free one by making the learning process simple and easy to understand.

With Wits+, learners are not required to spend hours attending lectures. Rather, they are given access to a collection of pre-recorded videos and other digital content that can be watched at any time. On a part-time basis, Wits Plus only offers programs for a Bachelor of Arts degree and a Bachelor of Commerce degree.

The Wits plus Centre for Part-time Studies offers short certificate courses. Wits Plus students are typically over 23 and professionals. Wits Plus also offers selected part-time undergraduate degrees and some postgraduate offerings, on the University campus.

Hugo Jacome-Andrade, Talov, Ecuador

A performer and programming designer situated in the U.S. also, Ecuador, Hugo helped to establish Talov to make innovation open to the diversely abled. Talov's SpeakLiz Watch uses AI to listen to a user's surroundings and notify the watch wearer of 300+ types of sounds, including human voices, music, animals, vehicles, and those associated with emergencies. The Gesture-based communication Acknowledgment highlights changes over gesture-based communication into voice and message with the telephone camera.

Talov supports people with hearing impairment and supports people with visual disabilities in accessing the simplest of services and support in their day-to-day lives (Seedstars Global, 2020). Present in over 60 countries and with 35 languages proposed on its apps, it gives a voice to a community of over 700 million people worldwide living the same challenges.

MNCs and Education

C3 micro-cloud, Microsoft

Mida C3 - Cloud Contact Community for Microsoft Groups is a turnkey solution that enables specialists to oversee proficiently calls and talks to offer great help.

C3 miniature cloud, otherwise called a cloud-empowered web administration, establishes a rich learning climate that offers a nearby satisfied vault and strong e-learning instruments (ADEA, 2023). Teachers and students connect to the local microcloud via Wi-Fi and have access to a fully cloud-based learning environment. It provides an excellent foundation for delivering e-learning, including content, rich media, and lessons that do not require constant internet access. With this solution, students and educators across the area approach cloud-based Learning Management Systems (LMS), educational programs, content, and assets, even in circumstances where the school has no network or power supply.

In a miniature cloud-empowered situation, the school's miniature cloud stage (typically a minuscule gadget) has the learning foundation as well as the educational plan, content, and assets.

The micro cloud systems have so far been implemented and operated in several African countries, including Kenya, Nigeria, Senegal, Madagascar, Mozambique, and Angola.

Standard Chartered Empowering Girl's Education

Standard Chartered is a UK-based MNC with an interest in financial services. The corporation's intervention in education was aimed at empowering girls' education through its programme called Goal. The pilot scheme was in India where 70 school-going girls were picked and taught life skills using sports.

Since its launch in 2006, Goal has grown into an internationally recognised global movement operating in more than 20 countries. Managed by Women Win and implemented by organisations around the world, the programme teaches girls critical knowledge and skills related to health, communication, rights, and managing their finances through four key modules: Be Yourself,

Be Solid, Be Engaged, and Be Cash Keen. Somewhere in the range of 2006 and 2019, the program arrived at in excess of 525,000 young ladies and young ladies. Its point is to arrive at 1 million young ladies somewhere in the range of 2006 and 2023. This assessment, in light of an examination of quantitative information gathered from members and subjective exploration in India, Nigeria, and Uganda.

In 2016, Standard Contracted Bangladesh (SCB) turned into the principal worldwide bank to start working with the networks, giving them pay-producing professional preparation in cultivation, animal raising, ICT, financial schooling, etc, and considering the shortfall of fundamental sterilization services, lavatory facilities.

SCB and JAAGO Foundation banded together to bring digital classroom solutions and flexible learning to the remote learning environment via a project to extend JAAGO's Digital School Program (tbs news site). The Computerized School Program associates study halls in remote and provincial regions with educators in Dhaka by means of video conferencing innovation.

As an initiative, the Digital School Program facilitates the Distribution of quality education to the nation's most remote districts and divisions. The project helps to equalise the pursuit of education and standardise the learning process and the materials used for thousands of children who belong to vulnerable communities.

Since 2007, JAAGO Foundation has been operating schools for thousands of underprivileged children all over Bangladesh. Utilizing the advanced stage, JAAGO has been spreading quality training in provincial pieces of the country. A large number of impeded youngsters are right now getting quality schooling liberated from cost.

Following 10 years of work in 2017, JAAGO was perceived by UNESCO as the Best Instructive Organisation on the planet for using ICT in training.

Extremely challenging to track down educators who can give quality training in distant regions like the school's area and for that reason JAAGO embraced an online idea.

Inside the study halls, there are goliath television screens. These television screens are utilized by educators dwelling in Dhaka to convey examples. In any case, the televisions are not one way. The educator can likewise see the homeroom and collaborate with the students.

To help the remote teachers, there are teachers present in the classroom as well.

A Computer-enabled LEGO Product, LEGO

LEGO is a Denmark-based MNC working in a noteworthy number of nations. The organization is engaged with certain exchanges which incorporate instructive solutions. Although the activities of a corporation can be classified as either philanthropic or commercial, LEGO falls into two of these categories.

It has created tools to aid teaching and learning as part of its commitment towards ensuring the universality of education, in particular, through the provision of a low-cost solution to STEM education, also by helping children learn better and improve their cognitive and creative skills via literacy-focused products. LEGO, in partnership with MIT, developed a computer-enabled LEGO product to aid STEM learning (United Nations Global Compact, 2013).

Other LEGO educational tools help in developing language and literacy skills, and creativity. Such products help teachers in increasing their pedagogical skills and thanks to them educators are provided with easy-to-use materials that facilitate learning in the classroom.

LEGO is a source of inspiration for future scientists, engineers, and other STEM careers. Governments around the world such as Singapore and Peru as well as some US-based governmental agencies use LEGO educational solutions. This is simply because the products aid computational and mathematical skills which are relevant to jobs nowadays (Junec, 2017).

The LEGO Foundation and UNHCR are working together towards inclusive and equitable quality education and lifelong learning opportunities, ensuring no child is left behind. Teachers and caregivers in East Africa are trained, and refugee children are offered play-based activities and access to content, both digital and offline, through solar radio and local solar servers (SolarSPELLs), as well as play kits with LEGO® bricks, that will help them learn and develop.

The LEGO Foundation and UNHCR come together to bring the power of learning through play to refugee children in Ethiopia (unhcr site). The partnership guarantees that 37,500 refugee and host community children can continue their education.

Adopt-A-School Initiative, Oando Petroleum

Oando Foundation was launched and financed by Oando Petroleum in 2013, to provide access to education, in particular, quality basic education. Oando Foundation focuses primarily on Nigeria.

The corporation through its Adopt-A-School initiative, in collaboration with the Nigerian Ministry of Education and the state's basic education boards, focuses on the improvement of education and learning outcomes and the establishment of an information and communication technology creative centre. The foundation has adopted some schools in 23 states, trained teachers, and awarded scholarships to students (Ramper sad & Skinner, 2014).

Oando Foundation in partnership with Theirworld UK piloted a coding club for young girls in an Oando adopted school (oandofoundation site). The task is intended to enable young ladies with innovation abilities through imagination and mastering and fabricating the limit of female ICT Teachers/Coaches who will uphold the manageability of the venture. The project educational program was created in organisation with Theirworld UK, Kano, and Codecademy. The pilot stage is currently functional at Olisa Elementary School, Lagos, taking special care of more than 300 students and educators the same.

The establishment has laid out 33 ICT Focuses in schools across 11 States.

Nestlé

Nestlé is committed to promoting education in the realms of health and nutrition, especially by combating malnutrition and obesity (Duprez-Naudy & Ca sas, 2014). The genesis of the programme was said to have started in communities where malnutrition and obesity were rife. It started with countries such as Russia, Brazil, and Portugal, but soon expanded to over 20 countries. As of 2014, the programme is currently active in 73 countries (Johnson et al., 2013).

The Solid Youngster's Partners incorporate legislatures, research organisations, and colleges, common social orders which work with schools to show educators and cafeteria laborers health and sustenance both practically speaking and hypothesis.

Nestlé also supports the Global Education First Initiatives (GEFI) which aims to improve youth and children's education, through the partnership of business-related support for the initiative. The impact of these on education is that the partnership with local education authorities and other stakeholders has helped build capacity in schools thereby improving the efficiency of education (Powell, 2014).

Pricewaterhouse Coopers (PwC)

PwC is a global corporation offering audit, assurance, consulting, and tax services. Its intervention in education was hinged on combining financial resources and skills-based volunteering. PwC leverages the skills of its employees to address issues in the US education system. Through the Earn Your Future (EYF) commitments which include helping in developing critical financial skills and providing educators with training and resources to teach those skills.

EYF Computerized Homeroom is a complete financial education program intended for students in grades 3-12 (app. pwcfdnearnyourfuture site).

Students draw in with financial proficiency ideas through creative self-guided modules highlighting custom recordings, movements, and intelligent exercises. Instructors are upheld with installed student evaluation apparatuses with constant input, Teacher Guides, and Module Asset Guides. The content is effective, interesting, and lines up with Chamber for Financial Instruction guidelines.

PwC collaborated with Wharton High School to conduct a seminar on financial and business responsibility. PwC has also sponsored 500 secondary school administrators and educators to help bridge the problem of the financial knowledge literacy gap. PwC has also helped in developing a financial literacy curriculum which includes the JA Build your Future App. Their employees receive training collaborate with educators and impart financial literacy knowledge to students. So far, about 47,000 educators have received educational resources concerning financial literacy training (United Nations Global Compact, 2013).

EYF works with an educational program organization with Worldwide Christian Youthworks - Cold Africa, which Junior and Senior Secondary School students go through for a year and receive a diploma or certificate upon completion from Springdale College in the UK (eyfglobal site). The EYF-ICY program began in January 2021, at the Methodist High Senior Secondary School in Saltpond in the Central Region of Ghana. The program began with 15 students in the green batch and 9 students in the gold batch. The goal of EYF is to spread this program in every SHS in Ghana over the next 10 years.

