



Smart Hubs for Rapid and Massive Implementation of Sustainable Development Goals – Key Results

Special Theme: Computer Aided Planning, Engineering & Management for SIDS and LDCs

Dr Amjad Umar¹, NGE Solutions Team², Robert St Thomas³, Debbra Johnson⁴, and Others⁵

United Nations ICT4SIDS Partnership (www.ict4sids.com) Report (March 2019)

About the ICT4SIDS Partnership (www.ict4sids.com): The ICT4SIDS Partnership (Registered UN Partnership No: 8005) was formed in Samoa in 2014, under the UN-OHRLLS guidance, to utilize the latest digital innovations for rapid implementations of SDGs for SIDS and LDCs. This report highlights the key results as of March 2019.

¹ Professor and Director of ICT Programs, Harrisburg University; Executive Director, ICT4SIDS; Adjunct Professor of Telecommunications, University of Pennsylvania; Fulbright Senior Specialist on ICT, email: umar@amjadumar.com, aumar@harrisburgu.edu

² The Computer Aided Planning, Engineering & Management toolkit discussed in this report has been developed by the NGE Solutions Team (Kamran Khalid, Nauman Javed, Adnan Javed, Hannan Dawood, Abdul Qadir, Arslan Dawood)

³ President, GTG Services; IBM Corporation (retired); Senior Advisor, ICT4SIDS; email: 'Robert St. Thomas' <robert.stthomas@gtgservices.net>

⁴ President, Debbra Johnson, LLC, Member UNISDR, email: DebbraJo@outlook.com

⁵ We greatly appreciate the support from Vittorio Coco (Sri Lanka), Peter Kenilorea (Solomon Islands), John Mwapapo (Tanzania), Emmanuel Morris (Nigeria), Dabbir Tirmizy and Ash Malik (ikdar.org), and many other Points of Contacts (POCs) and Subject Matter Experts (SMEs)

Executive Summary

Information Communication Technologies (ICTs) and digital innovations are widely recognized as the key tools for supporting progress towards the SDGs [3, 8, 16]. The objective of ICT4SIDS Partnership (Registered UN Partnership No: 8005) is rapid implementation of SDGs at a massive scale by using the latest developments in ICT. Specifically, we have developed:

- A vision and a solution approach that is based on smart collaborating hubs and a smart global village for rapid implementation of SDGs for the underserved populations.
- An extensive computer aided methodology that addresses the major challenges faced in planning, engineering and management of smart collaborating hubs at a massive scale.

This methodology and the associated toolkit have been used to quickly generate more than 60 smart hubs in 15 countries that span Asia, Africa, North America, South America, Russia and the Small Islands. This report highlights the results of computer aided strategic planning for smart hubs and illustrates how these hubs can be clustered to form smart towns, digital enterprises, and global villages at a large scale by using the latest digital innovations. Specifically, the smart hubs can operate over weak networks and are supported by powerful portals that provide highly specialized region and population specific services for SDGs. This fully supports the vision of widely distributed information hubs as specified in the Samoa Pathway Declaration (Para h, Section 109) [6].

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Exhibit 1: Frequently Used Acronyms in This Document

- ICT: Information and Communication Technologies
- IoT: Internet of Things
- HU: Harrisburg University of Science and Technologies
- LDCs: Least Developed Countries
- POC; Point of Contact
- SDGs: Sustainable Development Goals (a United Nations Initiative)
- SIDS: Small Islands and Developing States

Overall Objective and Vision

Our objective is rapid implementation of SDGs at a massive scale by deploying inexpensive smart hubs that provide *low cost but high impact* SDG services to underserved populations. *By definition, a smart hub is a center of activity, supported by a set of powerful portals, that provide location specific services of high value to its users.* A smart hub may be totally virtual (i.e., located in the cloud) or a physical building with access to the hub portals. The following four distinguishing features of our work make it an effective response to the SDG/2030 and the Urban Agendas:

I: SMART HUBS TO ADDRESS THE BASIC CHALLENGES: Each smart hub addresses many SDG challenges by providing highly specialized region and population specific low cost and high impact services in health, education, public safety, public welfare and other vital sectors. Specifically, each Smart Hub supports the following powerful portals so that no one is left behind [24]:

- Administration Portal that has prefabricated plug-ins for collaboration, business intelligence, observatories, decision support, security and project management.
- End-User Portal that directly supports SDG specific activities of the end-users (e.g., patients to get healthcare help, farmers to launch e-agriculture initiatives, and children in remote areas to get basic education)
- A Capacity Building Portal to educate the Hub-Masters to become successful entrepreneurs

II: SMART GLOBAL VILLAGE (SGV) FOR REGIONAL GROWTH THROUGH COLLABORATIVE HUBS: These smart hubs are designed to collaborate with each other to form a *Smart Global Village (SGV) for the Underserved Populations*. An SGV consists of smart collaborating hubs located in small islands, small towns and isolated communities. Members of an SGV can [25]:

- Collaborate with each other and also with a Global Center for HelpDesk capabilities
- Operate eco systems with entrepreneurs from different countries on different topics
- Support SDGs plus the UN Urban Agenda by gradually transforming regions

III: COMPUTER AIDED PLANNING METHODOLOGY FOR RAPID & MASSIVE IMPLEMENTATION: This methodology is based on free pilot projects so that the poorest populations and young entrepreneurs can participate. The most innovative aspect of our methodology is that it uses a “Hub Factory” to produce a complete smart hub in about an hour, create a community center in about a day, a village in two days, and a regional SGV in about a week (Smart Solomon was created in a week!). This acceleration changes the dynamics of our projects [27].

IV: ACADEMIC RESEARCH TO DEVELOP AN ADVANCED “HUB FACTORY” TO QUICKLY PRODUCE HIGHLY SPECIALIZED AND SOPHISTICATED SMART HUBS: We have developed a Hub Factory that supports the aforementioned computer aided planning methodology. This factory, called SPACE (Strategic Planning, Architecture, Controls and Education) uses an extensive array of latest developments in “additive” manufacturing, AI, Big Data, gamification, business patterns, technology patterns, and management patterns. SPACE is a research prototype that is being extended and enriched because of its use in deploying and managing the growing SGV (60 hubs in 15 countries at present). Several research papers have been written about SPACE [28, 9, 10, 11, 12, 13, 14].

