SDG Digital Investment Framework

A Whole-of-Government Approach to Investing in Digital Technologies to Achieve the SDGs

ITU

dial Digital Impact Alliance

SDG Digital Investment Framework

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ABOUT ITU

The International Telecommunication Union (ITU) is the United Nations specialized 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 the ITU or this paper, please visit our website: www.itu.int.

ABOUT DIAL

DIAL advances an inclusive digital economy for the underserved in emerging markets. An independentglobal alliance funded by leading development agencies and private foundations, DIAL was established in 2015 and is housed at the UN Foundation. DIAL combines practical research with evidence-based advocacy to advance digital inclusion. DIAL seeks to identify barriers to digital inclusion; test ways to remove them; and collaborate with digital service providers, policymakersand funders on ways to institutionalize digital technology into development services.

DIAL is staffed by a global team and is guided by a board of leading emerging market entrepreneurs, technologists and development experts. With this leadership, DIAL is uniquely positioned to serve as a neutral broker, bringing together government, industry and other development stakeholders to promote new solutions to old problems. For more information about the Digital Impact Alliance or this paper, please visit our website: www.digitalimpactalliance.org

FOREWORD

The United Nations Sustainable Development Goals (SDGs), set to be achieved by 2030, are not currently on track. Progress can be accelerated, however, through the transformational potential of digital technologies, and this was clearly recognized by UN Secretary-General António Guterres last year when he established the High-level Panel on Digital Cooperation.

To date, in spite of significant efforts and investments in digital technologies and applications for development, amounting to billions of dollars worldwide, progress has been hampered by a lack of coordination, and in particular from not taking a whole-of-government approach to digital investments.

This paper sets out an SDG Digital Investment Framework which is intended to be the start of a new dialogue with the digital investment community, building on the global ***Call to Action***[1] presented at the UN General Assembly in 2018. It encourages a whole-of-government approach and sets out to help governments address key strategic investment questions and choose effective, scalable technology-based solutions – and in particular help them to consider using ICT Building Blocks for economies of scale and maximum return on investment.

The SDG Digital Investment Framework is the first iteration of a process which aims to expand to include all of the main development priorities encompassed by the SDGs. In this first edition, it looks at some of the main development sectors such as agriculture, education and healthcare, and how technology can not just play an important part, but also be applied in a cross-sectoral fashion, in addressing the issues.

ITU and DIAL have benefitted from the help, input and expertise of numerous specialists in the production of this paper, and we welcome further inputs for future editions. In the meantime we hope that this paper will serve as an important starting point for governments looking to implement effective strategies to help leverage the power of information and communication technologies (ICTs) in achieving the SDGs.

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[1] ITU and DIAL. SDG Digital Investment Framework: Global Call to Action. 2018. https://digitalimpactalliance.org/wp-content/uploads/2018/10/ICT4SDGSReport.pdf

BACKGROUND

The Sustainable Development Goals (SDGs) promise to 'transform our world' by 2030, and innovative uses of information and communication technologies (ICTs) have the potential to propel government programmes to far greater effectiveness and scale, accelerating progress. Global development agencies have invested billions of dollars over the past decade to ride this wave and integrate government programming with digital technology. In 2015, the United Kingdom Department for International Development (DFID) reported investments in more than 1,800 mobile for development (M4D) apps and services that had been launched.[2] DFID was also funding more than 160 programmes with significant digital elements. Conservative estimates from the Bill & Melinda Gates Foundation place its digital investments at US$ 500 million. These two donors are far from unique in maintaining a growing portfolio of digital investments.

Despite significant investment, however, we have not seen ubiquitous scale, either in software platforms or data use, and we have not seen software vendors appreciably adjusting their product designs to help meet the SDGs. Maximizing the leverage that digital technologies can have on global development requires governments and their partners to take new approaches both to architecting and to investing in digital infrastructure that delivers development-related services.

In July 2018, United Nations (UN) Secretary-General António Guterres established the High-level Panel on Digital Cooperation to 'realize the transformational potential of digital technologies' by accelerating cooperation.[3] This panel is a great step forward, because it demonstrates that the effective use of digital technologies is necessary to achieving the SDGs by 2030. Policymakers still have many questions however, including: 'Which digital technologies matter most?'; 'Where do we invest first? National identification? Data privacy?'; 'How should we manage legacy information systems?'

To support government efforts in addressing these questions and choosing effective technologies, ITU and DIAL have developed a framework to inform global digital investment, building on the global *Call to Action*[4] presented at the United Nations General Assembly in 2018, encouraging a whole-of-government approach to digital investment supporting the SDGs.

In two parts, this paper presents an initial version of a framework to guide governments, donors, technology solution vendors, and other actors investing in taking a whole-of-government approach to investing in, developing, or implementing ICTs. As we partner with countries to apply the framework, we will continue to update it with our findings.

Part One introduces the theoretical framework and theory of change, and provides the rationale and business case for adopting a whole-of-government approach to digital investments, which we believe to be necessary for countries if they are to realize the full benefits of ICTs at scale, and to achieve the SDGs.

Part Two illustrates how the framework can be used to identify which technologies matter most in achieving the SDGs. The four interrelated layers – the SDG Targets, Use Cases, WorkFlows, and ICT Building Blocks – are introduced, and we provide a step-by-step process allowing organizations to use this framework and begin enterprise architecture planning designed to accelerate progress toward the SDGs.

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[2] Pippa Ranger, Julia Chandler, Beatrice Arscott. 'DFID Review of Digital in Development Programmes'. February 2015.
[3] https://digitalcooperation.org/
[4] ITU and DIAL. SDG Digital Investment Framework: Global Call to Action. 2018. https://digitalimpactalliance.org/wp-content/uploads/2018/10/ICT4SDGSReport.pdf

PART 1: INTRODUCTION TO THE SDG DIGITAL INVESTMENT FRAMEWORK

This section presents the rationale and a model for a whole-of-government approach to digital technology investments, describes the key elements of the SDG Digital Investment framework, and outlines who will benefit.

1.1 A whole-of-government approach to digital investments to achieve the SDGs

A whole-of-government approach to digital investments is needed if countries are to realize the full benefits of ICTs at scale in achieving the SDGs.

Despite significant investment, we have not seen ubiquitous scale either in software platforms or data use, and we have not seen commercial software providers appreciably adjusting their product design to meet the SDGs. A key reason for this is that digital investments, like global development investments in general, are most often siloed by sector, resulting in significant fragmentation and duplication of efforts. This makes it difficult for governments to understand where there are common products that could be used and disincentivizes technology providers from building these products, as the market size seems too small.

There is growing support for and evidence of governments taking a whole-of-government approach to investing in digital infrastructure that can deliver reusable digital services at scale with a greater return on investment (ROI). WGA refers to a cross-sectoral and cross-organizational consideration of individuals' needs with reference to delivering digital services in a more integrated and coordinated manner. Digital services is a broad term referring to the electronic delivery of data or functionality. Limited resources require a holistic architectural approach, taking advantage of economies of scale that are not available when delivering digital services in a piecemeal fashion. Evidence from countries as diverse as India and Estonia illustrates how a government-wide approach to investing in shared digital infrastructure can lead to a more rapid scaling-up of development services, with strong protection for citizens' rights at a fraction of the cost.[5]

In 2018, India published its government enterprise architecture, IndEA, which applied the whole-of-government approach to delivering common services throughout the public sector, with a particular focus on the SDGs.[6] The IndEA framework guides investment into digital public goods, which in effect are centrally administered digital infrastructure and applications available to all sectors. A prime example of a digital public good is India's national identification system, called Aadhaar, which was launched in 2009, and had over 1.2 billion subscribers by 2018. Since its introduction, Aadhaar has stimulated the growth of India's digital economy, enabling digital payments of US$ 57 billion, and saving the government US$ 13 billion in reduced transaction overheads.[7] A World Bank study showed that digital identification implemented as a public good yielded a significant net positive return on investment in a large variety of development-related services (eg banking, health).

The whole-of-government approach to digital infrastructure taken by India has provided a model for other countries. For example, Rwanda, under its Vision 2020 strategy, launched a modernization

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[5] Saha. 'Realizing SDGs with Government Enterprise Architecture'. https://www.linkedin.com/pulse/realizing-sdgs-government-enterprise-architecture-dr-pallab Accessed on 11 March 2019.

[6] Ministry of Electronics and Information Technology, Government of India. IndEA: India Enterprise Architecture Framework

[7] Nandan Nilekani. 'India's Inclusive Internet'. Foreign Affairs. September/October 2018. https://www.foreignaffairs.com/articles/asia/2018-08-13/data-people Accessed on 11 March 2019.

campaign to digitize its economy and empower its middle class. A key component of the programme is the move to a cashless economy, which the government aims to achieve through ubiquitous mobile phone penetration and high-speed Internet access. Four years ago, to achieve this ambitious goal, Rwanda joined the Better Than Cash Alliance, a global partnership committed to moving from cash to digital payments. Today, Rwanda is already realizing increased efficiency and revenue by eliminating collection costs and other expenses. It has also become a knowledge-leader in the region, hosting its second conference in 2018 to share best practices with others who are interested in pursuing a similar path, with representatives from Côte d'Ivoire, Ghana, India, Papua New Guinea, Malawi, Nepal, Paraguay and Sierra Leone all coming to learn from Rwanda's experiences and taking lessons back to their own countries.

FIGURE 1. Key challenges in the current global digital ecosystem landscape

In 2018, DIAL conducted a baseline survey of the current digital ecosystem in the development space.[8] The survey highlighted several key challenges that the SDG Digital Investment Framework is designed to address:

1. **Funding cycles are disconnected from tech development cycles.** Donor-based funding is time-bound and focuses on project-based solutions, leading to duplication and wasted effort, as projects end and their tools either do not survive or are only used in a limited fashion.

2. **Siloed planning and decision making across stakeholder groups.** Limited opportunities for coordination among stakeholder groups limits reuse of digital solutions and undermines their potential applicability across programmes and sectors.

3. **Lack of digital literacy.** Capacity in ICT leadership, and in the selection, design, implementation, scaling up, and maintenance of ICT solutions, are often lacking among governments and development practitioners.

4. **Absence of funding for scaling up ICTs.** The bulk of funds available for ICTs is focused on the early stages of the technology development life cycle, with limited funding available for scale and diffusion, core product maturity, and enterprise readiness. This funding gap, as illustrated in the image below, contributes to the dearth of ICT products with sufficient maturity for governments to institutionalize at the national scale.

Other countries have also launched digital investment campaigns to drive sustainable community and rural development. For example, Niger's Smart Villages initiative aims to increase national cellular and Internet coverage to 100 per cent to catalyze rural development in agriculture, commerce, education, finance and health.

Recognizing that many governments lack the economic justification, human resources, and long-term vision for a shared ICT infrastructure that emulates the enterprise architecture approach employed in India, ITU and DIAL have developed this present framework to identify and prioritize an initial set of shared ICT services that directly support national development priorities.

The experiences gained through implementation of these shared ICT services provide a political, programmatic and technical basis for gradually building the governance mechanisms, human capacity and infrastructure needed to support the transition towards a digital economy. For countries further along the digital transformation pathway, this framework can be used to strengthen emerging or existing application architectures by prioritizing and optimizing what we describe as 'ICT Building Blocks'.

[8] Digital Impact Alliance. Global Digital Ecosystem Baseline Study, 2018. https://digitalimpactalliance.org/wp-content/uploads/2019/01/DIALBaselineEcosystemStudy.pdf Accessed 11 March 2019.

1.2 What is the SDG Digital Investment Framework?

The SDG Digital Investment Framework helps governments and their partners to take a whole-of-government approach to invest in shared digital infrastructure to strengthen SDG programming across sectors.

The framework accomplishes this by defining four interrelated layers:

- **SDG Targets** define high-level objectives to which governments systematically align their development goals.
- **Use Cases** define the steps necessary to achieve a business objective contributing to one or more SDG Targets.
- **WorkFlows** are generic business processes, such as 'client communication' or 'procurement', that support the delivery of a Use Case.
- **ICT Building Blocks** are reusable software components that enable WorkFlows and Use Cases across multiple sectors.

The framework makes the connection between SDG Targets and ICT Building Blocks by borrowing from enterprise architecture planning (EAP), which is a process to align an organization's ICT investments to its business strategy.[9] As governments set long-term national development goals, administrators may want to use an EAP model to understand the business processes, organizational capabilities and ICT infrastructure to support those goals while driving digital transformation and modernization. EAP is an invaluable skill to build capacity in for governments and their partners; indeed, it is standard practice in many large organizations. It is a complex and resource-intensive practice, however, that may be out of reach for individual governments and projects. This framework is therefore meant to be used both as a quick start guide and a useful reference.

ITU and DIAL developed this framework to complete an important part of the EAP process in advance by designating the SDG Targets as the strategic business objectives, and then mapping priority Use Cases, WorkFlows, and ICT Building Blocks to those targets. Governments and their partners can use this framework to jumpstart their own whole-of-government approach digital investment and architecture planning processes. Figure 2 shows how a government might map its cross-sector development goals, as defined by the SDG Targets, through the layers of the framework to determine a set of ICT Building Blocks that could be shared across agencies and sectors. The Use Cases, WorkFlows, and ICT Building Blocks identified during this process are catalogued in the Appendix.

This architectural map is a key input for an organization developing its own long-term digital investment strategy. It is also a roadmap that an organization can use to increase efficiency and deliver a higher return on digital investments, even while scaling up digital services to a larger number of sectors and programmes. While each organization, country, and programme is unique, there exists significant overlap in how ICTs are used to support SDG-related programming.

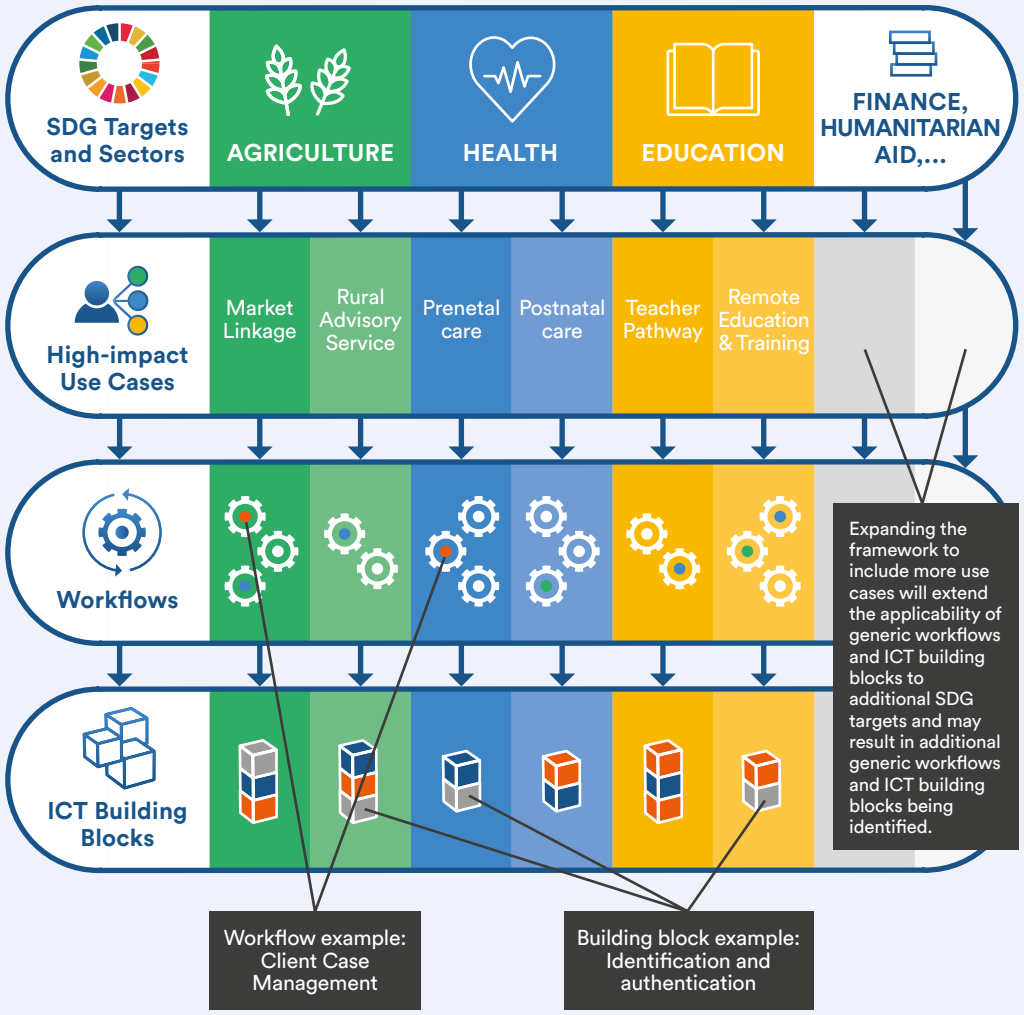
Consider an example of related programmes in agriculture and education. Providing rural farmers with direct transfer of benefits to purchase seed may use the same underlying core technologies as delivering electronic vouchers to parents for school supplies and textbooks. If a government

[9] A full discussion of enterprise architecture planning is beyond the scope of this publication. The TOGAF Enterprise Architecture methodology is a useful reference. https://www.opengroup.org/togaf-standard-version-92-overview Accessed on 11 March 2019.

implemented a set of generic software components to administer electronic payments, then the ICT infrastructure, human capacity, and organizational capabilities put in place to support one programme, such as digital farm subsidies, could be repurposed for many others, even if each programme is in a different sector. These common software components are what we refer to as **ICT Building Blocks**, and they share certain characteristics, including defining a package of functionality and being designed for scalability and extensibility, compliant with relevant standards, and capable of interoperating with other ICT Building Blocks.

To maximize ROI, a government must be able to draw a line connecting its national development goals to the programmes it is implementing to achieve those strategic goals, and to connect each programme to the reusable software components which help deliver them. Figure 3 illustrates this premise: **Common ICT Building Blocks enable generic business processes, or WorkFlows, that can be combined and repurposed in multiple ways to deliver priority Use Cases that contribute to SDG Targets**. National governments can prioritize Use Cases according to citizens' needs (eg improve neonatal outcomes), map functionality across sectors, and then invest in shared infrastructure comprising ICT Building Blocks.

FIGURE 2. Example architectural map using the SDG Digital Investment Framework



Using the framework as described above, we can show how a common set of ICT Building Blocks can be employed to deliver priority Use Cases within multiple sectors.

Consider ***SDG Target 3.1: End all forms of malnutrition by 2030***. Studies have demonstrated that periodic educational information and reminders, customized to a child's age and weight, and sent to a parent's mobile device via text message or interactive voice response, can lead to improved infant and child nutrition. Text messages or phone calls can also be used to coordinate health worker follow-up. This intervention represents a nutrition Use Case that can be delivered by a sector-agnostic WorkFlow to send predefined messages at scheduled intervals that are customized for each client and to schedule an appropriate human resource follow-up. This WorkFlow could be supported by a messaging service, a scheduling service, a WorkFlow service, and a shared data repository.

While there are many software components available that an implementer could deploy to facilitate the nutrition intervention, including off-the-shelf or bespoke products specific to this type of programme, adopting common ICT Building Blocks allows implementers to reuse the same technology for other Use Cases (eg sending a reminder to a farmer about crop insurance). Figure 4 illustrates how similar Use Cases in health, water and sanitation rely on the same scheduled messaging and coordinated follow-up WorkFlows, and can therefore reuse the same ICT Building Blocks.