Hess Corporation

Hess Corporation is an American energy corporation involved in the production of oil and gas operating in partnership with the government of Equatorial Guinea. As

Multinational Corporations, Education and United Nations Development Goals the corporation's scope expands, it aims at making sustainable development through the betterment of basic education in the country. The establishment of the PRODEGE initiative (Eng. Program for Education Development of Equatorial Guinea) was designed to improve access to quality primary education in the country. So far, they have committed 40 million USD to training teachers, building primary schools, and collecting data to aid educational policies and planning. The PRODEGE initiative has so far led to the certification of more than 900 teachers, and the provision of educational infrastructure for over 3,200 teachers in 54 schools. Also, a nationwide network called Teachers Circles was created to enable peer-to-peer support for teachers. (Kraus, 2010) ING Bank ING Bank is a Dutch MNC that Partners with UNICEF intending to provide access to education to children all over the world, through its ING Chances for Children. It is one of the employee initiatives aimed at fundraising and supporting children's rights to education. Apart from fundraising, the employees also volunteer for NGO operations for child rights and education. Since 2005, the total donation has stood at 31 million USD, and 800,000 children have benefitted from the scheme which has provided quality education and safer and healthier living conditions.

Project Badiliko, Microsoft

Through a partnership with the British Council, Project Badiliko, the Swahili word for change, was launched to improve digital literacy in sub-Saharan Africa. Microsoft sees educational initiatives as a means of developing the world and opening new frontiers for the company to grow. The scheme was launched in 2011 to build 100 digital hubs across the following countries of the sub-Saharan region: Nigeria, Tanzania, Ethiopia, Ghana, and Kenya. The scheme introduces teachers and students to the basics of ICT to aid learning. Teachers also receive training in global citizenship curriculum, leadership, and ICT teaching modules. They, in turn, train other teachers. So far, about 13,000 teachers have been trained, and 600,000 ICT learners have been impacted. The partnership was established, based on the fact that technology can be used to educate further through teachers' professional development, curriculum, and content development. British Council liaises with government departments, teachers, and students to offer a global citizenship curriculum (Flanagan, 2016). Apart from social development, access to educational opportunities is the central contribution towards an individual's welfare, community, and national development. Corporations as agents of globalisation can guarantee the advancement of commerce, markets, and technology to benefit societies and ultimately contribute to development.

Tata Center for Technology and Design (Tatacenter Site)

Tata Center for Technology and Design supports research through seed and translational grants to faculty-led project teams in IIT Bombay. Basing the research activities across seven domains – Food & Agriculture, Energy, Education, Healthcare,

Housing, Water, and Waste Management, the project teams are expected to design technological solutions for challenges seen in the social landscape. The work is collaborative and interdisciplinary with the Institute's various departments working along the Centre's mandate. There is an underlying focus on the need for validation, and development of product/process through research, stakeholder analysis, field testing, and translation analysis. The advancement of the continuous ventures is assessed at ordinary stretches and outlined across solution preparation levels. The quantity of patent applications from the ventures has been developing and a couple of undertakings have been interpreted from the lab to the market.

TCTD, IITB expects to foster HR prepared in innovation, planning, and business for interpreting start-to-finish developments and further develop access to solutions across society.

The Centre enrolls and sponsors Master's students and PhD scholars every year as Tata Fellows. These Fellows selected through a written test by the Centre are trained to work on socially relevant challenges, and become future leaders in engineering, business, and design and invent technologies and system solutions that serve human needs in resource-constrained communities. TCTD, IITB offers two class-based courses, Innovation and Plan for Start to Finish Development (MNG 629 and MNG 630) and a lab seminar on innovation and plan (CL 724) to help students understand the challenges of designing and implementing technology solutions in the Base of the Pyramid (BoP) segments. The courses are Foundation Electives that the Colleagues complete, alongside their expected office coursework.

Collaborative RDD Partnerships between Northern and Southern Countries

Supporting Inclusive Disruptive and Reverse Innovation

Herewith we present strategies to improve the capacity of selected countries to promote inclusive disruptive and reverse innovations contributing to their economic growth and quality of life. Through collaborative RDD partnerships between Northern and Southern countries and companies, it would be possible to accelerate the process of innovation in developing countries and also benefit the economies of the developed world in the process.

Introduction

Innovation platforms can be established at different levels such as village, community, sector, district, province, national, or international level (Tucker et al, 2013). The guiding question should be at what level can a challenge be addressed most efficiently? A problem of access to good quality planting material may be best tackled at the village or community level, whereas exploring irrigation options would require the involvement of stakeholders at the watershed level (van Rooyen et al., 2017). As problems at the local level are often rooted in and interrelated with problems at higher levels, the strategic involvement of national-level policy actors may be desirable (Schut et al, 2018). Local innovation platforms might resolve concrete agronomic or organisational issues but, without linkages to decision-makers at higher levels, will most likely not have enough weight to foster structural changes at higher levels (Lamers et al., 2017).

Innovation platforms consist of multiple and heterogeneous groups of stakeholders with different interests, ideas, and competencies in terms of what they can offer to the platform. Bringing together a group of stakeholders with diverse needs, interests, and objectives is likely to lead to tensions, conflicts, maneuvering to seek advantage, and even group displacement, which can hinder collective action toward achieving development outcomes (Hinnou et al, 2018). Moreover, power differences exist between different members (farmer versus government official), and not all members may have equal discussion and negotiation skills (Brouwer et al, 2013). Herewith we present the international platforms developing and diffusing innovations in developing countries in selected domains such as environment, healthcare, and agriculture.

Consultative Group on International Agricultural Research (CGIAR) Platforms

CGIAR has experience and knowledge spanning 50 years, built on a track record of continuous innovation and world-class research. CGIAR research has demonstrably

helped to lift hundreds of millions of people out of poverty. Over the past five decades, contributions of CGIAR together with its Partners to crop breeding, agronomic practices, plant and animal health, policy change, improving nutrition, natural resource management, and climate change responses have resulted in a 10-fold return on investment. CGIAR is also the world's largest steward of plant genetic resources: approximately 90 percent of all germplasm transfer reported under the International Treaty of Plant Genetic Resources for Food and Agriculture is distributed by CGIAR genebanks and breeders. CGIAR has a global presence across six major regions with 10,000 staff of 135 nationalities, living and working where the greatest food, land, and water systems challenges exist.

CGIAR Researches

They are non-profit research organizations conducting innovative research. Home to more than 9,000 scientists, researchers, technicians, and staff, the Centers work to transform food, land, and water systems in a climate crisis (CGIAR site).

Sub-Saharan Africa Solar Irrigation Explorer

The CGIAR Initiative on NEXUS Gains and the International Food Policy Research Institute (IFPRI) have launched the Sub-Saharan Africa Solar Irrigation Explorer. It supports investors who are interested in understanding the potential of investing in groundwater-sourced solar irrigation in the region.

It calculates the size of solar systems for key irrigated crops based on kilowatt peak (kWp), which is the maximum output in kilowatts that the photovoltaic system needs to produce given climatic, groundwater, and crop-specific requirements. The explorer additionally calculates the potential for solar system expansion at pre-selected break-even cost points at which the groundwater-sourced solar irrigation systems are more cost-efficient compared to other energy sources, such as diesel.

Network of Low Carbon and Clean Energy Innovation Centers

Several organizations, including the Indian government, the World Bank, and the World Economic Forum, have proposed structuring a network of low-carbon and clean energy innovation centers in the model of the CGIAR—to create a Consultative Group on International Energy Research (CGIAR site). Thus, it is an important case study for deeper research—and clarification on its effectiveness, its impacts, how it functions, and how it has evolved over its forty-year history.

Cassava Germplasm in vitro Conservation

Cassava is the third most significant food crop in the jungles, after rice and maize. In Asia, cassava fills in as a wellspring of food and animal feed, while likewise giving raw

substance to the assembling of drugs, modern starch, biofuels, and different Products. Subsequently, cassava is significant for provincial families and public economies.

The cassava variety KU50, bred by CGIAR scientists at CIAT (now part of the Alliance of Bioversity International and CIAT) and Kasetsart University in Thailand, has been the most successful ever in Asia. Delivered in 1992 in Thailand and 1995 in Vietnam, the superior assortment has shown to be better adjusted to a more extensive scope of developing circumstances, affects soil quality, and has a higher starch content than ordinary assortments.

CGIAR preserves in vitro the world's most significant assortment of cassava germplasm.

The cassava assortment held in trust at CIAT incorporates a sum of 6,155 promotions from 28 nations, addressed in 5,690 clones of (Manihot esculenta) and 465 genotypes of wild species rationed involving in vitro strategies.

Its improved varieties are agronomically competitive and more nutritious than regular varieties, with enriched content of provitamin A carotenoids.

It is estimated that 1.3 million hectares of KU50 are planted across Thailand using genetic material facilitated by CGIAR's CIAT genebank, with related economic benefits in Thailand and Vietnam reaching $393.5 million from 1992 and 2010. Farmers' gross annual incomes have risen by $386 million due to increased cassava yields. As part of the cassava revolution in Asia, the adoption of improved varieties resulting from CGIAR research by CIAT and its Partners in Asia has generated benefits worth almost $12 billion over the past 20 years.

Banana crop disease detection, Tumaini

Banana crops are prone to damage by several types of pests and diseases – for farmers to take swift action and save their harvest, they first have to know what's affecting their crop.

A smartphone application called Tumaini – which means "hope" in Swahili – is already helping banana farmers scan plants for signs of five major diseases and one common pest, providing a diagnosis, and steps for rapid treatment.

Tumaini has demonstrated a 90% success rate in detecting pests and diseases

The app was developed by CGIAR researchers at the Alliance of Bioversity International and CIAT, merging CGIAR expertise on banana genetic resources with new technology in artificial intelligence, geolocation, and image recognition. The researchers see it as a first step toward creating a satellite-powered, globally connected network to control disease and pest outbreaks around the world.

Impact: 90% success rate in detecting pests and diseases, 3,000 farmers using the app in the field, 50,000-image dataset, Tested in Colombia, the Democratic Republic of the Congo, Benin, Uganda, India, and China.

East Coast Fever

East Coast fever - a malignant growth-like, tick-sent illness previously found in 1903 in Africa - kills cows in no less than three weeks of disease through the development of an overabundance of liquid in their lungs, suffocating the animals. Endemic across twelve African nations, the infection kills one cow at regular intervals. In 2005, its annual cost was estimated at $300 million.

Building on decades of research, CGIAR scientists at the International Livestock Research Institute (ILRI) have helped to develop and mass produce a vaccine for the disease, in partnership with the Veterinary Research Centre and part of today's Kenya Agricultural & Livestock Research Organization.