Due to the experience with smart hubs in about dozen countries (half of them are SIDS, the rest are mostly LDCs), we strongly believe that this *distributed collaboration* approach -- also advocated by UN ESCAP “systems thinking” based SDG planning [15] -- is very effective for rapid SDG implementation. Specifically, we have developed the architectural vision, displayed in Figure 1, that shows:

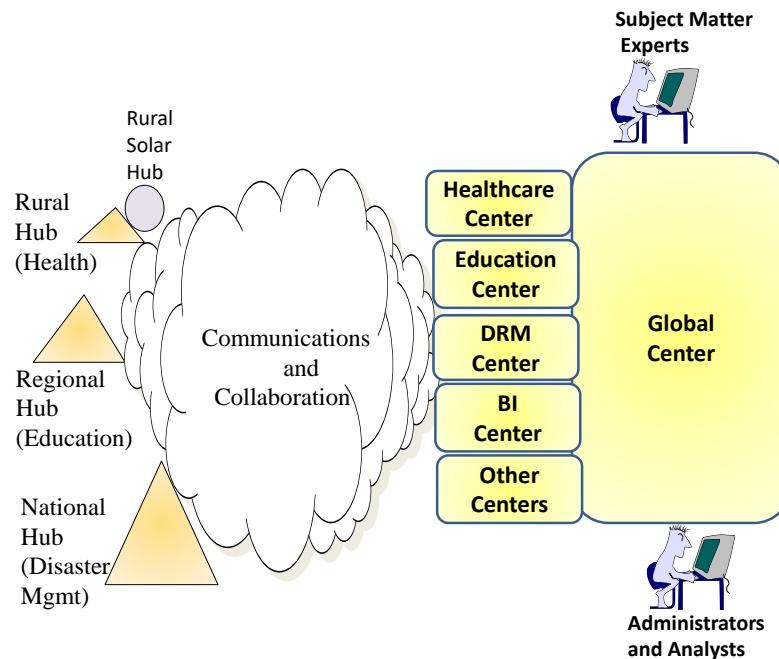


Figure 1: Overall architectural vision for smart hubs and the Global Decision Support Center

- All Smart Hubs fully support the UN initiatives such as the UN SDGs (Sustainable Development Goals) that address poverty reduction, hunger, health, education, gender equality, disaster recovery, economic development and other vital issues.
- The collaborating Smart Hubs are specialized to support different SDGs at different locations for local, regional and national needs and are managed by a Global Center, as shown in Figure 1.
- The Global Decision Support Center is located at Harrisburg University and resides on an IBM donated machine. The Decision Support Center, as shown in Figure 1, houses large databases and coordination centers. It also includes planning, administrative, analytics, and training tools that provide central support for the smart hubs at rural, regional and national levels. These capabilities, explained later, serve as the central decision support dashboard.

Exhibit 1: No One Left Behind -- Example of a Typical Rural “Smart Hub” in an LDC

- A physical site (a small building around a bus stop, gas station or rented rooms in a high school) that are close enough to the Internet Backbone (about 30-50 miles).
- A solar powered micro grid for supplying power and communication capabilities through a satellite link with remote users
- Basic capabilities to support Skype and Microsoft Office
- A “Computer Room” with a small LAN of 10-12 Laptops/Desktops for access to health, education, agriculture and other vital information systems
- Provision of smart phones and tablets (Android, Microsoft, iOS devices) for employing Mobile Apps
- A manager of the hub, usually a high school teacher who works on a part-time basis

Smart Global Village at a Glance and Highlights of the Results

We are implementing our vision of a Smart Global Village through pilot projects that have deployed several smart hubs for underserved populations in Small Islands, Africa, South East Asia, South America, Russia, and the United States. A partial snapshot of our projects at the time of this writing is displayed in Table 1. This sample table displays how different hubs (columns) are being implemented in different countries (rows). The cells of the table show the specific topics being addressed and illustrate the diversity of our approach. Here are the highlights of the main results so far (more are provided in the next section):

Table 1: Snapshot of implementation plan of the Smart Hubs and the Evolving Smart Global Village

	<i>Health (Telemed Hubs)</i>	<i>Education & Capacity Building Hubs</i>	<i>Entrepreneur -ship & eCommerce</i>	<i>Food and Agriculture Services Hubs</i>	<i>Business Intelligence (BI) Hubs</i>	<i>Disaster & Energy Hubs</i>	<i>Community Centers & Smart Towns</i>
<i>Haiti</i>	General						
<i>Jamaica</i>	Hyper-tension		Tech- Preneurship		Data Mining		Health and Agriculture
<i>Solomon Island</i>		Business Management	Digital Marketing		Data Mining	Storms	Health and Education
<i>Tanzania</i>		ICT4Teachers	Tech- Preneurship				
<i>Nigeria</i>	General	ICT4Teachers	eConsulting		BI & Data Mining	Solar Energy eMarket	Smart Town
<i>Togo</i>	General			e-Agriculture			
<i>Maldives</i>	Hyper-tension			Food Distribution			
<i>Sri Lanka</i>	General Telemed		Digital Marketing	Smart Farming & Fisheries	BI4Small Firms	Storms	Plastic Waste
<i>Pakistan</i>	General		eConsulting		BI4Health	Solar Energy eMarket	Education
<i>Peru</i>	General						
<i>USA</i>	Hyper-tension	Entrepreneur- ship Education	Tech- Preneurship		BI and Analytics	Remote Monitoring	Smart Towns & Cities

- The POCs of each hub are *required* to communicate and collaborate with at least 3 other hubs as part of the training program. They initially exchange educational materials and lessons learned but later start exchanging other vital information such as evacuation procedures in case of a disaster and digital marketing approaches and experiences for cottage industries.
- Even in its formative stages, the collaboration matrix in Table 1 is an extremely interesting playground for horizontal collaborations between different hubs in the same country (e.g., all hubs of the Solomons), vertical collaborations between different countries but on the same topic (e.g., telemedicine hub in Haiti collaborating with the one in Peru), and diagonally (e.g., micro-entrepreneurship and micro financing in Pakistan and Sri Lanka serving as connector hubs for each other).
- The collaboration matrix in Table 1 is a realization of the Smart Global Village for underserved populations. The Global Center of the Village, located on an IBM donated machine at Harrisburg University (USA), is playing a key role in the overall administration, data analytics, help desk, and coordinated collaboration among the smart hubs. An interesting example is the remote monitoring of disaster resilience capabilities of smart hubs located anywhere in the world.
- Diversity of applications of smart hubs is enormous globally ranging from solar energy to domestic violence. In addition, the capability of horizontal collaboration between smart hubs on different topics in the same region can be used for regional growth such as South to South and Carricom (Caribbean Community) initiatives. The vertical collaborations between different global sites but same topic can be used for global ecosystems in healthcare, education, public safety, public welfare and entrepreneurship.