This reuse allows governments to set the stage for digital transformation through an integrated whole-of-government approach model maximizing ROI and iteratively building up an application architecture in support of the SDGs. As government programming expands to other SDGs, the same infrastructure may be applied to related Use Cases in agriculture, education, finance and other sectors, increasing ROI even further. Figure 5 illustrates how leveraging common software infrastructure within different sectors and Use Cases results in significant cost savings and enables the scaling-up of multiple development programmes, extending both their reach and effectiveness. This potential ROI can help incentivize governments and other funders to make the large-scale investments needed to implement sustainable ICT platforms at scale.

FIGURE 3. SDG Digital Investment Framework Theory of Change

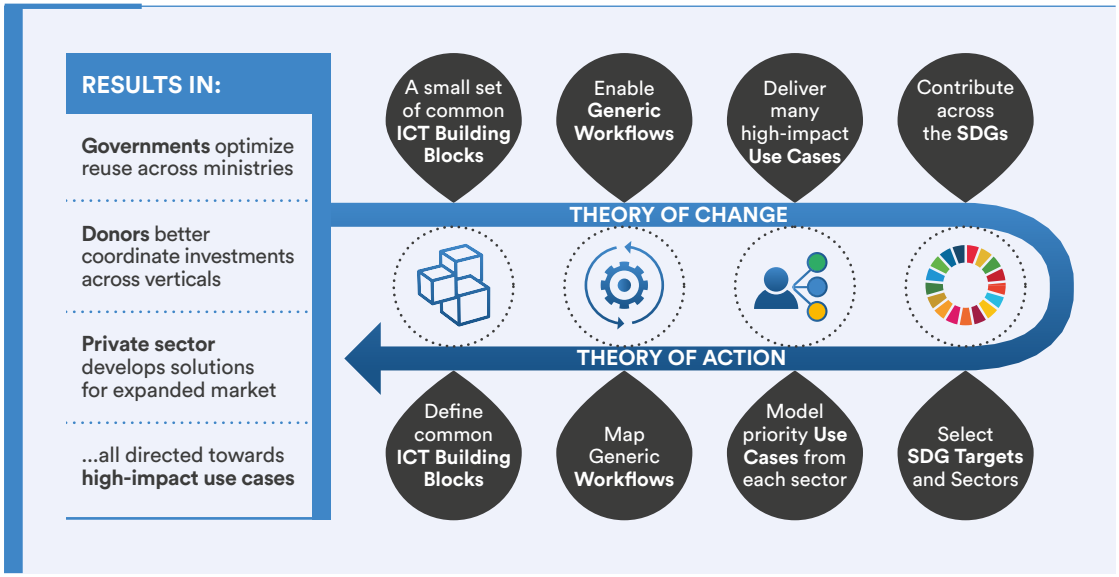


FIGURE 4. Example of reuse of ICT Building Blocks to deliver Use Cases for SDGs 2, 3 and 6

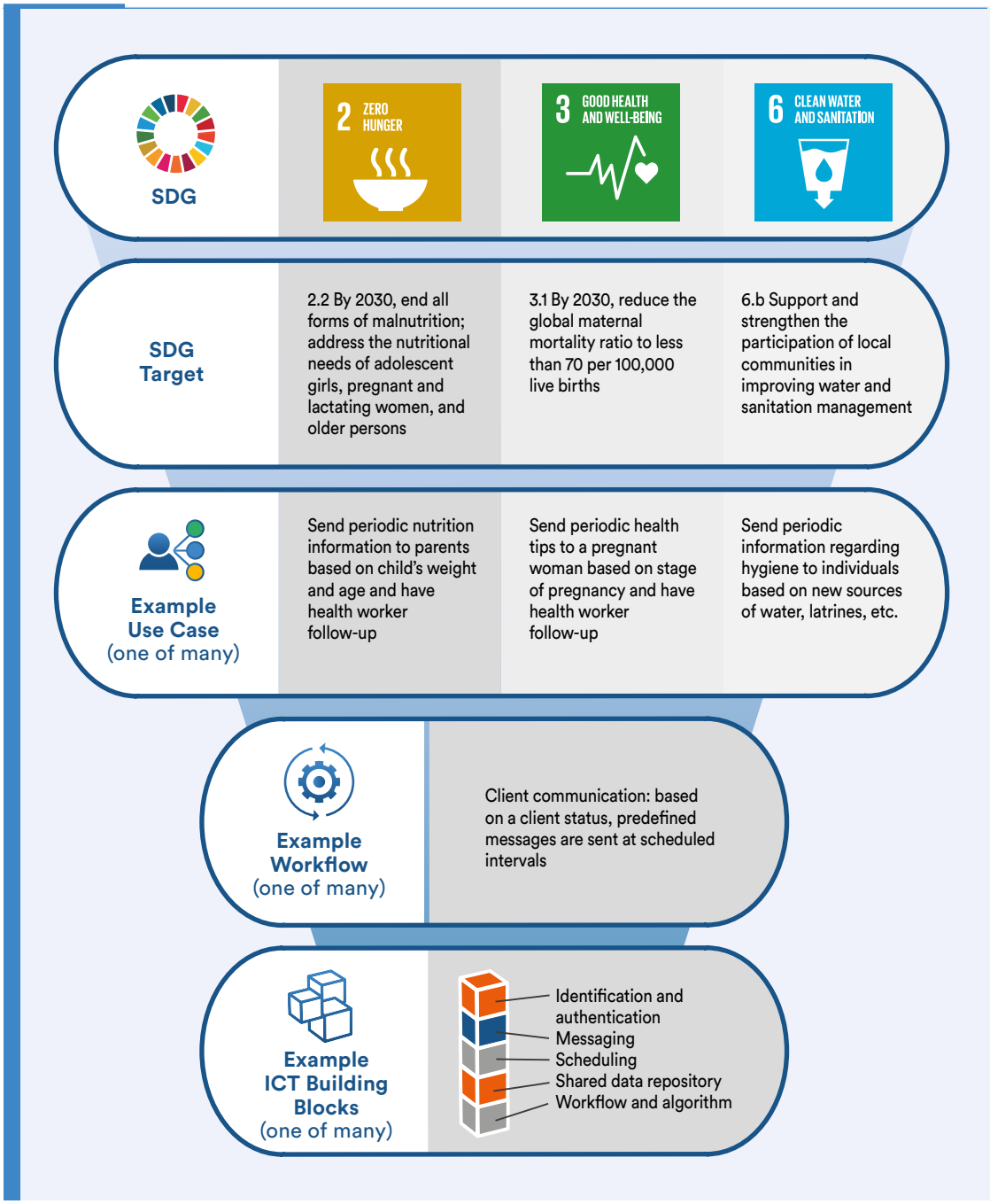
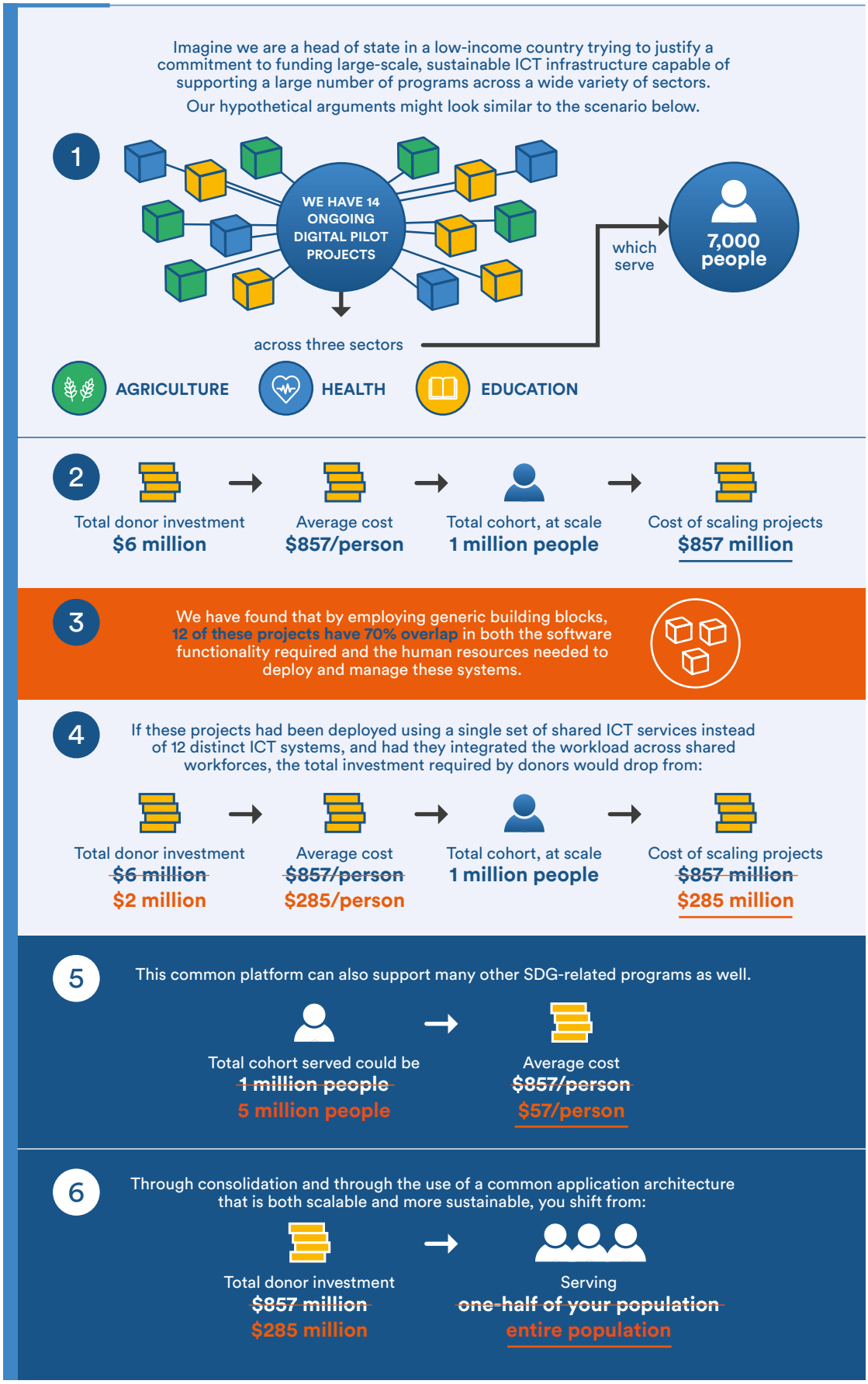


FIGURE 5. Illustration of Savings Through Reusable Digital Investment Approach



1.3 Benefits of the SDG Digital Investment Framework

A whole-of-government approach to digital investment to help achieve the SDGs stands to benefit the entire value chain: citizens, businesses, governments and their partners, and the supporting ecosystem of ICT developers and implementers.

Investing in reusable ICT Building Blocks increases efficiency and delivers better ROI for governments. It also creates a platform ecosystem providing incentives for a higher volume of application developers. Combining functionality in this way can also attract increased investment. This investment will in turn provide incentives for the private sector to fill the emerging cross-sector market demand and, critically, to extend services to populations that would not otherwise be able to afford them. Citizens, who are the direct beneficiaries of ICT-supported programmes, will enjoy more integrated, comprehensive and higher quality services from their government, ultimately leading to improved livelihoods. Figure 6 details the potential benefits of the framework by stakeholder type and objective.

FIGURE 6. Framework benefits by stakeholder type

STAKEHOLDER	STAKEHOLDER OBJECTIVE	POTENTIAL BENEFIT
Citizens	Co-create services with government to obtain more integrated, equitable and safer and more equitable access to services	The lives of significantly more citizens are improved through becoming active partners in governance
Businesses	Use shared digital services to lower the cost of doing business, improve service offerings, and access new markets	Increase profits and expand services provided to customers
Governments	Support whole-of-government approach and architecture-based approach to minimizing total cost of ownership while maximizing ROI and cost-effectiveness of their digital investments in support of SDGs	Accelerated progress toward SDGs through greater coverage of services by ICTs, increased government ownership of ICT infrastructure, simplified procurement processes, and access to enterprise platforms capable of supporting cross-sector applications Increased confidence in government by citizens
Technology vendors	Provide a roadmap for developers depicting what cross-sector functions should be developed and what interoperability requirements are needed in order to support integrated end-to-end service delivery	Rollout of enterprise, standards-based platforms leading to faster roll out and scale-up of services Access to expanded market, and quicker time to market for new services and sustainable support infrastructure
NGOs and implementing partners	Integrate offerings and interoperability hooks to address the end-to-end needs of government programmes	Reduced fragmentation and availability of higher quality products tailored to meet the SDGs, simplified procurement processes, lower costs through volume pricing
Donors	A strategic framework for coordinated cross-sector investment that increases ROI and cost-effectiveness	Improved ROI through ability to leverage and scale-up ICT infrastructure across investment portfolios

PART 2: SDG DIGITAL INVESTMENT FRAMEWORK

This section:

- Defines each layer of the framework in detail with examples;
- Summarizes the Use Cases, WorkFlows and ICT Building Blocks that have been catalogued to date; and
- Presents a step-by-step process for applying the framework to an organization's architecture and investment planning.

Both the Catalogue, found in the the Catalogue, at the end of this section, and the planning process described here are preliminary and will evolve as the framework is expanded to additional sectors and Use Cases. Additional enterprise architecture guidance that builds on this framework is also forthcoming.

The approach described here is primarily intended for individuals within government agencies and partner organizations who are contributing to digital investment and architecture strategic plans, such as a digital transformation or e-Government initiative. This includes decision makers and technical programme leads from the government programming side, and decision makers, enterprise architects, and business analysts from ICT-related agencies, such as the Ministry of ICT and the Ministry of Telecommunications. Funders and non-governmental organizations supporting SDG-related programming may also find value in applying the framework to their own digital investments. Solution vendors may use the framework to better tailor their products to meet the needs and technology requirements of SDG programmes.

2.1 Overview

The SDG Digital Investment Framework consists of four interrelated layers that connect reusable software components to SDG Targets. Figure 7 provides a definition, key characteristics, and examples for each layer. The Appendix includes a catalogue of the SDGs and the ICT Building Blocks, WorkFlows, and Use Cases defined to date, and is intended to be used as a reference. Examples are illustrative rather than exhaustive.

FIGURE 7. SDG Digital Investment Framework layer definitions and examples

LAYER	EXAMPLE
SDG Targets The SDGs comprise 17 goals and 169 targets representing global priorities for investment in order to achieve sustainable development	**SDG Target 2.2:** By 2030, end all forms of malnutrition; address the nutritional needs of adolescent girls, pregnant and lactating women, and older persons
Use Case The steps that an individual or system will undertake in order to achieve a business objective **Key characteristics:** • User-centric description of the steps or user journeys required to deliver an outcome • Defines the actor or actors involved in the Use Case • Identifies one or more SDG Targets as its business objective • Describes the generic WorkFlows and business processes involved in each step in the Use Case • Typically sector-specific • Able to be improved through digital technology	**Maternal and newborn health:** Care for mother during pregnancy and for mother and child during postnatal period by the health system, resulting in a healthy mother and child **Remote learning:** Digital content and tools to provide or supplement all types of learning in disconnected or connected environments **Market linkage:** Connecting rural farmers to market information, products, and related services to improve rural incomes
Workflow A generic business process that contributes to SDG Use Cases across multiple sectors and can be developed as a set of organizational capabilities **Key characteristics:** • Common business process used to help an organization carry out its overall function • Applicable to multiple SDG Use Cases in various sectors • Powered by one or more ICT Building Blocks	**Client case management:** Enrolment, tracking and monitoring of services provided to a beneficiary or household, often across multiple service categories **Procurement:** Management of business operations dealing with inventory, from re-stock to disbursement **Content management:** Create, organize, publish and secure content (text and multimedia) to make it easier to navigate and retrieve throughout an organization
ICT Building Blocks An enterprise-ready, reusable software component that provides key functionality to facilitate generic WorkFlows across multiple sectors **Key characteristics:** • Reusable software component • Can be open-source, commercial off-the-shelf (COTS), or freely available with open access to data • Facilitates one or more generic WorkFlows • Applicable to multiple SDG Use Cases across multiple sectors • Interoperable with other ICT Building Blocks • Designed for scalability and extensibility • Standards-based	**Payments service:** Implements and logs financial transactions such as insurance claims processing, product purchase or remittance of service fee; also provides features for tracking costs and extracting audit trails **Scheduling service:** Provides 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 **Messaging service:** Facilitates 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

2.2 SDG Targets

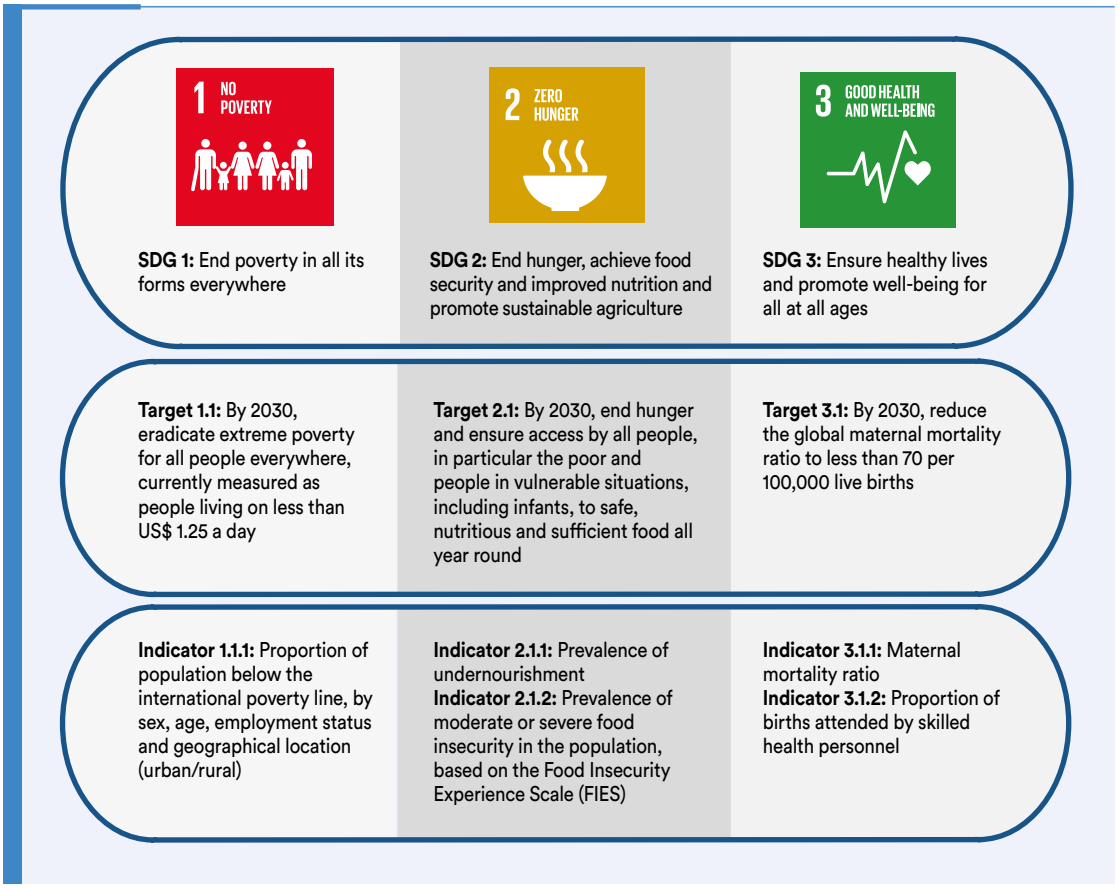
The SDGs comprise 17 goals and 169 targets representing global priorities for investment in order to achieve sustainable development.

The SDG Targets provide a set of high-level, measurable business objectives that governments can use to focus ICT-facilitated programming towards national and global priorities. For example, a government may set a national development priority to end hunger, aligning with ***SDG Target 2.1***, which the UN[10] recommends be monitored by measuring the prevalence of undernourishment (Indicator 2.1.1) and the prevalence of moderate or severe food insecurity in the population (Indicator 2.1.2).