Two large batches of the vaccine were manufactured by ILRI and Partners in 1996 and 2008, comprising 600,000 doses and 1.2 million doses, respectively. Through commercial distribution, about 2 million cattle have now been vaccinated, increasing the incomes of 156,000 households by $74 million. From 1997 to 2014, the vaccine vetoed the untimely deaths of some 400,000 animals.

2 million cattle were vaccinated, 156,000 households with increased income, $74 million in increased income for households, 400,000+ prevented untimely animal deaths

The vaccine uses an 'infection-and-treatment' method (ITM). Animals are inoculated with a cocktail of live virulent strains of the causative parasite, and a long-acting antibiotic to attenuate the ensuing infection. A solitary inoculation gives long-lasting insusceptibility against East Coast fever.

The strategy is involved today in Kenya, Malawi, Tanzania, and Uganda, where calf mortality because of East Coast fever has decreased by up to 95%. Endeavors are currently being aimed at improving and increasing creation of the immunization, to make it broadly and inexpensively accessible to the large numbers of domesticated animals subordinate to individuals across eastern, Central, and southern Africa, where the illness stays endemic.

Immunization has expanded salaries for domesticated animals keeping families in different ways.

Aside from avoiding herd losses, milk sales have increased due to more productive cows, vaccinated bull calves have fetched higher market prices than non-vaccinated calves, and, in the pastoral sector, and the vaccine has meant a higher number of yearling animals.

New Rice for Africa – NERICA

In sub-Saharan Africa, many of the poorest rice farmers depend on low-yielding local varieties that can grow without standing water in rainfed upland ecosystems. In contrast, Asian varieties produce much more grain but require fields to be flooded for planting.

In 1992, CGIAR scientists at AfricaRice chose to endeavor to cross the two developed species, keeping in mind the desire to create another sort of rice that could consolidate the high return capability of Asian rice (Oryza sativa) with the neighborhood variation qualities of African rice (O. glaberrima).

The result was called NERICA – and was the first wide-scale success in crossing the two species.

The researchers' success in overcoming hybrid sterility barriers and producing grain with the desired combination of traits was a major scientific breakthrough in rice improvement.

The capacity of the African rice to develop under low info conditions makes it a particularly helpful hereditary asset for creating pressure-lenient rice assortments for rainfed biological systems in Africa (africarice site). In 1992, a group driven by Dr Monty Jones, a senior rice raiser of AfricaRice, chose to deal with interspecific hybridization to foster assortments that could join the high return capability of Asian rice with the nearby variation of African rice.

The African rice assortments show solid flexibility to brutal conditions, solid capacity to rival weeds, oppose neighborhood illnesses and irritations, and endure dry season, flood, fruitless soils, and iron harmfulness.

Early development for instance is quite valued by farmers, particularly ladies farmers, as it permits them to have food during the 'hunger time frame' while sitting tight for the collection of different yields. Also, concentrates on showing that some NERICA assortments have on normal 25% higher protein than imported Asian assortments.

 NERICA varieties are now planted on about 1.4 million hectares in sub-Saharan Africa.

Genetically Improved Farmed Tilapia (GIFT)

Started in 1988, the GIFT project, a selective breeding project pioneered by CGIAR researchers at WorldFish, has played a critical role in boosting fish productivity both in commercial and small-scale systems. For limited-scope farmers, GIFT has given an economical type of revenue, food, and sustenance. It has additionally assisted farmers with adjusting to environmental change.

Tilapia is a reasonable wellspring of protein, nutrients, minerals, and fundamental unsaturated fats that are indispensable for good health.

Because tilapia is hardy and has good disease resistance, it is inexpensive and easy for small-scale farmers to grow. The improved strain is now produced in at least 14 countries on five continents and is responsible for more than half of the tilapia production in the world.

After 20 generations of GIFT, CGIAR scientists continue to work on developing more resilient, disease-resistant, and hardier strains that can be produced in stressful environments, helping farmers adapt to a changing climate.

Breeding Bananas and Plantains

Plantain and high-country cooking bananas are significant staple harvests in West-Central Africa and Eastern Africa, separately. They assume a fundamental part in food security, upgraded livelihoods, and tough horticultural systems.

Breeding bananas and plantains was for a long time considered impossible due to sterility and triploidy containing only vestigial seeds, they are unable to sexually reproduce. This poses challenges for the development of improved varieties able to withstand threats such as black sigatoka, a common and highly destructive leaf spot disease.

In 1987, CGIAR researchers at IITA at long last figured out how to raise a few dark sigatoka-safe plantain half and halves, showing that banana reproducing is conceivable, through a blend of regular and novel techniques.

Expanding on this achievement, the specialists began a reproducing program during the 1990s for matooke, a boring good country banana that is a staple in Uganda. Along with the Public Farming Exploration Organisation (NARO) they were effective in creating high-yielding, safe matooke mixtures.

NARO turned into the principal public program in Africa to formally deliver a banana assortment reared in Africa. One more plantain crossover, called PITA, was enrolled in Côte d'Ivoire in 2016 and has since become well-known among cultivators in Mali and Burkina Faso.

CGIAR-reared bananas and plantains have been demonstrated to be impervious to illness, yet in addition exceptionally useful. The assessed hereditary addition, or yearly yield increment, for matooke bananas is 1.4%, coming to up to 2.5% for mixture plantains - well over the objective 1% set for all CGIAR crop reproducing programs.

Improved matooke bananas have shown an increase in group weight of 136% compared to their hybrid parents, or 249% compared to the original matooke variety – the largest relative increase among all of the main food crops.

Protein from Plants

Prof Mary Abukutsa has conducted pioneering research on African indigenous vegetables. Prof Abukutsa's work has propelled students, youthful specialists, and impacted state-run services to think about the significance of native vegetables for nourishment, health, and pay age.

For Abukutsa, indigenous vegetables bring back memories of her childhood (Cernansky, 2015). Cow's milk, eggs, and some fish made her ill, so doctors advised

her to avoid all animal protein. All things being equal, the ladies in her family made scrumptious dishes out of the green vegetables that developed like weeds around her home. Her mom frequently cooked the tear-molded leaves of African nightshade (Solanum scabrum), as well as dishes of vile jute mallow (Corchorus olitorius) and the greens of cowpeas, referred to somewhere else as dark-looked-at peas (Vigna unguiculata). One grandma generally cooked pumpkin leaves (Cucurbita moschata) with nut or sesame glue. Abukutsa savored them all and ate the greens with ugali, a polenta-like dish normal in East Africa.

Prof Mary Abukutsa started in the early 1990s, surveying and collecting Kenya's indigenous plants such as African nightshade (Solanum scabrum), slimy jute mallow (Corchorus olitorius), and greens of cowpeas, known elsewhere as black-eyed-peas (Vigna unguiculata and pumpkin leaves (Cucurbita moschata) to investigate the viability of the seeds that farmers were using In the decades since, she has come to focus mainly on the vegetables' nutritional properties (Cernansky, 2015).

CGIAR Research Program on Integrated Systems for the Humid Tropics

Humidtropics is a CGIAR Research Program led by IITA (wur site). It looks to change the existence of the rural poor in tropical America, Asia, and Africa, and utilizations coordinated systems examination and novel organization stages for influence on neediness and biological systems honesty. Research organizations involved in core partnerships with Humidtropics are as follows.

Under the cross-cutting Leader Scaling and Institutional Advancement, Wageningen College along with its Partners creates and tests structures that improve institutional advancement and mindful scaling in an activity research mode and advance their utilization by means of distributions, connections, and limit advancement in light of the fact that mechanical choices can't scale except if they are attached by institutional development.

It is expected that organizations will use them to influence knowledge, attitudes, and practices in Actions Sites to bring best-fit systems innovations to scale.

The dependable scaling and institutional advancement work is important for the crosscutting subject connecting work across the other lead activity regions in the Humidtropics.

Buizer (2016) conducted a cost analysis of two innovation platforms implemented under the CGIAR Research Program Humidtropics in Uganda. Two calendar years (2014 and 2015) of innovation platform activities were analysed. One innovation platform focused on indigenous vegetables and pigs, the other on intercropping soya beans and maize. The two innovation platforms touched approximately 1500 farmers in the areas where they were operating.

Organisation of International Research and Development Centers for Agriculture (AVRDC). World Vegetable Center (Worlveg)

AVRDC mission is to develop Innovations contributing to diverse, safe, nutritious, and climate-resilient food systems for health, livelihoods, and the environment.

Worlveg Center Genebank

The WorldVeg Center genebank keeps a huge assortment of public space germplasm for the current and future utilization of all mankind. We disperse seed tests of our germplasm increases and high-level reproducing lines around the world.

Play

With 65,152 accessions encompassing germplasm of 133 genera and 330 species from 155 countries, the World Vegetable Center genebank includes globally important vegetables such as tomato, onion, peppers, and cabbage as well as more than 10,000 accessions of traditional vegetables.

Each year the Center distributes about 10,000 seed samples to researchers across the globe. Throughout many years this has prompted the arrival of many new vegetable assortments with specific effects in emerging nations.

WorldVeg, Africa

AVRDC has a devoted exploration and rearing project at its office in Arusha, Tanzania, and the Kenya Farming and Domesticated Animals Exploration Organisation in Nairobi.

The Middle African local program started in 1992 in Arusha, northern Tanzania. Today the Middle has proficient innovative work staff working across Africa on significant vegetable harvests like tomato, pepper, onion, and cabbage, as well as a scope of African conventional vegetables, and partners with in excess of 40 public foundations and numerous worldwide organisations.

The Center operates three regional bases in Africa: in Tanzania for Eastern and Southern Africa, in Mali for West and Central Africa – Dry Regions (established 2014), and in Benin for West and Central Africa – Coastal and Humid Regions (2017). There is a liaison office in Cameroon to reach sub-Saharan Africa with improved vegetable varieties and production technologies.

Vegetables are often the most important source of cash income for smallholder farmers, and indigenous vegetables provide an important source of nutrition, particularly for poor people. New assortments and further developed administration strategies have been created and stretched out through preparing programs for the exploration and augmentation of laborers and smallholder farmers.

The AVRDC is doing active research on native species in Asia and Oceania, as well as Africa such as okra and African eggplant (Solanum aethiopicum) in Mali, bitter gourd

(Momordica charantia) and Malabar spinach (Basella alba) in India, and slippery cabbage (Abelmoschus manihot) in the Pacific Islands.

