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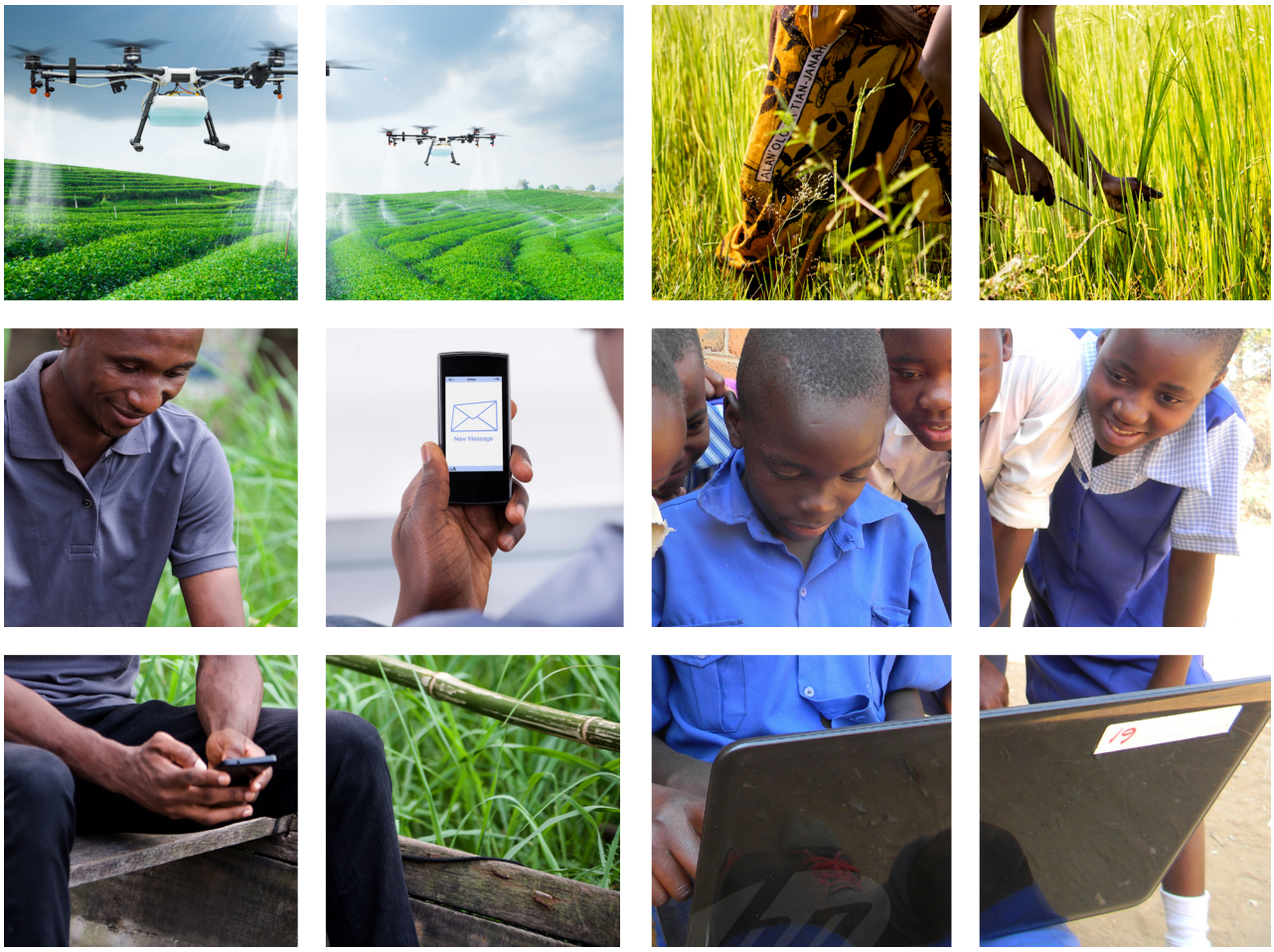
Building Smart Villages: A blueprint

As piloted in Niger



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Building Smart Villages: A blueprint

As piloted in Niger

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About ITU

The International Telecommunication Union (ITU) is the United Nations specialised agency for information and communication technologies (ICTs).

ITU allocates global radio spectrum and satellite orbits, develops the technical standards that ensure networks and technologies seamlessly interconnect, and strives to improve access to ICTs to underserved communities worldwide. ITU supports countries in implementing digital transformation projects to harness ICT for SDGs.

For more information about ITU or this paper, please visit the website: http://www.itu.int.

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The National Agency for the Information Society (ANSI) of Niger is responsible of the operational implementation of strategies, programmes and projects for the promotion and development of ICT, in accordance with the guidelines defined by the Government, in relation to the Ministry in charge of the sector and the other structures concerned.

ANSI's main mission is to drive the transformation of Nigerian society into a digital society, and consequently accelerate the progress towards achieving sustainable development objectives through the NIGER 2.0 strategic plan.

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The Digital Impact Alliance (DIAL) is an independent global alliance funded by leading development agencies and private foundations. DIAL was established in 2015 as a **“think, do, replicate” tank**. We combine **practical research** with **evidence-based advocacy** to advance digital inclusion to achieve the SDGs. DIAL identifies barriers to the routine use of digital solutions and data by development actors (countries, NGOs, multilateral institutions); tests ways to remove them; and package solutions for these actors to use in service delivery efforts vision. www.digitalimpactalliance.org.

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Foreword

Today, just over half of the world population is using the Internet, while the other half remains totally unconnected.

At the same time, the unprecedented global COVID-19 pandemic has underscored the vital importance of digital networks and services to economic resilience and the continuity of essential public services like education and healthcare.

Multi-stakeholder collaboration and partnerships are key to reaching out to under-served and unconnected communities and achieving universal and meaningful connectivity.

With this in mind, the International Telecommunication Union (ITU) and its partners are promoting the creation of smart villages to advance sustainable development in the remote and disadvantaged areas of the world.

This Smart Village Blueprint, piloted in Niger, has been conceived as a practical tool for establishing smart villages. It contributes to the implementation of the Niger 2.0 Smart Villages project, which aims at providing broadband infrastructure to improve Internet access in rural and remote parts of the country.

The Smart Villages project comprises a locally led, integrated, and holistic approach to providing access to digital services to all citizens of rural communities, with the integration of digital technologies serving as a crucial enabler of equitable, qualitative and efficient delivery of SDG-related services for all.

This Blueprint is based on the lessons learnt from experiences setting up, managing, and sustaining similar projects in different parts of the world, including the Niger Smart Villages project.

These lessons highlight the importance of dynamic local leadership, the continuous development of local capacity to manage and lead sustainable development programmes, and the need to work collaboratively with multiple stakeholders and adopt a whole-of-government approach, moving away from older, territorial, siloed development models.

The aim of this Blueprint is to make smart villages one of the mechanisms through which multiple SDGs can be achieved simultaneously in remote and underserved areas.

We hope it will serve as a living guide that continuously evolves and improves, as the Smart Villages project develops further and extends to other rural regions of the world.

Ibrahima Guimba Saidou
Minister Special Advisor to the President of the Republic, Niger

Doreen Bogdan-Martin
Director, Telecommunication Development Bureau

Preface

Inclusive digital transformation refers to new ways in which digital technologies can support social change that can benefit the most impoverished communities.

Today, the world is under more pressure to combat crises in world hunger, health, and education. The most recent Sustainable Development Goals Report 2018[1] shows that, compared to 2015, there were approximately 38 million more hungry people in the world in 2016, totalling 815 million people.

Its further reports that health care systems in least developed countries (LDCs) are under significant pressure because there are high shortages of doctors and medical staff. Ninety per cent of LDCs had less than one physician per 1 000 people in 2016, a problem ever more acute in rural villages.

In education, the UN has estimated that 617 million children and primary and lower secondary school age youth worldwide are not achieving minimum proficiency in reading and mathematics.

Traditional approaches have not been effective in addressing these complex problems of continuing poverty, inequality and marginalisation. The world is urgently in need of fresh approaches. Exploring the potential to catalyse social and economic change in rural villages through digital transformation in ways that benefit the poorest, most marginalised communities, has become a critical imperative. However, for digital transformation to be effective, there is a need to shift from traditional technology-centric, siloed, supply-side approaches, to demand-driven approaches. In addition to strong local leadership and political will, an integrated, cross-sectoral whole-of-government approach is part of a methodology that could possibly bring about change.

The purpose of this report is to offer a blueprint for the inclusive digital transformation of rural villages across the world based on a whole-of-government approach as part of broader digital government or digital transformation initiatives. It models the establishment and growth of smart villages as an essential cornerstone to realising the United Nations Sustainable Development Goals.

[1] UN. Sustainable Development Goals Report 2018. https://unstats.un.org/sdgs/files/report/2018/TheSustainableDevelopmentGoalsReport2018-EN.pdf Accessed on 14 February 2020.

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Executive Summary

This blueprint serves as a step-by-step guide on how to establish, manage, and lead a smart village for sustainable development project. With almost 80 per cent of the world's extreme poor living in rural areas where most are dependent on agriculture, rural villages become a critical focus to meet the United Nations Sustainable Development Goals (SDGs)[1] through digital transformation. High levels of poverty, low-income levels, poor infrastructure and lack of connectivity to the Internet rank among the biggest challenges in rural life across the world. At the end of 2018, ITU confirmed that 49 per cent of the world's population are offline. Those reside mainly in least developed countries and rural areas.

What is a smart village?

A smart village is a holistic and inclusive approach for rural digital transformation towards achieving the SDGs in remote and underserved communities where:

- Rural dwellers have access to network infrastructure via connected devices.
- Citizens can access impactful and transformational SDG-related digital services, as they need them, on time, anywhere and all the time.
- Services are customized for the specific SDG needs of citizens.
- Integrated SDG-related services are continuously improving and adapting to changes.
- Partner organizations involved are continuously learning and adapting their services.

Government shows leadership and political will by departing radically from territorial, silo behaviour, and adopt an integrated, cross-ministerial, cross-sectoral, whole-of-government approach to planning and implementation.

Traditional approaches have failed to solve the most pressing problems in rural areas. A radically different design and implementation approach is needed: a smart village approach.

The following table provides a summary of a step-by-step process for designing and implementing a smart village project

[1] The United Nations Sustainable Development Goals, adopted in 2015, committed the global development community to 17 inter-related goals and 169 indicators focused on improving the quality of life for all. The SDGs vision, goals and targets are also focused on revitalising rural societies and their many links with urban centres.

Plan, design, implement, and evaluate

ANALYSE & PLAN	Step 1: Learn from past experiences and initiatives	Learn from past smart villages projects or similar initiatives from different parts of the world.
	Step 2: Establish guiding principles.	• Design with the user or citizen. • Understand the rural village ecosystem. • Design for scale and complexity. • Build for sustainability. • Be data-driven. • Use open standards. • Reuse and Improve. • Address privacy and security. • Locally-appropriate, equitable and inclusive solutions.
DESIGN & DEVELOP	Step 1: Adopt an integrated approach.	• Incorporate a whole-of-government approach with multi-sectoral, multi-disciplinary, and multi-stakeholder engagement approach.
	Step 2: Involve citizens actively in smart village design.	Use several ways to involve citizens: • Host village meetings. • Design citizen engagement platforms. • Conduct surveys and focus groups.
	Step 3: Assess the market and demand for digital applications and services.	• Demonstrate genuine care for citizens. • Leverage the products and services that people already have. • Understand market barriers to grow new markets. • Cluster citizens into market segments.
	Step 4: Establish digital infrastructure.	Identify infrastructure required in terms of: • Low-cost sustainable power solutions. • Last and middle mile connectivity solutions. • Connected devices. • Local village cloud. • Central smart village platform.
	Step 5: Design integrated SDG digital services	• Identify and design digital services required. • Identify available common ICT building blocks such as payment. • services that can service all sectors in an integrated and reusable way.
	Step 6: Ensure appropriate data privacy and security.	• Clarify how data will be acquired, used and stored. • Define data ownership, access and sovereignty. • Clarify how sensitive information will be protected. • Minimize confidential information collection. • Develop and implement a data security policy. • Be transparent about data use and collection. • Consult resources on privacy for children. • Organize awareness-raising and advocacy.

	Step 7: Establish systems for fair procurement.	• Engage service providers for service delivery. • Procure products and services through fair tendering processes.
	Step 8: Establish a smart village organisational model.	• Establish a smart village coordination unit. • Establish an operation and maintenance unit. • Engage service owners and managers. • Engage domain service providers. • Engage a platform operator. • Establish a central local content creation and digitization unit. • Establish a village committee.
DEPLOY & IMPLEMENT	Step 1: Invest in management and leadership capacity.	• Organize leadership and management development programmes. • Coordinate skills transfer and management capacity development.
	Step 2: Build sustainable partnership.	• Differentiate between partners and service providers. • Agree on partnership goals, protocols and procedures. • Define partner contributions very clearly • Clarify project leadership and management roles. • Clarify role of service providers. • Develop clear partnership and communication plan.
	Step 3: Mobilise resources sustainably.	• Develop transparent cost models and apply a total cost of ownership approach • Develop resource mobilization strategies
	Step 4: Market initiative successfully.	• Develop communication and marketing plans. • Discuss with critical stakeholders what the most important messages are.
	Step 5: Manage service providers and third-party contractors.	• Formalize and manage external supplier relationships. • Conclude Business agreements to guide the relationships with service providers. • Establish Service level agreements (SLA) to ensure service quality. • Identify and manage external supplier-related risks. • Manage external supplier performance. • Audit external supplier performance against service level agreements.

	Step 6: Implement in phases.	**I. Proof-of-Concept phase:** • Develop an initial proof of concept document. • For efficiency, keep the number of solutions for testing to a minimum and focusing on high-priority use cases. • Do not over-engineer the initiative. • Do not commit to investing in expensive solutions at this stage. • Keep a negotiation mindset. • Manage deployment of solutions proactively. • Evaluate the concept at the outset, over a short period. • Keep the momentum by following quickly onto the pilot phase. **II. Pilot phase:** • Target a small number of villages over 12 months. • Set up the relevant organizational and management structures at this stage. **III. Scale-up phase:** • Add additional villages to form a network of smart villages. **IV**. Full-scale phase: • Cover all villages in the country and include more mature and advanced applications and solutions.
MONITOR & EVALUATE	Step 1: Design a monitoring and evaluation framework.	• Ensure that the monitoring and evaluation framework design is a collaborative process. • Involve stakeholders when designing the theory of change and logic model for the digital transformation of the smart village. • Write out the theory of change and logic model as a narrative with stakeholders. • Design a framework that integrates all successive phases: the pilot phase, the scale-up phases and the full-scale phase. • Consider monitoring and evaluation designs that have been tried elsewhere.
	Step 2: Implement the monitoring and evaluation plan.	• Establish a steering committee to oversee and manage the monitoring and evaluation plan. • Hire an independent third party to conduct the monitoring and evaluation over time. • Ensure independent third parties can be held accountable by a steering committee. • Establish key moments on a timeline
	Step 3: Apply lessons from the monitoring and evaluation plan.	• Establish ways to implement and apply the lessons, including the cost implications. • Develop accessible and straightforward ways to communicate key messages from the monitoring and evaluation and lessons learned.

1. Defining the smart village concept

This is a step-by-step blueprint guide on how to establish, manage, and lead a smart networked rural villages project for sustainable development. The blueprint is for government officials, private sector investors, donors, development agency officials, and NGOs that are interested in investing and supporting such endeavour.

The United Nations Sustainable Development Goals (SDGs), adopted in 2015, committed the global development community to 17 inter-related goals and 169 targets focused on improving the quality of life for all. The SDGs and their targets are also focused on revitalising rural communities and their links with urban centres.

Figure 1: The 17 Inter-related SDG goals

Source: ITU.

With almost 80 per cent of the world's extreme poor living in rural areas, villages should become a key focus for interventions to meet the SDGs through digital transformation. However, most rural villages, mainly in least developed countries (LDCs), are challenged with low, limited, or non-existent essential elements in terms of:

- access to broadband Internet;
- access to electricity;
- digital literacy and skills.

Inclusive digital transformation can serve as a crucial enabler for rural development and can reduce rural-urban migration and rural poverty. Improving the living conditions in rural areas by addressing the root causes of poverty and hunger, investing in rural development through inclusive digital transformation, establishing social protection systems, building rural-urban linkages, focusing on boosting the incomes of smallholder family farmers, especially women and the young, is vital to inclusive and equitable growth.

Establishing smart villages is a holistic and inclusive approach for rural digital transformation towards achieving the SDGs in remote and underserved communities. This approach has been strongly endorsed by the Government of Niger, which launched a dynamic smart village project for rural growth and digital inclusion in 2019.