The SDG Targets serve as the business objectives for Use Cases, the next layer of the framework, ensuring that all Use Cases and other components in the framework can be tied directly to development goals. Governments may also choose to use the SDG Indicators to inform their own monitoring and evaluating approach to tracking the effectiveness of their programming.

Figure 8 shows a sample of SDGs with a subset of their targets and indicators. The full list of goals, targets and indicators is included in the Appendix for reference.

FIGURE 8. Sample of SDG Targets and indicators



[10] The UN Statistical Commission Interagency and Expert Group on SDG Indicators. See https://unstats.un.org/sdgs/ Accessed 11 March 2019.

2.3 Use Cases

A Use Case defines the steps that an individual or system will undertake in order to achieve a business objective.

A Use Case is a common tool within ICT projects to help technology developers create solutions that support real processes and needs. A properly designed Use Case, if followed, would be expected to increase the likelihood of achieving a desired outcome. For the purposes of the SDG Digital Investment Framework, Use Cases are selected on the basis that they are prioritized by governments and their partners; contribute to one or more SDG Targets; and can be facilitated or improved by ICT solutions. For example, rural advisory services or market linkage programmes are both important Use Cases within the agriculture sector that contribute to specific targets within ***SDG 2: End Hunger.***

A primary aim of this framework is to assist decision makers and enterprise planners in the identification of common business processes and ICT solutions that can serve as the basis for a shared information architecture. A Use Case is an effective starting point for this analysis, because each step in a Use Case is comprised of one or more business processes, each of which may be supported by ICT solutions. Figure 9 illustrates the business processes and supporting technologies for an illustrative rural advisory service Use Case.

Note that Use Cases will often include steps that are supported by ICTs as well as steps that are not, as both may be required to deliver a specified business objective. For example, while a mobile service may assist a rural farmer in securing a product buyer, physical distribution of the product to the market is still necessary to complete the transaction.

A mapping of ICT-facilitated Use Cases to the SDG Targets illustrates potential applications of ICTs in helping to achieve global development priorities. Governments can use this mapping to assess current coverage and identify opportunities to use ICTs to support their goals. When Use Cases are further broken into generic WorkFlows and ICT Building Blocks (described below), this mapping serves as the foundation for reuse across programmes and sectors, helping to compose a portfolio of Use Cases that could bolster efforts to achieve the SDGs and be delivered by a shared ICT architecture applicable across sectors. Figure 10 demonstrates how a selection of Use Cases map to SDG Targets. Refer to the Appendix for the full details on Use Cases mapped and modelled as of the date of this publication. More Use Cases will be added as the framework is expanded to include additional development sectors.

FIGURE 9. Rural Advisory Service Use Case

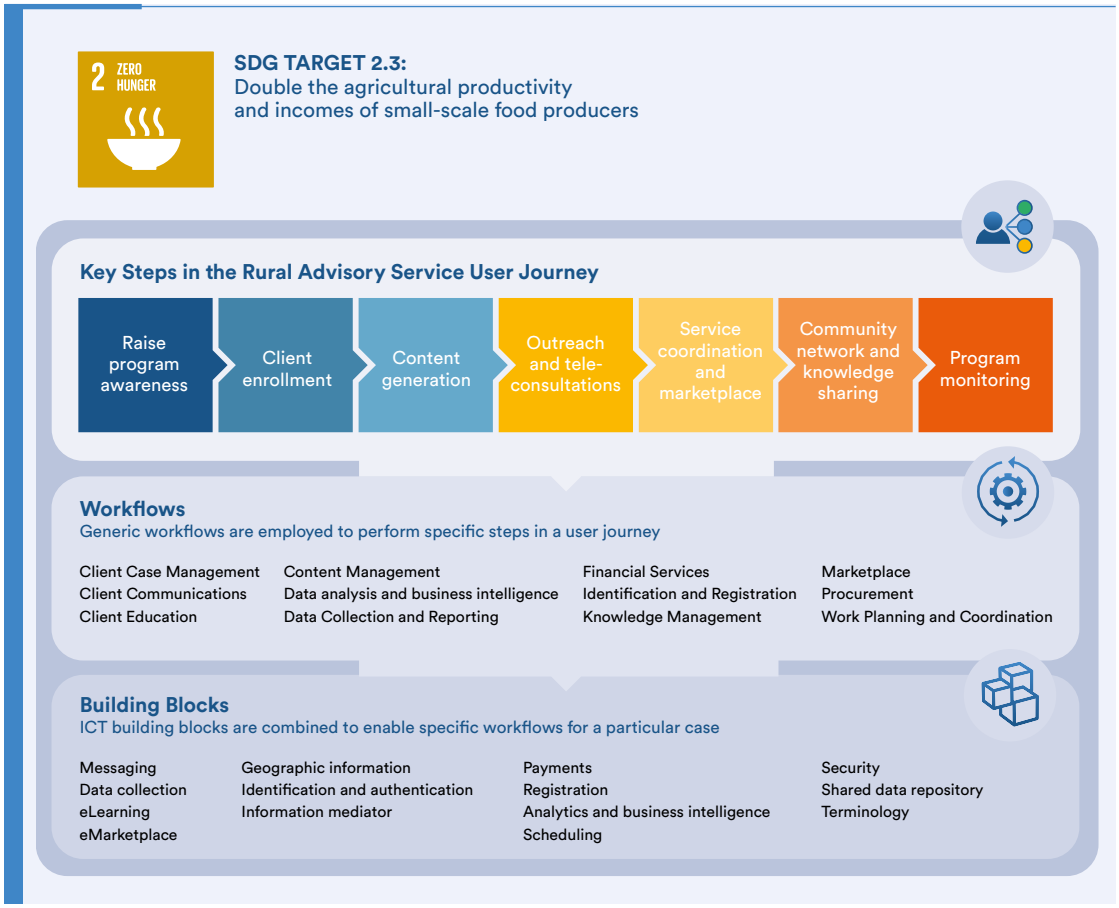


FIGURE 10. Selected priority Use Cases grouped by sector and mapped to SDG Targets

SECTOR	USE CASE	SDG TARGET
Agriculture	**Market linkage** Connecting rural farmers to market information, products, and related services to improve rural incomes.	**2.1** Ensure access to safe, nutritious foods **2.2** End all forms of malnutrition **2.3** Double small-scale agricultural productivity
	Rural advisory service Enhance rural farmer productivity through local outreach and training services.	**2.3** Double small-scale agricultural productivity **2.4** Implement resilient agricultural practices
Education	**Remote learning** Digital content and tools to provide or supplement all types of learning in both connected and disconnected environments.	**4.1** Free primary and secondary education **4.3** Equal access to tertiary education **4.4** Increase job skills **4.5** Ensure equal access to education
Finance	**Digital microinsurance** Insurance products targeted to underserved populations that leverage digital mechanisms to improve outreach and delivery.	**1.4** Ensure access to economic resources **2.4** Implement resilient agricultural practices **3.8** Universal health coverage
Health	**Maternal and newborn health** Care for mother and child spanning the prenatal and postnatal periods resulting in a healthy mother and child. **Communicable disease management** The coordination, diagnosis, and treatment of communicable diseases, such as HIV/AIDS or tuberculosis, often by teams of care providers across community and healthcare facility settings.	**3.1** Reduce maternal mortality **3.2** Reduce newborn and child mortality **3.3** Reduce incidence of HIV/AIDS, tuberculosis, malaria and other infectious diseases
Humanitarian Aid	**Beneficiary case management** Enrolment and tracking of beneficiaries and their household to deliver, coordinate, and monitor humanitarian services.	**1.3** Implement social protection systems

2.4 WorkFlows

A WorkFlow is a generic business process that can be applied to SDG Use Cases across multiple sectors.

WorkFlows are defined by abstracting similar business processes from multiple Use Cases into a single generic process that can be applied to related activities across sectors. For example, an enterprise planner may model the sector-specific processes for identification and registration of farmers, students, and patients as a common WorkFlow that takes into account the unique programme requirements of each. Identifying the common elements of business processes can be accomplished by separating each into the business functions performed as part of the process, such as 'Record personal identifiers', 'Assign unique identifier', or 'Retrieve person registration information with unique identifier'.

Such an approach may enable a government to consolidate human capacity and supporting ICT infrastructure and therefore benefit from economies of scale. Other government agencies and partners can then employ the same WorkFlow for identification and registration, increasing ROI even further. As the government invests in new capabilities, such as biometric identification, or links identifiers to other services, such as mobile payments, all stakeholders can benefit from the enhancement. In this way, developing organizational capabilities around common ICT-facilitated WorkFlows can be the basis for reusing human capacity and underlying technologies.

Figure 11 illustrates how related financial processes in programmes from three different sectors can be separated into common business functions and modelled as a generic WorkFlow.

Note that a Use Case based on generic WorkFlows would also typically still involve additional non-generic business processes.

Through the process of analyzing commonalities in business processes from priority Use Cases, a number of generic WorkFlows were identified. Figure 12 summarizes the generic WorkFlows defined in our initial analysis. WorkFlows will be added as the framework is expanded to include additional Use Cases, including Use Cases from other development sectors.

FIGURE 11. Financial services workflows common to use cases in multiple sectors

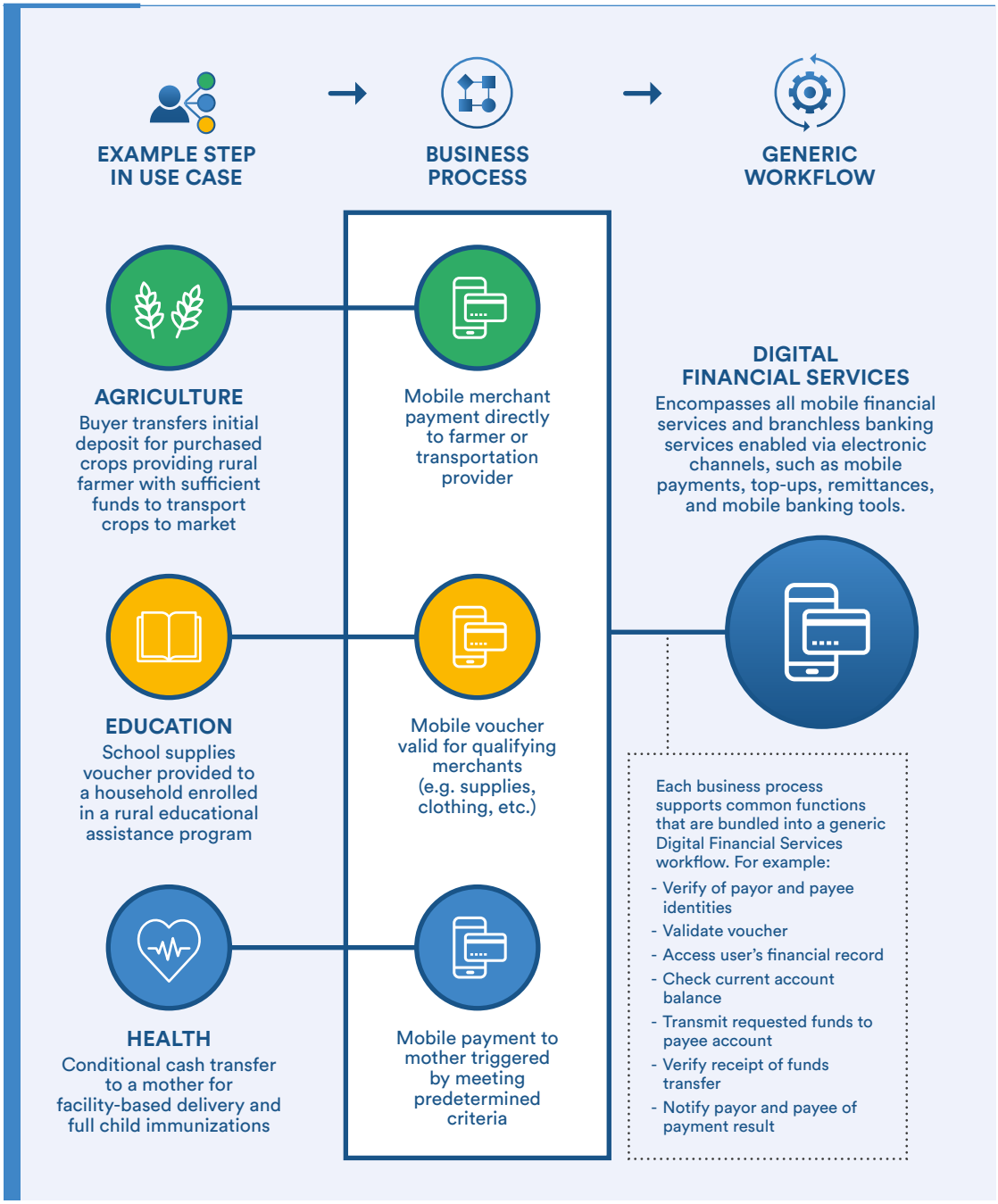


FIGURE 12. Summary of generic WorkFlows defined to date

Client case management – Enrol, track and monitor services provided to a beneficiary or household, often across multiple service categories

Client communication – Create bulk or individual communication between businesses and their clients or between individuals using a variety of digital and traditional channels, including mail, short messaging service, interactive voice response, or social media

Client education – Create and disseminate educational content for training or to promote awareness of a topic

Content management – Create, organize, publish and secure content (text and multimedia) to make it easier to navigate and retrieve, across the organization

Data analysis and business intelligence – Define aggregate functions across samples of data values; create alerts around anomalous or statistically significant events or occurrences in the data

Data collection and reporting – Define, collect, validate, normalize and aggregate structured data of all kinds (often to replace paper forms): text, numeric, geospatial or multimedia.

Decision support – Apply generic aggregation or analytical algorithms to raw data, combining these results with domain-specific business knowledge, to produce strategic, actionable insights or alerts

Financial services – Automate banking service functions between an organization and its beneficiaries, and integrate functions between the two

Identification and registration – Uniquely identify and collect pertinent information about people and business objects (inventory, locations, or events) for any particular business process

Knowledge management – Collect, sort and archive organizational assets for easy retrieval and assimilation

Marketplace – Create a discovery platform between buyers and sellers, allowing for simple transactions of goods and services

Problem diagnosis – Build a model of hypothetical diagnoses, iteratively incorporating new data and eliminating invalid findings

Procurement – Manage business functions of procurement planning, purchasing, inventory control, traffic, reception, incoming inspection and salvage operations

Remote monitoring – Automatically collect real-time data (often time-series) from remote person or object for status check or reception of emergency alerts

Supply chain management – Design, plan, execute, control and monitor all supply chain activities with the objective of creating net value and synchronizing supply with demand; avoid stockouts, minimize wastage, and provide an audit trail

Work planning and coordination – Orchestrate the coordination and timing of activities of teams and team members within an organization

Mapping generic WorkFlows to priority Use Cases points to common business processes that multiple government programmes and partners might employ or share within their business operations. An enterprise planner building a portfolio of Use Cases could use this mapping to guide development of organizational capabilities and possible consolidation of human resources. Figure 13 illustrates a selection of Use Cases mapped to generic WorkFlows.

FIGURE 13. Selection of generic WorkFlows mapped to Use Cases

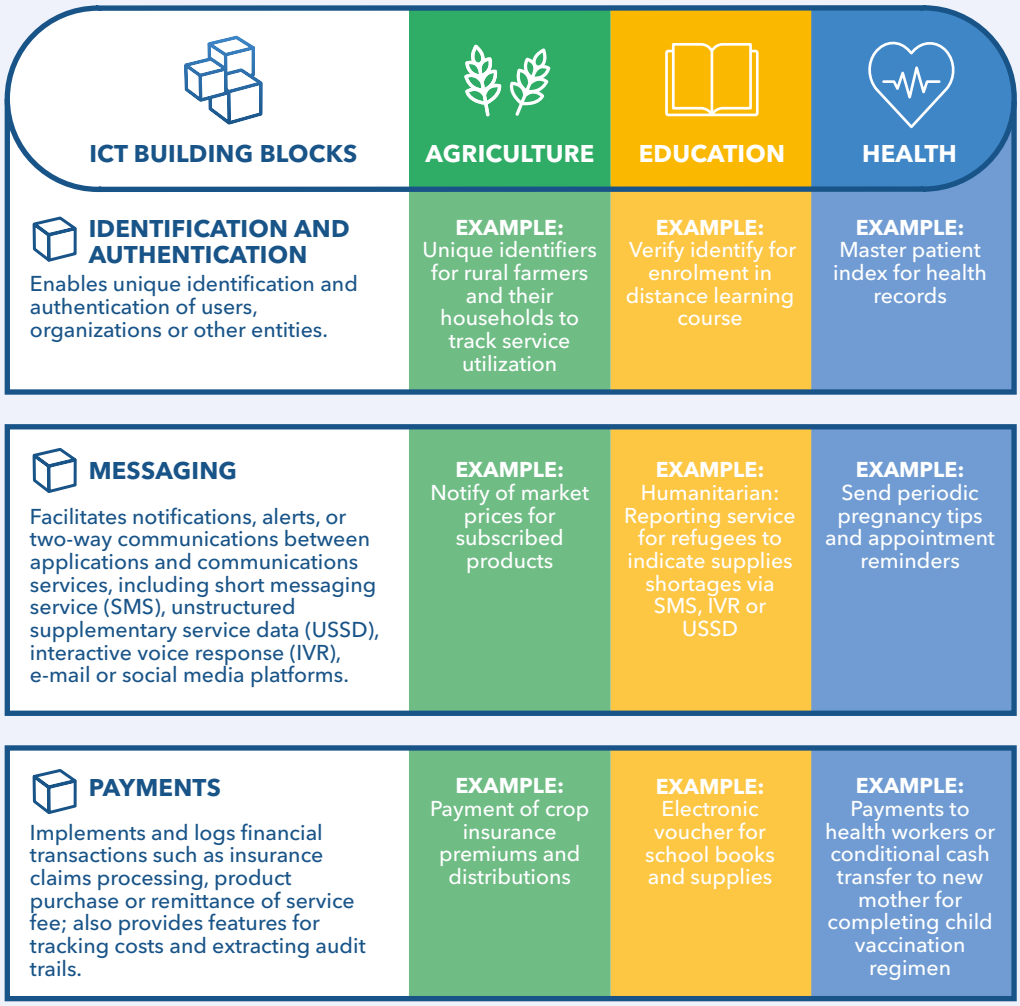
	USE CASES		
WORKFLOWS	**AGRICULTURE: MARKET LINKAGE**	**EDUCATION: REMOTE LEARNING**	**HEALTH: MATERNAL AND NEWBORN HEALTH**
Client case management	Tracking of market transactions	Enrolment in training programmes and tracking progress over time	Tracking of antenatal attendance, birth outcome and immunizations
Client communication	Automated notification of harvest schedule, market prices for subscribed products, and weather/ natural disaster updates	Notification of availability of instructor feedback on submitted materials or of local learning opportunities	Periodic health tips based on due date or age of child and automated reminders of upcoming appointments
Data analysis and business intelligence	Assess trends in rural farm productivity based on crop, proximity to market and other factors, such as weather	Analyze effectiveness of learning programmes in resulting in the development of new skills or competencies	Evaluate the impact of successful completion of maternal and newborn health programme on maternal and newborn mortality reduction
Financial services	Buyer transfers initial deposit for purchased crops, providing rural farmer with sufficient funds to transport crops to market	School supplies voucher provided to a household enrolled in a rural educational assistance program	Conditional cash transfer to a mother for facility-based delivery and full child immunizations
Identification and registration	Register and assign unique identifiers to farm, farmer and household	Register and assign unique identifier to remote learner	Register and assign unique identifiers for mother and newborn

2.5 ICT Building Blocks

An ICT Building Block is an enterprise-ready, reusable software component that provides key functionality to facilitate generic WorkFlows across multiple sectors.