WorldVeg Center, Asia, Latin America, and the Caribbean

The regional office in Taiwan addresses vegetable research and development in the region to improve nutrition and reduce poverty through hands-on training. The Center's annual International Vegetable Training Course has been held for more than three decades. Thousands of scientists across Asia have participated, enhancing their technical, scientific, and managerial skills in vegetable production and marketing to contribute to the sustainable development of their countries.

With the backing of the Government of Taiwan, WorldVeg started a venture in 2021 to moderately accessible vegetable biodiversity for sometime later with a significant spotlight on fostering a vegetable network in the region to improve production and introduce and promote new vegetable varieties for domestic and export markets to sustainably improve the livelihoods of resource-poor populaces in six-seven countries in Latin America and the Caribbean, Haiti, and Saint Kitts and Nevis.

In Saint Kitts and Nevis, the Ministry of Agriculture earmarked several key areas for immediate intervention in 2022, which included the need to increase the production of broccoli, carrot, cucumber, tomato, and sweet pepper among other crops. The Caribbean Agricultural Research and Development Institute (CARDI) in Holy Person Kitts and Nevis was explicitly entrusted with presenting and assessing new lines of these products to distinguish and choose appropriate ones for nearby development. WorldVeg became a critical Partner for CARDI and the wider sector in this endeavor, having made years of progress in breeding and evaluating vegetable crops of interest to the country. The Ministry of Agriculture has expressed great satisfaction with the results of the collaboration, which has evaluated WorldVeg-developed lines of tomato, sweet pepper, and broccoli on the islands. In view of the early victories, they have requested preliminaries to be stretched out to three extra destinations and have focused on giving extra assets to help this development.

Alliance Bioversity International-CIAT

Bioversity International

Bioversity Worldwide was laid out in Italy in 1974 as the Global Board for Plant Hereditary Assets (IBPGR) to arrange a global plant hereditary assets program, including crisis-gathering missions, and building and growing public, local, and global genebanks.

In 1991 it turned into the Worldwide Plant Hereditary Assets Foundation (IPGRI) lastly Bioversity Global in 2006, mirroring an extended vision of its part in agrarian and woods biodiversity and examination for-improvement exercises.

Bioversity International is the only global non-profit research organization that places the use and conservation of agricultural biodiversity in smallholder farming systems at the centre of its work.

The organization includes more than 300 scientists and staff based in more than 15 countries. Its scientists include experts in the fields of plant science, agronomy, agroecology, nutrition, economics, forestry, geography, anthropology, and more disciplines. They work with Partners on the ground to create change and add diversity to our agricultural systems.

International Center for Tropical Agriculture (CIAT)

CIAT works in collaboration with hundreds of Partners to help developing countries make farming more competitive, profitable, and resilient through smarter, more sustainable natural resource management (ciat site). CIAT helps policymakers, researchers, and farmers answer probably the most squeezing difficulties within recent memory, including food frailty and unhealthiness, environmental change, and ecological debasement.

The Alliance

In 2019, Bioversity International and CIAT joined forces to create the Alliance of Bioversity International and CIAT, a global organization building on their complementary mandates and long collaboration, to respond to the present worldwide difficulties of environmental change, biodiversity misfortune, natural corruption, and ailing health.

The Collusion conveys research-based solutions that bridle farming biodiversity and economically change food systems to work on individuals' lives. The Union works with neighborhood, public, and worldwide Partners across Latin America and the Caribbean, Asia and Africa, and with people in general and confidential areas. With Partners, the Collusion produces proof and standards developments in enormous-scope projects to make food systems and scenes that support the planet, drive success, and sustain individuals in an environmental emergency.

International Potato Center (CIP)

With more than 45 years of research-for-development work in potato and sweet potato, CIP has contributed to greater food and nutrition security, economic growth, and prosperity. CIP breeders and plant scientists work with local Partners and farmers to develop and manage potato and sweet potato varieties that are more resilient to the extremes of climate, pests, and diseases, harvest higher yields, and have better nutritional and culinary qualities.

Potato and sweet potato produce more calories per hectare and take less time from planting to harvest than most crops, giving them enormous potential to improve incomes and food and nutrition security) cipotato site).

However, couple of farmers in sub-Saharan Africa accomplish that potential, due basically to irritations and sicknesses spread by tainted tubers or plant cuttings - the standard seed for those harvests. Solid vegetative seed is hard to come by around here, where farmers propagate low yields by planting tainted potatoes or plant cuttings saved from their last reap or bought locally. The CGIAR Exploration Program on Roots, Tubers, and Bananas (RTB) met a multi-disciplinary group that launched a virtual Seed Systems Tool kit in 2021, to assist scientists, specialists, and strategy creators with improving farmers' access to quality seed.

Potato is Kenya's second most significant staple harvest after maize, developed by in excess of 800,000 homestead families, in this manner giving food to almost 4 million family individuals, and supporting an extra 2 million dynamic in the value chain.

The country's annual potato production is worth more than USD 430 million, and smallholders are responsible for 83% of it, but average yields of 6-10 tons of potatoes per hectare are holding most of them back.

CIP has spent more than a decade working with government Partners, companies, and farmers to catalyze the production and use of commercial seed. Seed creation takes time, in light of the fact that each plant delivers only 6-10 seed tubers, contrasted with many seeds per grain plant. To conquer this test, innovations have been elevated to speed up creation, for example, aeroponics and established apical cuttings.

While aeroponics is used by large operations, such as the Kenya Agriculture & Livestock Research Organization, apical cuttings can also facilitate the decentralization of commercial seed production.

Those technologies contributed to a more than 20-fold increase in approved seed potato production in Kenya from 2009 to 2018, and it continues to rise. Whereas production was less than 1% of what farmers planted in 2009, by the end of 2021, enough certified seed was being produced to plant in 9% of Kenya's potato fields. And since farmers only need to replace their seed every three or four years to maintain good yields, 9% is enough to meet 27% to 36% of farmers' seed potato needs.

Yam has similar seed difficulties as potato, so CIP has put forth tantamount attempts to expand the creation and utilization of value yam-establishing material.

This included offering specialized help to the Kenya Plant Health Inspectorate Administration (KEPHIS) to make a monetarily manageable venture that produces infection-free beginning material.

Forum for Agricultural Research in Africa (FARA)

Agroecology, characterized as the use of biological ideas and directors in cultivating is one of the all-encompassing methodologies that has been recognized to empower

understanding of agribusiness inside the setting of different cooperating financial, environmental, and social systems and contribute to food security and improved livelihood among the rural communities. The change towards agroecological food systems and the improvement of both useful and strong cultivating systems and worth chains are perplexing cycles and require new information, skills, and approaches to address complex problems, co-create solutions based on agroecological principles, and integrate scientific and local knowledge.

Headquartered in Accra, Ghana, FARA was conceived in the late 1990s by a core group, including both African scientists and enlightened donor aid officials, who believed in agriculture's potential to lift the continent from poverty (faraafrica site).

FARA plays a key role in galvanizing agricultural research for the development sector and brings a strong African voice to global forums such as the G-8 and the Global Forum on Agricultural Research (GFAR).

FARA and the Regional Universities Forum for Capacity Building in Agriculture (RUFORUM) alongside the Agroecology Consortium, EC-Joint Research Centre (EC-JRC) and the EC Directorate General's Department for International Partnerships (DG INTPA) have launched the Regional Multi-actor Research Network (RMRN) agroecology Project to support the Regional Centres of Excellence (RCoEs) related to Green Transition, as part of the FARA and RUFORUM component on agroecology (ruforum site). The undertaking's primary point is to build Science Innovation and Development limits of RCoEs in agroecology to add to green progress in Sub-Saharan Africa productively. The three-year project organizationally began on January 1, 2024.

Regional Multi-actor Research Network (RMRN)

The RMRN Task is subsidized by the European Organisation (EU) as a feature of its Provincial Long-term Characteristic Program (MIP) for Africa.

The MIP will uphold reinforcing the consortia of Africa-based organizations to lead mediations in Africa in a few spaces including multi-stakeholder organisations to carry agroecological developments to scale, utilizing co-learning, co-creation, and multi-stakeholder approach.

The proposed activities will advance organisation with applicable foundations like Rancher organisations under the Container African Farmers Organisation (PAFO), augmentation establishments under the African Gathering for Horticultural Warning services (AFAAS), NGOs, CSOs, the confidential area, and financial organizations. The undertaking targets nations in Eastern, Western, Southern and Central Africa.

In 2024 was launch the Launch of the Regional Centre of Excellence (RCoE) for Biodiversity, Forests, and Seascape Ecosystems Management (oacps-ri site)

InnovationXChange platform

The InnovationXChange platform brings together researchers, innovators, policy-makers, academics, civil society, and journalists, who believe that exchanging knowledge, skills, and good practices on current and emerging R&I topics is key to accelerating the changes needed for a sustainable and resilient world (oacps-ri site).

The ACP Innovation Fund (IF) is a key component of the OACPS Research and Innovation (R&I) Programme, aimed at strengthening R&I capacity in its African, Caribbean, and Pacific (ACP) member countries, to unlock their innovation potential and support their transition into knowledge-based economies for sustainable development.

Investments in R&I capacity are likely to pay a higher dividend, if embedded in an effective and inclusive innovation ecosystem and combined with efforts to constitute a critical mass of skilled people adapted to the labour market demand.

The Innovation Fund

The Development Asset offers financial help for the execution of activities propelling solutions in the accompanying regions: expanding access to computerized proficiency, information, and utilization of arising advances; making or strengthening effective links between R&I skills development and labour market demand; establishing or enabling effective synergies in the research and innovation ecosystem, including with the private sector; facilitating conditions for technology transfer; promoting R&I uptake; promoting local and indigenous knowledge and its use in combination with formal knowledge systems and practices.

World Agroforestry (ICRAF)

ICRAF is the only institution that does globally significant agroforestry research in and for all of the developing tropics. The knowledge produced by ICRAF enables governments, development agencies, and farmers to utilize the power of trees to make farming and livelihoods more environmentally, socially, and economically sustainable at scales (worldagroforestry site). Settled in Nairobi, Kenya, ICRAF works on six local projects in Sub-Saharan Africa, Asia, and Latin America and behaviors research in excess of 30 different nations around the creating scene.