A rural village in its most basic sense is an area that is situated outside of towns and urban centres where often, small settlements and farms are scattered over vast tracts of agricultural land and forests. The rural population refers to the number of people who live in rural areas or villages.

Most countries in the Africa and Asia-Pacific regions have high numbers of people living in rural areas. For example, in Burundi and Uganda, 88.24 per cent and 84.23 per cent of the people live in rural districts. In Nepal, most of the population (81.76%) occupy rural zones. In the Asia-Pacific region, Samoa has 80.74 per cent, and on the Solomon Islands, 78.12 per cent of the population live in rural areas.

Along with high levels of poverty, low-income levels and poor infrastructure, lack of connectivity to the Internet rank among the biggest challenges in rural villages across the world. At the end of 2018, ITU confirmed that 51 per cent of the world population is online, meaning they have access to the Internet. However, the rest who are offline reside essentially in least developed countries and rural regions. For inclusive social transformation to take effect in rural villages, having access to the Internet under appropriate conditions can serve as a crucial enabler to meet the SDGs. Delivering critical social development programmes through connected rural villages is a strategy towards meeting the SDGs.

1.1 What is a smart village?

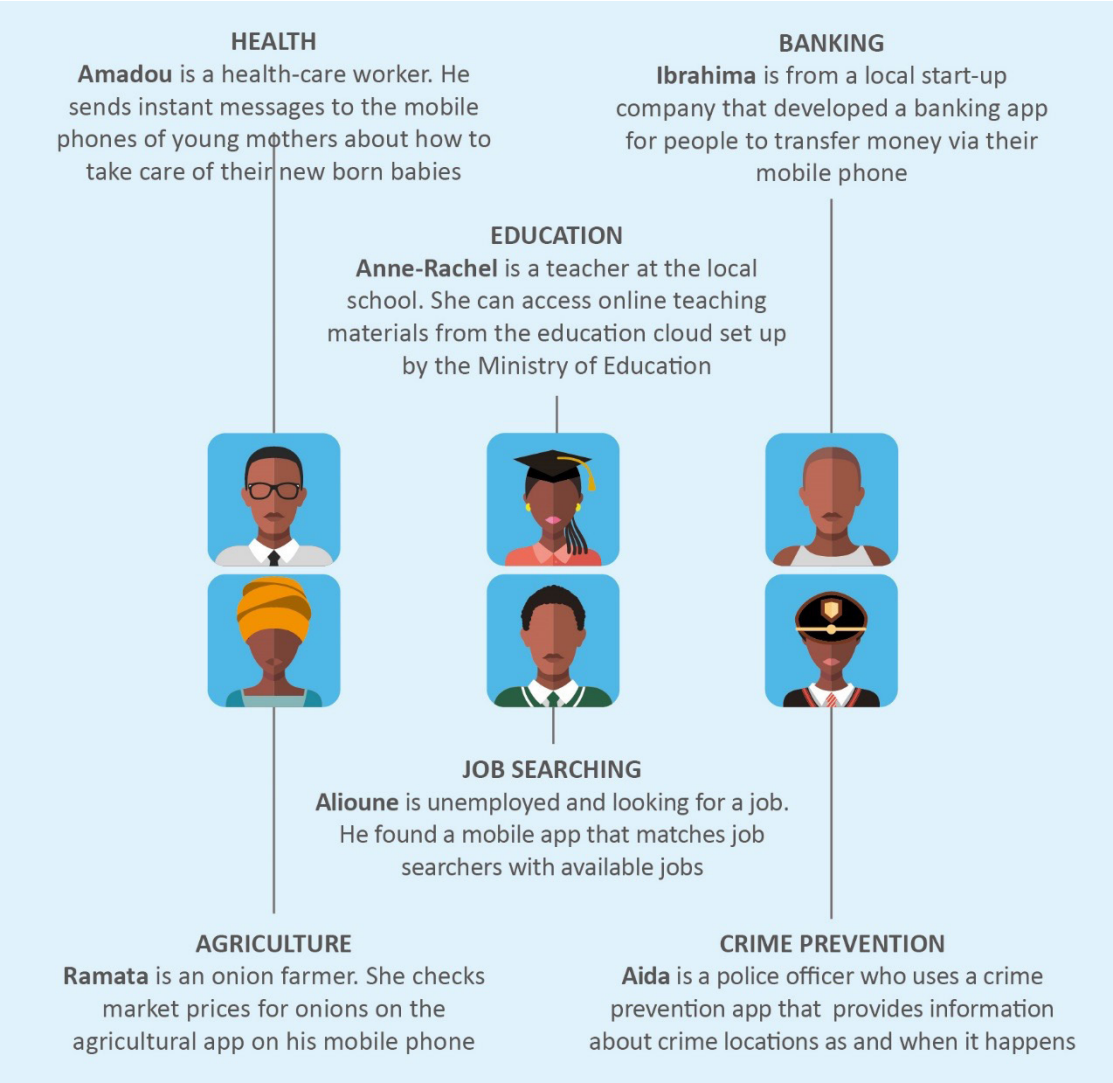
A smart village is a community in rural areas that leverages digital connectivity, solutions and resources for its own development and transformation towards attaining the SDGs.

“Smart villages […] develop smart solutions to deal with challenges in their local context. They build on existing local strengths and opportunities to engage in a process of sustainable development of their territories. They rely on a participatory approach to develop and implement their strategies to improve their economic, social and environmental conditions, in particular by promoting innovation and mobilizing solutions offered by digital technologies. Smart villages benefit from cooperation and alliances with other communities and actors in rural and urban areas. The initiation and the implementation of smart village strategies may build on existing initiatives and can be funded by a variety of public and private sources.”[1]

Connectivity alone cannot deliver optimal rural citizen services. Strong leadership, political will, strong partnerships, multi-stakeholder engagement, citizen-centred programmes are among the critical ingredients that will ensure that the digital network infrastructure can deliver sustainable development of inclusive and equitable services. Figure 2 shows a range of services that can be provided to citizens in such an inclusive networked smart village.

[1] Following a survey and consecutive consultations held in 2017, the above working definition was adopted by the European Union Smart Villages Pilot Project. See the official website of the Project: http://pilotproject-smartvillages.eu/ Accessed on 14 February 2020.

Figure 2: Examples of services to citizens in a networked smart village



Source: ITU.

A smart village can focus on digital transformation in the following sectors for example:

- **Health**: the deployment of telemedicine and digital health services will allow patients to have remote consultations and healthcare workers to deliver efficient services.
- **Banking**: support access to digital financial and investment services for citizens and businesses.
- **Education**: the access to open and distance learning opportunities will enable capacity building for teachers and education administrators as well as providing equitable access to quality literacy, lifelong learning and skills programmes for children, youth and adults.
- **Job search**: services that can assist unemployed people to find jobs and to enhance their employment skills.
- **Agriculture**: digital agriculture services can support efficient and productive farming capabilities among farmers.
- **Crime prevention**: applications and services for local law enforcement to communicate and share real-time information to keep communities safe.

All these services affect the lives of village citizens who, over time, are becoming digital citizens.

Smart villages can thus provide the following benefits:

- citizens and institutions can access integrated services, when needed, anywhere, quickly and at any time;
- services can be customised for specific needs of individual citizens, organizations or institutions;
- the package of integrated services is continuously improving, adapting to changes in local needs;
- the network of partner organizations involved in setting up and managing the smart village are continuously learning, adapting and customizing their offerings; and
- government leadership adopts an integrated, cross-ministerial, cross-sectoral, whole-of-government approach.

1.2 Why is a smart village approach needed?

Traditional approaches have failed to solve some of the most pressing problems in the world's rural areas. A smart village approach is a socially-driven initiative that departs radically from traditional design and implementation mechanisms of rural development projects. Table 1 illustrates ways in which a smart village approach differs in design and implementation approaches to rural development.

Table 1: Traditional vs smart design and implementation

Traditional design and implementation	Smart design and implementation
Top-down, hierarchical structures, management and decision-making.	Distributed, networked management structures and decision-making.
Every sector and ministry work in silos leveraging fragmented technologies.	Integration of sectors to focus on citizen experience leveraging innovative technologies.
Rigid and rule-bound.	Flexible and adaptable to change.
Many layers of management and decision-making.	Streamlined decision-making.
Stakeholders working on their own to achieve narrow goals.	Multi-stakeholder integration, collaboration and collective action towards shared goals.
Handling issues one by one.	A holistic view involving different dimensions of sustainability.
Duplication of investments and infrastructure among different ministries and projects	Shared and re-used infrastructure and investments

Smarter organizational and decision-making mechanisms will enable governments and their partners to deliver better services in rural areas to all citizens, equitably and inclusively, improving quality of life.

1.3 Social transformation through inclusive digital transformation

Smart villages will deliver SDG-related services and improve the quality of life for rural citizens through an inclusive digital transformation process, which means a continuous improvement to the way SDG-related service delivery is conceptualized, planned, designed, deployed, and operated, to improve daily life in the most impoverished communities.

Through inclusive digital transformation, rural citizens become digital citizens who, based on their consent and their needs, receive services that are personalized, and (where appropriate) paperless, and cashless. This report explains how the digital transformation process will unfold within an often resource-challenged rural context.

The potential of connectivity solutions in low-income settings: the case of Pamoja Net initiative in the Democratic Republic of Congo.

In 2016, a social business incubator *Ensemble Pour la Différence* began deploying the first WiFi network for the communities of Idjwi - an island on Lake Kivu in the Democratic Republic of Congo where the population suffered from exceptionally high levels of extreme poverty and lacked access to the most basic services. In collaboration with local businesses and a technology company Fjord, Ensemble provided start-up capital and installed the necessary infrastructure. An Internet access kiosk was built in the major market town on the island, granting Wi-Fi connection to the visitors. Over time, more than 3 900 people gained connectivity thanks to the project that was named "Pamoja" (meaning 'together' in Swahili). Local business benefited from the new opportunities provided by the Internet and now fund 60 per cent of the monthly operating costs of the project. Local coffee cooperative CPNCK reported to have secured partnerships with international buyers thanks to the better ability to communicate. The subsequent evaluation of the project conducted by Ensemble found that 98 per cent of users felt that Pamoja Net had contributed to a positive change in their life.

For more information about the Pamoja Net, please visit: https://www.la-difference.com/innovation-article-community-internet

1.4 Pre-requisites for building smart villages

Building smart villages requires a shift in the mindset of government leaders, managers and officials, partners and stakeholder organizations to work collaboratively, and across agency silos, towards common objectives.

A whole-of-government approach is needed

A whole-of-government approach[2] is a holistic and integrated method of planning, designing, and delivering government services and operations. It requires government to coordinate across and between ministries and government organizational structures to work together on policy

[2] "One where a government actively uses formal and/or informal networks across the different agencies within that government to coordinate the design and implementation of the range of interventions that the government's agencies will be making in order to increase the effectiveness of those interventions in achieving the desired objectives." See Organisation for Economic Co-operation and Development (OECD). Whole of Government Approaches to Fragile States. 2006. https://www.oecd.org/dac/conflict-fragility-resilience/docs/37826256.pdf Accessed on 14 February 2020.

development, citizen engagement, and service delivery. This approach is cost efficient, particularly with infrastructure, or investment, shared by all government departments, projects, and initiatives. It will allow the consideration of a comprehensive 360-degree view of citizen needs and the provision of an integrated set of services that respond to different aspects of wellbeing and livelihood.

A whole-of-government approach is not only targeted at national ministerial level but also at the municipality and village level where the different village and municipal authorities collaborate on joint activities. A whole-of-government approach is based on a shared recognition that:

- One agency or ministry can no longer solve complex development challenges on their own.
- Investments into digital platforms and services can be applied across sectors and agencies, resulting in far greater leveraging of investments, and thereby making national scale up possible from a resourcing standpoint.
- Each agency or ministry can contribute unique talents, skills, and expertise towards collective problem-solving.
- Wasteful expenditure on duplicated resources and bloated organisational structures can be reduced.
- Operational, governance, business process, and cost efficiencies can be gained for all of government and public service delivery.[3]
- A united, coordinated effort to aggregate demand in government can help build negotiating power, both for cost efficiencies and terms, when engaging and negotiating with non-state stakeholders such as the private sector and donor agencies.[4]
- A culture of sharing and collaborative problem-solving can be developed within the government.

However, adopting a whole-of-government approach means that governments will need to challenge deeply entrenched silo and territorial behaviour consciously. Doing so means that governments will need to:

- understand the organisational cultures and incentives that breed territorial and silo behaviour in order to develop strategies that nurture a sharing and collaborative culture;
- develop a clear understanding of the specific ways in which coordination will work across different ministries and government agencies;
- develop strategies for collaboration that deal specifically with the way silo behaviour exists within government ministries and institutions;
- build trust, grow knowledge of different agencies and ministries within government and develop facilitation and collaboration skills within government (Ojo & Janowski, 2010).

The smart village concept proposes a process of growing a culture of collaborative problem-solving through whole-of-government efforts in support of the SDGs through digital transformation.

Governments need to demonstrate strong political will

Political will is a complex concept that includes the commitment of political actors to undertake political actions to achieve a set of objectives and to sustain the costs of those actions over time (Brinkerhoff, 2010). From a sustainable development perspective, this will also involve leadership behaviour and political decision-making that can manage the potential political cost of popularity among some people, for the benefit of the public and society as a whole.

[3] Useful case studies on abandoning silos: https://munkschool.utoronto.ca/mowatcentre/abandoning-silos/ Accessed on 14 February 2020.

[4] See the Australia Government Digital Transformation Agency 2017-18 annual report at: https://www.dta.gov.au/about-us/reporting-and-plans/annual-reports/annual-report-2017-18 Accessed on 14 February 2020.

Through political will, the commitment of government leaders to change the conditions of poor and marginalised villages and rural communities will have to be visible and consistent over a long period.

Indications of political will include:

- credibility through leadership: that it gains credibility if the government instead of non-state actors lead it;
- well-founded and carefully considered policies: that policies or programmes driven by political will must have a technically sound foundation where options, choices, costs, benefits and outcomes have been carefully considered;
- stakeholder involvement: that policy or programmes driven by political will needs to be premised on consultations and engagements with stakeholders in order for it to be credible and gain support and buy-in;
- funding: dedicated public spending is allocated as a tangible expression of prioritised political intent and political will; and
- long-term vision: there is continuity of effort that demonstrate political will over time.

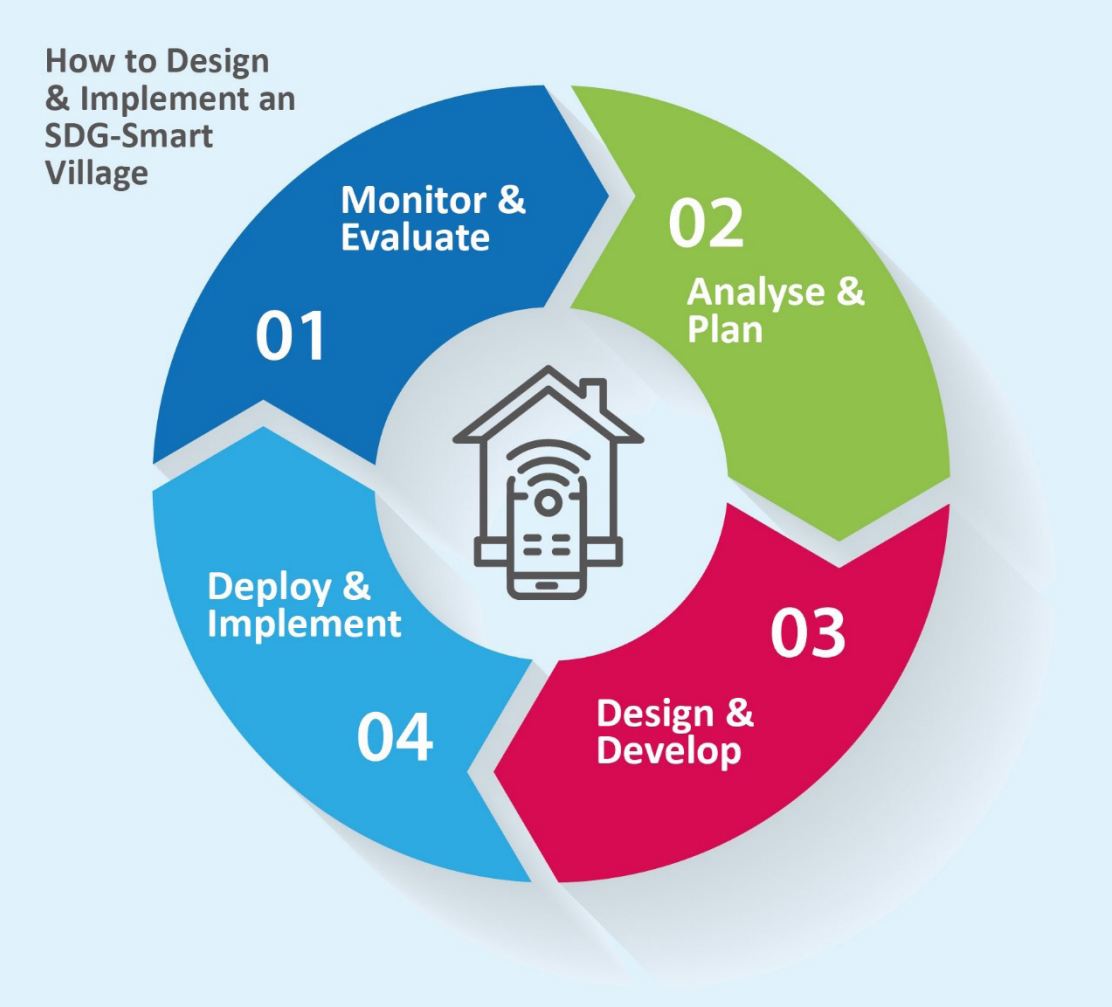
Sometimes exercising political will requires a capacity within governments to act on decisions driven by political will. The need for new skills, mechanisms, procedures, and resources may hinder the emergence of political will, especially when the capacity for implementation is limited. It becomes important, therefore that governments invest in building capacity to make decisions and manage their implementation in ways that encourage accountability and transparency.