It is common for software to be initially developed to solve a specific problem and then to evolve into more generalized software that can be used to solve additional related problems. This evolution from a narrowly focused to a generic, more broadly applicable software solution can be lengthy, as user behaviour and requirements become more clearly understood. ICT Building Blocks are software components intentionally designed to address a more generalized set of needs across multiple development sectors. For example, identification, digital payments, and messaging each represent needs that are common across many development programmes, creating an opportunity to reuse the same software components across sectors and programmes rather than developing, implementing and maintaining separate solutions for each. Figure 14 provides a description and examples for each of these three ICT Building Blocks.

FIGURE 14. Examples of ICT building blocks used across sectors



The reusability of ICT Building Blocks is central to improving returns on digital investments. Such ICT Building Blocks are designed for scalability and extensibility, to be compliant with relevant standards, and interoperable with other ICT Building Blocks. ICT Building Blocks may be commercial off-the-shelf products (COTS), open-source, or freely available with open access to data. An evaluation of the maturity, sustainability and total cost of ownership (TOC) of available products is necessary to maximize country customization and ownership. While there may be non-generic technology solutions designed to support a particular Use Case, whether off-the-shelf or custom-built, using common ICT Building Blocks allows implementers to consolidate human capacity and reuse the same technology for other Use Cases.

Figure 15 summarizes the candidate ICT Building Blocks defined in our initial analysis. The catalogue of ICT Building Blocks will evolve as other Use Cases and sectors are considered, to reflect new requirements and market dynamics. The catalogue does not currently assign any normative value of importance or complexity to the ICT Building Blocks. Subsequent research may reveal these rankings but the current list serves as an inventory rather than a prioritized list. While some ICT Building Blocks listed here are new and represent innovative or emerging ICT approaches, most already exist for specific sectors or Use Cases. These existing technologies are invaluable, because they can either serve as a technical foundation or inform the design for more generic solutions.

ICT Building Blocks are designed specifically to enable generic WorkFlows as defined in this framework. Figure 16 describes a selection of mappings between ICT Building Blocks and WorkFlows. Note that not all ICT Building Blocks apply to every WorkFlow.

FIGURE 15. Summary of candidates for ICT 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 analyze 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 – Records 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 and tracking of that entity over time

Reporting and dashboards – Provide pre-packaged and custom presentations of data and summaries of an organization's 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 (eg 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

FIGURE 16. Illustration of ICT Building Blocks mapped to generic WorkFlows

	WORKFLOWS		
ICT BUILDING BLOCKS	**CLIENT EDUCATION**	**DIGITAL FINANCIAL SERVICES**	**PROCUREMENT**
Identification and authentication services	Identification and authentication of client for educational services	Identification and authentication of payers and recipients	Identification and authentication of manufacturers and shipping agents
Messaging services	Notify students of available course grades or new assignments	Message recipients with a confirmation of funds received	Alert warehouse manager of shipment delivery date
Payment services	Submit voucher for tuition subsidy payment	Execute digital payments between payer and recipient(s)	Pay for procured products
Shared data repositories	Registry of educational institutions and group learning facilitators	Registry of financial institutions and cash-in agents	Registry of products and goods

2.6 Applying the framework to digital investment and architecture planning

Enterprise planners can use the framework and catalogue of ICT Building Blocks, WorkFlows, and Use Cases to begin their digital investment and architecture planning, in alignment with the SDGs.

The framework is designed to support the development of digital investment and architecture plans so that the ICT infrastructure and human resources put in place for one Use Case can be shared and reused across multiple programmes and sectors. For example, a government ministry investing in ICTs to support a specific programme might use the framework to identify generic ICT Building Blocks that meet its needs as well as also meeting the needs of other government initiatives. By doing so, it can distribute financial responsibility for maintaining the new infrastructure while simultaneously improving government services with new digital functionality. In another scenario, a country developing a digital transformation or e-government strategy could use the framework to begin to define the application architecture and organizational capabilities necessary to support government programming spanning multiple sectors based on a predefined set of development priorities.

In both of these scenarios, government administrators would use the process outlined here, along with the catalogue, to define their goals, Use Cases, WorkFlows, and ICT Building Blocks, providing an important input into an enterprise architecture planning process.

Figure 17 describes several investment scenarios informed by the framework. As countries experiment with this approach, and as the catalogue of ICT Building Blocks expands to additional Use Cases and sectors, stakeholders will be able to use the framework to inform increasingly sophisticated digital investment and architecture strategies.

FIGURE 17. SDG Digital Investment Framework – examples of investment scenarios

1) **A government ministry investing in ICTs to support a specific programme sees an opportunity to put in place ICT infrastructure that can be reused by other government initiatives.** By doing so, responsibility for maintaining new infrastructure can be distributed across sectors, helping reduce costs and maximizing ROI.
2) **A country launches a national digital transformation or e-government initiative investing in shared ICT infrastructure.** Whole-of-government approach initiatives such as this rely on a holistic approach to analyzing ICT needs across multiple sectors to ensure that ICT Building Blocks put into place are able to support diverse user needs and scale up as needed.
3) **A donor or multilateral coordinates an SDG-focused, ICT initiative in multiple countries aiming to increase ROI.** Applying the framework's ICT Building Blocks approach will assist the donor or multilateral in coordinating ICT investments across countries and programmatic areas towards reusable ICT Building Blocks.
4) **A technology vendor aims to expand the reach of its existing software product to new markets in other sectors.** A technology vendor can use the framework to identify Use Cases and requirements from other sectors to inform its product roadmaps and enter into new markets.

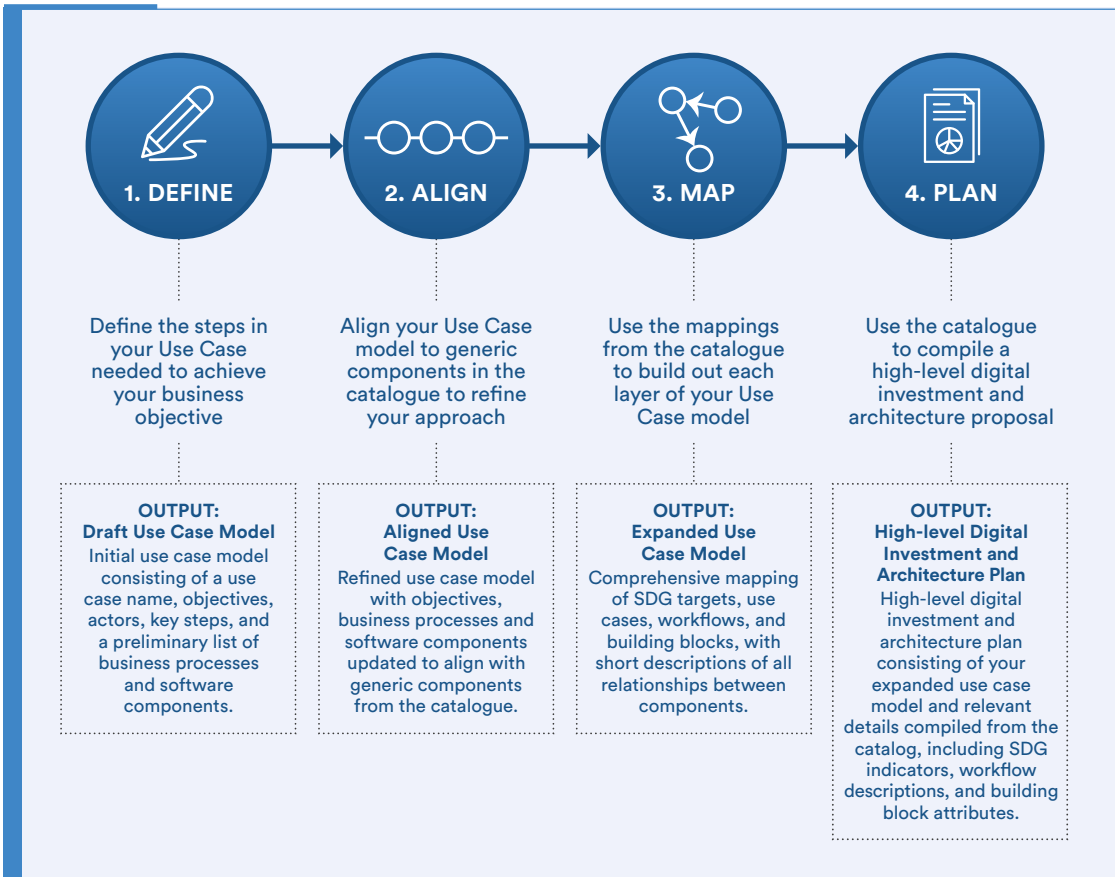
Each organization will begin planning its digital investments from a different baseline. Some organizations may have defined specific targets as part of a long-term national development policy. These organizations would use the framework to understand which ICT Building Blocks could help meet these development targets. Other organizations may have existing software components that they hope to apply to development programmes more broadly. These organizations would use the framework to identify how to repurpose and generalize existing software components into reusable ICT Building Blocks to cater to additional Use Cases in other sectors.

The remainder of this section presents a process which stakeholders can follow to apply the framework to their own digital investment and architectural planning process. The process described here starts with a Use Case as the entry point into the framework. However, this process can also be adapted to use ICT Building Blocks, WorkFlows, or SDG Targets as entry points.

The steps below show how the framework can be used to develop an illustrative Use Case model for 'subsidized vocational distance learning'. Figure 18 summarizes the steps to apply the framework to a digital investment and architecture planning process, with a Use Case as the entry point. The steps are described in further detail below.

This process results in a high-level digital investment and architecture plan which directly links investments in reusable ICT Building Blocks to your business objectives. The plan contains a Use Case model, detailed information on the generic WorkFlows, and ICT Building Blocks that are relevant to your Use Case, and the list of SDGS, targets, and indicators associated with your business objectives. This plan is intended to serve as a primary input into the digital investment scenarios described

FIGURE 18. Steps to apply the framework to a digital investment and architecture planning process with a use case as the entry point



above. For example, a Minister of ICT might use this plan to help prioritize which ICT Building Blocks to put in place first; how to leverage digitally enhanced WorkFlows to consolidate human resources and organizational capabilities from different programmes; or how to increase ROI through deployment of shared digital services.

The process helps to identify the generic WorkFlows and reusable ICT Building Blocks that can serve as the foundation for a shared application architecture, leading to higher ROI for SDG-related programming.

Step 1: Define — Define the steps in your Use Case needed to achieve your business objective

A Use Case describes the steps involved in achieving a specified business objective. In this first activity you set your business objectives, define the actor or actors involved in your Use Case, and model the steps that the actor(s) will undertake to achieve those business objectives. You also identify the business processes and software components that you expect to be used to support your Use Case. You may find it helpful to refer to the Use Case models in the catalogue to help you think through the structure of your own Use Case. Developing a Use Case is an iterative process. As you work through the activities below, revisit earlier steps to ensure that you have created as complete a picture as possible of all aspects of your Use Case. Do not worry at this stage if you are using the same names as in the catalogue, as the next step in the process focuses on aligning all of the items you have identified with components in the catalogue.

1. **Name your Use Case** – Start by writing the name of your Use Case, such as 'Rural advisory service' or 'Subsidized vocational distance learning'.

2. **Set your business objectives** – These can be as granular or as high level as is helpful for understanding your Use Case. For example, 'Strengthen workforce skills' and 'Increase employment".

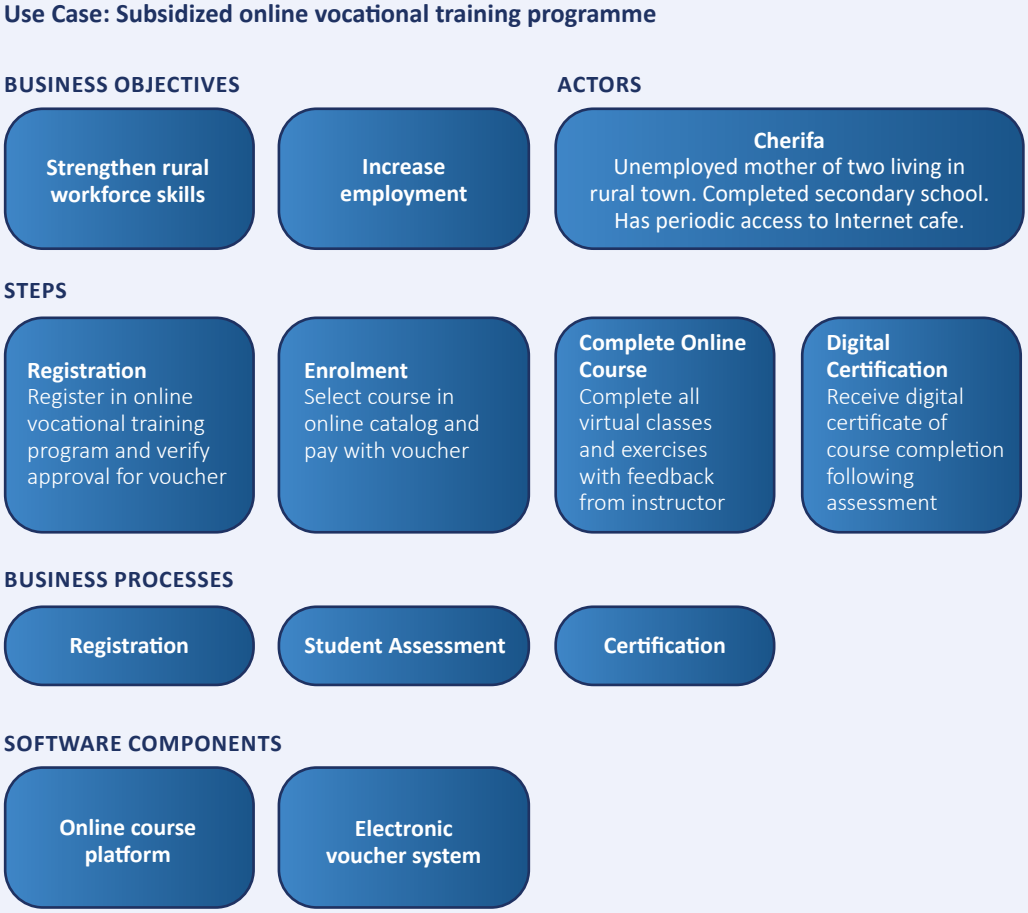
3. **Define the actors** – Identify the key individuals involved in your Use Case. You will refer to these actors by name as you model the specific steps in your Use Case, so at minimum, assign a name and a role to each actor. Developing a full persona for each actor will help you understand the user's journey as they walk through your Use Case.

4. **Model the steps** – Write out the steps involved in delivering your Use Cases. Give each step a short name, such as 'New student registration', and a description of what the actors you identified will undertake during this step. Identify business processes and software components that would be employed to enable or support each step. You can use a business process modeling tool and a requirements gathering methodology to support documenting your Use Case. If the Use Case is related to an existing programme, it may be helpful to model the existing business processes ('as-is' processes) in addition to how those processes could be strengthened and improved through the use of digital tools ('to-be' processes). Be sure also to note any legacy information systems that may be involved.

5. **Organize** – Organize the items in your Use Case model according to Figure 19. Refer to the definitions for each framework layer in the catalogue to help classify each item.

Step 1 output: Draft Use Case model
Initial Use Case model consisting of a Use Case name, objectives, actors, key steps, and a preliminary list of business processes and software components.

FIGURE 19. Sample output from Step 1: Define



Note: Business processes and software components displayed in this graphic represent how an enterprise planner might initially define their Use Case before aligning with the ICT Building Blocks in the catalogue, which occurs in the next step in this process.

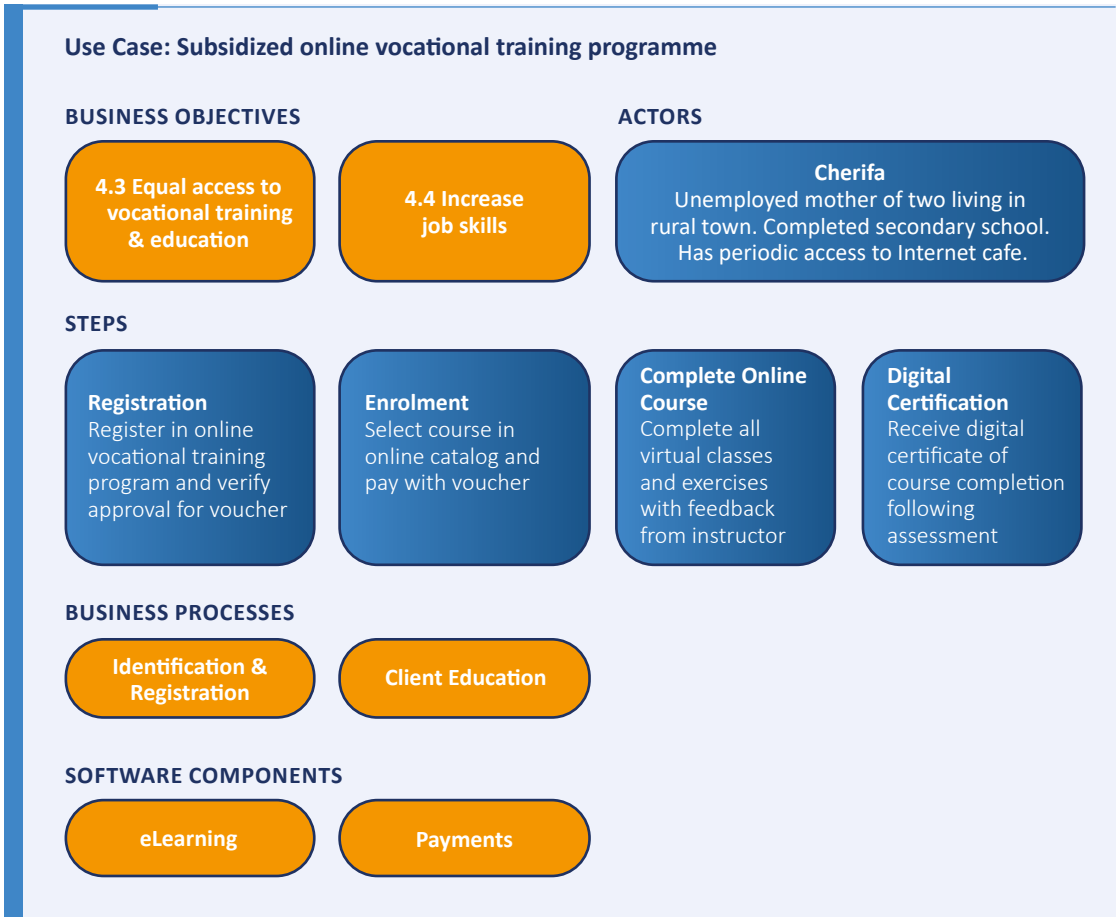
Step 2: Align — Align your Use Case model to generic components in the catalogue to refine your approach
Aligning your Use Case model with generic components defined in the catalogue sets the stage for a digital investment and architecture plan that improves ROI. In this step, you identify generic WorkFlows and ICT Building Blocks in the catalogue that correspond to the business processes and software components identified in Step 1. You also further refine your business objectives and key steps by referring to the SDG Targets and Use Case examples in the catalogue. *Note that you may not find a generic WorkFlow or ICT Building Block for each business process and software component in your model.* This is expected, in part, because the catalogue is still under development, but also because there are many programme-specific needs and processes which are not easily abstracted into more generic forms.