A Closer Look at the Results So Far

Our methodology and the SPACE Factory have been used for rapid generation of more than 60 smart hubs in 15 countries that span Asia, Africa, North America and Small Islands. The Sample Smart Hubs shown in Figure 2 display only a few interesting results of our work at present. Examples include

- Healthcare and Education Centers in Pakistan, Nigeria, Tanzania, and Bangladesh
- A Fisheries Center in Sri Lanka, a Solar Energy eMarketplace for Nigeria, and an e-Agriculture Center for Togo
- A sustainable tourism network in Maldives, Disaster Management Centers in Timore Leste and the Solomons
- A Domestic Violence Center in the Republic of Georgia, smart towns in Pakistan (Lahore) and the Solomon Island (Honiara)
- A large scale Smart SIDS initiative with initial focus on the Solomons
- Examination of hypertension data from Haiti, Peru and El Salvador

In addition to the actual Smart Hubs, the few Pilot Invitations shown on this page can serve as testimonials that these are real projects. The status reports on (<http://ict4sids.com/projdoc/statusreport2018.pdf>) and (<http://ict4sids.com/projdoc/Nigeria%20Project-Concept.pdf>) provide additional testimonials for our work in the Indian Ocean and Nigeria.

This sample site shows the diversity of topics (almost all SDGs) and the locations (almost all continents) covered by these hubs. The key outputs and results of our work so far are:

- The approach of highly focused pilot projects (about 3 months) works very well -- we quickly learn what really works and also provide educational and entrepreneurship opportunities for the POCs.
- The POCs of each hub are *required* to communicate and collaborate with at least 3 other hubs as part of the training program. They initially exchange educational materials and lessons learned but later start exchanging other vital information such as evacuation procedures in case of a disaster and digital marketing approaches and experiences for cottage industries. The Smart Global Village (SGV) of

underserved populations collaborating with each other is giving us unprecedented opportunities to collect, combine, and analyze highly valuable data from very diverse populations from different sectors living in different parts of the world.

- The Global Center of the Village, located in USA, can remotely monitor the disaster resilience capabilities of smart hubs located anywhere in the world.