1.5 Designing a smart village

The process of designing a smart village will require an approach that is iterative and consistently guided by the local conditions in the village and its sustainable development needs. Such an approach requires strong local leadership, a citizen-centric planning, design, implementation and continuous evaluation based on effectively-led multi-stakeholder partnerships.

Such an approach is comprised of reinforcing phases: analyse and plan, design and develop, deploy and implement, and monitor and evaluate on an ongoing basis, as shown in Figure 3.

Figure 3: Establishing a smart village - design approach



Source: Principles for Digital Development Project lifecycle phases.

2. Phase 1: Analyse and plan

Goal: Learn from and analyse what has been done by others and establish guiding principles to support the digital design process.

2.1 Step 1: Learn from past experiences and initiatives

The idea of setting up a smart village in an impoverished rural community is not new. Several communities across the world have set up smart villages before, and importantly, smart villages and smart cities are now mushrooming in many countries across the globe. What can we learn from these attempts?

Learn from existing smart village initiatives everywhere

Smart villages have been sprouting up across the world.

- Smart Villages Initiatives in Hyderabad, India. They leverage public sector funding to develop entrepreneurial activities to provide energy services to communities and villagers.
- European Network for Rural Development[1]: This provides insights on a range of smart villages and their activities in rural areas across Europe. They also provide tools and resources for managers of the villages in their network.
- Niger 2.0 Smart Villages: This is a recent initiative by the Government of Niger and its partners, aimed at expanding Internet access across the country through improved broadband infrastructure and access to digitally enabled services in health, agriculture, education, finance, and commerce.
- Millennium Villages Project (MVP): Since 2005, a small number of villages have also been set up in selected countries in the Africa region, from which many valuable lessons can be learned.

Lessons from past experiences: The case of the Millennium Villages Project (MVP)

The Millennium Villages Project was a 10-year multi-sector, flagship initiative of the UN Millennium Project set up to pioneer integrated rural development models in ten countries in the Africa region. The project provided fertiliser and seed to improve food yield; anti-malarial bed nets; improved water sources; diversification from staple into cash crops; a school feeding programme; deworming for all; and the introduction of new technologies, such as energy-saving stoves and mobile phones. One of the evaluations of the project found significant impact or 30 out of 40 outcomes, particularly in agriculture and health. It also found no significant impact on the consumption-based measures of poverty, but a significant favourable impact on an index of asset ownership. Impact on education and nutrition was inconclusive (see Mitchell et al., 2018)

Source: The Economist, 2006

[1] Visit the official website of the European Network for Rural Development at: https://enrd.ec.europa.eu/enrd-thematic-work/smart-and-competitive-rural-areas/smart-villages_en Accessed on 14 February 2020.

Figure 4: Millennium Villages in the Africa region

Source: The Economist, 2006

Even though it was the subject of intense debate (Kimanthi & Hebinck, 2018), the Millennium Villages Project was one of the few development projects that were subject to rigorous evaluation (Mitchell et al., 2018). Key lessons in general and for the Ghana project in particular (Barnett, 2018), concluded that:

- the project was very dependent on outside financial support and human resource capacity;
- the project was not cost-effective, development gains could be achieved at a lower cost;
- the project aims were over-ambitious; and
- while the project made a few gains and had some successes, they could not be sustained.

Therefore, the smart villages approach needs to focus on obtaining long-term inclusive sustainable growth using cost-effective smart solutions. In this regard, the smart sustainable city (SSC) concept can provide a useful blueprint for establishing the smart village approach.

Developed based on the international standard Recommendation ITU-T Y.4900, a SSC can be defined as: " an innovative city that uses information and communication technologies (ICTs) and other means to improve quality of life, efficiency of urban operation and services, and competitiveness, while ensuring that it meets the needs of present and future generations with respect to economic, social, environmental as well as cultural aspects."

International standards, such as those developed by ITU-T Study Group 20 "Internet of Things and smart cities and communities", can provide valuable guidance on developing a comprehensive approach to addressing smart cities and communities needs and tackling interoperability and scalability challenges of ICT solutions. They can be used to inform the design and deployment of certain components of the smart village ICT infrastructure, lower the cost of ICT solutions and ensure that the benefits of ICTs are accessible by all. [5]

Furthermore, the United for Smart Sustainable Cities (U4SSC) initiative has developed a set of international key performance indicators (KPIs) for SSC[6] to evaluate the smartness and sustainability of a city, many of which can also be applied in the context of smart villages. For example, basic water supply, wireless broadband coverage, electronic health records, and other.[7] Each KPI is also uniquely connected to one or multiple targets set in the 2030 Agenda for Sustainable Development Goals (SDGs), making them the ideal tools for smart villages to assess their progress in the SDGs.

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5 ITU activities on Smart Sustainable Cities: https://www.itu.int/en/ITU-T/ssc/Pages/default.aspx .

6 Collection Methodology for Key Performance Indicators for Smart Sustainable Cities. 2017. Accessible at: https://www.itu.int/en/publications/Documents/tsb/2017-U4SSC-Collection-Methodology/index.html Accessed on 11 May 2020.

7 Additional useful information may be found on the dedicated webpage of the U4SSC initiative, including case studies and examples of relevant ICT solutions: https://www.itu.int/en/ITU-T/ssc/united/Pages/publications-U4SSC.aspx.

In addition, the U4SSC has developed a series of deliverables that include practical tools and policy recommendations to support the transition to smart sustainable cities. Smart villages can leverage these resources to guide their development and inform their decision making.

Another relevant approach to rural connectivity and ICT deployment is through Community Networks.

As a result of the wide availability of low-cost off-the-shelf electronic networking equipment, there are increasing numbers of small-scale public networks which have been developed by the local population who take responsibility for the deployment, governance and maintenance of their physical communications infrastructure. These initiatives can adopt a variety of business models, cost recovery strategies and startup financing. Usually, their startup costs are minimised due to the low cost of the equipment, opportunities for in-kind contributions (especially labour and premises on which to mount masts or electronic equipment), and the sharing of other institutional resources in the area. Depending on the local conditions, more or less ambitious business models can be used, ranging from co-operative ownership by the community, to local entrepreneur-led initiatives and village authorities which may simply host services for deployment and/or management of the network infrastructure deployed by commercial MNOs, ISPs and government networks.

Information on community network projects in a wide range of low- and middle-income countries is available from thematic reports by the Association for Progressive Communications (APC) and the Global Information Society Watch (GISWatch).[8]

The potential of the community networks has also been explored by in a number of other publications and resources,[9] including the UNHCR report Community-led Connectivity: Assessing the potential of Community Network Models in the context of forced displacement in East Africa.[10]

It is essential that newly-emerging smart villages learn the lessons from similar past and present experiences.

2.2 Step 2: Establish guiding principles

Based on the lessons from past and present experience with setting up, managing and sustaining smart villages, the following suggested starting principles serve as valuable guidelines for the project to build upon. While each new smart village may identify their own additional principles based on their own context and effort, it is useful to start with the commonly accepted Principles for Digital Development[11] (Digital Principles) as a foundation.

8 See APC. (2019). Bottom-up Connectivity Strategies: Community-led small-scale telecommunication infrastructure networks in the global South. Accessible at: https://www.apc.org/sites/default/files/bottom-up-connectivity-strategies_0.pdf Accessed on19 May 2020. and GISWatch. 2018. Community Networks. Accessible at: https://www.giswatch.org/community-networks Accessed on 19 May 2020.

9 See, in particular, Information Society. (2017). Supporting the Creation and Scalability of Affordable Access Solutions: Understanding Community Networks in Africa. Accessible at: https://www.internetsociety.org/wp-content/uploads/2017/08/CommunityNetworkingAfrica_report_May2017_1.pdf Accessed on 19 May 2020 and the official webpage of the Fourth Summit on Community Networks in Africa: https://www.internetsociety.org/events/summit-community-networks-africa/2019/ .

10 UNHCR. (2020). Community-led Connectivity: Assessing the potential of Community Network Models in the context of forced displacement in East Africa. Accessible at: https://www.unhcr.org/innovation/wp-content/uploads/2020/05/Community-led-Connectivity-WEB052020.pdf Accessed on 19 May 2020.

11 Principles for Digital Development can be found at the official website at: https://digitalprinciples.org/principles/ Accessed on 14 February 2020.

The Digital Principles in their current iteration were created in 2015 by a diverse group of development practitioners and stakeholders. It was understood at the time that "Principles are valuable because they synthesize existing guidance in order to create a common vision about how to institutionalize lessons learned in the use of digital technologies to support development."[12] Though initially endorsed by 54 organizations, today over 200 organizations and 1,600 global practitioners use the Digital Principles to guide the design of digital services.[13]

The following principles draw upon the global work to define the key nine Digital Principles. Please visit www.digitalprinciples.org for more information, resources and tools.

Design with the user or citizen

This is equivalent to citizen-centred design. It means including processes that actively involve and engage with citizens when designing and developing a product or service geared towards their needs. Tools that involve observations, conversations and then support citizens in co-creating designs that serve their needs, are valuable to include.

Tools for rural citizen-centred design

The following are citizen-centred design tools that you may find useful:

1. human centred design allows you to learn about principles, tools and strategies that you can employ;
2. the collaborative requirements development methodology has been used widely in the health sector;
3. user experience for the masses guide provides additional tools that you may find useful.

Understand the ecosystem, specifically the rural ecosystem

This means understanding the different stakeholders, their needs, getting to know the challenges, complexities, tensions and contradictions among different stakeholders and role-players in the ecosystem. In this way, the design of the products, processes and services will be sensitive to the conditions within which the village is engaged.

Tools for understanding the rural village ecosystem

Here is a video on how to map the stakeholders in your ecosystem which is essential to understand who all the players are in the ecosystem.

[12] Adele Waugman. From Principles to Practice: Implementing the Principles for Digital Development. 2016. https://digitalprinciples.org/wp-content/uploads/From_Principle_to_Practice_v5.pdf Accessed on 14 February 2020

[13] As of February 2020.

Design for scale and complexity for rural contexts

This means that the design should not centre only on a small-scale pilot that reaches only a few stakeholders and citizens. Instead from the beginning, the design should consider reaching all villagers, citizens and institutions universally over a realistic period. This mainly involves designing to continuously secure funding and local ownership so that the initiative can continuously reach new communities and expand.

Tools for designing at scale

Designing for scale in most rural contexts means also designing for a youth population. There is a wealth of resources to support youth-friendly design at scale. ITU has also led digital inclusion for youth that also provides useful design insights.

Build for sustainability

One of the essential lessons from the smart village initiatives is that we need to establish a smart village to be sustainable at the outset. This involves including in the design from the beginning tools and mechanisms that can ensure the sustainability and long-term impact. In other words, the project must be designed in a way that ensures that it can be sustained over a long period.

The Digital Principles recommend that the team involved in setting up the smart village must develop a local definition of sustainability. Sustainability also requires identifying a local champion that will drive forward the smart village initiatives and continue to advocate for the program.

Tools for designing for sustainability

Planning for sustainability also means planning for the financial sustainability of the smart village. This means ensuring that there is a steady flow of income and revenue to maintain the activities and the involvement of institutions which run the village. This example of a financial sustainability site provides useful ideas such as diversifying donors and having a strong marketing and communication strategy. Another useful resource is the MAPS Toolkit provided by the WHO.

Be data driven

For managers and leaders of smart villages to make effective decisions, they need to access accurate data quickly and efficiently. Data is a strategic asset for all decision-makers. This means that you need to establish effective data systems as an integral part of the smart village system. It also means using existing data systems already in place and building on them for continuous improvement. Importantly too, it means designing and producing data so that everyone can easily understand them. Here it becomes essential to use visualisation tools creatively and ensure that the data is shared regularly with all citizens, organizations and institutions. Moreover, it also means investing in developing the capacity of all decision-makers to be competent in the production and use of data.

1. Consider ways in which the data will be collected, how regularly they would be collected and in what formats they would be made available to decision-makers;
2. Present data in ways that are accessible to decision-makers;
3. Clarify how data will be used and collected responsibly in accordance with local and international standards;
4. Clarify how the data will subscribe to open data standards and inter-operability.

Tools for data-driven decision making

This open data kit contains tools for data-driven decision-making.

Open data standards are publicly available standards that are developed through collaboration and sharing. See https://codeforaotearoa.github.io/.

Address privacy and security

An important consideration when using data for decision-making is how those data are collected, stored, shared, and disposed of. Managers and leaders of smart villages must take measures to minimize collection and to protect confidential information and identities of individuals represented in data sets from unauthorized access and manipulation. Consider the sensitivities around the data being collected, be transparent about how data will be used, minimize the amount of personally identifiable and sensitive information collected, create, and implement security policies that protect data and uphold individual privacy and dignity, and create a destruction policy for post-project data management.

Tools for addressing privacy and security

This Data Management Plan tool from Stanford Libraries provides templates for creating your own data management plan.

UN Global Pulse has also developed a Risks, Harms, and Benefits Assessment tool for data use in programmes.

Use open standards

Open standards are specifications developed by, agreed to, adopted by and maintained by a community to enable sharing of data across tools and systems. Such standards are important for consistency and accountability, ensuring digital programmes benefit citizens and do no harm. Local standards may exist within a country or community where a smart village is located; these policies and standards might include national policies for open government, donor open access policies that require that publications are made freely available or aid transparency standards. They should be adhered to whenever possible and appropriate to do so.

Tools for using open standards

When possible, check to see if there are relevant industry standards available. Some example resources are HL7 FHIR for digital health, FIDO for authentication, or IEEE for electrical or electronics standards.

Reuse and improve on existing solutions

To reduce costs for investments in technology products or services, managers and leaders of smart villages can look to reuse or improve upon solutions that have proven effective in other villages or contexts. While an existing product or approach may not exactly fit all of the project needs, improving and building on it, rather than creating something entirely new, can be more cost effective and preserve interoperability.

Tools for reusing and improving

Review catalogues and existing registries, both within country or globally, to see if there are existing products and solutions to use or build upon. One example, is the Online Catalogue hosted by DIAL which aggregates products from multiple sources and associates those solutions to ICT building blocks within the SDG Digital Investment Framework in an interactive format.

Develop solutions that are Locally appropriate, equitable and Inclusive

Many interventions for impoverished rural contexts have been designed from the perspective of wealthier more resourced contexts. Learning the lesson from this means that from the outset, the design process must be sensitive to the conditions of poverty, limited human resource and environmental capacity as well as the potential and vision to surpass these conditions.

In sub-Sahara Africa, for example, many rural communities lack access to even the basic resources. In particular, over 55 per cent of the rural population do not enjoy basic drinking water supply[14] and more than 77 per cent lack access to electricity[15]. The literacy rate in the region is comparatively low (at around 61 per cent)[16], which imposes limitations on the types of communication services that can be deployed in target communities. These factors need to be carefully considered at the stage of intervention design to ensure effectiveness and applicability.

This is an important principle. It involves making sure that the solutions that are applied are accessible and geared towards those who are most disadvantaged and marginalised and encourages their inclusion, recognition, and active participation.

Tools for local relevance & equity design

UNESCO has published with Pearson set of guidelines on “Designing inclusive digital solutions and developing digital skills”.

In rural South Africa an oral communication repository was created where villagers can share their stories.

[14] Progress on household drinking water, sanitation and hygiene 2000-2017. Special focus on inequalities. New York: United Nations Children’s Fund (UNICEF) and World Health Organization (WHO), 2019.