1. **Identify SDG Targets that correspond with your business objectives** – Review the SDG Targets in the catalogue to map your business objectives to one or more SDG Targets. Keep in mind that SDGs are designed for use at the national level, so you may need to modify the scope of your business objectives if they were originally defined with a different population group in mind.

2. **Align your business processes and software components with the catalogue** – Browse the catalogue to identify generic versions of the business processes and ICT Building Blocks in your Use Case model. The business processes in your Use Case model correspond with WorkFlows in the catalogue, and software components with ICT Building Blocks. Replace items in your Use Case model with generic components where applicable. This process often uncovers changes to the steps in the Use Case or additional business processes and software components. Feel free to modify your Use Case model as you go.

Step 2 output: Aligned Use Case model
Refined Use Case model with objectives, business processes and software components updated to align with generic components from the catalogue.

FIGURE 20. Sample output from Step 2: Align



Key:

Represents the original items defined by the planning team in Step 1.

Represents items that have been updated to align with SDG Targets or generic ICT Building Blocks and WorkFlows from the catalogue.

Step 3: Map — Use the mappings from the catalogue to build out each layer of your Use Case model

Now that your business processes and software components are aligned with generic WorkFlows and ICT Building Blocks from the catalogue, you can follow the catalogue mappings to build out your Use Case model iteratively. Following the mappings between the framework layers helps you understand the full range of business processes and software components which may be involved in fully supporting your Use Case. It also reveals opportunities to reuse ICT Building Blocks beyond the initial scope of your Use Case, whether by expanding your Use Case or by using the same components to support additional Use Cases you may not have considered earlier. Finally, it may point to opportunities to consolidate human resources around common WorkFlows.

1. **Follow mappings to build out your Use Case model iteratively**
   For each of the generic items in your Use Case model that you aligned with the catalogue in Step 2, consider how it relates to other layers in your Use Case model by referring to its 'mappings' in the catalogue. For example, the 'Payments' ICT Building Blocks supports (or 'maps to') several different WorkFlows, including 'Client case management', 'Client education', and 'Financial services'. Similarly, the 'Identification & registration' WorkFlow maps to Use Cases and SDG Targets in agriculture, education, and health. Examining how this WorkFlow is used in the mapped Use Case models from the catalogue may illustrate additional ways to use the same WorkFlow within your own Use Case model. Furthermore, analyzing existing Use Case models can guide programme design and inform the inclusion of other digital services within your Use Case.

   Consider incorporating any missing items into your Use Case model, though note that not all mappings defined in the framework will be applicable to your specific Use Case. ***Also note that you may find that your Use Case would benefit from an interaction between two components even though that mapping is not explicitly defined in the catalogue.*** Feel free to include these in your Use Case model as well.

   When you add an item, review its mappings in the catalogue at the same time, as this may point to opportunities to use the same set of components to deliver new Use Cases. In this way, you can iteratively assess each item's mappings, add additional generic components, assess the mappings of newly added components, and repeat until there are no more additions or refinements to make.

2. **Describe relationships between components**
   Write a short description for how each business process and software component supports each step in your Use Case model. ***Note that not all business processes or software components will be used for each step.*** The descriptions of these interactions will serve as the starting point for business-level requirements to be included in a digital investment and architecture plan. For example, within a remote learning Use Case, you might describe the relationship between a messaging services ICT Building Blocks and a client education WorkFlow as 'Notifying students of available course grades or new assignments'.

Step 3 output: Expanded Use Case model

Comprehensive mapping of SDG Targets, Use Cases, WorkFlows, and ICT Building Blocks, with short descriptions of all relationships between components.

FIGURE 21. Sample output from Step 3: Map

Key:

Represents the original items defined by the planning team in Step 1.

Represents items that have been updated to align with SDG Targets or generic ICT Building Blocks and WorkFlows from the catalogue.

Represents new items added by following the mappings defined in the catalogue.

Step 4: Plan — Use the catalogue to compile a high-level digital investment and architecture proposal

Now that you have expanded your Use Case model, using the mappings in the catalogue, you can compile a high-level digital investment and architecture plan, linking investments in reusable ICT Building Blocks to your business objectives. This plan will contain your Use Case model, detailed information on each generic WorkFlow and ICT Building Blocks, and the sustainable development indicators associated with the SDG Targets you set as your business objectives. This proposal is intended to be a key input into the next steps of your digital investment and architecture planning, providing guidance on key functions within each business process, products to assess for procurement of ICT Building Blocks, key digital functions of ICT Building Blocks, and examples of applying all components to multiple Use Cases.

1. **Compile your high-level digital investment and architecture plan** – Compile detailed information from the catalogue for each component in your expanded Use Case model that you created in Step 3. The document will consist of the following:

    a. *Expanded Use Case model* – Your digital investment and architecture plan starts with the expanded Use Case model you created in Step 3, setting your business objectives and the key steps in your actors' journeys as the frame for implementing new or strengthening existing business processes and software components.

    b. *Descriptions of component interactions* – The description of interactions between the components in your Use Case model, prepared in Step 3.2, will help inform the development of more detailed requirements.

    c. *Selected SDG indicators* – The business objectives in your Use Case model translate to specific SDG Targets and indicators, which can help create a monitoring and evaluation plan for your initiative.

    d. *Selected WorkFlows* – WorkFlows point to opportunities to assess, implement, enhance and consolidate business processes and organizational capabilities so that they can be used more efficiently and broadly across the enterprise.

    e. *Selected ICT Building Blocks* – Building blocks are the foundation of an enterprise application architecture that can be put in place to support your Use Case and can be shared by other programmes and Use Cases.

Step 4 output: High-level digital investment and architecture plan

High-level digital investment and architecture plan consisting of your expanded Use Case model and relevant details compiled from the catalogue, including SDG indicators, WorkFlow descriptions, and ICT Building Blocks attributes.

FIGURE 22. Sample output from Step 4: Plan

SDGs
- Goals
- Targets
- Indicators

1.1.1 Proportion of population below the international poverty line, by sex, age, employment status and geographical location (urban/rural)

4.3.1 Participation rate of youth and adults in formal and non-formal education and training in the previous 12 months, by sex

4.4.1 Proportion of youth and adults with information and communications technology (ICT) skills, by type of skill

WorkFlow Definitions
- Descriptions
- Sector-specific Usage
- Use case mappings

Client education

Other names	Learning
Short description	Creation and dissemination of educational content for training or to promote awareness of a topic.
Full description	Several organizations need to educate their users with knowledge targeted at developing specific skills or behavioural changes, or enhancing public awareness about a topic, service or programme. In most cases, they use a course or programme's educative content, which is delivered inside or outside of a traditional classroom or educational institution. It could also include information and illustrative content to create awareness about specific concepts, services and facilities. It uses assessment tools to evaluate the achievement of learning objectives. Common examples of client education include the training of field workers supporting users in adopting new processes, introducing women to the importance of and facilities for hygiene management, family planning and institutional assistance for managing pregnancy, or for supporting formal education in educational institutes.
Sample mappings of WorkFlows to Use Case	**Agriculture: Market linkage** – Enrolment in training programs to access market services to improve profitability **Education: Remote learning** – Creation and dissemination of all course materials **Health: Maternal and newborn health** – Information about facility-based deliveries, the importance of pre- and post-delivery care and scheduled vaccinations

Building Block Definitions
- Descriptions
- Key Digital Functionalities
- Sector-specific Usage
- Example Software
- Workflow mappings

Identification and authentication

Other names	Identity management
Short description	Enables unique identification and authentication of users, organizations and other entities.
Full description	Attribute a unique foundational ID to users, organizations or any other entities with the primary task of letting an entity prove who it is. According to the World Bank, digital foundational identity is one that is 'built in a top-down manner with the objective of bolstering national development by creating a general-purpose identification for use across sectors'.[13] It also allows for proper authentication using passwords, One-time password/pin (OTP), biometrics, digital tokens, etc.
Key digital functionalities	• Foundational IDs come with no specified purpose or attached entitlement but simply let an entity prove who it is • Captures only limited information about users, such as name, date of birth, address and gender • For a given set of credentials, fetches a corresponding ID if it exists in the registry • Uses different biometric methods to identify and authenticate users through means other than user photographs (eg fingerprints, iris scans, facial recognition) to ensure there are no duplicates or fakes, creating a highly trustworthy database • This ICT Building Blocks also uses a publicly available interface, or open API, which allows any licensed service provider to verify if users are who they claim to be • Used to enable services such as opening bank accounts, buying SIM cards, receiving entitlements from the government, signing forms electronically, investing in mutual funds and getting credit • Incorporates privacy into its design when the purpose of the authentication is not revealed if a service provider sends an authentication request.
Examples of use in different sectors	The use of a foundational ID is cross-sectoral. It can be used to verify user identity and enable any service that a user has access credentials for, such as a fertilizer subsidy or food voucher. **Health sector:** • Enterprise Master Patient Index
Examples of existing software	• Apache Syncope • Modular Open Source Identification Platform (MOSIP, currently under development)
Sample mappings of ICT Building Blocks to Work-Flows	• Client case management • Client communication • Data collection and reporting • Financial services • Identification and registration • Knowledge management • Procurement • Supply chain management • Work planning and coordination

CONCLUSION

Overall progress towards the achievement of the SDGs is not on track. According to Francesca Perucci, the chief of the Statistical Services Branch at the UN Statistics Division, "In almost all areas where you see progress, if you look at the rate, or the pace of progress, it is never sufficient to meet the targets."[11] Innovative uses of ICTs have the potential to propel government programmes to far greater effectiveness and scale, accelerating progress toward the SDGs, but investments in technology have this far been fragmented and duplicative.

This framework is not simply an academic exercise, therefore, but rather a pragmatic response to the global community's challenges in understanding what technology is needed and how to scale it up to deliver citizen services efficiently, effectively and sustainably. To capitalize on this opportunity, governments, donors and service providers must work together. By applying a whole-of-government approach, investments in digital infrastructure will help to deliver reusable digital services at scale with greater ROI.

Governments should:

- Enact strategies to coordinate digital investments towards whole-of-government architecture-based approaches to implementing shared ICT services, such as digital identification, e-Payment systems, digital registries and other ICT Building Blocks;
- Track the cost savings of this approach as and when it is applied; and
- Engage in pilots to provide global reference examples of how a cross-sectoral approach to technology products, policies, practices and people can help digital services reach the underserved more efficiently and effectively.

It is recommended that donors:

- Fund cross-sector country pilots to demonstrate the effectiveness and efficiency of architecture-based approaches to implementing reusable ICT Building Blocks in support of national development priorities;
- Support efforts to evaluate ROI and aggregate demand for digital services, strengthening the evidence base on which cross-sector digital investments lead to the greatest impact;
- Invest and participate in communities of practice that collaboratively define robust, cross-sector requirements for ICT Building Blocks and their linkages to service delivery value chains; and
- Incorporate a whole-of-government approach to future ICT investments, even if a programme is sector specific.

Technology vendors and implementing partners for their part are recommended to:

- Research and develop ICT products that meet cross-sector requirements and that are interoperable, extensible and use existing standards when possible;

[11] https://www.devex.com/news/sdgs-show-slow-progress-not-on-track-to-reach-2030-targets-un-reports-92971 Accessed 12 March 2019

- Participate in global communities of practice, bringing specific expertise to collaboratively define robust, cross-sector requirements for generic ICT Building Blocks; and

- Work with donors and countries to establish threshold pricing for varying demand levels, licensing terms and service level agreements that can inform pooled procurement.

ITU and DIAL are committed to helping document and share learning experiences with other countries on a similar path, recognizing that innovation may come from countries with fewer legacy systems and policies. We therefore invite the global community's participation in the advancement of this first version of a framework and the implementation of WGAs to digital investment.

In 2018, we jointly published a Global Call to Action[12] with specific actions each stakeholder could take in order to contribute to this end. Our belief is that this approach will help governments make the right cross-sector digital investments to help propel countries' efforts toward digital transformation and the achievement of national development priorities.

[12] ITU and DIAL. SDG Digital Investment Framework: Global Call to Action. 2018.

SDG DIGITAL INVESTMENT FRAMEWORK CATALOGUE

1. CATALOGUE OVERVIEW

This catalogue is intended to be used as a reference for the SDG Targets and the Use Cases, WorkFlows, and ICT Building Blocks defined as part of the SDG Digital Investment Framework. The SDG Digital Investment Framework provides the background, instructions and examples needed to leverage and use this catalogue's reference materials effectively.

The SDG Digital Investment Framework consists of four interrelated layers that connect reusable software components to SDG Targets, as described in the first part of this document.

Note: This initial release of the framework represents the results of ITU and DIAL's analysis of selected Use Cases from three development sectors: agriculture, education and healthcare. New ICT Building Blocks and WorkFlows will be added to the catalogue as the scope of the framework expands to include additional sectors, Use Cases, and SDG Targets. The catalogue is a step towards demonstrating the value of the framework and an important step in the process of mapping the remaining the SDG Targets to reusable ICT Building Blocks.

2. USE CASE MODELS

This section of the catalogue provides detailed illustrative models of three Use Cases prioritized by the development community. Each Use Case model describes primary actors, key steps involved in achieving a specified business objective, descriptions of the WorkFlows and ICT Building Blocks involved in each step, and mappings to SDG Targets. The list of Use Case models is not exhaustive and more will be added in future releases of the catalogue.

Use Case definition

The steps that an individual or system will undertake in order to achieve a business objective

Key Characteristics:

- User-centric description of the steps or user journeys required to deliver an outcome
- Identifies one or more SDG Targets as its business objective
- Describes the generic WorkFlows and business processes involved in each step in the Use Case
- Typically sector-specific
- Able to be improved through digital technology

A.1. Maternal and newborn health Use Case 48

A.2. Remote learning Use Case 55

A.3. Market linkage Use Case 61

A.1. Maternal and newborn health Use Case

Summary: Care services for mother and child spanning the prenatal and postnatal periods resulting in a healthy mother and child.

Sector: Health

Mapped SDG Targets:

- 3.1 By 2030, reduce the global maternal mortality ratio to less than 70 per 100,000 live births
- 3.2 By 2030, end preventable deaths of newborns and children under 5 years of age, with all countries aiming to reduce neonatal mortality to at least as low as 12 per 1,000 live births and under-5 mortality to at least as low as 25 per 1,000 live births

Use Case steps

1. Sona, an ASHA worker, meets Sowmya and her family
Sona, a government-accredited social health activist (ASHA), works in a rural Indian town and routinely visits patients at homes and hospitals in the area. She works with a mother and child tracking system (MCTS) to coordinate healthcare services for her clients. During her visit to a hospital, Sona meets Sowmya, who has delivered her first baby, and educates her about post-delivery care (eg breastfeeding, nutrition, immunization, personal hygiene), and the importance of using the support and facilities provided by the mother and childcare programme.

2. Sona registers Sowmya in MCTS
With Sowmya's consent, Sona registers Sowmya's child's name, address and birth certificate, and Sowmya's name and ID as the caretaker of the child into the MCTS system, which automatically validates the birth certificate and Sowmya's ID with the government's citizen records system. Sowmya then creates an account in MCTS for her electronic health records (EHRs) and a barcoded unique ID card for getting further assistance. MCTS connects Sowmya's mobile phone number to her ID and enables permissions for Sona to electronically coordinate various MCTS services for Sowmya.

3. Arranging baby's first visit to the paediatric clinic
Sona helps Sowmya upload her baby's photo, family medical history and hospital discharge summary into the EHRs from her mobile phone and download guidance information from the MCTS system. Sona then uses her mobile phone to book an appointment with a paediatrician. A few days before the appointment, Sona and Sowmya get SMS messages on their mobile phones from MCTS reminding them of the appointment.

4. Paediatrician visits
At the clinic, the paediatrician swipes the baby's ID card to access and study the baby's EHRs and update the information and findings, as well as the prescriptions for medication, nutrition and immunization. She educates Sowmya on managing child growth and the importance of immunization and shows her relevant information on the MCTS system. Sona helps Sowmya access the information, order medication and nutrition supplements, and book appointments for future immunization and follow-up visits. Over the first year, the paediatrician tracks the development of the child and observes normal physical growth but sustained delays in behavioural development. She notes that the child does not make eye contact, smile in reciprocation, respond when called or to familiar voices, or follow gestures or pronounced verbal cues. She suspects early signs of autism, a neurological disorder that can cause significant challenges to the social, communication and behavioural development of the child. She counsels Sowmya about the situation and the importance of early treatment and refers the child to a therapy centre. Sona helps Sowmya book an appointment with a nearby therapy centre and download more information about autism from the MCTS website to Sowmya's mobile phone.

5. Procuring medicine and nutrition supplies
Sowmya visits an authorized pharmacy and food store to pick up her prescribed medicine and food. Sona also picks up medication and food prescribed for her other clients and delivers them to their homes. The store scans the barcode on Sowmya's card to retrieve her MCTS record and matches it with the e-prescription received. The pharmacist fills the prescription, assesses the instructions Sowmya has already received from her physician, and reinforces the benefits of Sowmya following the instructions.

6. Visit to the therapy centre
Sowmya goes to the therapy centre, where the therapist scans the child's MCTS card to retrieve health records, referral notes and appointment details. The therapist conducts interactive tests with the child and plans a therapy schedule. She helps Sowmya download an interactive game-like rehab application from MCTS onto her mobile phone that will help the child learn to recognize colours,

shapes, objects and gestures, as well as perform gestures, pronounce words and trace lines. The therapist educates Sowmya on how to interact with and monitor the child, and record and report any abnormal behaviour from her phone. The MCTS system automatically tracks and sends alerts to Sowmya at each encounter according to the schedule.

Sowmya does the prescribed exercises with her child and visits the therapy centre based on the prescribed plan, getting help from Sona to make follow-up tele-consultation appointments with the paediatrician and therapist. The MCTS system automatically populates the appointment in the respective doctor's electronic worklist along with links to Sowmya's medical records. When the doctor opens the appointment from the worklist, the MCTS automatically places a call to Sowmya on her mobile phone. Sowmya attends the tele-consultation call with the doctor remotely and shares the records she has uploaded. Eventually, the child responds to the therapy and shows significant recovery from the developmental delays.

7. Sowmya and Sona are paid incentives for participation in the health intervention

Because Sowmya and Sona have followed all of the procedures for a safe and healthy recovery of the child, both are paid the incentive offered to participate in the MCTS health intervention.