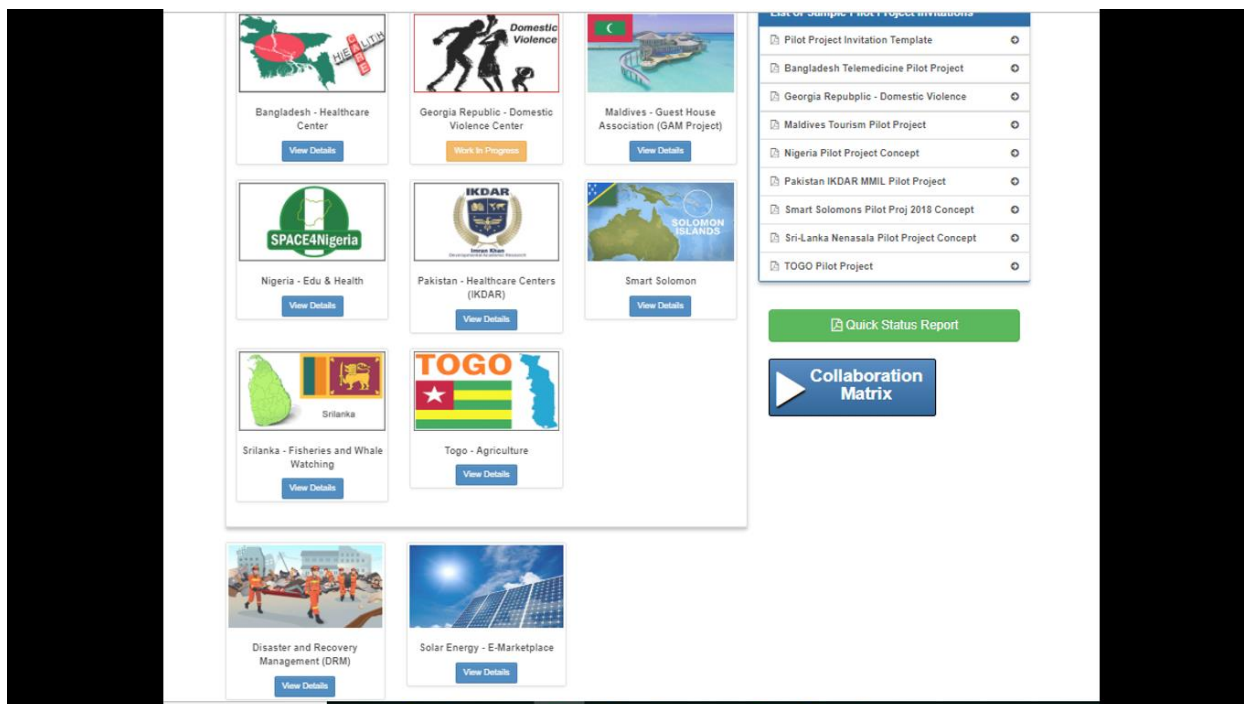


Figure 2: Samples of Smart Hubs

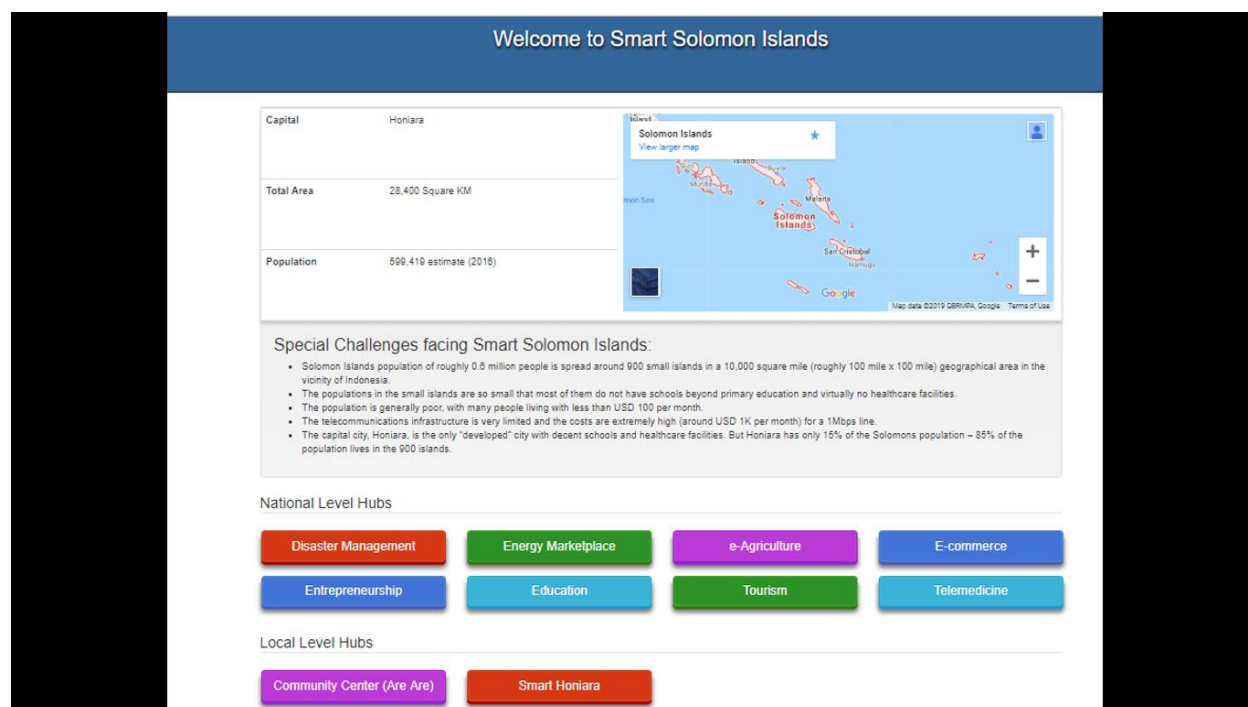


Figure 3: Smart Solomons Home Page

For further insights, let us take a closer look at the Smart Solomons Project (videoclip: <http://ict4sids.com/ved13.html> and smart Solomon site: <http://ict4sids.com/Solomon.html>) that is attempting to transform the Solomons into a smart island by 2020. The Smart Solomons Home Page, shown in Figure 3, supports eight Hubs at the national level (health, education, disaster management, energy management, e-agriculture, e-commerce, entrepreneurship, and tourism), a Smart Honiara Hub to support the city of Honiara as a smart town, and a community center for AreAre rural area for health, education, and tourism. Collaboration scenarios include a tourism hub in AreAre collaborating with micro-entrepreneurship and micro financing hubs in Pakistan, Maldives and Harrisburg. Also, blood pressure readings at the AreAre Center can be sent to the National Healthcare Center in Solomons and the Global Healthcare Center located at Harrisburg University.

Global Decision Support Center for Monitoring and Administration

Figure 4 shows the Global Decision Support Center that supports the vision presented in Figure 1. This site, developed by the ICT4SIDS Partnership, serves as a Center for Collaboration and Control between all hubs, and provides the following capabilities:

- *Collaboration Matrix (Table 1)* that supports various collaboration scenarios between different hubs and global centers. For example, telemedicine centers in Samoa and Solomon Islands can exchange information with each other and also with a nursing education center located in Aruba.
- *Global Healthcare Center* located in Harrisburg can be used to store hypertension data from Haiti, Jamaica, El Salvador, Peru, Tanzania, and other countries for across-country analysis and advice to populations in these islands.
- *Education Center* is available as the central repository of education and training for capacity building of different regions. We are currently working with Tanzania to educate local teachers for effective use of computers in classrooms.
- *Business Intelligence Center* is a new capability that will be used by any of the hubs for analytics so that even the remotest villages can also participate and benefit from simple analytics to promote local economic activities in the global marketplace
- *Smart SIDS* is a new initiative that is using the SDG Advisor and Computer Aided Planning to develop smarter SIDS. We are currently working with Solomon Islands on a Smart Samoa Pilot Project. This concept is also being expanded to smart towns and isolated communities.
- *Entrepreneurship Portal* is a new initiative that is primarily focusing on micro-entrepreneurship through microfinancing. This portal is providing resources for education, social networking, digital marketing and e-commerce as the basic tools for young entrepreneurs.
- *Smart Agriculture Portal* is a new initiative that is extensively based on using IoTs and embedded systems for monitoring the growth of crops and food security as the key areas of focus at present.
- *Disaster Recovery Center* is currently not operational but is in design to reduce risk from disaster situations such as climate change and earthquakes, and to accelerate recoveries of economic activities thereby reducing risks to public and private sector investors
- Additional centers on food safety, micro-grids, AI applications, and Internet of Things (IoT) solutions are also under investigation at present.

In addition, the following tools and a computer-aided methodology support the Global Center:

- *SDG Advisor* is available to all hubs and the Global Center users for quickly checking the SDG indicator for their regions/countries, receiving recommendations for the services that can improve the needed status, and even launch the needed services through the Computer Aided Planner.
- *Computer Aided Planner* is a sophisticated toolset, called SPACE that conduct detailed feasibility studies and produces a strategic plan, plus a highly customized working portal for a proposed hub

within hours. Benefits include lower development costs and lower risk to potential donors/investors. Additional information about the SPACE environment can be found at [7, 9, 10]



Figure 4: Screenshot of the Global Decision Support Center for SDGs (watch the video clip on <https://youtu.be/EqHeozRcuGA>)

Computer Aided Implementation Methodology for Launching Pilot Projects

The vision presented so far is promising, but implementing this vision at a massive scale is a non-trivial task due to the technical, management and logistical challenges summarized in Figure 5. These are serious barriers that must be addressed systematically. Unfortunately, many ICT projects are not carefully addressing these challenges and are experiencing a failure rate of 60-85% due to expensive retries, especially in developing countries. Smart hub projects are no exception. In response, we have developed a careful methodology, discussed below, that is supported by the integrated set of tools shown in Figure 3 to do more (provide more services to more customers) with less (time, money, trained staff and risk). This methodology and the associated tools have been improved and enriched successively through the hands-on experience and practical insights gained through more than a dozen pilot projects.

Important Note: The computer aided implementation methodology, briefly described here, is further illustrated in Appendix A through an example. The computer aided environment used in this methodology has been published widely [9, 10, 11, 12, 13, 14] and has been used extensively in computer aided consulting assignments and in graduate level courses on computer aided planning and integration at the University of Pennsylvania and Harrisburg University of Science and Technology. This environment is being expanded and enriched through hands-on experiments with the overall goal of using latest digital innovations for long range solutions for the underserved populations. In addition, we are taking advantage of industry developments (e.g., [1, 2, 4, 21, 22]) and UN publications (e.g., [15, 16, 17, 18, 19, 20]).