International Institute of Tropical Agriculture (IITA)

IITA is a non-benefit organization that creates horticultural developments to address Africa's most squeezing difficulties of craving, unhealthiness, destitution, and regular asset debasement. Working with various Partners across sub-Saharan Africa, we improve livelihoods, enhance food and nutrition security, increase employment, and preserve natural resource integrity (iita site).

IITA's fundamental need is to guarantee a food-secure future for sub-Saharan Africa.

We center on key examination subjects that address staple food crops, including banana and plantain, cassava, cowpea, maize, soybean, yam.

International Livestock Research Institute (ILRI)

ILRI works for better lives through livestock in developing countries (ilri site).

ILRI is co-facilitated by Kenya and Ethiopia, has 14 workplaces across Asia and Africa, utilizes around 700 staff, and has a yearly working financial plan of about USD 80 million.

ILRI is a worldwide exploration organization for a food-secure future. CGIAR science is committed to lessening destitution, upgrading food and sustenance security, and working on regular assets and biological system services. Its exploration is done by 15 CGIAR focuses in close cooperation with many Partners, including public and provincial examination establishments, common society organisations, the scholarly world, improvement organisations, and the confidential area.

Innovative Water Solutions for Sustainable Development (IWMI)

IWMI's Strategy 2019-2023 responds directly to the demand for innovative, scientifically tested water management solutions for sustainable development (iwmi site). With workplaces in 14 nations and a worldwide organization of researchers working in excess of 30 nations, our examination, at field-to-bowl and local scales, will address three high-need water difficulties:

Food

To improve food security while sustainably managing water resources and ecosystems. IWMI provides evidence and data analytics needed by governments, financing institutions, farmers, and other Partners making choices about agricultural water management technologies, and the development of inclusive business models for smallholder irrigation or reforms in large-scale, public-sector irrigation. The research will address water solutions for sustainable intensification in agriculture, including management of groundwater, agricultural water pollution, and integration of inland fisheries in water management for agrifood systems. We will expand the application of water accounting to support improvements in water productivity, and in basin planning, national policy development, and water-related investments. The research will evaluate the impacts of equality and women's empowerment on agricultural water management and food systems.

Climate

To adjust to and mitigate climate change while building resilience to water-related disasters and disruption.

IWMI will integrate ecosystem values, services, and sustainability into water resource allocation and management practices, as well as water infrastructure design and operations. Projects will support the assessment of tradeoffs and synergies in planning portfolios of built and natural water infrastructure, application of environmental flows, and conservation of biodiversity. We will develop knowledge of the hydrological impacts of restoration and applications to the design of large-scale programs for strengthening water security through wetland and watershed restoration. IWMI research on the social and economic impacts of ecosystem degradation will be applied to ensure that governance and incentives for the protection and restoration of water-related ecosystems strengthen equality and inclusion.

Growth

To decrease neediness and advance consideration with uniformity as farming changes, energy advances, and urbanization increases.

Water security is key for maintainable and inclusive development, supporting practically a wide range of financial action - from cultivating to assembling, energy, and transport. Water shortage, floods, contamination, and struggle over water all pose dangers to individuals and economies. How water is designated among agribusiness and urban areas or contending areas influences development and the sharing of its advantages across social orders.

Water management should occupy a central place in development plans and strategies, helping to achieve equitable and inclusive growth.

Research is expected to make sense of what water means for the elements of development, the ramifications of water asset designation and water strategies for the financial turn of events, the jobs of establishments and motivators in water executives, its effects on orientation and consideration, and the genuine or perceived trade-offs among growth and sustainability.

Reasonable development: IWMI will uphold the change to practical development through advancement for the roundabout economy.

Research will address the use of non-conventional water resources and the development of alternatives to conventional, centralized infrastructure to recover nutrients for agriculture and reduce public health risks from pollution.

IWMI will further develop and scale up machinery and business models for resource reclamation and reuse from wastewater and sanitation.

Wageningen University & Research (WUR), the Netherlands

Experts at WUR are working on a unique, integrated system approach to future-resistant and regenerative agricultural systems and nature-inclusive agriculture (wur site). In this manner, agroecology is the beginning stage, and normal people are viewed as key to

accomplishing a beneficial creation, for instance by reusing regular assets, biodiversity, and conservation of solid soil.

From 2022 to 2025, WUR is collaborating with the Center for International Forestry Research (CIFOR) and the International Center for Research in Agroforestry (ICRAF) on applied research in ecology and social sciences in support of sustainable management of forest ecosystems in Central Africa (RESSAC), a support programme for applied research in ecology and social sciences. The goal is to strengthen the impact of research on the sustainable management of forest ecosystems in Central Africa. Wageningen University is one of the "Northern" Partners with academic institutions in Central Africa and policymakers, who benefit from dedicated scientific support that enables them to implement innovative strategies of action in the management of natural resources.

CGIAR Innovation Rice Platforms

Seventeen advancement stages, which filled in as the fundamental apparatus for system-wide change and effect, were laid out in the rice area improvement centers — key rice-developing conditions — in the recipient nations.

Based on demand, the platforms focused on specific technologies and innovations generated by AfricaRice and its Partners such as improved seeds. Herewith are presented the *RiceAdvice* and the Grain quality enhancer, Energy-efficient and durable Material (GEM) parboiling technology.

Under the name RiceAdvice, AfricaRice has developed Android-based decision support tools for providing farmers with field-specific management guidelines for rice production systems in Africa (riceadvice site).

Currently, there are three tools available:

RiceAdvice (target yield, supplement the executives and harvest schedule) - upheld dialects: English, French, and Kiswahili

RiceAdvice Light (target yield, supplement the executives and harvest schedule in 30 seconds) upheld dialects: English and French

RiceAdvice-WeedManager - supported languages English and French

RiceAdvice tools can be used on Android devices. The development stages stressed dynamic cooperation with little and medium endeavors engaged with ranch automation, rice handling, and seed supply, which advanced rice agribusiness.

Grain Quality-Enhancer, Energy-Efficient, and Durable Material (GEM)

An improved parboiling innovation called Jewel consolidates the utilization of a uniform steam parboiler and an improved parboiling oven (ricehub site).

The parboiler comprises a hardened steel network bushel that sits on a help in a treated steel tank. During steaming, bubbling water in the tank produces a fume that steams the paddy in the cross-section crate. The tank is shut by a tight-fitting top that diminishes heat misfortune however the framework isn't compressed.

The oven is a superior rocket oven made of prepared mud blocks with exceptional ventilation.

The Jewel parboiling innovation can be tailored for small (20-300kg), medium (300-1000kg), and huge (1000-3000kg) scale processors.

The Diamond parboiling innovation was co-created with ladies from the Glazoue Development Stage (IP) in Benin.

The Diamond parboiling innovation decreases the steaming time from around 60-90 min to 20-25 min for every 100kg of paddy. The interior pace of return (IRR) of the Diamond parboiling innovation is 70% contrasted with 14% for the traditional innovation.

More than 2,560 rice parboilers (14% men and 86% women) were trained in the use of GEM in Benin and Nigeria.

Learning System for Agricultural Research for Development (LESARD), Ghana and Tanzania

LESARD has two major functions. It serves as a data management system as well as a decision support system. Image Sources: www.ni.com (left), www.study.com (right

The LESARD program provides performance and impact of research and development projects and programmes that use Innovation Platforms (Schut et al, 2017; Sartas *et al*, 2017).

During each Innovation Platform event, data were gathered on stakeholder participation and engagement. These data were linked to an event log in which activities and interventions were documented. This provided valuable insights into which types of actions had a positive effect on stakeholder engagement. Furthermore, after each cycle of (field) experiments, a reflection meeting was organized in which the Innovation Platform members self-monitored and evaluated the outcomes of their work, as well as the innovation process, the facilitator's performance, and contributions made by the different types of Partners.

This provided a basis for the next cycle of participatory action research. Another valuable methodology tested under LESARD to measure the performance of Innovation Platforms is social network analysis. Social network analysis allows for the visualization, documentation, and analysis of the networks that Innovation Platforms represent. It identifies key factors such as relationships between actors as well as their centrality and power, brokering and bridging actors, and potential bottlenecks. Social network analysis allows for the analysis of the network's capacity to facilitate

collaboration, knowledge exchange, and advocacy among stakeholders from different groups (e.g. private sector, government, NGOs) and across different levels (e.g. local level, national level).

LESARD was implemented in East and Central Africa in Burundi: Bujumbura and Gitega; DRC: Bukavu and Ngweshe; Rwanda: Kigali, Kadehanda and Kayonza; Uganda: Kampala, Mukono – Wakiso, Kiboga-Kyankwanzi.

East and Central African Humid Highlands Flagship Project

The East and Central Africa Leader Undertaking covers the high countries (1,125-1,800 m above ocean level) of Western Kenya, Southern Uganda (Lake Victoria Bowl), the Ethiopian high countries, Eastern DR Congo, Burundi, and Rwanda.

The area is uniquely endowed with great potential in terms of water, soils, and a variety of staple and cash crops as well as livestock. Agriculture is the mainstay of the economy of the area. However, with an average populace density of 263 persons/km2, 36% of the populace living on less than US$1.25/day, and 49% of the total land estimated to be degraded, the region faces debilitating poverty and food insecurity. The Flagship Project involves integrated research to remove barriers to production and enable enhanced livelihoods and natural resources management.

The passage focuses recognized incorporating superior soil ripeness into the executives, joining of vegetables and trees into creation systems, crop enhancement, healthful mix into trimming and food systems, reinforcing of seed systems, coordinated domesticated animals' creation, Striga management, and the advancement of further developed esteem chains for need wares.

Andino Boliviana (ANDIBOL)

In Bolivia, the private sector took a more proactive role and sought additional funding for the ANDIBOL (*Andino Boliviana)* multi-stakeholder platform for linking smallholder farmers to value chains (Thiel et all, 201).

ANDIBOL has acted as a broker for technological innovation. "Chuñosa" is a bundled and evaluated item produced using chuño, an artisanally freeze-dried potato that can be put away for extensive periods and is a vital fixing in a few nearby dishes. Chuño is ordinarily created utilizing extremely essential innovation, under unhygienic circumstances, and sold ungraded with contaminations.