Red denotes sector-specific software components, blue denotes generic WorkFlows, and yellow denotes generic ICT Building Blocks

MATERNAL AND NEWBORN HEALTH Use Case

USE CASE STEP	WORKFLOWS	ICT BUILDING BLOCKS
1. Linkage with community health worker: Sona meets Sowmya, who has delivered her first baby Sona educates Sowmya about post-delivery care (eg breastfeeding, nutrition, immunization, personal hygiene), and the importance of using the support and facilities of the mother and childcare program.	Client communication for spreading awareness and encouraging enrolment in the community health programme Client education for educating Sona on post-delivery care Content management for the backend marketing staff of the community health programme to populate relevant educational and promotional content that Sona can use during field visits	Sona uses the scheduling service* of the MCTS system to plan her promotional field visits and gets reminders based on the female community members she meets to identify relevant candidates for the community healthcare programme Sona uses eLearning services to educate Sowmya about the relevance and importance of the community health programme for her and her child Sona uses registration services to enrol Sowmya into the community health programme The community health programme managers provide relevant promotional content using content management services
2. Enrolment in the MCTS system: Sona registers the child's name, address and birth certificate, as well as Sowmya's name, phone number and ID as the caretaker of her child MCTS automatically validates the birth certificate and Sowmya's ID with the government's citizen records system Sowmya creates an account with electronic health records (EHRs) and a barcoded unique ID card for getting further assistance MCTS connects Sowmya's phone number to the child's ID and enables permissions for Sona to electronically coordinate various services for Sowmya	Identification and registration for registering Sowmya and her child in the system and enabling permissions for interaction with MCTS Client case management for creating EHRs for Sowmya and giving Sona permission to use EHRs to coordinate with various service providers that Sowmya may need	The MCTS system uses identity-authentication services to validate Sowmya's child's identity by comparing the birth certificate to an external national identity system, and then mapping to the MCTS record. To track the child's encounters with the MCTS system, a barcoded ID card for that account is issued The MCTS system uses a registration service to create a new account for Sowmya's child with a unique MCTS ID The MCTS system uses a shared data repository to create an EHR for Sowmya and link it to the MCTS ID The MCTS system also uses the WorkFlow service to create a complete individualized WorkFlow for Sona and Sowmya to interact with MCTS for managing the child's development

MATERNAL AND NEWBORN HEALTH Use Case

USE CASE STEP	WORKFLOWS	ICT BUILDING BLOCKS
3. Arranging the first visit to the paediatric clinic Sona uses her mobile phone to book an appointment at the local paediatric clinic Sona helps Sowmya by uploading the child's details into the EHRs from her mobile phone Sona downloads information about managing child growth and the importance of immunization from the MCTS system to Sowmya's phone Sona and Sowmya receive SMS messages on their mobile phones from MCTS reminding them of the appointment	Work planning and coordination for booking appointments at the paediatric clinic and lab, auto-populating doctors' worklists and calendars, generating SMS reminders to mobile devices of relevant participants, and tracking completion/no show status until the appointment expires	The MCTS system accesses a shared digital registry to identify the nearest service facilities Sona uses the scheduling service of the MCTS system for booking appointments at the chosen facility The MCTS system uses messaging services to remind Sowmya and Sona about their appointment a few days prior Sona uses eLearning services to download information onto Sowmya's mobile phone
4. Paediatrician visits: The paediatrician swipes the baby's ID card to access and study the baby's EHRs and update information, findings and prescriptions Sona books appointments for future immunization and follow-up visits and orders nutrition and medicine as per the paediatrician's prescription During the first year, the paediatrician tracks the development of the child and finds early signs of autism Sona books an appointment for the therapy centre and downloads autism information from MCTS to Sowmya's mobile phone	Client case management and problem diagnosis for the doctor to inspect EHR records of relevance, have face-to-face or mobile phone-based discussions with the patient, and populate new records such as examination findings, prescriptions and referral notes as needed	The MCTS system uses a shared data repository to search, retrieve, review and track the child's development and update findings and prescriptions into the EHR The MCTS system uses eLearning services to download educational content on managing the child's development onto Sowmya's mobile phone The MCTS system accesses a shared digital registry to identify the nearest service facility Sona uses the scheduling service of the MCTS system to make appointments at the chosen facility The MCTS system uses messaging services to remind Sowmya and Sona about the forthcoming therapy visit a few days prior

MATERNAL AND NEWBORN HEALTH Use Case

USE CASE STEP	WORKFLOWS	ICT BUILDING BLOCKS
5. Procurement of medicine and nutrition: Sowmya goes to the pharmacy and presents her MCTS card to the pharmacist The pharmacist scans the barcode on Sowmya's card to retrieve her MCTS record from the system and matches it with the e-prescription received. The pharmacist fills the prescription, assesses the instructions Sowmya has already received from her physician, and reinforces the benefits of Sowmya following the instructions	Procurement WorkFlow for ordering commodities Supply chain management WorkFlow for managing the delivery	The MCTS system uses an eMarketplace service to enable clients to electronically order supplies from different entities that internally use a payment service to settle payments to vendors from the MCTS program Workflow services enable those entities to: Receive medicine orders placed from multiple pharmacies along with respective prescriptions Determine the nutritional supplements or the equivalent supplements to be provided Dispense medication and supplements for shipment and delivery units Update the electronic records after dispensing
6. Getting therapy: The therapist scans the child's MCTS card to retrieve health records, referral notes and appointment details The therapist records the findings of the interactive tests with the child and a therapy schedule. The MCTS system automatically tracks and sends alerts to Sowmya at each encounter according to the schedule The therapist helps Sowmya download a rehab application from MCTS onto her mobile phone. The therapist also educates Sowmya on how to monitor the child and record her observations into the MCTS system from her phone	Client case management for coordinating admission to the hospital and scheduling in-hospital consultation/treatment /procedures as needed until delivery, along with the ability to view old records and update new medical records generated during therapy Data collection and reporting to compile observations and decision support for help making decisions.	Workflow services are used for routing all electronic transactions involved in providing in-hospital care from admission to discharge The MCTS system provides scheduling services to the therapy centre staff to book resources and appointments for the child, populating staff calendars and worklists as needed Rehab tools uses data collection services and AI services to provide the functionality for Sowmya to log observations at home and for the therapist to derive key indicators to assess response to treatment and make course corrections as necessary

MATERNAL AND NEWBORN HEALTH Use Case

USE CASE STEP	WORKFLOWS	ICT BUILDING BLOCKS
7. Recognition incentive: Sowmya and Sona are paid an incentive for participation in and compliance with the community health program	Procurement WorkFlow for giving incentives to recognize Sona and Sowmya for their strict compliance with guidelines and successful outcomes	Workflow services are used for routing successful adherence cases to the incentive list Payment services are used for transferring incentives to corresponding accounts

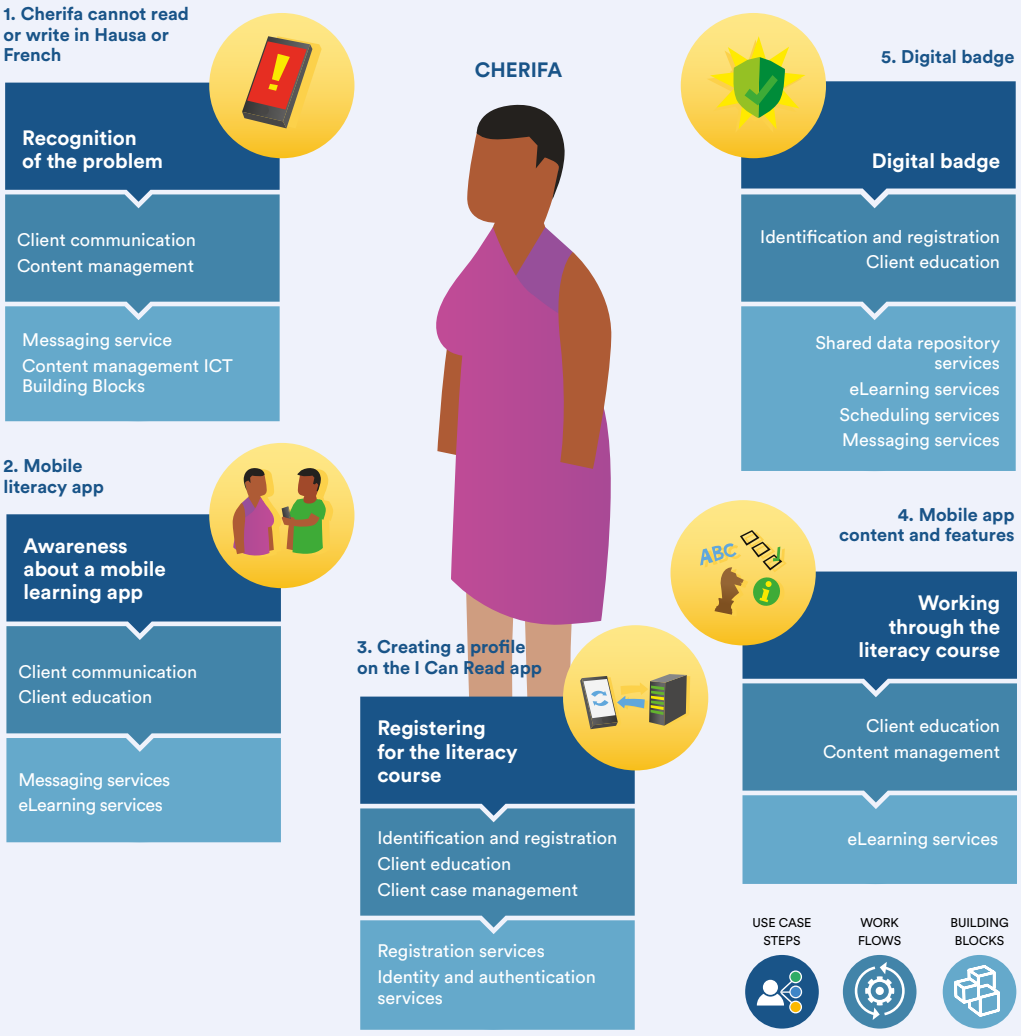
A.2. Remote learning Use Case

Summary: Digital content and tools to provide or supplement all types of learning in either connected of unconnected environments.

Sector: Education

Mapped SDG Targets:

- 4.1 By 2030, ensure that all girls and boys complete free, equitable and quality primary and secondary education leading to relevant and effective learning outcomes
- 4.3 By 2030, ensure equal access for all women and men to affordable and quality technical, vocational and tertiary education, including university
- 4.4 By 2030, substantially increase the number of youth and adults who have relevant skills, including technical and vocational skills, for employment, decent jobs and entrepreneurship
- 4.5 By 2030, eliminate gender disparities in education and ensure equal access to all levels of education and vocational training for the vulnerable, including persons with disabilities, indigenous peoples and children in vulnerable situations



Use Case steps

1. Cherifa cannot read or write in Hausa or French
Forty-five-year-old Cherifa feels very frustrated as she tries to make sense of the words on her cell phone screen. She knows the message has something to do with a looming disaster, but she doesn't know exactly what it says. She hates that she cannot read or write in Hausa or French.

It is a hot, dry day, and the onion crop on her 3.5-hectare farm in Zinder, a city in the southern part of Niger, is growing slowly. It has not rained for a long time, and Cherifa wonders if the message on her cell phone is about the possibility that they are facing yet another drought. This makes her worry and wish she could understand the message.

2. Mobile literacy app
Cherifa owns her own Itel cell phone with a pay-as-you-go subscription with Orange, which includes an affordable data package. When her son Amadou arrives home, she asks him to read the two SMS messages that she has received. The first one is indeed a warning about another impending drought and the need to save water. The second is from the Ministry of Non-Formal Education (MNFE), which is supporting a literacy programme called the **I Can Read** project run by the Niger Literacy Trust, a local NGO. The programme, aimed at adults who want to learn how to read and write, uses a **mobile literacy app** to teach people how to read. The NGO is hosting classes once a week in Zinder for interested participants. This makes Cherifa very happy, and she decides that she wants to participate.

3. Creating a profile on the *I Can Read* app
Cherifa's son Amadou **downloads the I Can Read app** that was developed by Girl Geeks, a technology company partnering with the Niger Literacy Trust, the MNFE and West African Aid, a donor organization. The app is hosted on a **server** based in Niamey, the capital city. As a user, Cherifa communicates with the server, which keeps track of all the information she supplies. The server also communicates data to Cherifa, including changes that are made to the app. The app has a strong backend system, which means that if there are any breakdowns or challenges, they can be addressed immediately.

Amadou **registers Cherifa** on the app and shows her how to **log in** using an ID and password whenever she wants to use the app. After Cherifa logs in, she is asked to create a profile. Unsure what to do, she asks Amadou for help. He creates her profile, and the built-in **GPS** on her mobile phone automatically captures her location data so the app can provide location-based services.

4. Mobile app content and features
Cherifa discovers that the mobile app contains a host **of features and the full literacy curriculum in Hausa** and **Zarma**. Based on Cherifa's profile, which indicates that Hausa is her home language, the app allows her to engage in Hausa. The literacy content uses many examples that she can relate to as a woman farmer, including practical market information. The words and letters are written clearly and the voice of a cartoon woman speaks to her in Hausa, calling her by her name. Cherifa finds **games** that teach her how to recognize letters, pronounce the sounds of written letters and phonics, and write and read texts. She also finds practical farming examples, including information about market prices, how to obtain them and how to make sense of them. Every time she completes an exercise, she receives congratulatory messages and is encouraged to take a test. After completing the test, she receives another congratulatory message and is guided to the next level. From time to time, Cherifa receives messages that changes are being made to the app. Overall, she enjoys learning on her phone. She works through the entire six-module literacy course, taking the tests at each level. She works at her own pace and in her own time, and she decides what she wants to learn from the app.

The app allows her to engage with other female and male farmers who are part of the course, some of whom she has not met before. The app has a **scheduling feature** that indicates when and where meetings are taking place and what they will be about. During these weekly meetings, a facilitator shows how to make the most of the app.

The app also gives Cherifa access to a wide range of resources, videos and online books that she finds very helpful. But to access all of them, she needs more data on her phone.

5. Digital badge

When she completes all six modules, Cherifa is sent a **digital badge** that confirms her successful completion of the course. She receives alerts about follow-up literacy courses she could take that are also available in Hausa and is encouraged to keep learning.

Cherifa can now recognize the word onion in Hausa on her cell phone. She can understand how much her products are selling for on the market each week. This helps her negotiate a good price every time she goes to the market. Cherifa realizes that learning how to read makes her better at selling her products and improves her livelihood.

6. The MNFE uses Cherifa's example

The MNFE and its partners are pleased that their literacy app has proven to be useful to Cherifa, and they promote her as an example of a hardworking farmer who is committed to learning and improving her life. They use her story to encourage more women and men farmers to download the app and improve their literacy skills.

REMOTE LEARNING Use Case

Red denotes sector-specific software components, blue denotes generic WorkFlows, and yellow denotes generic ICT Building Blocks

USE CASE STEP	WORKFLOWS	ICT BUILDING BLOCKS
1. Recognition of the problem Cherifa receives a message on her mobile phone about a looming drought; not able to read the message but sensing its importance, she realizes she has a problem and decides to address it	Client communication for providing early warning awareness about farming conditions to reach adult farmers Client communication for providing relevant information to inform farmers about weather patterns and farming; this also triggers Cherifa's interest in learning how to read Content management provides relevant, timely content to users	Cherifa uses a messaging service to raise her awareness of impending farming and weather conditions that affect her livelihood Cherifa also accesses instantaneous updates on changing weather conditions through a service backed by a content management ICT Building Blocks
2. Awareness about a mobile learning app Through an SMS message and the help of her literate son, Cherifa learns about literacy classes and a mobile learning app through the I Can Read project, promoted by the Ministry of Non-Formal Education.	Client communication for raising awareness about upcoming literacy classes Client communication for providing relevant information about the literacy classes and app Client education providing relevant, timely content to users via a mobile literacy app	Cherifa accesses messaging services that make her aware of classes and a mobile app to help her with her literacy challenges Cherifa accesses eLearning services that provide relevant literacy content to help her improve her literacy skills via a mobile app

REMOTE LEARNING Use Case

USE CASE STEP	WORKFLOWS	ICT BUILDING BLOCKS
3. Registering for the literacy course Cherifa's son Amadou **downloads the I Can Read app** that was developed by Girl Geeks, a technology company partnering with the Niger Literacy Trust, the MNFE and West African Aid, a donor The app is hosted on a **server** based in the capital Cherifa communicates with the server, which keeps track of all the information she supplies The server also c**ommunicates data** to Cherifa, including changes that are made to the app The app has a strong backend system, which means that if there are any breakdowns or challenges, they can be addressed immediately. Amadou **registers** Cherifa on the app and shows her how to **log in** using an ID and password whenever she wants to use it After she logs in, she is asked to create a profile; unsure what to do, she asks Amadou to help He creates her profile, and the built-in **GPS** in the mobile phone automatically captures the location data so the app can provide location-based services	Identification and registration to register Cherifa in the literacy program Client education to provide relevant, timely content in the form of a mobile app where user information and use can be tracked Identification and registration for validating user access to the content management system Client case management WorkFlow for enabling Cherifa to access the mobile app from the content management system	Cherifa downloads the mobile application from the Ministry's website The app uses registration services to enrol Cherifa in the literacy programme and then map to the skills development portfolio. The registration services record her in the relevant literacy program, assigning her a unique programme identifier and capturing her profile information The registration services uses identity and authentication services to validate her identity with an external national identity system

REMOTE LEARNING Use Case

USE CASE STEP	WORKFLOWS	ICT BUILDING BLOCKS
4. Working through the literacy course Cherifa discovers that the mobile app contains a host **of features and the full literacy curriculum in Hausa** and **Zarma** She finds tools and resources such as games, tests, information about farming, exercises, scheduling services and feedback loops	Client education WorkFlow for providing locally relevant interactive tools as part of the education cloud service to users Content management providing relevant, timely content to users via a mobile literacy app	Cherifa uses eLearning services with a strong back-end system that maintains and monitors her use of all eLearning features and provides relevant data to policy intermediaries on usage patterns
5. Digital badge When she completes the six modules, Cherifa is sent a **digital badge** that confirms her successful completion of the literacy course She receives alerts about follow-up literacy courses she can take that are also available in Hausa and is encouraged to keep learning	Identification and registration WorkFlow for validating user access to the content management system Client education WorkFlow for coordinating the completion of the course and enabling access to further learning courses to encourage lifelong learning	The literacy education services use the shared data repository services to search, retrieve, review and track Cherifa's lifelong learning and development, updating her qualifications and digital badges The literacy education services use eLearning services to make available a suite of further literacy development courses and other skills development programmes to encourage Cherifa to become a lifelong learner The literacy education services also have scheduling services for upcoming courses that may interest Cherifa that are communicated via messaging services

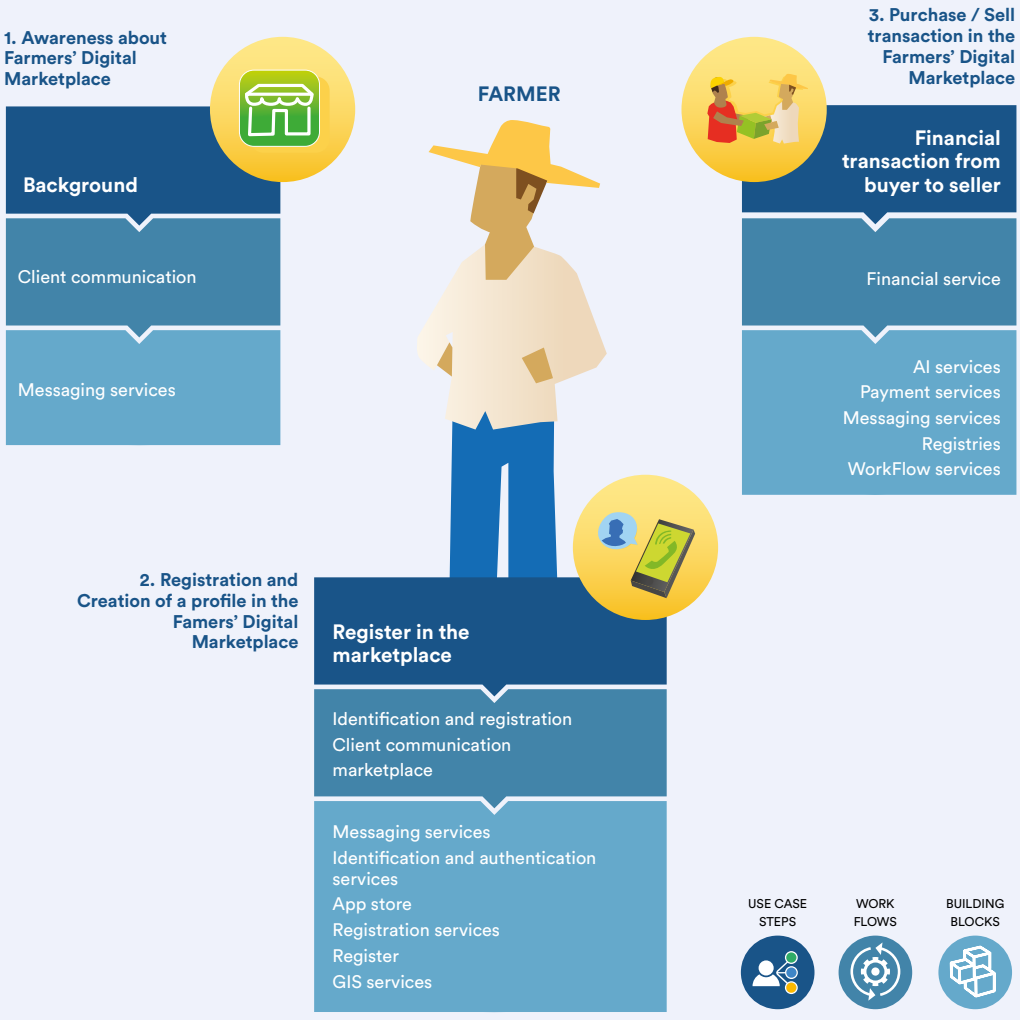
A.3. Market linkage Use Case

Summary: Connecting rural farmers to market information, products, and related services to improve rural incomes.