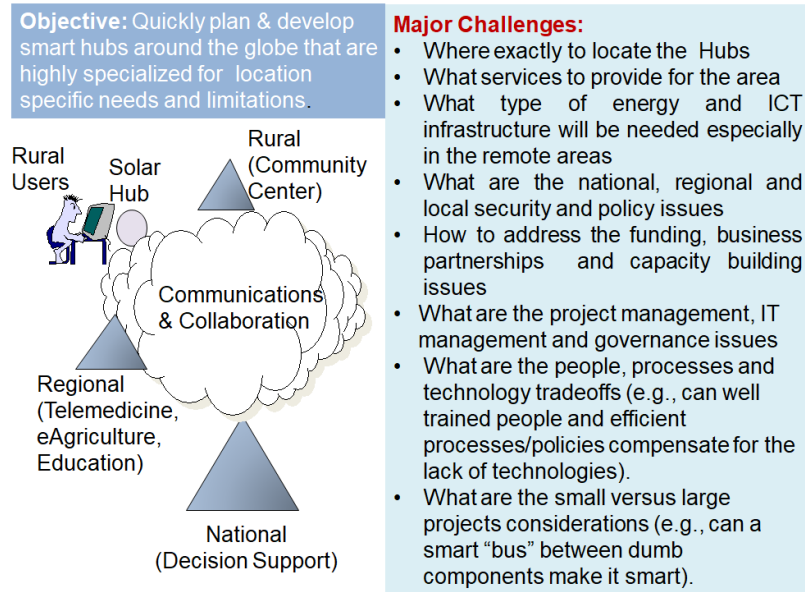


Figure 5: Summary of challenges facing large scale planning and deployment of smart hubs

Figure 4 shows our systematic computer aided planning methodology that addresses these challenges. This methodology relies heavily on a powerful computer aided planning and decision support environment, called SPACE (Strategic Planning, Architecture, Controls and Education) and other tools. The SPACE environment (www.space4ict.com) addresses the challenges faced in Figure 3 and produces a highly customized portal to support different smart hub configurations within hours. Most importantly, SPACE supports individual services that can be combined into complex “*service bundles*” to represent offices, community centers, corporations and even cities. This allows us to plan and architect very simple to very large and complex scenarios for smart hubs. This methodology is based on the insights gained by implementing the pilot projects shown in Table 1 and will be further refined and used in the future. The methodology consists of the following phases (see Appendix A for a detailed tour of the methodology):

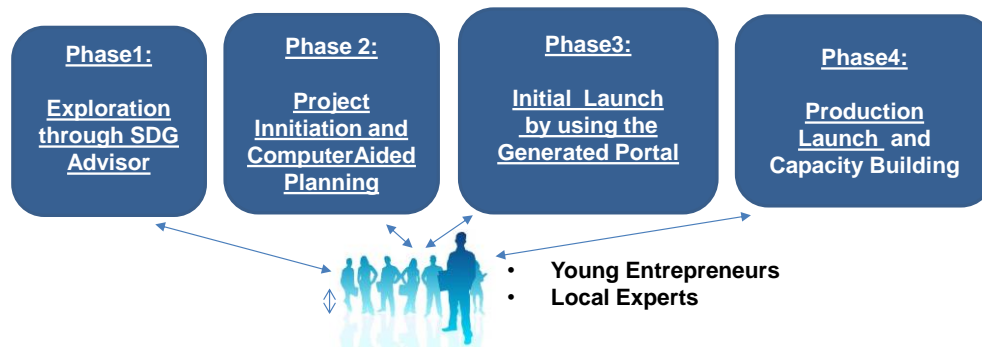


Figure 6: Computer Aided Implementation Methodology for Launching Pilot Projects

- Phase 1: We invite potential users to join a smart pilot project that implements smart hubs to support health, education, public safety, public welfare, and other SDGs for the community. We ask the interested users to use the SDG Advisor tool (part of SPACE) to help them assess their needs and determine which SDGs should be addressed in the pilot project. Appendix A gives a detailed example of how the SDG Advisor supports Phase 1 of our methodology.
- Phase 2: A hub vision is proposed and a pilot project is initiated by a user and a *Point of Contact (POC)* is appointed by the target community. The POC is trained to use the SPACE computer aided planning tool to conduct an extensive feasibility study and produce a strategic plan, a funding proposal and a

working prototype of the selected smart hub(s) – all within a day. Appendix A provides additional details.

- Phase 3: The results of the feasibility study are analyzed/revised and a final smart hub is created in collaboration with the POC and local experts. The final hub is “registered” in the Collaboration Matrix and also in the appropriate Global Center (e.g., a hypertension hub is registered in the World Hypertension Center). The POC goes through an intensive training and is responsible for refining and expanding the hub based on local needs.
- Phase 4: The produced portal is refined for a production version as a repeatable asset. The results are published in the Donor Portal for attracting funding sources, business partners and system builders. Funding models accessible by this process include, public, private, or even “crowd sourcing” which allows individuals to contribute to specific projects. The Donor Portal also serves as a connector hub for micro financing. A production version of the hub portal is launched at the end of this phase.

Concluding Comments

Finding solutions that address massive needs of almost 3.5 Billion people -- as captured in the UN SDGs - is a daunting task. We have presented an architectural vision of a smart global village (SGV) that is based on smart collaborating hubs to serve these populations. These hubs provide inexpensive and highly specialized services in health, education, public safety, public welfare, energy and other vital sectors for the populations that are being left out of the digital revolution. We have identified the key challenges faced by massive implementation of smart collaborating hubs and developed a computer aided methodology plus the needed “SPACE Factory” that attempts to answer these challenges.

The result of our effort is a smart global village, consisting of several smart hubs, that is currently operational and is actually being used to help developing countries and small to medium businesses make progress towards SDGs. In addition, this village is being used extensively to support graduate courses and professional education in computer aided strategic planning and enterprise architectures and integration.