[15] Estimates from the World Bank, Sustainable Energy for All (SE4ALL) database from the SE4ALL Global Tracking Framework led jointly by the World Bank, International Energy Agency, and the Energy Sector Management Assistance Program.

[16] UNESCO Fact Sheet: Sub-Saharan Africa. Accessible at: https://en.unesco.org/gem-report/sites/gem-report/files/fact_sheet_ssa.pdf .

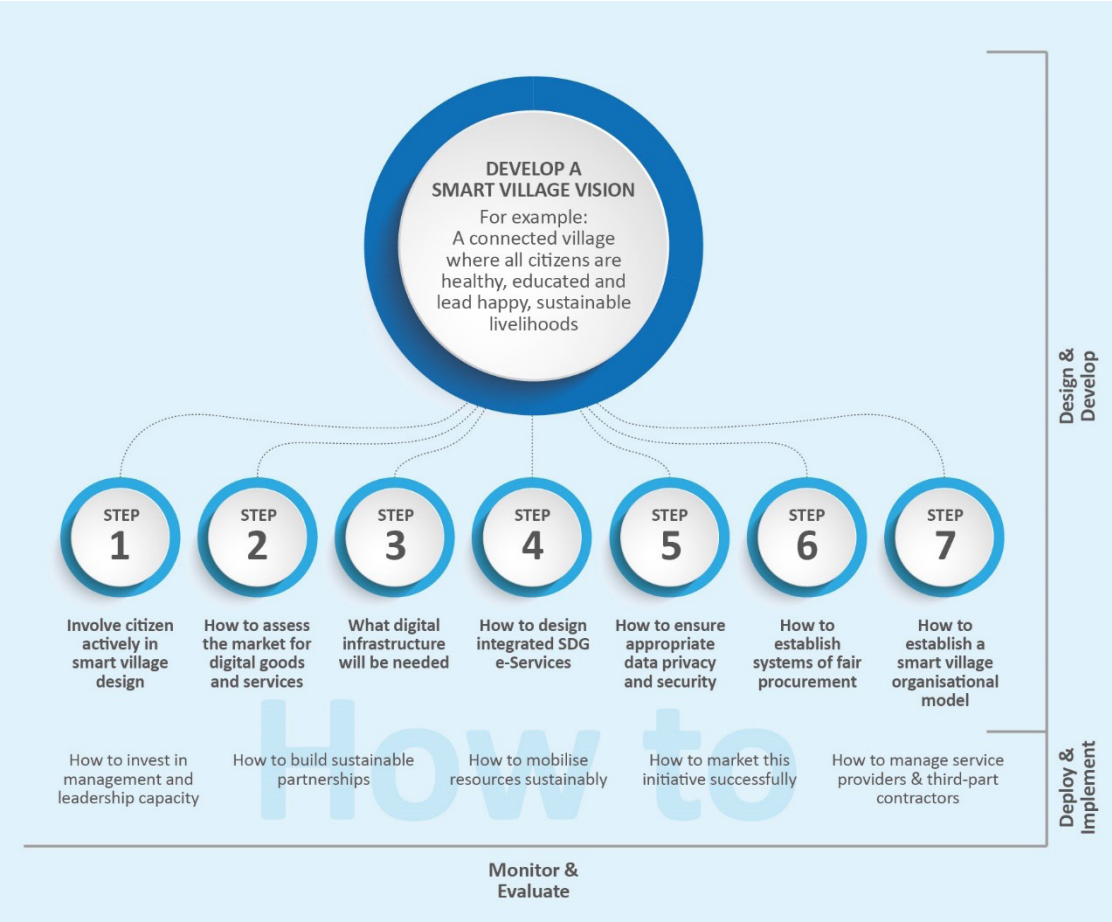
3. Phase 2: Design and develop

Goal: Design appropriate and relevant digital services based on citizen needs and demand. Develop (and/or select) quality services and solutions.

3.1 Step 1: Adopt a holistic and integrated design approach

The need to adopt holistic, integrated and well-coordinated design for the establishment of smart villages is consistent with a whole-of-government approach. Such an approach requires multi-sectoral, multi-disciplinary and multi-stakeholder engagement. Figure 5 is an illustrative example of what an integrated approach may include.

Figure 5: An integrated design model



Source: ITU.

A holistic and integrated approach will include a clearly stated aspirational and inspirational shared vision that articulates the interests and aspirations of all the citizens and stakeholders of the rural village covering different aspects of their life. This is different from other approaches that focus on one particular issue or try to solve a specific problem. The approach proposed for the smart villages should adopt a comprehensive view to consider and identify different needs of citizens in terms of their health, livelihoods, education, employment, etc. It should seek to propose integrated set of digital services that would address several of those needs leveraging the same investment.

To implement this integrated approach, the process could be guided by any of the available tools or methodologies such as enterprise architecture methodologies e.g., TOGAF[17] that could be leveraged as a framework for designing, planning, implementing, and governing an enterprise (the village in this case) information technology architecture including business, application, data, and technology levels. The following steps demonstrate how to undertake this integrated approach.

3.2 Step 2: Involve citizens actively in smart village design

There are several ways to involve citizens and stakeholders in the design process, below are a few examples:

1. Host village meetings or events focused on engaging citizens about their most pressing needs and importantly, tap their ideas on how to address them.
2. Encourage service providers to design citizen engagement platforms.
3. Conduct a survey that asks essential questions. If citizens cannot read and write you can ask them to call into a radio station to provide answers.
4. Arrange for organised focus group discussions on SDG-related issues that can give ideas on creative responses to providing SDG-related services.

Tools to involve citizens in smart village design

While designed for citizens of cities from wealthy countries, there are mobile apps to engage with citizens that can be designed for local conditions in rural areas.

Another is to capture stories of citizens which they can relate orally or write about. They can also even produce photos or videos in telling their stories. Storytelling is a powerful tool. Here are some tips from free code camp on how to use storytelling.

This is a detailed case study on user-centered design in a rural area in South Africa that describes the methods they used.

5. Ensure that you have included all relevant stakeholders in the consultation and active participation process. In this way, shared ownership of the smart village is encouraged at the outset.

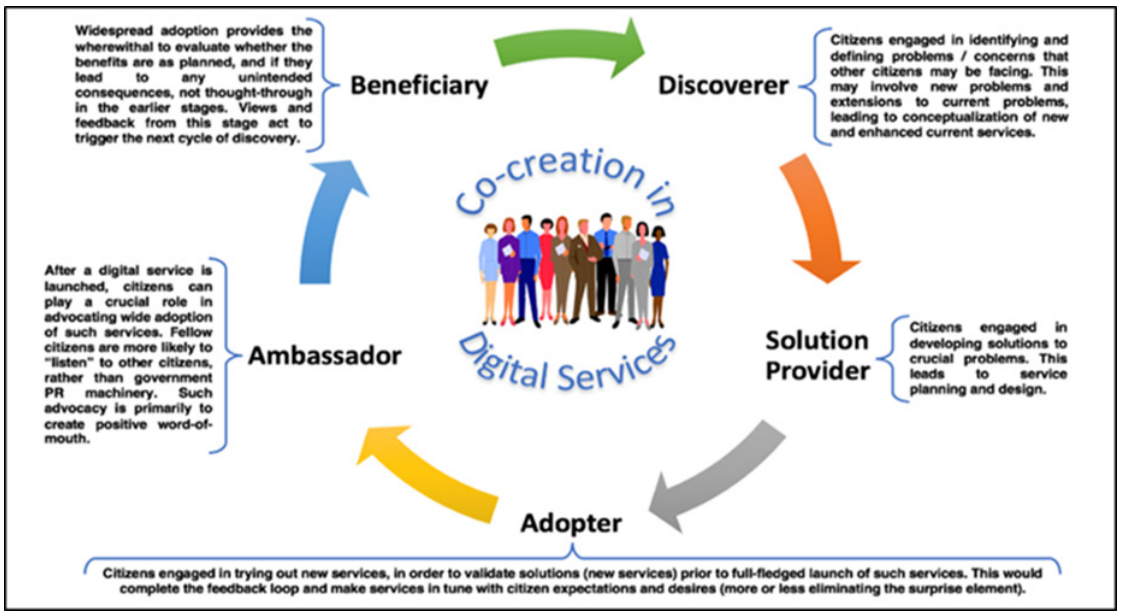
Stakeholder mapping and engagement tools

This is a useful stakeholder analysis tool that helps you define the stakeholders and map them onto a matrix of who has power and whose interest matters.

Remember, citizen insights provide the cornerstone of the digital transformation process. Citizens can fulfil various roles as discoverers of digital services; as solution providers; as adopters of digital services; as advocates and ambassadors for digital services; and as beneficiaries as shown in Figure 6.

[17] The TOGAF® Standard Version 9.2 Overview is available at: https://www.opengroup.org/togaf Accessed on 15 February 2020.

Figure 6: Role of citizens in co-creating digital services



Source: ITU (2019).

3.3 Step 3: Assess the market and demand for digital applications and services

Many investors and donors would want to know the nature and potential of the market for digital solutions and services and what the strategies can be to grow and unlock the demand of rural population to digital connectivity and services through the smart village project.

To assess the market and demand for digital services and applications, it is important to:

1. Demonstrate genuine care for citizens and customers by building strong relationships and networks. Governments, organizations and companies that have been successful have invested in people and have devoted time to learn to know and care about their citizens and customers. For example, in India a company that invested in hiring people whom they trained up to go out to talk regularly to villagers, to get to know them, know their interests, build relationships with them so that they can be adequately served.
2. Understand what are the services or solutions that people already use to be able to offer services that leverage and add value to what they have already. For example, if social media tools are already used by local communities, this channel should be leveraged to deliver some of the smart villages services and content instead of creating a new one.
3. Understand current barriers to market growth and user adoption in terms of literacy, digital literacy, cost, cultural issues, etc. Again, this requires strategies to engage with citizens, communities and organizations to understand the barriers in order to break them.
4. Assess the maturity of local ICT market and ecosystem and the existence of local ICT companies, SME and entrepreneurs who can provide the required expertise to develop and deploy digital services. For example, to leverage any existing digital public goods products that are available as assets and resources under open source or creative commons licences, there is a need to verify which local partner can support their deployment and maintenance since in case of absence, the total cost of ownership (TCO) could be quite high.

Cluster citizens into market segments

Not all citizens will have the same needs and interests. It is useful to group individuals into market segments that have common needs and are distinct. These market segments will help in making key decisions on the development of services and content and the choice of needed hardware and software. Below are some examples of potential market segments in a typical rural village:

1. **Professionals:** these would include teachers, healthcare workers, agriculture extension workers, police officers, government officials or anyone in the village who has a professional role. They would have specific needs related to their work as well as their lifestyles. These would include, for example, their need for continuing professional development and access to online professional development courses and specialized digital services so that they can grow their respective skills and serve their profession.
2. **Students and youth:** these would include children in primary school and secondary school and youth who may be attending community courses or college or university. They may be attending education institutions full time or part-time. Different student and youth groups will require different learning applications, curriculum content, tools and devices that can support their learning. When students are attending their various institutions, they may not be able to download media-rich content from the Internet. These can be made available instead on caching servers to which the school or educational institution has access.
3. **Farmers:** Many rural village adults and youth practice subsistence farming and some practice small-scale commercial farming. They would have specific information and communication needs that would include information on weather patterns, crops, livestock, information about farming methods, prices of agricultural products, etc. Their information needs may also be media rich such as video and audio content that require high bandwidth. These can also be downloaded onto local village servers from the cloud so that farmers can access them at local community centres.
4. **Women:** A special emphasis should be given on serving specific women needs and interests to avoid excluding them from benefiting from digital services that will be available. Targeted content should be provided catering to their needs in a format and on a device that will be accessible and adapted to them.
5. **Village leaders:** This segment would require information that would help them make decisions about social and cultural issues that affect their respective communities.
6. **Community members:** The majority of village citizens are community members who would have a range of needs and interests. They might be interested in accessing social media or accessing entertainment and multi-media content.

Tools for market assessment

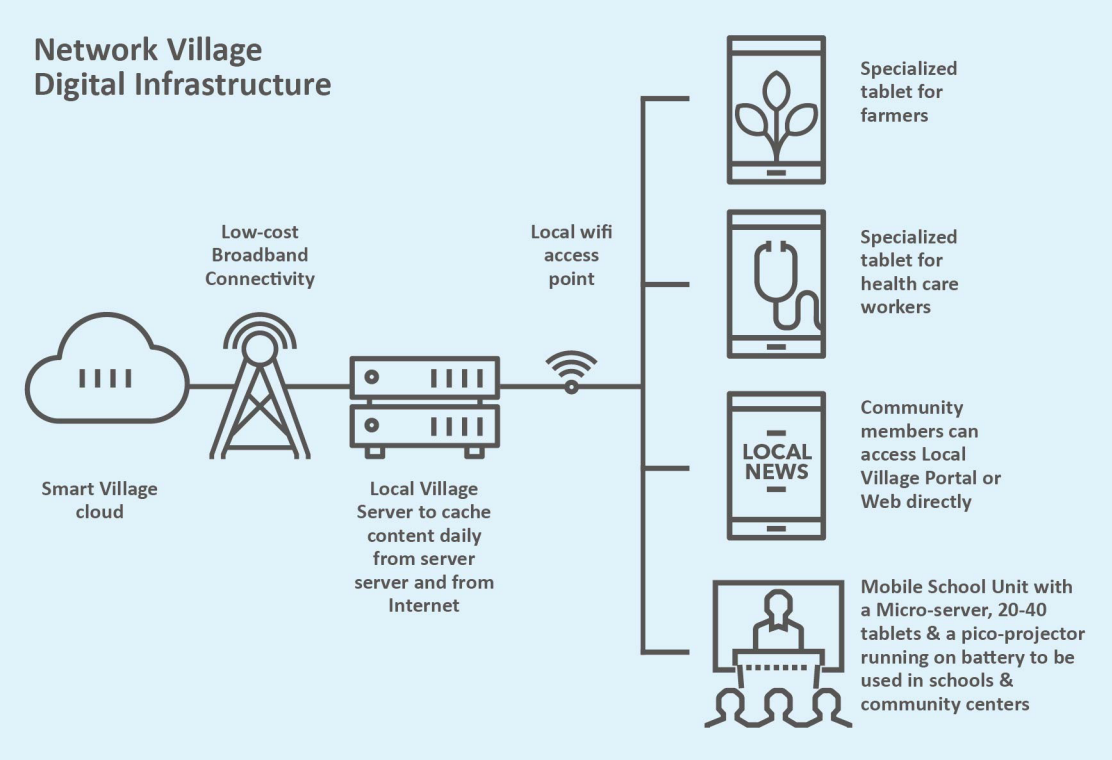
This is an interesting article that provides tips on the way bottom of the pyramid markets were unlocked in India.

This is a useful article that highlights the need to create markets by understanding market barriers.

3.4 Step 4: Decide what digital infrastructure will be needed

For all citizens to have access to SDG-related services, low cost affordable and sustainable digital infrastructure is required. Figure 7 is an illustrative example of a digital infrastructure model that could support a connected smart village.

Figure 7: A digital infrastructure model

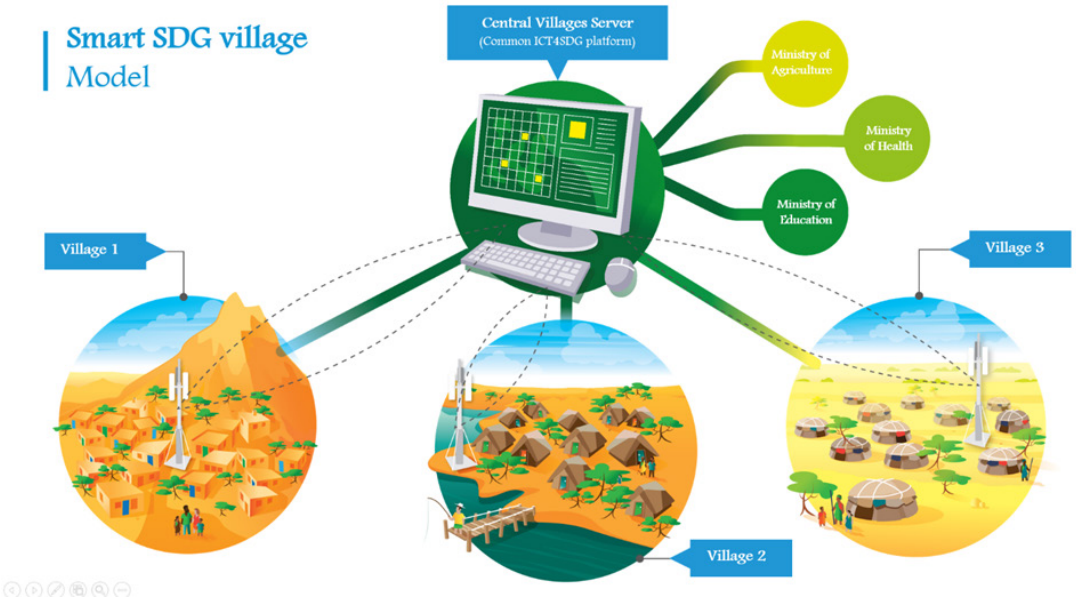


Source: ITU.