The Ricafrut handling organization, which claims the Chuñosa name, needed to work on the item. They mentioned help to work on the quality and evaluation of the chuño raw substance. The stage expedited this interest to further develop neatness, evaluation, and show with PROINPA and Kurmi Establishment, which consequently did a participatory examination to foster a potato peeler and grader.

The manager of Ricafrut visited the production area to see how the machines performed and verify if the chuño obtained met market quality standards. The Chimborazo platform only played a limited part in commercial innovation.

This was related to the material characteristics of the market chain. The platform did not develop any new products but instead sought to exploit existing market opportunities for French fries with restaurants in Ambato and Riobamba. It played a central role in articulating the demand for a potato suitable for frying from the platform's clients, refining the technology for the supply of quality potatoes of the Fripapa processing variety. ANDIBOL includes food-processing companies, such as Ricafrut, Ascex, and Bolivia Natural; farmer organizations, such as Asociación de Productores Ecológicos de la Provincial Aroma (APEPA); NGOs such as Kurmi Foundation; and others.

Cadenas Agrícolas Productivas de Calidad (CAPAC), Peru

The challenge is to produce a niche market for native potatoes as part of a more general interest in Andean cuisine. CAPAC interacts with some private-sector actors as members (formal membership), including Mi Chacra, a supplier of marketing information; the Gastrotur cooking school; potato processors, including Frito-Lay, a multinational chip producer; and the Wong supermarket group. Researchers and other agricultural service providers, including the NGOs Asociación Fomento de la Vida (AFOVIDA) and Asociación para el Desarrollo Sostenible (ADERS), promote and support these market-driven platforms.

CAPAC assumed a basic part in the making of brand names for local potatoes, a sort of business development. CAPAC's aggregate brand name "Mi Father" perceives quality across a different scope of potato-based Products. The "Andean Potatoes Label" is a certification trademark for native potato trade with CSR. CAPAC participated in the public-private workgroup to define quality parameters for selling under the label and was chosen by the group to be the legal owner of the brand (Thomann et al. 2011). CAPAC additionally gives the ability to private Partners to the formation of new Products. It laid out "Ayllin Dad," a product possessed by a supplier of the Wong general store, with spotless, reviewed, sacked, and named local potatoes, which focuses on the connoisseur high-esteem market. Concerning mechanical advancement, the creation of local potatoes in Peru is exceptionally occasional, and growing and lack of hydration lead to moderate loss of market quality after the pinnacle time of harvest. CAPAC linked with researchers at CIP to extend the period of supply through modifications to storage methods and the use of sprout inhibitors in stored potatoes (Manrique and Egusquiza 2009).

Chimborazo Platform, Ecuador

The Chimborazo platform brings together 28 farmer organizations and a group of service providers comprised of three NGOs, two universities, and Instituto Nacional de

Investigaciones Agropecuarias (INIAP). Frito-Lay and restaurants serving French fries in Riobamba and Ambato are involved but as clients rather than full Partners.

The Chimborazo platform played a central role in articulating the demand for a potato suitable for frying from the platform's clients, refining the technology for the supply of quality potatoes of the Fripapa processing varieties from small farmers through the farmer field schools (*FFS*), and establishing local farmer capacity for multiplying high-quality seed. This was a complex technological innovation. Because processing characteristics are variety-specific, the exploitation of a new market for potatoes for French fries, which involved a specific technological innovation triggered a series of other innovations.

For example, restaurants prefer larger tubers for French fries. But Fripapa, initially selected by breeders for chipping, harvests predominantly medium-sized tubers. This demand for larger tubers was brokered through the platform and led to the implementation by INIAP of research on planting densities and fertilization to Trias, in an organisation with INIAP and Service of Horticulture and Animals of Ecuador (MAG), puts resources into testifying ranch the executives through preparing programs on coordinated bug and sickness management (IPDM) in FFS and Rural administration preparing programs (CDC). This year, 32 seed pioneers and 10 specialists from public and confidential establishments have been prepared in Chimborazo, Tungurahua, and Bolívar (Ecuador).

Trias follows its underlying foundations back to 1964 in the Belgian farmers and business visionaries' affiliations and is subsequently an extraordinary development NGO that cultivates worldwide fortitude with, and between, part-based organizations and their singular individuals.

Amantin and Savelugu Platforms, Ghana

In Amantin and Savelugu, Ghana, the enlistment of the IP as a helpful was recognized as a component that made sense of its result since this design was considered to adjust the personal responsibility and shared interest of individuals (Thiele et al, 2011).

Amantin sub-sticky, 1300 mm Ghana Blended crop-domesticated animals creation little ruminants Feb-July 2012 Further develop access to double reason vegetables for all-year grain creation, better little ruminants, and showcasing value-added Products.

Meetings, field demonstrations, trials, farmer training & field visits on row planting, seed treatment, box bailer construction and use, dual-purpose legume use, salt licks 50% increased crop yields, healthy small ruminant populaces, and improved market access by 2018.

Savelugu sub-humid, 1077 mm Ghana Efficient sustainable seed systems Cowpea, sorghum, soybean Oct-12 Improve agronomic practices and access to agricultural production inputs (improved varieties, ploughing, credit) for production of certified seed. Elite farmers trained as seed outgrowers, contracts negotiated with a reputable

seed company. Farmers trained in good agronomic practices; and encouraged to keep records. Exchange visits; demonstrations of improved crop varieties.

Partner with a seed company through an out-grower scheme to make improved seed readily available; Raise farmers' awareness on improved and superior production and post-harvest technologies; Strengthen relationships and linkages.

Tanga Dairy Platform, Tanzania

The instance of the Tanga Dairy Stage that effectively campaigned strategy creators to diminish esteem included charging dairy data sources and Products and eliminating limits on metropolitan dairy cultivating in Tanga City, Tanzania (Cadilhon et al, 2016).

After creating the platform with key dairy stakeholders in 2008, Research into Use (RIU) organized training of the platform members and leaders (Cadilhon et al, 2016). The main constraints already identified in 2009 were milk production fluctuation in the dry season, the lack of a negotiation process between dairy chain actors to address milk price issues, and the lack of unity of stakeholders in the dairy industry.

The members of the Tanga Dairy Platform are both individuals involved in dairy value chains, and firms and institutions that are linked to the dairy industry. The Tanga Dairy Platform has allowed all dairy stakeholders to reach a common understanding of how milk prices are formed and value-added along the chain. Awareness was raised among participants of the important collection and processing costs that contribute to big price differences across the chain.

The International Livestock Research Institute (ILRI) has led a project on enhancing dairy-based livelihoods in India and Tanzania through feed innovation and value chain development approaches (Pham Ngoc Diep et al, 2014). Commonly known as MilkIT, this project has been implemented in the Tanga Region by the International Center for Tropical Agriculture (CIAT) since late 2012 with support from the IFAD. The overall goal of the project is to contribute to improved dairy livelihoods in the Tanga Region via the intensification of smallholder production focusing on the enhancement of feeds and feeding using innovation and value chain approaches. As part of the CGIAR Research Program on Livestock and Fish, ILRI, and CIAT, together with other international and local Partners, are also implementing the 'More Milk in Tanzania' project in the region, funded by Irish Aid, which primarily targets pre-commercial smallholder cattle keepers who do not currently participate fully in dairy value chains (ILRI, 2015). At last, the Government of Tanzania and a few public and global improvement Partners are leading the activity Maziwa Zaidi to increment milk creation in the nation, including Tanga District.

Meridian Institute

The nonprofit organization Meridian Institute manages the Innovations for Agricultural Value Chains in Africa project, funded by the Bill and Melinda Gates Foundation

(Moreyet al, 2011). It was created to unite driving researchers (deliberately from beyond the agribusiness area) with little makers in the maize, cassava, and dairy esteem chains in Africa to distinguish innovative "out-of-the crate" post-gather the executives and handling advancements.

The multi-disciplinary project team identified key bottlenecks and inefficiencies in the dairy, maize, and cassava value chains that became the focus of their innovation concepts.

Meridian's years of experience brokering discussions among people with widely opposing viewpoints have taught us that solutions are possible nonetheless—if the right conditions are developed.

Meridian's team has managed collaborative problem-solving efforts on a range of health-related subjects, including intellectual property rights for medicines, pandemic preparedness, and planning, healthcare worker shortages, aflatoxins, healthcare coverage for the uninsured in the United States and human health effects of antibiotic use in livestock.

Clean water is essential to healthy people, economies, and ecosystems. Meeting the full array of water needs—municipal, industrial, agricultural, and environmental—is a persistent challenge that demands steadfast attention and the continual exploration of innovative solutions. Collaboration and

Because water is ultimately a local issue, the most promising innovations often go unnoticed by broader audiences. Meridian implements the latest thinking on crucial water management issues, including water reuse, the food-energy-water nexus, nutrient management, river restoration, and water utility climate adaptation.

Partnership for Aflatoxin Control in Africa (PACA)

Aflatoxin is a naturally occurring, highly toxic residue from strains of the *aspergillus* fungus found in the soil (acdivoca site). Aflatoxin has numerous serious long-haul health implications and is a critical worry in the maize and ground nut businesses. The undetectable poison is connected to liver illness and disease and is related to safe framework concealment, development hindrance, and passing in the two people and domestic animals. Maize in Kenya and numerous different pieces of Africa is now debased when it is gathered, and the parasite keeps on developing regardless of farmers' endeavors to dry their maize.

In 2011, African pioneers met up to further develop food handling to support more prominent health and efficiency across the mainland. They perceived that aflatoxins, a longstanding peril in different African staple harvests, represented a danger to human existence, creature government assistance, and the more extensive economy.

With support and facilitation from Meridian, the African Union Commission (AUC) developed and launched PACA. PACA is an African-led, African-owned initiative that

works to minimize the harmful presence of aflatoxins in the foods that millions depend on to survive.

The AflaSTOP: Storage and Drying for Aflatoxin Avoidance project recognized the most encouraging storage choices to block the development of aflatoxin and planned feasible drying choices that will permit smallholder farmers to dry their grain to safe capacity levels. AflaSTOP attempted to guarantee that organizations working in Africa could give these gadgets to smallholder farmers.

Linking scientifically rigorous research with human-centric design and grounded in marketplace realities, the project consisted of three core components: storage, drying, and commercialization.