We have learned the following invaluable lessons in this project:

- As mentioned previously, every hub is a potential entrepreneurial opportunity for young entrepreneurs. Widespread availability of smart inexpensive hubs focusing on different topics with automatically plugged-in capabilities for collaboration and business intelligence could spark innovative entrepreneurial products and services. We are hoping that these digital innovations happen in remote areas and isolated populations that are being left out of the digital revolution.
- Women can find more entrepreneurship opportunities to run hubs as small businesses from their homes in backward areas where women cannot work outside their homes.
- Interactions and collaborations between different hub owners on different topics in different parts of the world can be of great value in discovering, understanding, and analyzing various large scale scenarios in a Smart Global Village that need future research.
- Business continuity planning (BCP) for small hubs is an active area of technology planning and transfer between many hub masters, at the time of this writing. This is automatically leading to disaster resilience in remote areas. Other common areas of interest will emerge as we gain more knowledge and insights with the rapidly growing SGV. These “bottom up” developments could lead to valuable results.

Our approach could also be used to support the UN Urban Agenda because the local smart hubs could provide the needed services to people living in rural areas to reduce the global urbanization trends. Our hypothesis is that people living in rural areas would prefer not to move to the expensive, congested and crime ridden cities if needed services are available at local hubs. For example, young entrepreneurs in

Nigeria are going back to the countryside from Large Cities for a better life [31]. In addition, smart hubs can be used to provide needed services to a few neighbourhoods of a large city and thus can gradually implement a large smart city plan instead of a centralized “one size fits all” solution.

APPENDIX A: Quick Tour of Computer Aided Implementation Methodology

PHASE 1: Using the SDG Advisor to Get Started

Phase 1 of our methodology conducts a quick feasibility study by using the SDG Advisor and then helps a user to select and launch low cost but high impact pilot projects. The overall objective of the SDG Advisor is to accelerate the implementation of UN Sustainable Development Goals (SDGs) through ICT at local, regional and national levels. Specifically, the SDG Advisor initiates our methodology by answering the following questions:

- What is the status of my country/region as calculated by the SDG indicator (good/bad)
- What type of services could improve the needed status
- What are the costs versus benefits of launching a service and how exactly can a service be launched quickly and inexpensively within the local context

The SDG Advisor, shown in Figure 7, is a working prototype that begins to answer these questions by systematically walking the users through a three-step process displayed in Figure 7. These steps are described in more detail below.



Figure 7: Conceptual overview of the SDG Advisor

STEP 1: Select a country/region and initiate the process

The user selects a country/region and the SDG Advisor fetches all open information about the location from sources such as the World Bank, UN Department of Statistics, World Economic Forum, and others.

STEP 2: Select an SDG for status and service recommendations

The user selects an SDG¹⁸ and the SDG Advisor shows how well the country/region is doing based on SDG indicators. Figure 6 displays a screenshot of the SDG Advisor that shows the following:

- The user selected SDG3 (Health) for Jamaica as a country.
- The Advisor shows status of Jamaica based on UN-specified SDG indicators for healthcare such as number of physicians and hospitals per 1000 people.

- The status is indicated as red, yellow and green to show if the status is below, OK, or above the desired levels. As shown in Figure 8, Jamaica needs to improve its status in terms of the number of physicians and hospitals per 1000 people while life expectancy at birth for male as well as female is quite good.
- The Advisor also recommends a number of ICT-based services that could improve the status. This recommender feature is based on our knowledgebase of business patterns and heavily utilizes analysis performed by well known studies such as the ITU-CISCO, Columbia-Erickson, and others. We are constantly updating our database.
- The user can select any of the displayed services and perform basic cost-benefit analysis to make an initial judgement if the service is worth pursuing. Ideally, the users should select the services that are low cost but high benefit and impact.
- If the user believes that the service is worth pursuing, then the user presses the Explore button that is processed in Step 3.

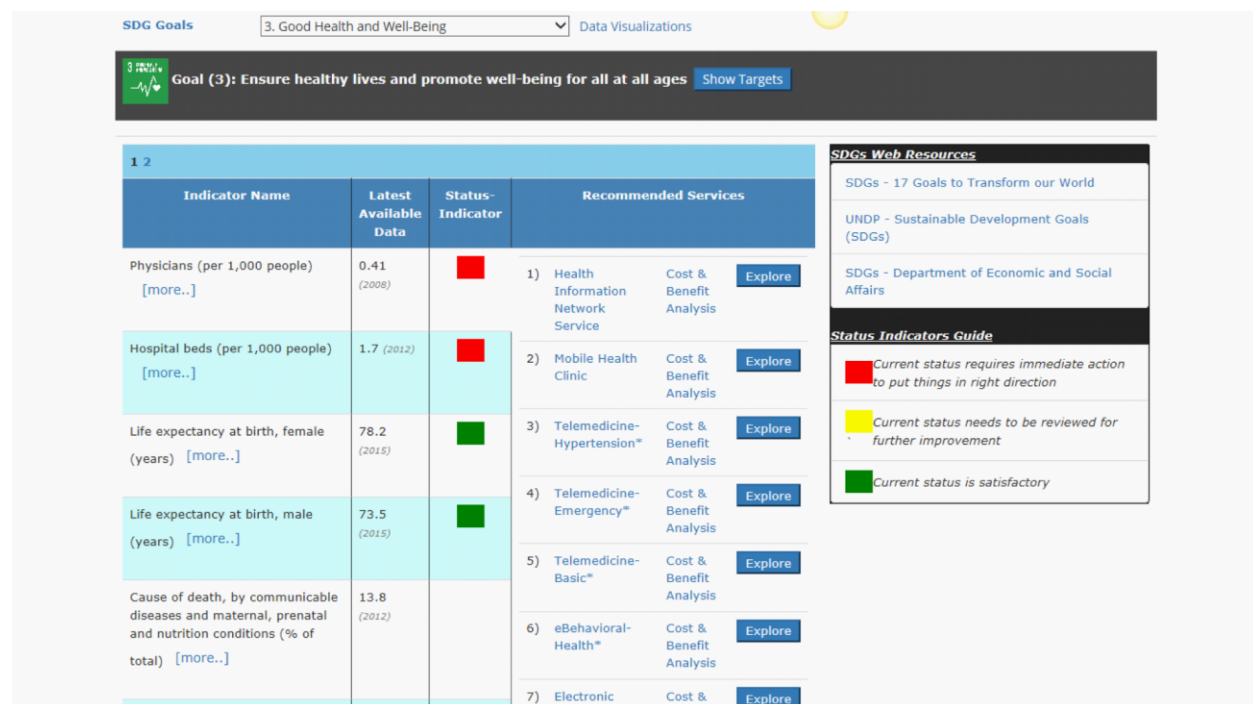


Figure 8: Screenshot of the results produced by step 2 of the SDG Advisor

STEP 3: Exploration and launching/implementing needed services

The SDG Advisor goes beyond recommendations, to enable implementation of the needed ICT-based services through the SPACE computer aided planner. The launched services are Samoa Pathway compliant ICT hubs that directly support SDGs in Health, Education, Public Safety and Public Welfare services through ICT. The SPACE e-Planner conducts a feasibility study and generates extensive reports such as a strategic planning report to show the overall vision and architecture with business/technical justification and standardized RFPs (Requests for Proposals) that can be used to attract vendors for bidding. A very important feature of SPACE is that it automatically generates a sample portal that can be quickly converted to an actual working system. All these outputs and the working portal can be used to initiate a free pilot project with ICT4SIDS Partnership or any other organization to implement the needed services quickly. The following section presents a quick tour of using SPACE to launch a service.