Figure 8 describes an approach to how the smart village network could be setup and managed. A centrally managed server can provide a common platform to manage all different applications used in the smart villages and secure access to service owners for example ministries of health, education, agriculture, etc. to access and manage their respective applications.

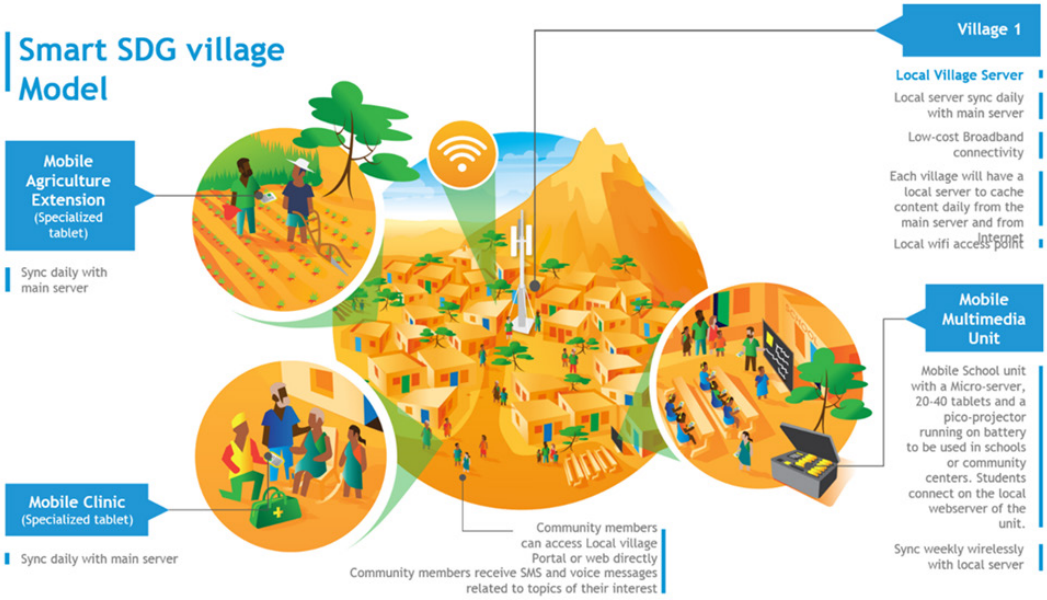
Having a centralized hosting and management of all digital assets and resources can facilitate the re-use of resources and allow for significant reduction in maintenance and operation costs.

Figure 8: A digital infrastructure model



Source: ITU.

Figure 9: A digital infrastructure model



The figure above describes how digital tools and ICT will manifest themselves physically in the context of smart villages and how citizens will interact with digital technologies and services for different purposes.

For this model to work, the smart village will have to invest in:

- low-cost sustainable power solutions;
- last and middle mile connectivity;
- access to connected devices;
- access to digital content;
- a local cloud hosted on a central server in the village;

- a smart village platform.

Low-cost sustainable power solutions

There is a range of power solutions from solar powered to grid electricity solutions. There are also versatile off-grid technology solutions available, such as solar solution in rural Uganda[18], a power solution in Nigeria[19], and another solar system[20] in a rural village context in Africa.

Last and middle mile connectivity

Affordable, quality, universal access to Internet connectivity has been one of the most prominent digital inclusion challenges in rural communities across the world. There are, however, increasing prospects for rural villages to leverage a host of low-cost connectivity solutions that are increasingly available. Last and middle mile connectivity is the biggest concern for rural connectivity. The range of technologies that can support connectivity include:

- Wireless technologies
  - mobile cellular
  - satellite: geostationary satellites (GEO), Low earth orbit satellites (LEO)
  - Wi-Fi
  - local area networks (LAN) and Internet of Things (IoT) technologies
- Wired technologies
  - optical fibre
  - coaxial cable
  - asymmetric digital subscriber line (ADSL)

Each of these solutions differs in terms of signal penetration, frequency, energy consumption, data range, bandwidth, mobility, cost, and market size, as well as how networks services are provided and whether they operate within a licensed or unlicensed spectrum.

Table 2: Examples of solutions for backhauling, middle and last mile connectivity

	Mobile Cellular	Satellite	Optical Fibre	Wi Fi
Coverage	Wide or metropolitan area	Wide area	Wide area	Local area
Data rate	Increasingly high	Increasingly high	Very high	Initial 54 Mbit/s to 14 Gbit/s (theoretical) expected for 802.11ax
Advantage	Popular for last mile connectivity	Connect remote and hard-to-access places	High performance High capacity of the fibre Low error rates in the transmission	Low cost access devices, widely available equipment, use of license exempt frequencies."

[18] CGTN Africa: https://www.youtube.com/watch?v=qQlYsy3pGp4 Accessed on 15 February 2020.
[19] CGTN Africa, off-grid solar power in Nigeria: https://www.youtube.com/watch?v=VlzlLrm8AaY Accessed on 15 February 2020.
[20] ZOLA Electric, decentralised renewable energy for Africa: https://www.youtube.com/watch?v=h_IMdVeBQVM Accessed on 15 February 2020.

	Mobile Cellular	Satellite	Optical Fibre	Wi Fi
Challenges	Service providers are reluctant to provide services in some remote and rural areas due to "low return in investment."	High costs are the main limitation	High cost of installing fibre to each premise The end to end path needs to have similar performance	If tower sharing is not available, it can be costly to erect large towers that may be needed for long distance links
Example of use	Many rural areas	Mexico uses satellite technologies to connect several rural villages	Used in many urban areas	India uses Wi-Fi as last mile connectivity solution in many rural areas

There are examples of low-cost sustainable WiFi connectivity solutions[21], and micro-server[22] installed in public transport vehicles and villages linked to a free public WiFi network[23] that allows anyone to get free access to the Internet.

An interesting alternative solution available in some contexts is TV White Space technologies (TVWS). This offers great potential to address long distance backhaul links at lower cost than Wi-Fi and can be used in areas where obtaining the line-of-sight links needed for Wi-Fi requires the erection of costly high towers. While few developing countries have as yet adopted a TVWS licensing framework, this is now beginning to take off in the Africa region, with Ghana, Mozambique, Kenya, Nigeria, South Africa, and Uganda now having adopted, or are in the process of adopting, TVWS licensing frameworks.

It should be noted, however, that the ability to use some of the technologies described above is often constrained by the policy and regulatory environment, especially for village level or community network operators. Licence fees and reporting requirements are usually too onerous for small networks, although a few developing countries have adopted more permissive licensing frameworks. This signals the need for the governments to update policies and regulations to facilitate the bottom-up initiatives for rural connectivity.

The ITU-D Study Group Question 5/1: Telecommunications/ICTs for rural and remote areas report provides a detailed overview of technologies for connecting rural and remote areas as well as information about required public policies, regulatory measures, funding for development, maintenance and operation of telecommunications/ICTs in rural and remote areas[24]. The ITU-D Study Group Question 2/1: Broadband access technologies, including IMT for developing countries provides also additional relevant information about Broadband access technologies and deployment methodologies[25].

ITU is developing a last mile connectivity toolkit that aims to drive new collaborative strategies to ensure that people at the bottom of the social pyramid achieve reliable and meaningful connectivity. This project will enable partners to share resources and take a more holistic approach that treats broadband as a basic public utility and tool for socio-economic development. The toolkit provides guidelines, software tools and capacity building to support members to close the connectivity gap. Building on previous ITU projects and partners, the toolkit will support member states to plan,

21 BLUETOWN, their low-cost, sustainable Wi-Fi solution: https://www.youtube.com/watch?v=WTFNni1qsP8 Accessed on 15 February 2020.

22 CNBC Africa with CEO of BRCK: https://www.youtube.com/watch?v=r4R68toYkWU Accessed on 15 February 2020.

23 Afri Fi, Free Public WiFi project: https://www.youtube.com/watch?v=BAjoJiSDjFM In addition, BBC Africa, a village that built its own wi-fi network: https://www.youtube.com/watch?v=R9u-hfxAeBo accessed on 15 February 2020.

24 ITU-D, Question 5/1: Telecommunications/ICTs for rural and remote areas Final Report, https://www.itu.int/dms_pub/itu-d/opb/stg/D-STG-SG01.05-2017-PDF-E.pdf.

25 ITU-D, Question 2/1: Broadband access technologies, including IMT for developing countries Final Report, https://www.itu.int/dms_pub/itu-d/opb/stg/D-STG-SG01.02.1-2017-PDF-E.pdf.

design and implement last mile connectivity solutions. This include identifying the unconnected areas and selecting sustainable technical, financial and regulatory solutions to ensure affordability and accessibility to relevant connectivity services[26].

Access to connected devices

It is essential to consider a range of access models. Initially, the smart village can provide access to resources to all citizens who already have access to their own devices. This is called a *bring your own device* (BYOD) model. Villages and partners can also arrange access to digital devices at digital centres that are based at schools, clinics, and community centres. These digital centres can have a range of digital access models ranging from a shared resource computing model to a one-on-one computing model where each person working at the centre uses a dedicated device.

Public access centres can be used to mitigate the limited availability of personal access devices. Although more costly than simply providing Wi-Fi access points, they are also needed to allow use of more powerful and diverse types of equipment (e.g. big screens, printers, scanners etc), and to obtain guidance or training. In addition, they can provide public Wi-Fi hotspots, and foster entrepreneur development such as in the provision of electric power for small businesses.

Where devices are supplied by local government, they could be specialised connected devices such as tablets for agriculture extension workers, healthcare workers, teachers and students as shown in Figure 4.

It should be noted that smart village devices that are provided to community for specific purposes, and are owned by the project, should be all enrolled in a device and applications management system to be able to perform remote control and management of the device and its applications.

Access to digital content

For any smart digital intervention to work, ensuring that various communities have access to locally-relevant content in local languages has proven to be essential. This means that the smart village initiative will have to invest in the creation or curation of relevant local multi-media content for a variety of users. It also means that there will have to be dedicated structures whose role will be to develop new content, curate/adapt existing content, and drive the optimal use of the content by citizens.

For most villages, market segments would have different content needs, including:

- sector specific content such as healthcare content, education or agriculture content;
- cross-sector content to cover topics that span all sectors, such as information on leadership development that applies to all sectors;
- media-rich content for education or entertainment purpose and that is bandwidth-heavy and can best be stored on a local caching server (in the village);
- non-local content that can be adapted and translated for local use, typically open education resources that are usually freely accessible and downloadable;
- zero-rated content for which the user does not bear the cost of downloading the content.

[26] ITU, Last Mile Connectivity toolkit Draft. 2020. https://www.itu.int/en/ITU-D/Technology/Documents/RuralCommunications/20200120%20-%20ITU%20Last-Mile%20Internet%20Connectivity%20Toolkit%20-%20DraftContent.pdf.

Steps towards accessing digital content: a quick win approach

Step 1: ASSESS which digital content is available and identify the gaps.

Step 2: ADOPT readily available content by uploading and linking them in the smart village cloud and on local servers.

Step 3: ADADPT relevant digital content that can be easily translated or customised for use by local citizens.

Step 4: DIGITIZE content that may be available in print or analogue format.

Step 5: CREATE new content to fill the gaps in digital content availability.

Sources of digital content

The following are examples of valuable sources of digital content:

- Wikipedia is one of the largest and fastest growing reference websites that offers volumes of searchable and re-useable content.
- Video-sharing websites offer a wide range of videos that can be downloaded. YouTube is a video-sharing website that contains channels specializing in education, health, finance, business, agriculture, and entertainment. For example, here is a list of the top 10 education channels.
- Digital libraries also offer a wealth of books, manuscripts, movies that are often freely downloadable.

National broadcast authorities, local TV and radio stations would also have a wealth of locally-produced videos and audio content in their archives. This content is often under-utilised and can be made available to citizens, and can be tagged, downloaded and stored in the village cloud and on local servers.

Tools for accessing digital content

Media-rich content often requires high bandwidth connectivity that is not always available in rural villages. Here is a way of downloading an entire website for offline viewing.

Here is how YouTube videos can be translated into different languages. However, machine translations often make use of artificial intelligence and are not always accurate, mainly when translating oral languages, which is the case, for example, for many languages in Africa. Use these translation services with caution.

There have been many cases where digital content are made available but are severely under-utilised by their target audiences. Marketing digital content in order to drive their use by citizens becomes a crucial part of any digital content strategy. Here are useful tips and tools to drive content marketing and use among citizens and users.

A local cloud hosted on a central server in the village

Smart villages are usually cloud-powered. However, cloud services rely on broadband Internet connectivity and stable electricity. Broadband infrastructure is still very uneven, especially in rural areas, and power outages that often tend to occur can pose a challenge to cloud service delivery. The optimal functioning of the local cloud with data-heavy content and traffic can be challenging to sustain. A local cloud could host verified digital health, digital learning, agricultural e-content plus content categories including entertainment, news, weather reports, and more.

However, in order to ensure that citizens gain easy access to relevant digital content, it can also be stored on local servers that sync relevant content from the local cloud at given times during the day or week (at night for example where there is no traffic). Complex and data-heavy applications can also be stored on local servers. In this way, connectivity and bandwidth challenges are managed, and citizen content needs are considered.

Develop a smart village platform

A smart village platform[27], which is a suite of integrated digital applications and services that are working together, will serve as a central repository of information, tools, applications to support the access and use of content and services by a variety of users and stakeholder groups. The following outline likely core digital services:

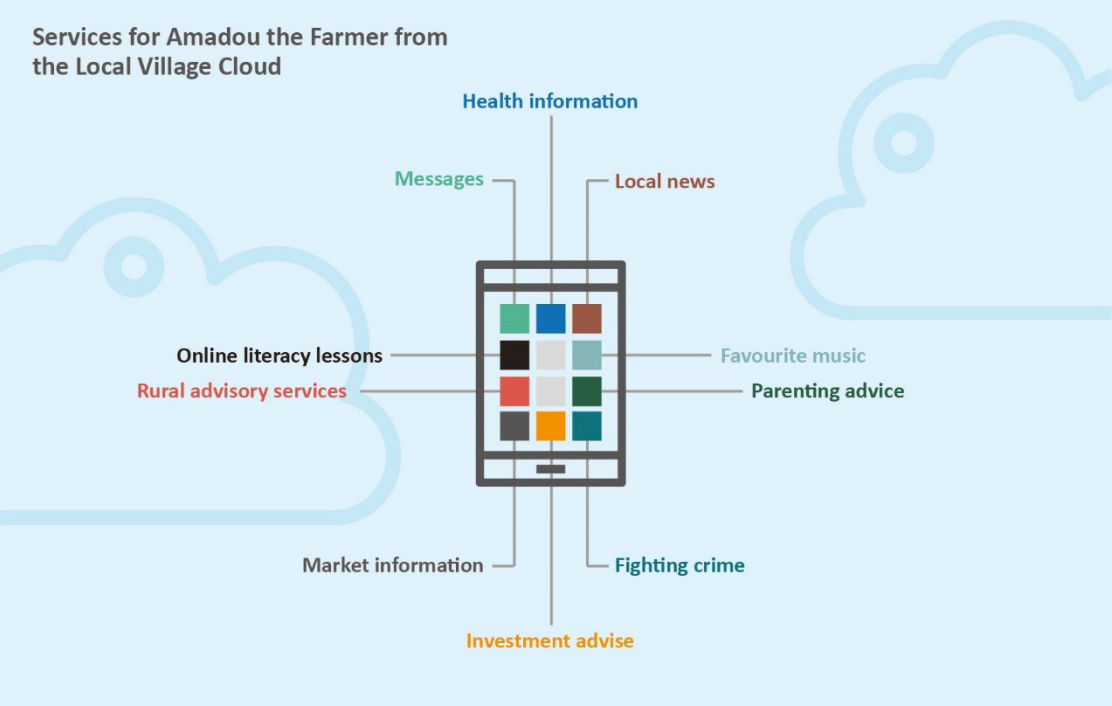
- content management systems that navigate and manage the upload and download of useable digital content, tools and applications;
- interactive learning management systems to enable users to participate in online learning and training courses that have high-quality instructional designs;
- data security and privacy management services;
- identification and authentication services;
- mobile devices and applications management services;
- user support through a help desk and troubleshooting functions;
- shared repositories, data analytics tools, etc.