AflaSTOP directed the biggest aflatoxin preliminary to date of limited scope agrarian grain storage gadgets (90kg-1,000kg). AflaSTOP's examination shows that until the hidden issue of maize being sullied in the field is tended to, airtight capacity can be a significant commitment to tending to the marvelous expansion in pollution experienced during the capacity time frame because of current storage strategies.

AflaSTOP supported the objectives of the Partnership for PACA which is establishing an inclusive, Africa-wide approach to aflatoxin control. Cofunding for this project was provided by the Bill & Melinda Gates Foundation and USAID, and the project is jointly implemented by ACDI/VOCA and Agribusiness Systems International (ASI), under the direction of Meridian Institute.

In March 2012, the Bill & Melinda Gates Foundation, USAID, and Meridian Institute established a Global Development Alliance (GDA) to jointly support AflaSTOP: Storage and Drying for Aflatoxin Prevention, totaling $4,000,000 over three years. In the AflaSTOP project, Meridian and its Partners (including ACDI/VOCA and Agribusiness Systems International) develop and commercialize existing smallholder-friendly technologies for post-harvest storage of staple and legume crops to prevent aflatoxin.

Research findings include the following (acdivoca site):

- 75% of farmers had maize tainted over 10 ppb in the areas in which AflaSTOP obtained maize; the set-up gauge level in one locale was 500 ppb; in the other district, it was 1,900 ppb. These levels are amazingly high.

- Airtight capacity essentially lessens the increment of aflatoxin during capacity, showing that despite the fact that utilizing airtight packs can't destroy post-reap aflatoxin levels, they can forestall critical expansions in the poison and limit expanding family openness

- Hermetic storage also eradicates insect infestation and thus stops insect-induced post-harvest losses, further moisture losses, and exposure to insecticide that farmers currently use to control insects

To be able to use bulk hermetic devices effectively, the grain must be below 13.5 percent moisture content, which is a difficult level to attain on the farm and underlines the need for enhanced drying options.

Destroying aflatoxin requires different techniques, for example, soil-based bio-control that is exorbitant, not right now promptly accessible to country farmers, and will require inescapable, bordering use.

In the wake of being frightened at the defilement rates gathered from AflaSTOP's maize obtaining movement, the Service of Horticulture in Meru embraced AflaSTOP's aflatoxin mindfulness preparing materials, preparing 6,000 extra farmers to date past the underlying 3,200 farmers at first came to by AflaSTOP.

Innovations for Agricultural Value Chains in Africa

Kenya Cargo Cycle

Close term an altogether new bike intended for freight that could be worked out of neighborhood parts and utilize neighborhood fabricating limit Milk Bike Racks and Extenders Close term A superior rack for existing bicycles that reduces losses from dropped bottles and increases delivery speed due to more secure attachment or a frame extender that adapts a conventional bike to carry more cargo.

Milk Container with Anti-Microbial Properties

The Plastic Milk Compartment is an enemy of microbial, stackable ("lego-block" molded) milk holder. By making the holders effectively stackable, they can be safely attached to a bicycle or some other method of transportation. This will reduce the milk lost during transport as well as create a stable, better-balanced transport system. Extra properties could be added to limit bacterial defilement of the milk, including: hostile to microbial properties to forestall bacterial development during transport as well as diminish the gamble of bacterial tainting from one group to another of milk; and very hydrophobic properties to make the compartment simple to clean and decrease milk deposits and related dangers of bacterial development.

Scholarly Endeavors created and field tried a milk holder model in mid-2012 in Kenya. Upgrade work and improvement of a commercialization system are in process. Scholarly Endeavors' work is essential for a more extensive set-up of developments focusing on the dairy esteem chain in East Africa. Current exercises center on the plan of the milk holder.

Future activities may include the addition of anti-microbial functionality.

GeoChiller

Close term to medium term makes geothermal cooling framework to cool milk and store it securely short-term Elective Refrigeration Close Term Assimilation fridges to cool milk and store it securely short-term Battery-powered.

Rechargeable, Chemical Cooling Packs

Near-term to medium-term Cooling packs could be dropped in milk to keep the milk cool during storage and transport and then recharged at the chilling plant.

Power Universal Power

Near-Term A universal interface between available power and simple machines or farm implements Power Distribution – Line Shafts and Turntables Near-Term A turntable which would allow a small diesel motor to power a wider range of implements or a "Flexible Line Drive".

Cassava Drying & Processing

Efficiency Cassava Tuberator: small-scale dryer for usage in the production of High-Quality Cassava Flour (HQCF) Integrated. Cassava Roaster: An integrated cassava roasting pan with a built-in chimney, firebox, and heat exchanger to enable excess heat to be used for other purposes. Cassava Basket Press: Grated cassava can be handled in smaller batches and moved through the plant in a basket that is easily carried and used as a sieve in which to press the cassava.

Cassava Decay and Storage Water Additives for Cassava Storage: Peeled cassava is stored in tanks that are filled with water and additives to prevent deterioration.

Low-Cost Drying and Storage Technologies for Maize

Modified Plastic Tank with Dryer Options: low-cost maize storage tanks for shelled grain that can be used on farms by small producers, in local co-ops, or local facilities. Near-term Existing plastic storage bags treated in situ to prolong the storage of maize ISSB Granary Near-term Interlocking Stabilized Soil Blocks (ISSB) are the basis of small-scale, low-cost maize storage granaries for unshelled cobs or storage tanks for shelled grain.

Collaborative Crop Research Program (CCRP)

The McKnight Foundation's Collaborative Crop Research Program (CCRP) funds projects that bring together smallholder farmers, researchers, and development practitioners to explore solutions for sustainable, local farming systems to improve nutrition, livelihoods, and productivity. Focusing its support through regional communities of practice in Eastern Africa, Southern Africa, West Africa, and the Andes, the CCRP funds projects in 12 countries where poverty and food insecurity have created "hunger hot spots." Since the CCRP's origin in 1994, The McKnight Establishment has committed more than $100 million to the program, including past and future responsibilities and non-award help, like help for convenings. Of the aggregate, more than $74 million has been endorsed in awards to help the program's

objective. The CCRP unites grantees to altogether uphold AEI research in neighborhood cultivating systems by fortifying nearby limits and planning coordinated mediations that address creation, dietary, and ecological objectives in locally proper ways.

Sustaining Farmer-Managed Seed Initiatives

Sustaining Farmer-Managed Seed Initiatives for Sorghum and Pearl Millet in West Africa One of the CCRP's projects called Sustaining Farmer-Managed Seed Initiatives for Sorghum and Pearl Millet in Mali, Niger, and Burkina Faso, contributes to sustainable seed supply and marketing for small-scale farmers in the three West African countries (Meridian, 2015). The program is focused on farmer-managed production of seed. The Sustaining Farmer-Managed Seed Initiatives project has been funded by The McKnight Foundation since 2006 and is now beginning a third phase of funding. Across Mali, Niger, and Burkina Faso, three national research institutes, seven farmer organizations, and several informal farmer groups are involved in the project. To assess the outcomes of the project to date, The McKnight Foundation commissioned a case study that was released in November 2014. The study found that, since 2009, 36 new sorghum and pearl millet varieties have been released. These varieties have been bred for resistance to diseases and pests, tolerance to drought and heat, and increased production in sub-optimal soils. The project has also worked with farmer's organizations to produce seeds for distribution.

The resulting farmer-led seed commercialization initiatives across the three countries produced enough seed to sow approximately 27,500 hectares in 2013. The project has also focused on making many different varieties available in a low-cost manner. These "mini-packs" meant that smallholder farmers only had to invest the equivalent of $US 0.10–0.20 to try out a new variety. The villages of the farmers that participated in this project increased their adoption and utilization of new varieties by 25–50 percent and experienced up to a 50 percent yield increase from using a combination of new varieties and improved agricultural practices. In particular, women farmers in the case study highlighted the improved living conditions, health, and nutrition of their families.

A study by Smale et al. (2018) found substantial rates of return for investments in sorghum research in Mali, to which The McKnight Foundation contributed, among others. The study estimated "a net present value of USD 16 million from investing in sorghum improvement in Mali. The internal rate of return is estimated at 36% per year with a benefit-cost ratio of 6:1. This contribution to growth in agricultural productivity was sufficient to lift an estimated 20,000 Malians out of $1-a-day poverty, given assumptions described in the methods section.

The Andes

The Andes is the center of domestication of several important crops, including potato, peanut, quinoa, and lupin as well as llamas, alpacas, and guinea pigs. The ancestors of

modern Quechua and Ayamara people developed agriculture in the highland Andes more than 5,000 years ago. Their relatives have been refining Andean cultivating systems from that point forward to adjust to the limited and unincremental hilly climate described by huge diurnal temperature changes and steep slants.

The two central principles of Andean agriculture are communal structures emphasizing reciprocity, and mitigating risks through a diversity of crops, varieties, planting dates, and plot locations.

Recent threats to Andean agriculture include global markets for labor and food as well as climate change. Local sources of innovation are abundant. Multi-actor connections need to be strengthened to provide sustainable responses to changing conditions.

CRFS's East & Southern Africa

This cooperation comprises project teams in Kenya, Malawi, Tanzania, and Uganda. The district's editing systems depend on maize, sorghum, and root crops. Framework efficiency is low due to climatic, biotic, and abiotic challenges, incorporating endured soils with low and declining ripeness, whimsical precipitation exacerbated by environmental change, field, and capacity bother pervasions, restricted access to quality seed, unfortunate dispersal of creation advances, and immature worth chains and markets.

Product Development Partnerships (PDPs), WHO

PDPs are public-private partnerships established to develop and provide access to new health products – especially vaccines, therapeutics, and diagnostics – for poverty-related and neglected diseases (who site). PDPs are non-profit-making and typically financed by public and philanthropic organizations. With their origins at a Bellagio conference by the Rockefeller Foundation on accelerating research and development (R&D) of a preventative HIV vaccine in 1994, more than a dozen PDPs have been established. They have proven to be a successful model to undertake R&D in disease areas that would otherwise lack commercial interest.

While the disease focus of PDPs has mainly been on HIV, malaria, and tuberculosis, PDPs have also made substantive progress in developing new health products for neglected diseases and drug-resistant infections. PDPs engage with academic research institutions and the pharmaceutical industry and are dynamic in all stages of pharmaceutical product development.

It is estimated that about 2.4 billion people have so far benefitted from 60+ new health technologies introduced by PDPs.