Sector: Agriculture

Mapped SDG Targets:

- 2.1 By 2030, end hunger and ensure access by all people, in particular the poor and people in vulnerable situations, including infants, to safe, nutritious and sufficient food all year round
- 2.2 By 2030, end all forms of malnutrition, including achieving, by 2025, the internationally agreed targets on stunting and wasting in children under 5 years of age, and address the nutritional needs of adolescent girls, pregnant and lactating women and older persons
- 2.3 By 2030, double the agricultural productivity and incomes of small-scale food producers, in particular women, indigenous peoples, family farmers, pastoralists and fishers, including through secure and equal access to land, other productive resources and inputs, knowledge, financial services, markets and opportunities for value addition and non-farm employment



Use Case steps

1. Awareness about *Farmers' Digital Marketplace*
Raghu is a smallholder farmer in India with two acres of land. He grows paddy, wheat and seasonal vegetables. He also has two cows that provide milk for his family and to sell to a local milkman who visits him at his home for collection. Raghu has to travel 30 kilometres to the nearest agro-market, Mandi, to buy seeds, fertilizer and other goods and to sell his produce to the commodity wholesaler, Aratiya, which in turn sells it to big buyers. Raghu feels that income from his farm is not sufficient to provide for his family and his children's education. He believes he gets too little compensation for his products and often gets fake products sold to him by resellers in the market.

Krishi Vigyan Kendra (KVK or Agriculture Science Centre) is a government-run agriculture extension institution that has a small outreach centre near Raghu's village. The KVK runs an **awareness programme** about a ***Farmers' Digital Marketplace*** that helps smallholder farmers like Raghu sell their products directly to buyers, thus avoiding a multitude of middlemen and earning more profit. Raghu learns about the programme by calling a toll-free number and discovers he can register in the Farmers' Digital Marketplace for free.

2. Registration in the Famers' Digital Marketplace
Raghu calls the toll-free number to **register** in the Farmers' Digital Marketplace. An interactive voice response system (IVRS) operated by a private company collects basic information (eg citizen ID, age, gender), and then sends an SMS to the caller confirming registration and provides a first-time user ID and password, and a link to download a digital marketplace mobile application.

3. Creating a profile in the Famers' Digital Marketplace
Raghu installs the mobile app on his phone and logs in with the user ID and password he received. He creates his profile in the digital marketplace, and the built-in **GPS** on his mobile phone automatically captures the location data so the app can provide location-based services.

4. Purchase transaction in the Farmers' Digital Marketplace
After completing his profile, Raghu starts using the Farmers' Digital Marketplace, which highlights the products and services that may be of most interest to Raghu, based on his profile, location and other factors. Raghu wants to buy a chemical for pest management that he bought last year and got good results from, but he cannot read the name written on the empty can. Using a search-by-image feature on the app, he takes a picture of the container and is able to find the product he is looking for by recognizing it from a list of suggested products. Raghu is given a list of sellers and the price they are asking. He chooses a seller and shares his location. The seller agrees to deliver the product to Raghu for INR 20 extra, which still leaves the product cheaper than he would have found it in the market.

5. Financial transaction from buyer to seller in the Farmers' Digital Marketplace
The seller tells Raghu to pay him for the product using the built-in **payment** function in the marketplace application. Raghu clicks on **Payment Service** and enters his Universal Payment Interface ID (UPI-ID) provided to him by his bank. After the transaction, Raghu receives an SMS informing him of the transaction with an authentication code, which has to be shared with the delivery person when the product is delivered. Another SMS goes to the seller informing him of the remittance. The money is deposited to an escrow account managed by a **financial services** provider, which holds the final remittance to the seller until the physical delivery happens successfully.

6. Physical delivery of goods purchased online in the Farmers' Digital Marketplace
Once the seller receives confirmation about the remittance by the buyer, he searches for a logistics service provider (courier company) to deliver the product to Raghu. He finds a company that delivers to Raghu's location and generates an invoice with Raghu's name and address. The seller pays the

courier company for on-site pick-up and the courier company picks up the product and delivers it to Raghu. On receipt, Raghu provides the authentication code to the delivery person. The code is authenticated and the seller receives payment.

7. Sell transaction in the Farmers' Digital Marketplace
Raghu has a good harvest and wants to sell his crop directly to buyers so he can get a better price than at the local markets. The application gives him information about the prevailing market price at different markets near his location, expected arrivals based on the number of other farmers and volume, and other information. Raghu finds several buyers who are paying a good price. He contacts them, and after price negotiation, he finalizes a deal with one buyer. The buyer authenticates Raghu's identity, then obtains a quality assurance report that evaluates various data points, such as Raghu's farm location, weather and seeds used, so he can be sure that the crop produced at Raghu's farm is of good quality. The buyer locates a warehouse near Raghu's location and executes a purchase contract so Raghu can deliver the goods to the warehouse and obtain a receipt, which will allow the buyer to remit payment.

8. Financial transaction from buyer to seller in the Farmers' Digital Marketplace
Raghu asks the buyer to pay him against the purchase contract for the product. The buyer uses a **payment service** to authorize the bank to pay Raghu against the warehouse receipt. An SMS is sent to the selected warehouse informing them of the incoming consignment along with a payment authentication code, which has to be shared with Raghu when the goods are delivered to the warehouse. Another SMS goes to Raghu informing him of the remittance and a delivery authentication code, which has to be shared with the warehouse to identify the incoming consignment. The money is deposited into an escrow account managed by a **financial service** provider, which holds the final remittance for the seller until the physical delivery happens successfully.

9. Physical delivery of goods sold online in the Farmers' Digital Marketplace
Raghu searches for a logistics service provider (transporter) who can deliver the goods to the designated warehouse. He books the transporter online and the transporter picks up the goods from Raghu's farm. The transporter delivers the goods to the warehouse, and the warehouse issues a receipt and shares the payment authentication code and the receipt with Raghu. Raghu sends the warehouse receipt and the payment authentication code to his bank, which authenticates it and instructs the escrow account to release the payment to Raghu's bank. Raghu receives payment for his produce, which is much more than he used to get when he took his goods to the local market and waited for an interested buyer to purchase them.

MARKET LINKAGE Use Case

Red denotes sector-specific software components, blue denotes generic WorkFlows, and yellow denotes generic ICT Building Blocks

USE CASE STEP	WORKFLOWS	ICT BUILDING BLOCKS
1. Background: Awareness about the marketplace service is spread using digital promotional activities Users can access the service by downloading a mobile app from the ministry's mobility management service	Client communication to raise awareness and advertise new products or services to the prospective customers or users	Messaging services send promotional messages to prospective users, making them aware of new services, events, etc Farmers can access the Ministry's website to download a certified eMarketplace app
2. Register in the marketplace: 1. Raghu calls a toll-free number to register 2. He provides information about his identity using an IVR system 3. The system verifies information and sends a link to Raghu to download the marketplace mobile application 4. Raghu downloads the marketplace mobile app and registers 5. After registration, Raghu creates his profile 6. His profile data is stored 7. His location is captured, and it is used to suggest localized services	Identification and registration allows users to register themselves in the marketplace in order to access it and its services Client communication sends users promotional information from the marketplace	Messaging services are used to capture Raghu's registration information and send confirmation messages, often with instructions about further onboarding processes The marketplace system uses identification and authentication services to verify and authenticate Raghu's identity with the national ID system and then uses messaging services to send Raghu an authorized link to download the app from the app store Raghu uses the Ministry's app store to download a certified marketplace app The app uses registration services to collect information and register users into the marketplace and store the farmer's data in the register and assign a unique identifier to the farmer for the marketplace. The registration services collect additional information, including demographic and geographic information (in addition to geolocation) to profile the user The marketplace system uses GIS services to identify other location-based services that might be relevant to the farmer

MARKET LINKAGE Use Case

USE CASE STEP	WORKFLOWS	ICT BUILDING BLOCKS
3. Financial transaction from buyer to seller Raghu finds out that there is a search-by-image feature, so he takes a picture of the container of a product he bought last year and finds the product he is looking for from a suggested list Raghu pays for the product using the online payment feature After the transaction, Raghu receives an SMS with an authentication code, which has to be shared with the delivery person when the product is delivered Another SMS goes to the seller informing them of the remittance The seller searches for a logistics service to deliver the product to Raghu On receipt, Raghu provides the authentication code to the delivery person The code is authenticated and the seller receives payment	Financial services facilitate financial transactions between buyers and sellers in order to conclude the buy-sale process.	Raghu uses AI services to search images of similar products Payment services (Payment Gateway) are used to exchange money (eg credit card, net-banking) Messaging services are used to confirm the transaction and send an authentication code The seller searches registries of logistics providers to find a provider to deliver the goods Messaging services are used to authenticate the code and then WorkFlow services trigger payment services to pay the seller

3. WORKFLOWS CATALOGUE

This section of the catalogue provides detailed definitions of the generic WorkFlows identified as of the date of publication. Each WorkFlow includes a description, sector-specific examples, and mappings to Use Cases defined in this catalogue. The list of WorkFlows is not exhaustive, and more will be added in future releases of the catalogue.

WorkFlow definition

A generic business process that contributes to SDG Use Cases across multiple sectors and can be developed as a set of organizational capabilities.

Key Characteristics:

- Common business process used to help an organization carry out its overall function
- Applicable to multiple SDG Use Cases in various sectors
- Powered by one or more ICT Building Blocks

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Client case management

Other names	Beneficiary case management
Short description	Enrolment, tracking and monitoring of services provided to a beneficiary or household, often across multiple service categories.
Full description	The client case management WorkFlow involves the registration or enrolment of a user and the longitudinal tracking of services for that user often across multiple service categories, multiple service providers, and multiple locations. Users may avail themselves of one or more services from the organization. Services may be delivered by one or more providers at different points in time. From initial client registration, all services booked, availed of, or cancelled, along with transactional history and status, often need longitudinal tracking to avoid confusion across the multiple service categories, multiple service providers, and multiple locations and schedules that the client may be associated with as they journey through different organizations. Common case management WorkFlow includes capturing client and demographic information, appointment and event scheduling, messaging and reminders, management and prioritization of tasks across multiple cases, and summarizing client case data for reporting. Case managers commonly employ one or more job aids, each facilitating a particular service, and potentially customized according to client attributes.
Sample mappings of WorkFlows to Use Case	**Agriculture: Market linkage** – Tracking of market transactions **Education: Remote learning** – Enrolment in training programmes and tracking progress over time Track beneficiaries progress through course material **Health: Maternal and newborn health** – Tracking of antenatal attendance, birth outcome and immunizations

Client communication

Other names	Campaigning, Promotion, Marketing, Awareness raising
Short description	Bulk or individual communication between businesses and their clients or between individuals using a variety of channels, such as email, short messaging service, interactive voice response, or social media.
Full description	All organizations need to communicate with their end-users to share information, influence behaviour changes or get feedback. Communication may be targeted to a certain user or certain profile of users or be untargeted (mass communications). It can also be one-way or two-way (interactive) communication. It can serve to send alerts and notifications in real time in case of emergencies, or can be based on specific conditions or time intervals.
Sample mappings of WorkFlows to Use Case	**Agriculture: Market linkage** – Automated notification of harvest schedule, market prices for subscribed products, and weather/natural disaster updates **Education: Remote learning** – Reminders for assignment due dates, new course material availability, etc **Health: Maternal and newborn health** – Sending appointment reminders, receiving questions from mothers

Client education

Other names	Learning
Short description	Creation and dissemination of educational content for training or to promote awareness of a topic.
Full description	Several organizations need to educate their users with knowledge targeted at developing specific skills or behavioural changes, or enhancing public awareness about a topic, service or programme. In most cases, they use a course or programme's educative content, which is delivered inside or outside of a traditional classroom or educational institution. It could also include information and illustrative content to create awareness about specific concepts, services and facilities. It uses assessment tools to evaluate the achievement of learning objectives. Common examples of client education include the training of field workers supporting users in adopting new processes, introducing women to the importance of and facilities for hygiene management, family planning and institutional assistance for managing pregnancy, or for supporting formal education in educational institutes.
Sample mappings of WorkFlows to Use Case	**Agriculture: Market linkage** – Enrolment in training programs to access market services to improve profitability **Education: Remote learning** – Creation and dissemination of all course materials **Health: Maternal and newborn health** – Information about facility-based deliveries, the importance of pre- and post-delivery care and scheduled vaccinations

Content management

Other names	Content digitization
Short description	Create, organize, publish and secure content (text and multimedia) to make it easier to navigate and retrieve throughout an organization.
Full description	Most organizations need to create/access/populate content in different (digital) formats including text, images, video, audio, etc, stored in various locations and that have to be distributed securely from/to various entities. Content management WorkFlow therefore manages and organizes different types of multimedia content along with the mechanisms to access and operate on it as key assets of the organization. It also enforces policies for information security, privacy, storage, retention, optimization, transmission, quality, etc, and enables its indexing, searching, sorting, access control, compression, encryption, replication and anonymization.
Sample mappings of WorkFlows to Use Case	**Agriculture: Market linkage** – Manage content customized to farmer needs based on language, geographical region, education-level, or other attributes **Education: Remote learning** – Providing relevant, timely content for literacy learners **Health: Maternal and newborn health** – Store and retrieve educational and promotional content for use during field visits

Data analysis and business intelligence

Other names	Data mining, Dashboards and alerts
Short description	Defining aggregate functions across samples of data values, creating alerts around anomalous or statistically significant events or occurrences in the data.
Full description	Throughout any programme lifecycle of engagement with citizens, different departments/projects need to monitor and analyze the progress of certain activities to identify and promote best practices, course corrections and interventions as needed for continuous improvement in effectiveness, efficiency and sustainability of activities. Data analysis and business intelligence WorkFlow provides this functionality. Common data analysis and business intelligence activities include analysing samples from relevant groups of parametric values to derive statistical and combinatorial indicators, and then analysing the indicators to identify and flag abnormal events/ trends and relevant parties. They can subject the information to preset thresholds to determine whether escalation is required or not, and accordingly trigger notification/ alert mechanisms to proactively/reactively inform authorized users.
Sample mappings of WorkFlows to Use Case	**Agriculture: Market linkage** – Assess trends in rural farm productivity based on crop, proximity to market and other factors, such as weather **Education: Remote learning** – Analyze effectiveness of learning programmes in resulting in the development of new skills or competencies **Health: Maternal and newborn health** – Evaluate the impact of successful completion of maternal and newborn health programme on maternal and newborn mortality reduction

Data collection and reporting

Other names	Surveying, Surveillance
Short description	Defining, collecting, validating, normalizing and aggregating structured data of all kinds (often to replace paper forms): text, numeric, geospatial or multime***dia.***
Full description	This generic WorkFlow or business process concerns the collection and reporting of data that almost every organization needs in order to support decision-making and planning. It is also used to generate operational performance indicators for the service delivery process. For example, data collection activities can focus on the environment to help promote public health safety and hygiene; gather information such as sowing date, sowing area of crops, and livestock age, sex and vaccination records; and track health information such as malaria cases or disease outbreaks. Common data collection and reporting activities include the capture of different types of data, such as text, sensory and multimedia data; normalization of formats from various sources into standardized measurement units; data aggregation; grouping measurements of different parameters into sets for various applications; and presenting data in corresponding report formats.
Sample mappings of WorkFlows to Use Case	**Agriculture: Market linkage** – Collect commodity price data from major marketplaces **Education: Remote learning** – Collect data on service use and results of visits **Health: Maternal and newborn health** – Record student performance and feedback on teaching

Decision support

Other names	Analytics
Short description	Applying generic aggregation or analytical algorithms to raw data, combining these results with domain-specific business knowledge, to produce strategic, actionable insights or alerts.
Full description	This WorkFlow involves a process of analysing data and parameters to produce meaningful information or inferences (models), which help in decision-making (for humans). Decision support can be purely analytical or cognitive (eg deep learning). Examples of decision support include crop pest alert systems, clinical decision support systems, etc. Common decision support WorkFlow involves capturing raw data using collection tools; filtering the data through the application of algorithms to extract parametric values; and interfacing with analytics and business intelligence tools for combinatorial and statistical analysis of parameters. This allows specific indicators of symptoms, behaviour, and outcomes of the system to be obtained, and to interface with knowledge management tools to interpret the situation, and predict possible causes, future outcomes and suggestions for corrective actions if any. It can also learn and improve the accuracy of interpretation, prediction and correction using feedback collected from users, and by tracking system responses to corrective actions.
Sample mappings of WorkFlows to Use Case	**Agriculture: Market linkage** – Support decision making on harvest timing and best seed selection based on local conditions **Education: Remote learning** – Data-driven analysis of teacher and student performance for informed school development **Health: Maternal and newborn health** – Analyze test results to determine treatment/therapy planning

Financial services

Other names	eCommerce, Payment platforms
Short description	Integration between an organization, its beneficiaries, and the ability to automate banking service functions between the two.
Full description	Many organizations need to enable certain financial services with a broad range of stakeholders that can be individuals, banks, credit-card companies, insurance companies, merchants, and government organizations. Financial services may involve remittances, credit, savings, insurance, reimbursements, vouchers, paying bills and invoices, subsidies, etc. Financial services WorkFlow enables smooth cashless secure transactions and simple and rapid transfer of funds.
Sample mappings of WorkFlows to Use Case	**Agriculture: Market linkage** – Register and assign unique identifiers to farm, farmer, and household **Education: Remote learning** – Register and assign unique identifier to remote learner **Health: Maternal and newborn health** – Register and assign unique identifiers for mother and newborn

Identification and registration

Other names	Onboarding
Short description	Uniquely identify and collect other pertinent information about people and relevant business objects (inventory, locations, or events) for any particular business process.
Full description	Organizations need to register persons, facilities, professionals, equipment, procedures, etc in such a way as to be able to uniquely identify them, access their information and grant appropriate access and permissions to transact with them. Identification and registration WorkFlow enable the creation of 'functional registries' which provide directory services for different purposes. During the registration process, a unique identifier of an entity is attributed, basic profiling (demographic and/or geographic) information is collected and identity is mapped to already existing national identifiers if any. Registration WorkFlows ensure the enrolment of entities in different programmes and their access to certain entitlements.
Sample mappings of WorkFlows to Use Case	**Agriculture: Market linkage** – Register and assign unique identifiers to farm, farmer, and household **Education: Remote learning** – Register and assign unique identifier to remote learner **Health: Maternal and newborn health** – Register and assign unique identifiers for mother and newborn

Knowledge management

Other names	Information architecture
Short description	Collect, sort, and archive organizational assets for easy retrieval and assimilation.
Full description	Common knowledge management WorkFlow enables the collection, assimilation, classification, linking, searching, sorting and distribution of information assets automatically or on demand to provide meaningful knowledge that can be converted easily into action. Most organizations are involved in knowledge management activities to enhance business processes, build user capacities and improve user experience. They can help to share experiences, predict situations, register/propose best practices in various situations and supply relevant information for decision support. The knowledge management process also link researchers and those who have experience and skills with those who need them.
Sample mappings of WorkFlows to Use Case	**Agriculture: Market linkage** – Management of information resources about national and international best practices, crop yields, and rural extension programmes **Education: Remote learning** – Repository of teacher resources, such as exercises, student handouts, and assignments **Health: Maternal and newborn health** – Management of health information resources for mothers and their households, and for their caregivers

Marketplace

Other names	Trade, commerce
Short description	A discovery platform between buyers and sellers, allowing for easy transactions of goods and services.
Full description	Many organizations need to enable marketplaces where buyers and sellers can discover each other, negotiate contracts, buy or sale goods and services and make payments to each other. Marketplaces operate on various models depending on the needs of buyers and sellers. Primarily there are three kinds of marketplaces: business-to-consumer (also government-to consumer); business-to-business; and consumer-to-consumer. Key activities in a marketplace are registration by buyers and sellers, who are authenticated by the marketplace operators. It also allows for product, service and price discovery, buyer-seller interaction, payment transaction, fulfilment and after sales support. Marketplace WorkFlow enables promotion and awareness to users about the marketplace, registration of buyers and sellers, identification and authentication of users, and the sending of transactional updates (eg payment processed, shipments, etc) to transacting parties, as well as actuating financial transactions between buyers and sellers or buyers and marketplace operators.
Sample mappings of WorkFlows to Use Case	**Agriculture: Market linkage** – Buying and selling of agricultural goods and products **Education: Remote learning** – Marketplace for academic textbooks **Health: Maternal and newborn health** – Buying and selling of birth preparedness products and related health items

Problem diagnosis

Other names	Troubleshooting
Short description	Build a model of hypothetical diagnoses, iteratively incorporating new data and eliminating invalid diagnoses.
Full description	Problem diagnosis WorkFlow involves an iterative process of collecting data and drawing inferences based on predefined algorithms or rules. In this process, a hypothesis about a set of possible causes is inferred based on observable facts (symptoms) and then iteratively the most unlikely causes are ruled out as more and more observable facts are collected, so that in the end, one (or very few) most probable causes can be inferred. A common example of problem diagnosis is identifying nutrient deficiency in plants by observing leaf colours and leaf or fruit damage.
Sample mappings of WorkFlows to Use Case	**Agriculture: Market linkage** – Identify nutrient deficiency in plants by observing leaf colours or leaf/fruit damage **Education: Remote learning** – Support teacher in identifying and addressing student learning challenge **Health: Maternal and newborn health** – Identify signs of behavioural disorders by incorporating pertinent EHRs.