3.5 Step 5: Design integrated SDG digital services

In a smart village, the citizens will have access to a wide range of online and offline SDG-related digital services. For example, Amadou is a farmer in a rural village. He owns a cell phone with a mobile subscription with a local network provider. In a smart village, he could have access literacy lessons, farming advice, health information, parenting information, investment information, and listen to his favourite music and watch entertainment programmes on his cell phone. All this information he can access in various ways, including via mobile apps that he sources from the local village cloud.

[27] A platform is a group of technologies that are used as a base upon which other technologies can be built or applications and services run. For example, the Internet is a platform that enables web applications and services.

Figure 10: Integrated e-services for Amadou



Source: ITU.

The smart village can decide on the core applications that will support the provision of SDG-related services to citizens. To streamline the delivery of a wide range of digital SDG-related services that citizens, communities, organizations, and institutions need, ITU and Digital Impact Alliance (DIAL) propose leveraging a set of generic ICT building blocks[28]. These ICT building blocks can service several sectors in an integrated way, thereby reducing redundancy and creating efficiencies.

Reuse of ICT building blocks is what makes scaling a smart village approach possible, both technically and financially. It is not feasible for each sector to implement its own local digital services and its own central digital platform and for each sector to scale up those services nationally. Taking a platform approach in which the ICT building blocks are leveraged across sectors will make scaling up possible from a resourcing standpoint, through leveraging of digital investments, and it allows for the consolidation of human resources around organizational capabilities, eliminating duplication on both the technology and human resource fronts.

Figure 11 illustrates how these ICT building blocks could be used in use cases within and across three development sectors.

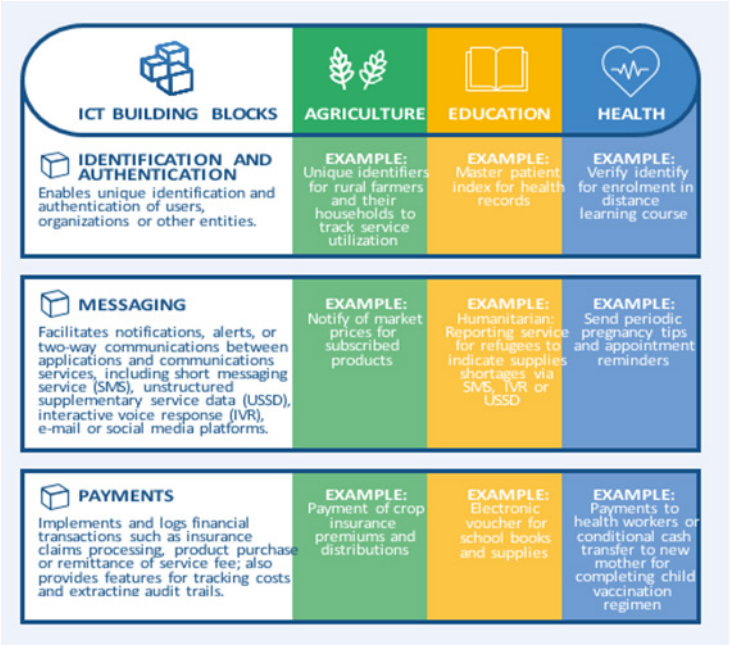
These ICT building blocks, plus others, can serve as the foundation of a digital platform by which actors across sectors can use to create customised applications and services for each programme or intervention for each respective development sector. For example, in education, health, agriculture and finance, an identification and authentication system is required. The development of a shared identification and authentication system across all these sectors allows for efficient use of shared resources.

The SDG Digital Investment Framework[29] makes the connection between SDG targets and ICT building blocks, via use cases and workflows, by borrowing from the best practice of enterprise architecture

[28] ICT building blocks are enterprise-ready, reusable software components providing key functionality facilitating generic business processes across multiple sectors. See the list of ICT Building Block detailed in the SDG Digital Investment Framework. A list is attached at Annex 1 for an easy reference.

[29] ITU, DIAL. SDG Digital Investment Framework: A Whole-of-Government Approach to Investing in Digital Technologies to Achieve the SDGs. 2019. https://www.itu.int/dms_pub/itu-d/opb/str/D-STR-DIGITAL.02-2019-PDF-E.pdf Accessed on15 February 2020.

Figure 11: ICT building blocks across sectors



Source: ITU and DIAL (2018).

planning. This framework outlines taking a process that aligns the smart village investments and strategy for investment sustainability. The framework is anchored in the SDG targets. For example, SDG Target 3.1 calls for an end to all forms of malnutrition by 2030. To meet this target in the smart village means developing specific use cases[30] where digital technologies are used in the health sector in the village that can help meet this target.

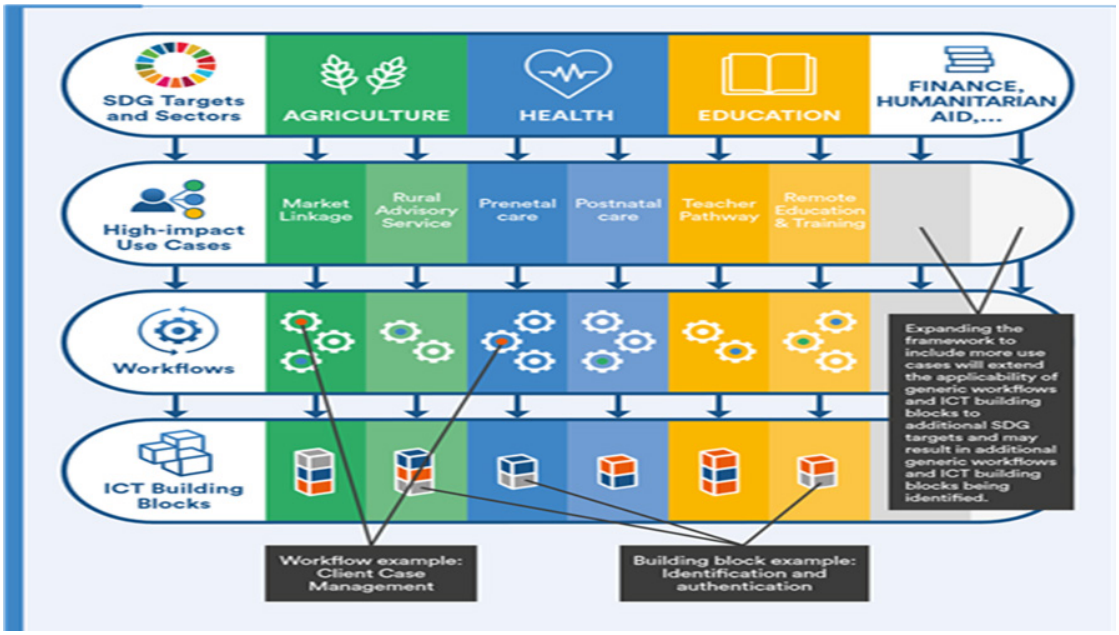
One such example use case could be that the smart village improves the communication of messages to parents about ways to improve nutrition for their child. These messages can be sent by a health worker and received by the parents on their mobile phones. This example highlights the need for a combination of ICT building blocks- messaging service, a scheduling service, a workflow service and a shared data repository. These would be the ICT building blocks that would enable the nutrition messaging program.

ICT building blocks[31], such as a generic messaging service, can be used in other sectors, especially education, health, and finance. The model described in Figure 12 offers one way in which a digital platform, comprised of ICT building blocks, for the smart village can meet the critical SDG targets within the rural village environment.

[30] The SDG Digital Investment Framework defines a use case as the steps that an individual or system will undertake in order to achieve a business objective.

[31] See Annex 1: List of common SDG building blocks

Figure 12: Architectural map using SDG Digital Investment Framework



Source: ITU.

Example of a smart village simple application architecture

A suite of tailored domain specific applications will be used to deliver the wide range of services that are required as priority areas in villages. An example of an application architecture is presented in Figure 13. Those applications will leverage the digital platform of ICT building blocks. Applications can be categorized in the following manner:

Domain applications: Specialized applications for different sectors. Those applications need to be managed remotely by experts and service owners e.g., ministries of health, education, agriculture, etc.

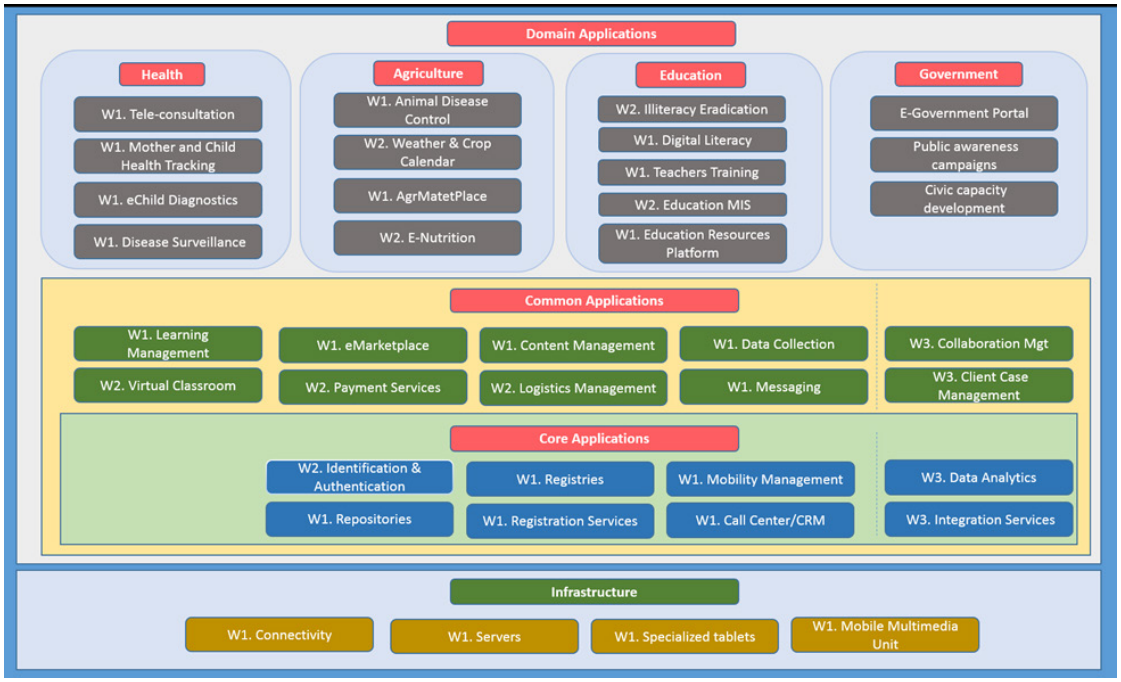
Common applications: Generic sharable applications that can provide common services such as training for health workers or teachers. Those applications can be managed by a common service provider.

Core applications: Providing foundational services that will maintain critical and sensitive digital assets such as identities, registries, repositories, etc. or critical services that will manage the overall network of smart villages. Those applications can be managed by a local provider under the direct supervision and control of the central smart village management unit.

Refer to the list of ICT building blocks defined in the SDG Digital Investment Framework for candidate common and core applications in Annex 1.

Figure 13 is an example to determine the set of digital services that might be required in the context of a smart village project.

Figure 13: Smart village platform application architecture and infrastructure components



The example of the platform application architecture provides an overall roadmap to coordinate digital investments that avoids duplication and facilitates interoperability between different applications within the architecture.

Applications do not all need to be simultaneously deployed but can be deployed in different waves based on priority, resourcing and infrastructure. The value of an incremental approach is that the team can achieve quick wins to improve long-term buy-in and satisfaction, address critical technical challenges over time as the platform complexity grows, provide time for individuals to adjust to the change and allows for iterative change to the architecture based on early learnings.

The following provide a simplified example of a sequenced deployment schedule:

Wave I: Simple core applications and quick-wins. Focus on deploying applications that meet the following criteria:

- can be deployed relatively easy and that will deliver valuable quick wins;
- serve as the core applications for the smart village platform;
- have already ready to deploy open source or commercial solutions available;
- can work as standalone with limited or no need for integration with other applications;
- do not require locally managed applications or infrastructure outside of electricity and connectivity such as messaging or payments;
- will help to operate the platform such as mobility management or call centre/customer relationship management (CRM).

Wave II: Common and locally managed applications. Focus on deploying applications that meet the following criteria:

- require the existence of core applications;
- require the development of new applications or large amounts of new content e.g., illiteracy eradication;
- require integration with other existing services and applications e.g., weather data;

- require local management;
- require time to develop specialized content.

Wave III: Domain and complex core applications. Focus on deploying applications that meet the following criteria:

- domain specific applications e.g., health or agriculture;
- provide advanced features such as "Collaboration Management" that are not urgently required;
- enable integration and sharing of information among applications e.g., integration services like an enterprise service bus (ESB), which will require however the development of an interoperability framework prior to its deployment;
- require the aggregation of normalized data e.g., data analytics and business intelligence services.

The above waves are illustrative, and a team can define more waves based on the resources and timeline of the smart village goals and priorities. Applications waves are different from project phases though they must be synergized. Each wave describes the common characteristics of applications that can be deployed together within a specific period. Waves suggest deploying applications in sequence to be aligned with the development of the ecosystem moving from simple and easily scalable services to more advanced ones that would require more mature ecosystem in terms of skills, interoperability, security, etc.

Additional waves could include applications developed by local entrepreneurs and innovators. Also, it should be noted that scaling up and integration of different applications might be more of a cyclical/iterative activity rather than a single action, because some services will be able to reach national scale early on while others would take considerable time. It is important also to consider creating stability and testing gates for each wave before starting the next wave of applications.

3.6 Step 6: Ensure appropriate data privacy and security

A smart village will also need to meet the privacy and security needs of users, citizens, and stakeholders by following ethical and equitable data practices. These needs will have to be carefully assessed, and data privacy and security frameworks will have to be guided by national government laws and policies on data privacy and security. Each country will have a varying degree of the following covered within current policy and laws, and smart villages should be compliant with the law. However, legislation often cannot keep pace with the speed of innovation. The following should be included within the smart village project whenever relevant with or without legislation in place:

1. Clarify with stakeholders, which data will be collected, how they will be acquired, how they will be used, how they will be stored, and how they will be shared. Ensure meaningful consent is sought.
2. Define what is meant by data ownership, access and sovereignty, and ensure that these definitions are clearly understood in the context of privacy and protection of personal information legislation.
3. Consider how the confidentiality of sensitive information and the identities of children and youth will be protected from unauthorised access.
4. Minimise the amount of personally identifiable and confidential information that is collected to ensure that confidential data is protected.
5. Develop and implement a data security policy that guides the protection of the specific data that will be collected, stored and shared. Such a policy will need to include an end-of-life data management plan for when projects come to an end.
6. Be transparent about personal data that will be collected.

7. Consult resources on privacy and security for children as well as resources on securing private data that can be accessed in the cloud.
8. Ensure that issues of data privacy and security are included in awareness-raising, advocacy and extensive adoption campaigns.
9. Consult the community to set broader responsible data policies and practice that reflect a more holistic view of risk and potential harm from data and digital technologies than data privacy encompasses, such as data bias, digital exclusion, and digital safeguarding.

Tools on data privacy and security

You can consult the following guidelines and resources on data privacy and security and on responsible data.

3.7 Step 7: Establishing systems for fair procurement

Governments across the world have limited resources, products, services, and capacities to deliver all the SDG-related services to their citizens, and many governments rely on service providers and third parties to assist them with service delivery.

Governments that rely on products and services from service providers, companies, third-parties and other stakeholders, generally acquire them through internationally established tendering practices. Smart villages will rely on fair and transparent government products and services procurement to establish, run, maintain, and sustain them.

Tools for fair procurement

The United Nations Development Programme (UNDP) provides guidelines on how to tender and ensure fair procurement.

The Food and Agricultural Organisation (FAO) procurement guidelines for tender preparation, evaluation and award of contract.

The ICT Commissioning playbook by the OECD Working Party of Senior Digital Government Officials.

The tendering process can encourage providers to offer, when appropriate, global public goods, providing that they can demonstrate the ability to maintain and scale them up at comparable or more favourable costs than other commercial or bespoke applications. The development of new applications should be avoided especially if there are similar open source or off-the-shelf commercial products that could be leveraged or adapted to provide the same functionalities.

3.8 Step 8: Establishing a smart village organisational model

The smart village will need a dynamic organisational and management model to deliver the smart village digital transformation using the tools and resources outlined above. The following are recommendations for the establishment of dedicated units for consideration. These units can function under the auspices of a dedicated central structure that the national government can establish. This dedicated central structure will incorporate the following units:

A smart village steering and coordination unit

This unit should take responsibility for the oversight and governance of the smart village project, managing the relationships among strategic partners and stakeholders and making decisions on budgeting, resource allocation and future investments. This unit should bring all multi-stakeholders together from relevant ministries, donors and development partners and be led by a central digital government/digital transformation unit attached to the president, prime minister offices, ministry of ICT or other relevant government organizations.