PHASE2: Using the Computer Aided Planner to launch a service

A user of the Planner selects a service (e.g., mobile health clinic) for a given country (e.g., Nigeria) as recommended by the SDG Advisor and quickly generates a working portal for the smart hub plus the following reports (see Exhibit 2 for more details about these reports):

- Business plans that can be used for obtaining funding
- Detailed Planning Reports (DPRs) that show the architecture, the policies needed, and enabling technologies for the chosen service
- Standardized RFPs (Requests for Proposals) that can be used to attract the needed vendors through an open bidding process
- Project management, disaster recovery and governance guidelines for monitoring and controlling the development activities
- Education, training and public awareness campaigns needed for success

Let us briefly review how these outputs are produced by using Figure 7, which shows a more detailed view of the Planner. *Simply stated, the Planner is a set of intelligent apps (“advisors”) that are integrated around common resources.* These advisors collaborate with each other to cover five phases (P0 to P4), shown in Figure 7. These advisors invoke the games, patterns, and other resources to generate the outputs shown in Figure 7. These outputs can be customized by local experts and/or end-users. Suppose that a user wants to develop the strategic plan for an e-learning service in Nigeria. P0 helps the user to capture Nigeria specific information and P1 helps in specification of the e-learning service. P2 generates a customized plan based on P0 and P1. P3 generates the information for RFP (Request for Proposal) and requirements & integration. P4 generates outputs to support project management and governance. The outputs can be customized by the users or local experts manually, or by invoking specialized games and simulations. Our goal is to produce the outputs that require less than 30% of local modifications.

Using Big Data: The Planner fetches, uses and customizes extensive big data resources such as a set of knowledge repositories that provide links to a wide range of case studies and educational materials, and external resources such as the UN Public Administration Network (UNPAN), World Economic Forum (WEF), and World Bank Institute initiative on open data. Rules in different phases of the Planner retrieve needed data and use it to produce outputs and/or modify decisions.

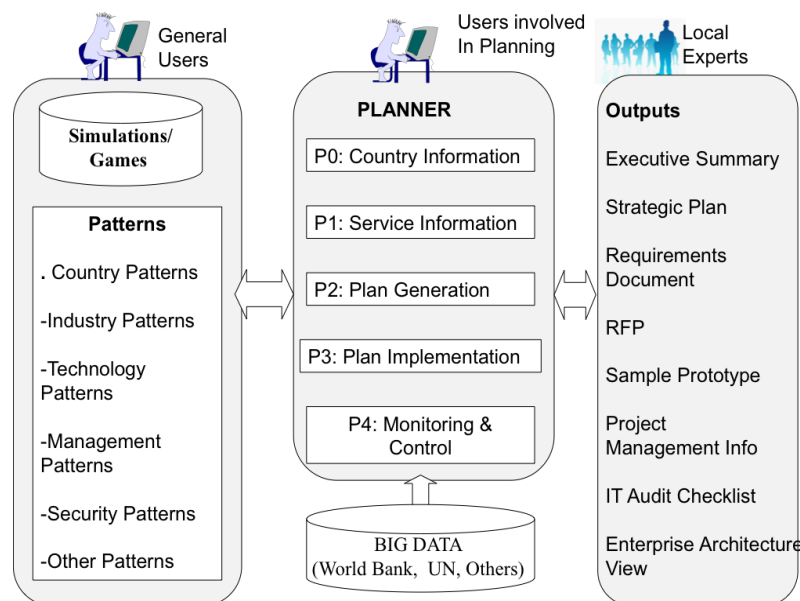


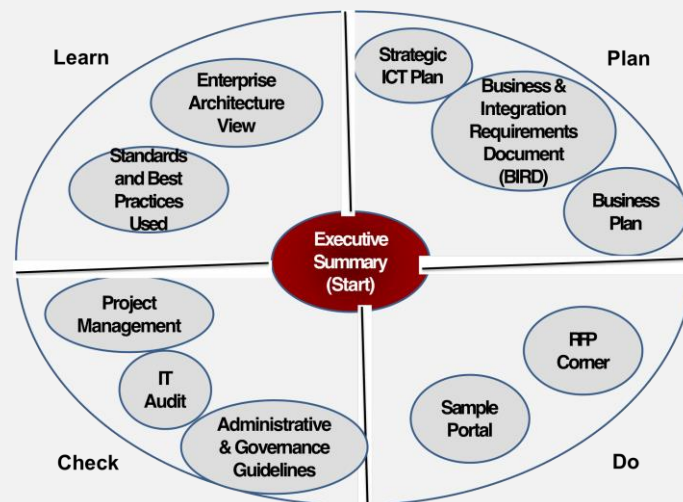
Figure 7: A Conceptual View of SPACE

Exhibit 2: The Outputs Produced by the Planner -- The Checklist

A user of the SPACE Environment selects a service (e.g., mobile health clinic) for a given country (e.g., Nepal) and generates a working portal that supports the smart hub in Nepal. In addition, it generates the following outputs to make the smart hub a success:

- Strategic planning report that shows the overall vision and architecture with business/technical justification
- Requirements documents for system development
- Business plans that can be used to obtaining funding
- Standardized RFPs (Requests for Proposals) that can be used to attract vendors for bidding
- Project management, policies and procedures, disaster recovery and needed governance guidelines
- Education, training and public awareness campaigns needed for success
- Enterprise architecture (EA) views for overall governance
- Suggested standards and best practices

These outputs, displayed graphically below, cover the entire Learn-Plan-Do-Check cycle, are produced *in less than an hour (it takes almost a year to produce similar outputs manually)*.