Medicines for Malaria Venture (MMV) and Coartem® Dispersible

The MMV is based in Geneva Switzerland and was founded in November 1999 with funding from the Rockefeller Foundation, the World Bank, and the governments of Switzerland, the United Kingdom, and the Netherlands.

Its consumption of innovative work developed from about $2.3 million every 2000 to a normal of about $45 million from 2006 through 2009 ((MMV, 2009) MMV works agreeing to a standard R&D process with the following components: compound screening and hit-to-lead identification, lead optimization, preclinical development, and candidate selection, clinical phase 1, clinical phase 2, clinical phase 3, and registration and launch (Mahoney et al, 2007). In a joint effort with Novartis, MMV has created and launched a blend treatment for jungle fever, Coartem® Dispersible. This item is a sweet-tasting, dispersible pediatric portion plan of a jungle fever drug mix treatment utilized broadly for grown-ups. It is exceptionally successful and all-around acknowledged by kids. The licensed innovation including expertise has a place with Novartis for both the consolidated utilization of the dynamic fixings, artemether, and lumefantrine and for the dispersible definition. The understanding between MMV and Novartis incorporates a responsibility by Novartis to disperse the item in jungle fever endemic nations. In the event that Novartis neglects to do so, MMV gets a sub-licensable permit to fabricate and sell in those nations. Further Novartis consented to make the item accessible at a cost to the public area in jungle fever-endemic nations.

To bring this product to developing countries, MMV sponsored clinical bridging studies that assessed the safety and efficacy of the new formulation in children and allowed the registration of this new product. In December 2009, it was supported by Swissmedic, then proceeded to acquire WHO prequalification, and was put on the WHO fundamental meds list.

The International Vaccine Institute (IVI)

IVI was established in Seoul, Korea in 1997 as an independent worldwide organisation under the Vienna Show. The settlement laying out the IVI has 40 country signatories in addition to WHO. It is the main worldwide organisation focused on the advancement of new immunizations for individuals in agricultural nations. It has dealt with a few PDPs including ones for cholera, shigellosis, salmonella (DOMI - Infections of the Most Ruined), cholera (CHOVI - Cholera Immunization Drive), typhoid (VIVA - Vi Typhoid Vaccine Program), and for dengue (PDVI - Pediatric Dengue Vaccine Initiative).

The International Vaccine Institute and the Pediatric Dengue Vaccine Initiative (PDVI)

Dengue is the world's most significant vector-borne viral illness undermining over 3.6 billion individuals overall and bringing about in excess of 500,000 cases for every annum. While mortality from the infection is low (around 23,000 passings each year most among kids), horribleness related to dengue demands significant weight on

emerging nations for their health systems and for individual families who should pay the expenses of treatment for this illness.

The PDVI was established in 2002 and has received funding from the Rockefeller Foundation and the Bill & Melinda Gates Foundation. Its programs have been designed specifically to address each of the six components of innovation (Mahoney et al, 2007). It has worked with separate countries to plan for the introduction of the new vaccines to their domestic markets.

In January 2011, the PDVI was renamed the Dengue Vaccine Initiative consisting of a consortium of four organizations: IVI, the International Vaccine Access Center of Johns Hopkins Blumberg School of Public Health, the Initiative for Vaccine Research of WHO, and the Sabin Vaccine Institute.

Aeras Global TB Vaccine Foundation

The Aeras Global TB Vaccine Foundation (www.aeras.org) is a non-profit research organisation growing new tuberculosis immunizations and guaranteeing that they are disseminated to all who need them all over the planet. Aeras is subsidized fundamentally by confidential establishments and government help offices. Aeras is situated in Rockville, Maryland, where it works a cutting-edge assembling and research center office, and in Cape Town, South Africa.

Drugs for Neglected Diseases Initiative (DNDi)

Since 2003, the Drugs for Neglected Diseases initiative has developed 13 treatments for 6 deadly diseases, saving millions of lives.

 Merck, a main science and innovation organization, today declared a coordinated effort with the Medications for Disregarded Illnesses drive (DNDi) to speed up the examination cycle and decrease costs in seeing as new treatments for neglected tropical diseases leishmaniasis and Chagas disease, which 450 million people are at risk of contracting (merck site). DNDi is a collaborative, patient-needs-driven, non-profit drug research and development (R&D) organization for neglected diseases.

Through the collaboration with DNDi, Merck is working with a network of leading, internationally renowned experts in this area. In addition, Merck is supporting local R&D capacity-building via DNDi's network of centers of expertise in R&D for NTDs in the Global North and Global South.

In a coordinated effort with five other drug organizations (Eisai, Shionogi, Takeda, AstraZeneca, and Celgene), the DNDi NTD Sponsor explores different avenues regarding another open-development way to deal with drug revelation through a multilateral, concurrent inquiry process across the part organizations. Through an iterative search process, companies continually examine their libraries for better matches as the search is refined, condensing the time it takes to find treatment leads.

Foundation for Innovative New Diagnostics (FIND)

FIND is a global health non-profit based in Geneva, Switzerland. It is a product development partnership that collaborates with over 150 Partners to facilitate the development, evaluation, and implementation of diagnostic tests for poverty-related diseases. FIND aims to provide innovative and affordable diagnostic products for all levels of the healthcare system in developing countries. Its mission is to ensure equitable access to reliable diagnosis around the world.

Its mission is to ensure equitable access to reliable diagnosis around the world.

The Foundation works in collaboration with WHO/TDR, the diagnostics industry, and other organizations to apply the latest biotechnology innovations to develop and validate affordable diagnostic tests for diseases of the developing world (gsatesfoundation, site). The Gates Foundation has committed up to $30 million over the next five years to the initiative.

Expanding on the achievements of TDR's Tuberculosis Diagnostics Drive, FIND will zero in at first on TB, accelerating the turn of events and assessment of new tests to identify the sickness, including drug-safe structures. TB was picked as the primary objective for FIND as a result of the extent of the issue — 33% of the total populace conveys the TB microbe — and the capacity of existing health systems to treat cases whenever they are identified.

International AIDS Vaccine Initiative (IAVI)

IAVI conducts preclinical and clinical trials of our vaccines and antibodies. Our focus is on diseases of international importance for which there is no market and little financial incentive for development. IAVI lso collaborates with and supports other scientific organizations to conduct their clinical trials of priority disease prevention and therapeutic interventions.

AVI's scientific team works with more than 50 academic, commercial, and government institutions to develop and assess candidate HIV vaccines.

IAVI has collaborated with nearby examination establishments to foster an organization of complex labs in India and southern and eastern Africa. IAVI likewise has united driving HIV specialists into logical consortia, including the Killing Neutralizer Consortium and the Vectors Consortium, to address key resistances to the advancement of compelling Guides immunization and to produce novel up-and-comers.

Janssen Pharmaceutical Companies of Johnson & Johnson and IAVI agreed to develop an HIV vaccine based on the company's AdVac adenovirus vector technology and obtained the rights from J&J to use a cell line for these vectors. A Phase I clinical trial evaluating the safety and immunogenicity of a candidate vaccine based on this technology started in 2009.

In August 2010 Janssen and IAVI reported their cooperation in a worldwide Stage I clinical preliminary in the US and Africa of a mix of two Promotion-based Helps antibody competitors, Ad26.ENVA.01 and Ad35-ENV, in solid grown-ups who are not contaminated with HIV. The clinical preliminary, driven by IAVI began in October 2010, addressing a coordinated effort between IAVI, Janssen, the Ragon Establishment, and Beth Israel Deaconess Clinical Center (BIDMC), a significant showing emergency clinic of Harvard Clinical School.

Perhaps the most critical roadblock to the improvement of an effective AIDS vaccine arises from HIV's uncanny ability to avoid neutralization by antibodies. However, a handful of antibodies capable of shutting down the many variants of the virus have been isolated from HIV-infected individuals.

Work done inside IAVI's Killing Immunizer Consortium (NAC) has since uncovered not just how every one of the known killing antibodies figures out how to close down HIV, yet in addition how the infection safeguards its weak spots from resistant assault. This information is now being harnessed by NAC scientists to devise new approaches to developing AIDS vaccine candidates.

Infectious Disease Research Institute (IDI)

IDI was laid out in 2002 in Kampala, Uganda by Scholastic Collusion for Helps Care and Avoidance in Africa. The Scholastic Union was established by a gathering of irresistible infections specialists from Uganda and North America, Dr. Merle A Sande, Dr. Henry A. McKinnell, Jr, and Dr. Nelson K Ssewankambo whose vision and determination for an Africa liberated from the weight of irresistible sickness empowered the IDI to turn into a top-notch Central point of greatness.

With Pfizer subsidizing, Drs. Sande, McKinnell, and Sewankambo had the option to start preparing medical care laborers, treating patients, and leading state-of-the-art research through the Scholastic Union. This public-private organization planned to give superb consideration to Individuals Living with HIV (PLHIV) in Uganda, to prepare medical care laborers to serve the huge number of PLHIV in Africa, to keep up with the essential accentuation on counteraction, and to direct research pertinent to working on the result of the pestilence.

In 2004, responsibility for Organization was moved to Makerere College, and the Foundation moved into its ongoing structure, the McKinnell Information Center.

International Partnership for Microbicides (IPM)

IPM's mission is to develop HIV prevention products and other sexual and reproductive health technologies for women, and to make them available and accessible where they are urgently needed.

Innovative Vector Control Consortium (IVCC)

IVCC was established in 2005, through an initial $ 50 million grant to the Liverpool School of Tropical Medicine (LSTM) from the Bill & Melinda Gates Foundation, and is a registered charity in the UK. IVCC facilitates the development of novel and improved public health insecticides and formulations to combat the rapidly growing problem of insecticide resistance. We unite Partners from industry, the public area, and the scholarly community to create new answers for forestalling infection transmission. By centering assets and focusing on reasonable logical solutions we speed up the cycle from advancement to effect.

Sabin Vaccine Institute

Sabin Immunization Organization is established on the heritage and vision of Dr. Albert B. Sabin, a forerunner in destroying polio and a backer of immunization access. Learn more about his legacy. The Sabin Vaccine Institute works to strengthen immunization in communities most affected by infectious diseases with a focus on low- and middle-income countries. The foundation creates antibodies for probably the deadliest infections that excessively influence the world's most unfortunate populaces and produces information to educate policymakers about the significance of vaccination.

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