A project management unit

This unit will be responsible for overseeing and managing the deployment of digital infrastructure and applications in the smart village. This unit will also be responsible for managing the procurement processes of various digital infrastructure and application projects. The project management unit will work closely with the relevant organizations and teams.

Service owners and managers

Service owners, which are often government ministries, are responsible for setting the requirements of a sector specific service e.g., health, agriculture, etc., monitoring its deployment, analysing collected data, and deciding on courses of action. These roles will assume the following responsibilities:

- Managing domain services for each of the sectors e.g., in health, education and agriculture which fall under the jurisdiction of respective government ministries.
- Managing domain content for each of the sectors e.g. in health, education and agriculture, which will fall under the jurisdiction of respective government ministries.

Systems integrator

The smart villages model is based on system integration. A systems integrator is needed to bring together components and solutions into a whole and ensure that those systems function together. The system integrator can create a consortium of domain service providers to ensure integration and interoperability between different solutions based on the applications architecture that should have been developed during the “design and develop” stage of the project.

Sector specific service providers

This refers to local enterprises and private companies that will provide, manage and maintain the delivery of services using sector specific applications such as telemedicine, surveillance, advisory services or animal disease management. These applications will require sector specific expertise and should be managed by local providers who will develop their own capacity in specialised areas such as health, agriculture, and education. Sector specific service providers will have to liaise and collaborate with international actors that developed similar applications or digital public goods and that can provide technical support and human capacity development.

Platform operator

A platform operator needs to:

- Learn and understand the functionality of every application by engaging regularly with solution providers and application developers.
- Enable local users and government officials to make optimal use of available applications by providing relevant training in the villages and within ministries and organizations.
- Act as a super user to master all applications and be able to operate them independently.
- Develop as appropriate, simple user-guides that can help citizens to use the applications appropriately.
- Provide technical support and helpdesk services to users to enable optimal use of applications and content and solve minor technical problems as they arise.
- Monitor technical problems and user feedback and communicate with third party application providers for the purposes of knowledge sharing and assistance as required.
- Monitor additional user requirements for new functionalities or for activation of existing features and communicate these to third party application providers.

A central local content creation and digitization unit

It is essential to establish this unit at the outset. This unit will specialise in the development of local content that can be distributed across all villages via the national cloud. Local servers in village can store content and synchronize it with a central repository of content. This unit will develop, upload, and distribute new local content. It will also ensure that content is marketed appropriately to drive optimal usage. The content related functions include:

- Content specialist designers who choose which content needs to be produced for which audiences.
- Subject matter experts who are knowledgeable about specific subject areas such as agriculture, healthcare, literacy, numeracy.
- Creative writers or authors who usually write the scripts needed on specific content areas targeted at specific audiences.
- Editors who will responsible for editing and proof-reading content as well as assuring quality control.
- Language experts/translators who may be responsible for conducting or managing content translation to local languages.

The production functions will include people in the following roles:

- Multi-media illustrators to produce illustrations and animations as required.
- Video and film producers to produce high quality video clips and films.
- Broadcast specialists to broadcast radio and television via the Internet.
- Game developers to repackage content into games.
- Application developers to prepare content as mobile apps.

Content storage and curation roles will include:

- Content curators ensure that content is appropriately tagged, searchable, stored, and backed up. They also identify existing content that could be leveraged and/or adapted easily for the smart village environment.
- Marketing and communication roles will include people who understand the users, user experience and how to drive usage and user experience.
- Social media specialists ensure that relevant content is made known to their target audiences through various social media strategies. They will also make use of the user data analytics to track usage patterns and drive usage.
- Marketing specialists work on branding and messaging to encourage users to use the content optimally.
- Communication specialists who understand specific communication strategies for specific groups of citizens in order to drive optimal use. Programme management roles will include:
- Production managers who understand the business processes and scheduling multi-media production.
- Distribution and delivery roles would involve people who are knowledgeable about content management systems, learning management systems that enable users to access, use and even upload user-generated content as well as managing the back-end of the system through maintenance and regular upgrades.
- Furthermore, investment will need to be made in purchasing a range of equipment, editing suites and studios, their secure storage, maintenance and upgrades. It would make sense therefore that a content creation unit be established at a central level to service the content development needs of all smart villages in the country for different sectors if such a capability does not exist already.

Establishing a village committee

Forming a dedicated smart village committee is important to ensure accountability to the citizens and communities. This committee is responsible for:

- physically managing the infrastructure and equipment, reporting on technical problems, assisting in the registration process of the local population in different services, and protecting digital assets and equipment from theft or vandalism;
- deciding on a policy to rent devices and Internet connectivity to community members (user tablets) against a small fee.

In the long term, the committee will need to cover the cost of connectivity to ensure sustainability of the smart village.

4. Phase 3: Deploy and implement

Goal: Create a successful enabling environment to deploy developed services effectively and sustainability.

4.1 Step 1: Invest in management and leadership capacity

Management and leadership of the smart village are critical to its success. Management of a smart village initiative will require skills in managing innovation, change and complexity. Often in resource-challenged environments such as those in which rural villages are located, it also means working under conditions of scarce human capacity resources, challenging infrastructure, and limited finances. Leadership and management of smart villages under these conditions require creative and even disruptive ways of leading and managing. Often this means that dramatic shifts are needed from traditional leadership and management cultures that are often:

- top-down and hierarchical;
- based on silos;
- rigid and structured and sometimes highly bureaucratised;
- focused on following rules and procedures;
- based on centralized planning.

The smart village project demands a flexible, adaptable and dynamic organisational culture, management and leadership with:

- a bottom-up and integrated approach (as opposed to a top-down, silo approach);
- challenging group-thinking;
- accommodating both (rapid) change in technology and slow systems uptake of SDG;
- inclusivity and openness to working collaboratively with opposing views;
- talking openly about failure, preparedness to fail fast and to learn consciously from failure;
- actively engage with 'users' and citizens in the design process; and
- recognizing that the design process is:
    - never complete;
    - emergent and iterative; and
    - constantly changing.

The competencies that leadership and management of a smart village project require are often referred to as 21st-century leadership and management competencies. These include among others, developing skills in:

- critical thinking;
- working collaboratively with people who have different and sometimes conflicting ideas and attitudes;
- taking risks and being open to failure;
- being flexible and be able to adapt to change and crises;
- having empathy;

- being able to work with many different role players and stakeholders that come from different and sometimes conflicting organisational cultures; and
- being able to manage complexity and change.

Dedicated investment will need to be made in building the managerial and leadership capacity at village and ministerial level.

Leadership and management development programmes

It becomes essential therefore, that smart village managers, leaders and decision-makers are encouraged to enlist in leadership and management development programmes. There are a host of open online courses (MOOCs) that are available for free that allows for skills development in these areas.

Coordinating skills transfer and capacity development

In the face of high levels of dependency on external managerial capacity and support, it becomes important that skills transfer, and management of capacity building be coordinated and managed systematically:

- conducting a skills audit of local management capacity and identifying skills gap;
- planning systematic skills development and transfer through structured programmes;
- documenting and monitoring skills deployment and transfer arrangements over time;
- hosting regular programmes at ministerial and village level focused on knowledge building and skills sharing;
- coordinating the process of skills transfer and management capacity development at ministerial and village level.

4.2 Step 2: Build sustainable partnerships

When do partnerships not work?

There are several cases of multi-stakeholder partnerships that have broken down and did not work. The reasons for break-down or lack of success include:

- lack of clearly defined roles, responsibilities and accountabilities of various partners;
- lack of mutual trust between partners who are not addressed through trust-building activities;
- lack of leadership among multi-stakeholder partnerships; and
- high levels of competition among partners that are not managed effectively.

Ways to establish and manage partnerships

Often the design and implementation of innovation for sustainable development in resource-challenged contexts will involve several partners and stakeholders with diverse organisational cultures. Creating an appropriate model for building partnerships by managers of a smart village is essential. In doing so, the following needs to be considered:

1. Differentiate between partners and service providers. Partners are agencies who pool their resources to support an initiative. Service providers are paid to render a service to help with implementing a project or programme.
2. The smart village managers will have to initiate conversations with partners and agree on partnership goals, protocols and procedures.

3. Partner contributions will need to be defined very clearly. This must include available resources that consider both monetary and non-monetary resources, roles, responsibilities and mutual accountabilities need to be clearly stated.
4. Funding partners must be transparent on how funds are allocated and spent based on full costing of an intervention. In other words, accountability must be reinforced through transparency among all partners involved.
5. Clarify project leadership and management roles within the partnership.
6. Clarify the role of service providers.
7. Clarify and develop a clear partnership communications plan.

Tools on for partnership dvelopment

This ITU guide includes agreement and MOU templates that can be used when developing partnerships with telecommunication providers.

The DIAL Guide to Using Mobile Aggregators to Deliver NGO Services at National Scale.

4.3 Step 3: How do we mobilise resources sustainably?

The digital transformation in poor rural villages requires significant financial and resource investment. The return on such an investment will be realised when there are high levels of engagement and participation by citizens, communities, organizations and institutions across different sectors, when citizens earn sustainable livelihoods and the local economy is thriving.

However, many villages face several financial and resource constraints that challenge their ability to implement effective SDG-related programmes. To address these challenges, it is necessary that the system mobilises enough resources and partners to be sustainable. This will require the development of a financing plan with cost-effective and cost-efficient budgeting and cost models; financing solutions; as well as resource mobilisation strategies.

Costing models

A total cost of ownership approach considers all costs including direct and indirect costs to the design, implementation, ongoing iteration, improvement, maintenance and extensive use of a given digital solution for sustainable development. This is important to document and determine the cost-effectiveness of the intervention for expansion. Many cost factors will also depend on the design choices that are made. The following are significant cost factors to consider:

1. A process of trust and transparency needs to be instilled among all partners and service providers involved when engaging on the costs of the innovation including unanticipated and hidden costs.
2. The highest costs are usually the initial technical development costs, which include engagements with users and developers or with third party service providers.
3. Project management, coordination and partnership engagement costs are often not costed adequately and will need to be established collectively. This will include costing the creation of project staff posts.

4. Ongoing consultations and engagements with 'users' in user-centred design and implementation is also a substantial cost.
5. Because of the emergent nature of digital innovation design, project staff will also require ongoing training and upskilling which are also cost bearing.
6. Often the costs of continuing maintenance, support and system upgrades are overlooked or under-estimated. These will need to be budgeted for and monitored.
7. One of the most important costs that have not been catered for is the cost of awareness raising, advocacy, and communications to drive widespread adoption and use.
8. The cost of ongoing learning is also critical in a design-based approach to digital innovation. Here the value of integrating monitoring, evaluation, research and knowledge dissemination at the outset is consistently proving to be very important.

Tools for costing digital solutions

The Global eSchools and Communities Initiative (GESCI developed a total cost of ownership (TCO) model in 2008, which was further adapted as a total cost of ownership model for ICT for rural education (ICT4RED) initiative in South Africa.

The DIAL Beyond Scale outlines the steps to estimate the total cost of ownership and forecast the revenue for digital programmes.

It is important to bear in mind that different costing models will apply at different implementation stages.

Proof of concept: During the initial proof of concept stage, the costs of various solutions will be experimental, and the focus is on testing whether certain solutions work within a given environment. These costs are often also concessionary and relevant only during the proof of concept stage. It becomes crucial that no commitments are made to procure any solutions during the proof of concept stage. Following the evaluation of the proof of concept, decisions are made about whether the models that have been explored work or not. Here the cost implications need to be worked out in detail for where the model worked and if they have failed, what the cost implications would be to make the model work based on lessons from failure.

Pilot stage: This often involves a further exploration of solutions on a small scale over a short time horizon. It becomes important at this stage to understand all the cost elements at this stage, including hidden and unintended costs that arise. Here too, it becomes essential not to commit to any solutions following the pilot stage.

Scale up stage: Usually with the scale-up stage, the costs are substantially higher and more complex because they cover a larger area, over more diverse terrain and user base. More layers of management and transactional costs are involved, and usually, procurement is conducted based on fair and open tender mechanisms where costs are detailed and more explicit.

Resource mobilisation strategies

Some resource mobilisation strategies could include:

- Mobilising existing networks and partnerships in support of the implementation of critical programmes of the smart village initiative. These could include an **End Illiteracy Campaign**, for example for which there may be keen interest from a wide range of prospective donors, private sector companies and development agencies.

- Accessing national universal service funds in support of dedicated programmes or campaigns also offers another avenue for mobilising financial resources for the smart village.
- Often individual philanthropists from the diaspora also provide a valuable opportunity to pursue as well.
- Blended finance models can be adopted, whereby an initial investment, often from a philanthropic or government entity, is used to attract additional private capital or to trigger self-sustaining commercial operations. This is particularly relevant in situations where local populations are not able to express demand, which leaves them off the radar of the service / product providers. In addition, the initial investment reduces the risk and ambiguity associated with a project, making it more attractive in the eyes of commercial actors.
- Recently crowd-funding strategies have also served to mobilise financial resources in support of specific causes and programmes.

Tools for resource mobilisation

Innovative ideas for fundraising have been tried elsewhere.

Check also this blog on blended finance.

4.4 Step 4: How do we market this initiative successfully?

There have also been many cases in digital technologies for development initiatives where the resources that are made available to citizens, such as mobile apps, courses and training resources, are grossly under-utilised because citizens, communities and institutions do not know about them.

It is important to develop a communications and marketing plan that will ensure that the services made available by the smart village, are utilised optimally, for the initiative to make a long-term impact.

It is important to discuss with key stakeholders what the most important messages are about the smart village that needs to be widely publicised.

Tools for successful marketing and communications

Some innovative ideas for marketing for a good cause have been tried elsewhere.

Here is a link to marketing that small businesses have tried.

Try this link for ideas on communications strategy.

4.5 Step 5: Managing service providers and third-party contractors

It is important also to recognise upfront that some national, local government do not have enough human resource capacity to implement smart village services to its citizens. Governments can

dependent on effective third-party contractors and service providers. This means that the role of government in the smart village initiative could be to oversee, manage, coordinate, guide and direct its implementing partners and service providers effectively and hold them accountable. In many cases where initiatives have experienced break-down, it was the service providers who were not held accountable, nor were they managed or guided effectively.

Some of the principles that must inform the management of service providers should include:

- external supplier relationships should be formalised and managed;
- business agreements must guide the relationships between the government entity and the service provider;
- service level agreements (SLA) must be established and must guide service levels and quality;
- external supplier-related risks must be identified as upfront and must be managed;
- external supplier performance should be managed; and
- external supplier performance must also be subject to external audit against standard service level agreements.

Tools for managing service providers

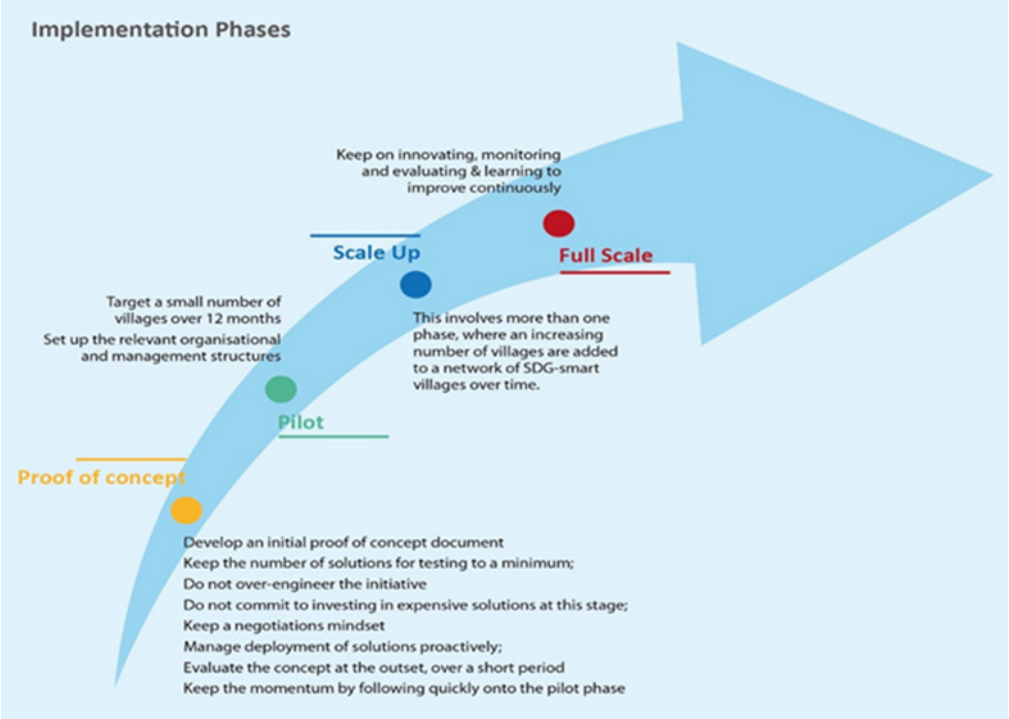
Here are some ideas on how to develop a service level agreement.