PHASE3 and PHASE4: Deployment and Capacity Building

In Phase 3 and Phase4, the results of the feasibility study are analyzed/revised and a final smart hub is created in collaboration with the POCs (typically young entrepreneurs) and local experts. Specifically:

- The final hub is “registered” in the Collaboration Matrix and also in the appropriate Global
- All local stakeholders go through an intensive training and refining the hub based on local needs.
- A production version is created as a repeatable asset and the results are published in the Donor Portal for attracting funding sources, business partners and system builders.

Funding models accessible by this process include, public, private, or even “crowd sourcing” which allows individuals to contribute to specific projects. The Donor Portal also serves as a connector hub for micro financing. The Pilot Project concludes when the hub portal is launched for regular use.

Additional Information: Visit www.ict4sids.com or send an email to A. Umar at umar@amjadumar.com

Key References

- [1] Data Initiative, Weblink: www.sdg16.org
- [2] IBM CAMSS (Cloud, Analytics, Mobile, Social, Security) Services, Weblink: <http://www-01.ibm.com/common/ssi/cgi-bin/ssialias?htmlfid=PO103036USEN&appname=skmwww>
- [3] ITU and Cisco Report: “Harnessing the Internet of Things for Global Development”, Weblink: (<https://www.itu.int/en/action/broadband/Documents/Harnessing-IoT-Global-Development.pdf>), Jan 19, 2016.
- [4] Infodev, a World Bank initiative on Innovation and Entrepreneurship, Weblink: <http://www.infodev.org/>
- [5] ICT4SIDS Partnership, UN Registered Partnership No:8005, Weblink: <http://space4ict.com>
- [6] Samoa Pathway Document, Weblink:<http://www.sids2014.org/index.php?menu=1537>
- [7] SPACE – A Computer Aided Planning, Engineering & Management Environment, developed by a startup. Website: www.space4ict.com
- [8] Sustainable Development Solutions Network, “ICT and SDGs: How Information and Communications Technology Can Accelerate Action on the Sustainable Development Goals”, Columbia University and Ericsson Report, May 11, 2016, Weblink: www.unsdsn.org/resources/publications/ict-and-sdgs/
- [9] Umar, A., and Zordan, A., “Enterprise Ontologies for Planning and Integration of eBusiness”, *IEEE Transactions on Engineering Management*, May 2009, Vol. 56, No. 2, pp. 352-371.
- [10] Umar, A., “Computer Aided Planning, Engineering and Management of IT Services”, IEEE International Technology Management Conference, Dallas, June 2012.
- [11] Umar, A., “Computer Aided Consulting for Developing Countries”, IEEE International Technology Management Conference, Hague, June 2013.
- [12] Umar, A., “Decision Support for Smart Healthcare”, IEEE International Technology Management Conference, Chicago, June 2014.
- [13] Umar, A., “Smart Collaborating Hubs and a Smart Global Village – An Alternative Perspective on Smart Islands, Towns and Cities”, IEEE Conference on Technology and Engineering Management, June 2018. Link: <http://ict4sids.com/newdoc/IEEE-TEMS%20SmartHubs-Final.pdf>
- [14] Umar, A., “Computer Aided Strategic Planning for the United Nations Sustainable Development Goals”, International Journal of Engineering and Applied Sciences, ISSN: 2394-3661, Vol-4, Issue-12, December 2017. Link: <http://ict4sids.com/newdoc/IJEAS-SPACE4SDGs-Published-Final.pdf>
- [15] UN ESCAP (Economic and Social Commission for Asia and the Pacific), Weblink: www.unescap.org, Report on “Integrated Approaches for Sustainable Development Goals Planning: The Case of Goal 6 on Water and Sanitation”, May 17, 2017, weblink: <http://www.unescap.org/publications/integrated-approaches-sustainable-development-goals-planning-case-goal-6-water-and>
- [16] UN Fast Forward Report on ICT4SDGs – July 17, 2017. Weblink: http://www.itu.int/en/sustainable-world/Documents/Fast-forward_progress_report_414709%20FINAL.pdf
- [17] UN-OHRLLS “State of the Least Developed Countries 2017”, Weblink: http://unohrlls.org/custom-content/uploads/2017/07/State-of-the-LDCs_2017.pdf
- [18] UN Statistics Department (UNSD) Data Sources: UN Data website (<http://data.un.org/>)
- [19] UN Sustainable Development Goals, Report 2016, Weblink: <http://unstats.un.org/sdgs/report/2016/The%20Sustainable%20Development%20Goals%20Report%202016.pdf>
- [20] UN Millennium Development Goals, Report 2009, UNDP (2009)
- [21] Water 2.0: Digital Transformation for the Water Industry Conference, March 22, 2016, Washington DC
- [22] World Bank Open Data initiative, Website: <http://datacatalog.worldbank.org/>
- [23] "Embracing the E-commerce Revolution in Asia and the Pacific", UNESCAP Report, June 27, 2018, url: <https://www.unescap.org/resources/embracing-e-commerce-revolution-asia-and-pacific>
- [24] What is a Smart Hub: 3 Minute Video Clip (<http://ict4sids.com/ved14.html>)
- [25] How Does Collaboration Help a Smart Global Village: 4 Minute Video Clip (<http://ict4sids.com/ved4.html>)

- [26] What is Our Computer Aided Methodology: 5 Minute Video Clip (<http://ict4sids.com/ved6.html>)
- [27] What is the SPACE Factory: 2 Minute Video Clip (<http://ict4sids.com/ved9.html>)
- [28] SDG Advisor: Video Clip (<http://ict4sids.com/ved7.html>), Link to the Tool (<http://space4ict.com/pages/sdgsadv.aspx>)
- [29] ICT4SIDS Partnership: Sample Pilot Projects, URL: <http://ict4sids.com/proj.html>
- [30] Global Entrepreneurship Zone for All (GEZA): URL: <http://ngegeza.com/>
- [31] “Nigeria: Young Entrepreneurs are Going Back to the Countryside From Large Cities.” <https://www.trouw.nl/home/jonge-ondernemers-in-nigeria-vaarwel-stropdas-en-airco-hallo-platteland~aa6c8c48/>. Note: This article is in Dutch, the main message is: In Nigeria, the agricultural sector was in decline due to oil related jobs in big cities. But now that the oil sector is in trouble, the young entrepreneurs are going back to the countryside for a better life and investing in poultry and e-agriculture.