Here is an example of a service level agreement template and an example from ITIL.

4.6 Step 6: Implementation phases

A smart village will need to develop a phased approach to implementation. The first phase, often a proof of concept phase, is followed by successive scaling-up phases. A timeline can be provided to prepare successive phases as illustrated in Figure 14.

Figure 14: Implementation phases



Proof of concept phase

This phase serves mainly to test a combination of mature, and in some cases experimental, solutions some of which may fail. It is essential for governments and local authorities not to commit to investing in any solutions before testing the host of factors that come into play and that may militate against an appropriateness for conditions within which they are being tried. It is essential that the following be considered:

- Develop an initial proof of concept document before experimentation that outlines a limited number of solutions to be tested.
- Keep the number of solutions and features that are being tested to a minimum and focusing on high-priority use cases.
- The initiative should not be over-engineered, and it should be kept flexible.
- Keep a negotiation mind-set when engaging with providers.
- Manage the preparation and deployment of solutions at targeted villages and centres proactively.
- Integrate an evaluation framework for the proof of concept at the outset.
- Evaluate the proof of concept over a short period (e.g. six months), with a competent, independent evaluator where possible. An independent evaluation report will reveal what works, what the cost implications are, what can be tried for the pilot phase, what did not work and what the cost implications are if they can be made to work.
- Keep project momentum by following quickly onto the pilot phase based on the recommendations of the evaluation.

Pilot phase

A core package – first wave of applications- can be identified for delivery during this phase. Services can be identified in collaboration with key stakeholders and this phase could target a small number of villages over a 12-month timeline.

This phase can also set up the relevant organisational and management structure for the initiative, including:

- setting up the different organisation and management units;
- developing detailed functional and technical requirements for required solutions;
- developing a detailed costed implementation plan and *request for proposals*;
- securing funding for the pilot phase deployment;
- launching several *request for proposals* to acquire and deploy the core applications and services;
- concluding agreements and memorandum of understanding (MoU) with different partners;
- building the capacities of providers at all levels;
- monitoring and evaluating and identifying lessons learned.

Scale-up phases

This phase will replicate activities as in the pilot phase but for an increased number of villages to create a network of smart villages over time. All organisational and managerial arrangements will have to be fully institutionalised by this stage.

Full-scale phase

This phase can cover all villages in the country and can include more mature and advanced applications and solutions.

5. Phase 4: Monitor and evaluate

Goal: Execute ongoing monitoring and evaluation of the smart village for continuous improvement.

Many digital technologies for development initiatives exclude monitoring and evaluation altogether. Developing a monitoring and evaluation system is a way of ensuring that the smart village project and all its stakeholders can learn collectively and improve and innovate continuously and consistently. This system will also increase the evidence-based implementation by knowing what works and what does not when establishing smart village projects.

5.1 Step 1: Designing a monitoring and evaluation framework

The following are ways to approach the design of the framework:

- Identify how the theory of change will be used for monitoring and evaluation. Ideally, the theory of change will be more than a framework for simple reporting, but the extent of its use will inform how extensive the theory of change should be[32].
- Ensure that the framework design is a collaborative process. Relevant stakeholders need to be involved in designing the **theory of change and logic model** for the digital transformation of the smart village. A logic model is a visual way of outlining programme resources, inputs, activities and outcomes[33].

  Figure 15 sets out a logic model for smart village interventions and shows what inputs and activities will be required, and what outputs will be achieved, as well as what the intended outcomes will be in the short-term, medium-term and long-term.
- Write out the theory of change and logic model as a narrative in collaboration with all relevant stakeholders.
- The theory of change should not only include inputs, outputs and outcomes but also assumptions behind the causal chain, situation context, complementary projects/programmes, and other external factors.
- Design a framework that integrates all successive phases: the pilot phase, the scale-up phases and the full-scale phase.
- Also include monitoring and evaluation in the conceptualisation, design, implementation and deployment aspects of the smart village design.
- Consider monitoring and evaluation designs that have been tried elsewhere[34].
- Clarify what constitutes evidence of impact. Good indicators of impact will be high-level and directly and indirectly result from the outputs and outcomes underpinning the theory of change. They also will typically be the results of organizational and behaviour change in the theory of change.
- Data sets should include baseline data and set targets for digital integration and meeting local SDG needs. Data sets should include information on infrastructure, connectivity, management, capacity development and meeting citizen SDG needs.

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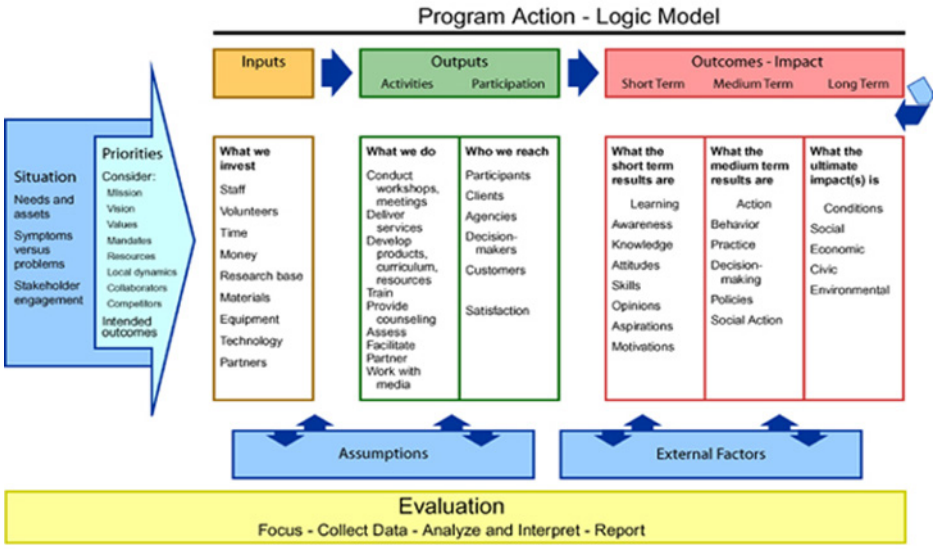
[32] Some useful details on the theory of change were made available by betterevaluation.org at: https://www.betterevaluation.org/en/node/5280 Accessed on 15 February 2020.

[33] A logical model is described in a blog by AN. Brown "What is this thing called 'Theory of Change'?" published on the website of the USAID Learning Lab: https://usaidlearninglab.org/lab-notes/what-thing-called-theory-change Accessed on 15 February 2020.

[34] A list of some monitoring and evaluation design tools can be found at: http://www.tools4dev.org/category/skills/monitoring-evaluation/Accessed on 14 February 2020.

- Ensure that the data that you are collecting under your theory of change is credible, actionable, responsible, and transportable[35].
- Use monitoring and evaluation to promote shared learning among system stakeholders, practitioners and policy decision makers[36].
- Establish a transparent knowledge management system that documents the design, implementation and evaluation process including all meetings, conference calls, communications, reports and project documents.
- Establish a shared storage and retrieval system of all knowledge artefacts within the knowledge management system.
- Clarify which documents, information and knowledge resources need to be available in the public domain and which are internal.
- Publish results, lessons, and promising or good practice widely, under Creative Commons (CC) licence[37].

Figure 15: Logic model



Source: United States Department of Agriculture[38].

Tools for developing output, outcome and impact indicators

The World Health Organisation develops output, outcome and impact indicators for their child health programmes.

Developing indicators is a useful presentation developed by the Public Health Foundation India.

[35] See CART Principles (Credible, Actionable, Responsible, and Transportable) by Innovations for Poverty Action (IPA): https://www.poverty-action.org/right-fit-evidence/principles Accessed on 15 February 2020.

[36] Useful tool kits are made available by USAID Learning Lab: https://usaidlearninglab.org/qrg/me-learning Accessed on 15 February 2020.

[37] For a creative commons licence, please visit: https://creativecommons.org/licenses/Accessed on 15 February 2020.

[38] See: https://www.fs.usda.gov/main/conservationeducation/programs/program-development,the dedicated webpage on the of USDA Forest Service website. Accessed on 15 February 2020.

5.2 Step 2: Implement a monitoring and evaluation plan

A smart village monitoring and evaluation plan will need to be developed collaboratively in consultation with relevant stakeholders. Developing the theory of change and logic model of the smart village collectively is an important part of this process. The logic model will articulate clearly the intended outputs and outcomes of the smart village interventions. The following monitoring and evaluation strategies should be considered[39]:

- Establish a steering committee or group that will oversee and manage the monitoring and evaluation and will ensure accountability for and during implementation.
- Encourage an impartial and independent perspective on what has been achieved, the strengths and weaknesses of the interventions, and the lessons learned.
- The impartial and independent perspective (third party) should report to and be held accountable by the steering committee.
- Establish key moments on a timeline when concept notes, inception reports, initial findings and first draft reports can be reported to the steering committee.
- Ensure that feedback from the steering committee, and a wider stakeholder audience is rigorous and extensive for at least the initial findings and all draft reports before reports are finalised.
- Importantly, develop accessible and straightforward ways to communicate key messages from monitoring and evaluation, and lessons learned.
- Establish forums where the findings can be discussed and shared.
- Acknowledge the report of recommendations, discuss and plan ways to implement agreed recommendations.

5.3 Step 3: Apply lessons from monitoring and evaluation

Monitoring and evaluation process and findings help to apply lessons learned. It becomes important, therefore, to share findings widely and discuss how the lessons can be applied.

In consultation with partners and stakeholders, it is crucial to establish ways to implement and apply the lessons, including cost implications. Lessons learned should be taken seriously, especially in the case of changes in staff or leadership and limited planned continuity, as this impacts negatively on the use of monitoring and evaluation data and experience.

To ensure that lessons learned are shared internally and externally as well as help inform the implementation of the project, the smart village should use a collaborating, learning, and adapting approach (CLA). This can be implemented through:

- Periodic pause and reflect sessions: a facilitator guides questions on what is working well, what is not working well, and what can be improved[40].

[39] A lot can also be learned from projects with integrated monitoring and evaluation and how they have been implemented. The Millennium Villages Project Evaluation is an example, although there have been criticisms of design and implementation of monitoring and evaluation of comparison villages. See: S. Mitchell. The Millennium Villages Project: a retrospective, observational, endline evaluation. The Lancet. May 2018 and E. Bendavid. The fog of development: evaluating the Millennium Villages Project. The Lancet. May 2018.

[40] See relevant post by Amy Leo at the USAID Learning Lab website: https://usaidlearninglab.org/lab-notes/walking-talk-learn%E2%80%99s-pause-reflect-practices-1 Accessed on 15 February 2020.

- After action reviews: an assessment conducted after a major activity or new approach to appraise and assess the actions taken[41].
- Appreciative inquiry: a change management approach to focus on identifying what is working well and what is not working well[42].

[41] See After-Action Review Guidance on the USAID Learning Lab website: https://usaidlearninglab.org/lab-notes/walking-talk-learn%E2%80%99s-pause-reflect-practices 1 Accessed on 15 February 2020.

[42] See introduction to Appreciative Inquiry at: https://appreciativeinquiry.champlain.edu/learn/appreciative-inquiry-introduction/Accessed on 15 February 2020.

6. Conclusion

For this blueprint guide to be dynamic and remain relevant, it must be considered as a living document. This is the first iteration and will continue to evolve as our experiences grow. The smart village model is a whole-of-government approach for digital rural development and transformation. It is based on the premise that aggregating and pooling citizen demands can reach economies of scale and can create cost efficiencies in acquiring, developing, deploying and maintaining digital services while enabling integration and interoperability to ensure smooth information flow across different applications and services.

Cost efficiency and integration are the basis and pre-requisites for scaling up digital services. No one government entity, nor service provider, can scale up the multitude of digital services that a citizen needs. It is therefore critical to adopt new mind-sets and approaches for coordinated digital investments particularly in rural areas where efficacy of investment would be improved through reuse, and lead to meeting development goals.

The smart village model brings all stakeholders under an efficient coordination framework, where every public and private entity involved contribute in a win-win and meaningful manner to innovative governance and investment mechanisms.

This requires a well-resourced and light-touch central entity to be responsible for orchestrating multiple sectors and stakeholders' efforts. A smart village model can only be successful if both public and private sectors know how to work together.

The public sector is responsible for setting requirements, frameworks, financing models, and overseeing and evaluating implementation, while the private sector should be empowered to deliver agile, flexible and personalized services to citizens.

This model calls for innovative financing models which will have to be a blend of government and donor funding, development loans, and other resources from revenue generation or citizen contributions.

The smart village model is a citizen-centric initiative and a learning journey for digital for rural development and transformation.

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Abbreviations

ANSI	National Agency for the Information Society (ANSI) of Niger
BYOD	Bring Your Own Device
CC	Creative Commons
DIAL	Digital Impact Alliance
DRCM	Development Requirements Collaborative Methodology
FAO	Food and Agriculture Organization
GESCI	Global e-Schools and Communities Initiative
HL7	Health Level 7
ICT	Information and Communications Technologies
ICT4RED	ICT for Rural Education
IFAD	International Fund for Agricultural Development
ITU	International Telecommunication Union
LDC	Least Developed Countries
MOU	Memorandum of Understanding
MVP	Millennium Villages Project
NGO	Non-governmental organizations
OER	Open Education Resources
SDGs	Sustainable Development Goals
TCO	Total Cost of Ownership
UN	United Nations
UNESCO	United Nations Educational, Scientific and Cultural Organization
WHO	World Health Organization

Annex 1: List of common SDG building blocks

- Analytics and business intelligence – Provide data-driven insights about business processes, performance and predictive modelling.
- Artificial intelligence – Package machine intelligence capabilities as reusable services to perform work, extract insights from data, or provide other business capabilities.
- Client case management – Register or enrol of a client and provide longitudinal tracking of services, often across multiple service categories, vendors and locations.
- Collaboration management – Enable multiple users to simultaneously access, modify or contribute to a single activity, such as content creation, through a unified access portal.
- Consent management – Manage a set of policies allowing users to determine the information that will be accessible to specific information consumers, for which purpose, for how long, and whether it can be shared further.
- Content management – Support the creation, editing, publishing and management of digital media and other information.
- Data collection – Support data collection from human input, sensors and other systems through digital interfaces.
- Digital registries – Centrally manage databases that uniquely identify and describe persons, service providers, facilities, procedures, products, sites or other entities related to an organization, industry or activity.
- eLearning – Support facilitated or remote learning through digital interaction between educator and students.
- eMarketplace – Provide a digital marketing space where provider entities can electronically advertise and sell products and services to other entities (business-to-business) or to end-user customers.
- Geographical information – Provide functionality to identify, tag and analyse geographic locations of an object, such as a water source, building, mobile phone or medical commodity.
- Identification and authentication – Enable unique identification and authentication of users, organizations or other entities.
- Information mediator – Provide a gateway between external digital applications and other ICT Building Blocks, thereby ensuring interoperability and implementation of standards, which is essential for integrating various ICT Building Blocks and applications.
- Messaging – Facilitate notifications, alerts, or two-way communications between applications and communications services, including short messaging service (SMS), unstructured supplementary service data (USSD), interactive voice response (IVR), email or social media platforms.
- Mobility management – Securely enable employee use and management of mobile devices and applications in a business context.
- Payments – Implement and log financial transactions such as insurance claims processing, product purchase or remittance of service fee; also provide features for tracking costs and extracting audit trails.
- Registration – Record identifiers and other general information about a person, place or other entity, typically for the purpose of registration or enrolment in specific services or programmes, as well as tracking of that entity over time.
- Reporting and dashboards – Provide pre-packaged and custom presentations of data and summaries of an organization pre-defined key performance metrics, often in visual format.
- Scheduling – Provide an engine for setting up events based on regular intervals or for triggering specific tasks in an automated business process, based on specific combinations of status of several parameters.

- Security – Provide ICT administrators the ability to centrally configure and manage user and group access permissions to network resources, services, databases, applications and user devices.
- Shared data repositories – Provide a common repository to store data for a specified knowledge area used by external applications, such as a soil registry, often providing domain-specific functionality and data presentations.
- Terminology – Provide a registry of definitions and terms with defined nomenclature standards, metadata, synonyms and sometimes a knowledge map for a particular domain of knowledge (e.g., agriculture) which can be used to facilitate semantic interoperability.
- Workflow and algorithm – Help to optimize business processes by specifying the rules that govern the execution of a sequence of activities and the exchange of associated information in order to orchestrate the process flow from initiation to completion.

Source: International Telecommunication Union & Digital Impact Alliance, SDG Digital Investment Framework, 2019 is available at https://www.itu.int/dms_pub/itu-d/opb/str/D-STR-DIGITAL.02-2019-PDF-E.pdf and https://bit.ly/ITUDIAL.

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