Procurement

Other names	Inventory management
Short description	Management of business functions of procurement planning, purchasing, inventory control, traffic, receiving, incoming inspection and salvage operations.
Full description	Almost all organizations are involved in the procurement of consumables, equipment, raw materials, etc. They engage with a large network of purchasing and consuming entities all along a supply chain. Common procurement activities include supporting users in searching and maintaining lists of preferred products and suppliers; aggregating internal demand for various commodities and raising procurement requests; getting and comparing price quotes and terms/conditions; placing orders; receiving bills; triggering payment services; and posting procured items into an inventory management system.
Sample mappings of WorkFlows to Use Case	**Agriculture: Market linkage** – Identify local suppliers for seed, fertilizer, and related products **Education: Remote learning** – Bulk acquisition of school supplies and equipmentr **Health: Maternal and newborn health** – Ordering commodities such as pharmaceuticals

Remote monitoring

Other names	Distributed sensing
Short description	The automated collection of real-time (often time-series) data of remote person or object for status check or receiving emergency alerts.
Full description	This WorkFlow involves real-time collection of data about a person, an object or an event, without being physically present, exchanging such collected data with other persons or machines and producing inferences in terms of diagnosis report, analytics, etc. Common examples of remote monitoring include remote field monitoring through in-situ and remote sensors, and remote patient monitoring.
Sample mappings of WorkFlows to Use Case	**Agriculture: Market linkage** – Record remote weather station data for forecasts and weather alerts **Education: Remote learning** – Monitor student device usage during remote closed-book exam **Health: Maternal and newborn health** – Monitor cold chain equipment status

Supply chain management

Other names	Track, manage and optimize all aspects of a supply chain, including avoiding stockouts, minimizing wastage, and providing an audit trail.
Short description	The design, planning, execution, control and monitoring of all supply chain activities with the objective of creating net value and synchronizing supply with demand, including avoiding stockouts, minimizing wastage, and providing an audit trail.
Full description	Several types of products travel in a supply chain from manufacturers to wholesalers, retailers and end consumers. This WorkFlow optimizes shipment logistics and delivers goods efficiently without loss of quality all the way from the manufacturer to the end consumer, avoiding wastage and associated losses. For example, vaccines have short expiry periods and can become impotent or adversely potent even before expiry dates, if exposed beyond a narrow range of temperature, humidity and brightness of light. Common supply chain management WorkFlow comprises utilities to enable entities across the value chain to receive and respond to customer enquiries; collect and aggregate supplies of different orders based on delivery schedules and geographical regions; organize and track the location and safety of storage conditions; manage stock levels to avoid shortages; track consignments against delivery schedules; and track undelivered inventories against expiry dates, all along the supply chain.
Sample mappings of WorkFlows to Use Case	**Agriculture: Market linkage** – Manage supply of seed and shipment and export of harvested crop **Education: Remote learning** – National distribution of school supplies and equipment to public education facilities **Health: Maternal and newborn health** – Manage delivery of supplies to the beneficiary

Work planning and coordination

Other names	Project management, Task tracking
Short description	Orchestrate the coordination and timing of activities of teams and team members within an organization.
Full description	The delivery of services involves the execution of several activities on both the user and the provider side in a planned WorkFlow with contingencies to absorb uncertainties and variable dependencies. Work planning and coordination WorkFlow provides this functionality. Common work planning and coordination WorkFlow enables the provider side in planning and allocating appropriate resources for various services; managing customer appointments; tracking delivery; managing field workforce; triggering settlements thereof, etc; and enabling users to book and track their service appointments.
Sample mappings of WorkFlows to Use Case	**Agriculture: Market linkage** – Coordination of market vendors seasonally to accommodate bulk purchasing and sales **Education: Remote learning** – Initiate scheduling of phone screening interview between student and enrolment advisor based on student's stated interest in an advanced course **Health: Maternal and newborn health** – Automate follow up with provider and patient for missed appointments or upon availability of laboratory test results

4. ICT BUILDING BLOCKS CATALOGUE

This section of the catalogue provides detailed definitions of the ICT Building Blocks identified as of the date of publication. Each ICT Building Blocks definition includes a description, key digital functionalities, sector-specific examples, example software products, and mappings to WorkFlows defined in this catalogue. The list of ICT Building Blocks, exemplar software products, and mappings is not exhaustive and more will be added in future releases of the catalogue. Please note that the software product examples are for illustrative purposes only. Further mapping and ranking of existing products based on maturity, sustainability and applicability to the SDGs will be addressed in subsequent work.

ICT Building Blocks definition

Enterprise-ready, reusable software components providing key functionality facilitating generic WorkFlows across multiple sectors.

Key Characteristics:

- Reusable software components
- Can be open-source, commercial off-the-shelf (COTS), or freely available with open access to data
- Facilitates one or more generic WorkFlows
- Applicable to multiple SDG Use Cases across multiple sectors
- Interoperable with other ICT Building Blocks
- Designed for scalability and extensibility
- Standards-based

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Analytics and business intelligence

Other names	
Short description	Provides data-driven insights about business processes, performance and predictive modelling.
Full description	The *analytics and business intelligence services* ICT Building Blocks enables comprehensive services providing important data-driven insights about the current state of an organization's business. It also identifies trends to help users understand information that can drive business change and support sustainable and successful business practices. These services can aggregate, transform and extract features from data, as well as analyzing them to identify specific patterns and classifications. They can either operate on data stored in various repositories and registries, or process real-time data streams passing through the platform from one application to another. For analytics processing, warehouses are an essential component. Warehouses copy and aggregate data from collection tools and backend data repositories into a database designed specifically for analytical purposes. By doing so, these warehouses transform the data from multiple sources into formats suitable for analysis, helping optimize analytical queries and creating outputs more efficiently without affecting the performance of other applications. Web interfaces and external data visualization applications allow end-users to view the analytic outputs.
Key digital functionalities	• Provides a user interface (UI) to access and work within the software environment • Provides an administrative function to define user rights and accessibility control • Provides artificial intelligence tools for analysis and manipulation of data • Sets business rules and algorithms • Provides data visualization and rendering • Aggregates datasets from various sources into a warehouse database that organizes the data into corresponding groups identified for specific analysis • Processes raw data to find and remove noise, artefacts, etc, and to clean the data • Extracts specific features from data and feature sets • Combines feature sets subject to numerical or logical boundary conditions based on preconfigured rules • Classifies threshold outcomes and triggers corresponding responses in other applications based on classification rules

Examples of use in different sectors	**Agriculture sector:** Use for conducting root cause analysis of problems and applying predictive analytics in order to make appropriate interventions in time, as well as to make informed decisions while implementing various schemes. Examples include: • Analysis of trends of cropped areas and the economics of various crop districts in order to optimize crop area planning and to give advice to farmers • Analysis of soil health records along with the crops grown during the period, rainfall and irrigation amounts, yield, and other parameters, in order to plan how to maximize micronutrient corrections through focused interventions • Prediction of commodity prices, disseminating information to farmers so they can make informed decisions on storage and future sales of non-perishable agricultural produce • Real-time analysis of climatic conditions and early detection of sporadic pests and other pertinent parameters to predict pest attacks on agricultural crops and fish or prawn ponds. Use data to improve preparedness for these pest infestations by issuing advisories to farmers and by adequately stocking the materials required to mitigate these attacks **Education sector:** • Use in supply chain management systems for optimizing distribution of equipment, such as desks and textbooks to schools and learning institutions • Track analytics on learner performance, providing diagnostic information to guide future learning interventions • Track teacher professional development based on self-diagnostic assessment and development of professional learning pathways **Health sector:** • Disease surveillance systems can use analytics and business intelligence services to identify disease incidence, morbidity/mortality rates, density, distribution, etc • Supply chain management systems can use them to optimize shipment logistics for efficient delivery and inventory management • Point-of-service data analysis can help optimize health commodities production and demand-based pricing • Health insurance companies can use this for risk analysis and region- or disease-based optimization of insurance plans
Examples of existing software	• Microsoft Power BI • Tableau
Sample mappings of ICT Building Blocks to Work-Flows	• Data analysis and business intelligence

Artificial intelligence

Other names	Machine learning, Deep learning, Smart systems, Intelligent machines
Short description	Machine intelligence capabilities packaged as reusable services to perform work, extract insights from data, or provide other business capabilities.
Full description	AI (artificial intelligence) is the process by which learning, pattern matching, and recognition and evolution of rules by inference takes place by mathematical modelling, filtering and classification algorithms on computer systems. These processes include learning (the acquisition of information and rules for using the information), reasoning (using the rules to reach approximate or definite conclusions) and self-correction. Examples of emerging AI services include: • Natural language processing (NLP) • Machine translation • Image recognition • Text-to-speech conversion
Key digital functionalities	• Offers sensing or data capture and transmission by machine to machine (eg sensors) or humans to machine (eg data input) • Provides controllers to manipulate data collection tools and external systems in a predefined or adaptive way to achieve the desired result (eg a mail sorter rotating its bar code scanner each time an envelope appears on the scanning console) • Includes metadata standards and definitions to classify and index data in storage • Provides cognition and machine learning to understand input data in various contexts (eg hyper spectral image analysis to infer plant health conditions) • Offers logic and decision-making based on algorithms • Provides modelling, using data, algorithms and deep learning to predict outcomes or initiate action
Examples of use in different sectors	**Agriculture sector:** • Smart and precision agriculture applications use artificial intelligence to interpret data captured by other machines (eg drones or sensors) and create models and strategic inferences (eg whether to initiate harvesting or pesticide spray) and activate other smart machines (eg a remote operated pump-set to start irrigation of fields, farm robots or self-driven tractors) • Machine vision (image recognition) for diagnosing pests or soil defects **Education sector** • Intelligent tutoring systems that work with learners directly and provide support to teachers on personalized learning support strategies • Artificially intelligent assessment software to support adaptive, personalized learning **Health sector:** • Clinical decision support systems that assist doctors in diagnosing a patient's disease condition and related intervention • Rehabilitation tools for patients with stroke, Alzheimer's, autism, etc • AI can also help insurance companies detect high-yield and low-risk ROI patterns or fraud across various claim settlements
Examples of existing software	• Google TensorFlow
Sample mappings of ICT Building Blocks to Work-Flows	• Data analysis and business intelligence • Problem diagnosis

Client case management

Other names	Beneficiary case management
Short description	Registration or enrolment of a client and the longitudinal tracking of services for the client, often across multiple service categories, providers and locations.
Full description	The *client case management services* ICT Building Blocks enables the enrolment of a client in an organization's services. It also enables the longitudinal tracking of services for the client, often across multiple service categories, providers and locations. Common case management activities include the capture of client identification and demographic information, appointment and event scheduling, messaging and reminders, management and prioritization of tasks across multiple cases, and summarizing client case data for reporting. Case managers commonly employ one or more job aids, each facilitating a particular service and potentially customized according to client attributes.
Key digital functionalities	• Registers clients via phone, SMS, web, etc and updates records when needed • Sends predefined messages to subscribers based on rules and data triggers • Sends automated triggers to external systems based on data updates • Schedules activities based on rules and triggers • Generates activity lists and loads job aids based on scheduled activities • Manages multiple cases and prioritizes action • Summarizes client case data for reporting
Examples of use in different sectors	**Agriculture sector:** • Once farmers are registered for a rural advisory service, they are regularly provided information and interventions on various aspects of farming **Education sector** • Learner profiles are tracked from students' first enrolment throughout their schooling careers **Health sector:** • Pregnancy and birth registration, as well as longitudinal tracking of antenatal and postnatal visits
Examples of existing software	• Dimagi CommCare
Sample mappings of ICT Building Blocks to Work-Flows	• Client case management • Client communication • Client education

Collaboration management

Other names	Groupware, Wiki, Online knowledge sharing platform
Short description	Enables multiple users to simultaneously access, modify or contribute to a single activity, such as content creation, through a unified access portal.
Full description	The *collaboration management services* ICT Building Blocks enables the sharing, processing and management of files, documents and other data types among several users or systems in order to help people involved in a common task achieve their goals. In terms of the level of interaction it allows, this ICT Building Blocks may be divided into real-time collaborative editing (RTCE) platforms that allow multiple users to engage in live, simultaneous and reversible editing of a single file (usually a document), and version control (also known as revision control and source control) platforms. These platforms allow separate users to make parallel edits to a file, while preserving every saved edit by every user as multiple files that are variants of the original file.
Key digital functionalities	• Provides a user interface (UI) to access and work within the software environment • Requires user identification and authentication, mostly using a token-based authentication system • Provides an administrative function that defines user rights and accessibility control • Facilitates integration with social media and discussion forums for live discussion threads • Helps users organize or participate in webinars and knowledge sharing platforms • Facilitates information sharing, including multimedia-based information eg video, audio and photos. • Provides an HTML-based rich text editor • Offers a version control system • Enables peer-to-peer messaging • Provides audio/video conferencing
Examples of use in different sectors	**Agriculture sector:** • Agri-Wikis (eg Agropedia) help agriculture research and development (ARD) and agriculture extension communities collaboratively develop knowledge packages for farmers **Education sector** • User-generated content produced by learners, teachers and management can be uploaded to education portals that service various education communities
Examples of existing software	• Google Drive • Microsoft SharePoint
Sample mappings of ICT Building Blocks to Work-Flows	• Client case management

Consent management

Other names	eApproval, Opt-in system
Short description	Manages a set of policies allowing users to determine the information that will be accessible to specific potential information consumers, for which purpose, for how long and whether this information can be shared further.
Full description	The *consent management services* ICT Building Blocks allows an application or system to acquire and validate consent from an authorized user in order to grant access or permissions for carrying out a task. It allows users to take control of their data. Biometric identities, digital signatures or simply SMS messages may be used to provide consent. Consent services may also be integrated with security services to control access to user's data and registry services, to record the user's consent in the corresponding registry.
Key digital functionalities	• Users can record their consent using web-based or mobile applications • Users can digitally sign an electronic document that specifies who can use the data, for how long, and whether the information can be shared further • Users can access and manage their consent records for different services and can revoke their consent • Consents are stored in corresponding registries or in other data repositories, such as electronic health records • Allows for repeated expressions of consent, if required
Examples of use in different sectors	**Agriculture sector:** • Farmers can opt-in for push messaging services by sending an SMS with a keyword (eg YES) to a specific number. Alternatively, they place a missed call to a number or press a numeric key on their phone to indicate their consent to receive information from a specific source (eg RAS) • Generally, the opt-out process uses the exact same WorkFlow with different keywords (eg NO) or different keys to press **Education sector** • Automated parental consent system for approving children's participation in school activities **Health sector:** • Patients can grant consent to health professionals to collect, use or disclose their personal health data, whether it is stored in a local system or it needs to be transferred to other organizations • Consent can also be obtained to allow a certain clinical procedure to be performed
Examples of existing software	• No generic solution identified at this time
Sample mappings of ICT Building Blocks to Work-Flows	• Client case management • Identification and registration

Content management

Other names	ePublication, Document management
Short description	Supports the creation, editing, publication and management of digital media and other information.
Full description	The *content management services* ICT Building Blocks is used to create and manage digital content. It allows multiple users to create, access and share content in a collaborative environment. This ICT Building Blocks is typically used for enterprise content management (ECM) and web content management (WCM). Content management systems can be software as a service (SaaS) or platform as a service (PaaS).
Key digital functionalities	• Requires user ID and authentication for access control • Allows the administration and moderation of content creation, access and sharing • Enables web- or mobile-based user interfaces (UI) for content creation; editing; and managing version control, storage, access and sharing. Commonly known as content management application (CMA) • Offers a content delivery application (CDA) that delivers content to users and devices (eg website and mobiles) • Provides a content repository, which is a database to store content in digital format • Allows for the creation and management of websites by users with limited technical skills • Offers digital media converters that convert media according to the storage needs (eg reduce file size) or rendering needs (eg converting audio/video codec) of different access devices
Examples of use in different sectors	**Agriculture sector:** • Agriculture Wiki (eg Agropedia) • Create knowledge banks (eg IRRI Rice Knowledge Bank) • Collaborative knowledge sharing platforms, such as Global Open Data for Agriculture & Nutrition **Education sector** • Ministry of education content portals that provide curriculum-aligned digital content, lesson plans, and exam papers for download by education communities **Health sector:** • Preventive care programmes can use these tools to raise awareness and spread information about medicines, diseases, lifestyle disorders, family planning, stress management, etc • CME programmes can use this tool to create or publish education and training content for students • Digital marketing can use content management services to manage advertisements as well as display and promote health messages, products and services
Examples of existing software	• Drupal • WordPress
Sample mappings of ICT Building Blocks to Work-Flows	• Client case management • Client education • Content management • Knowledge management

Data collection

Other names	Survey software, Enumeration application, Data point application
Short description	Supports data collection from humans, sensors and other systems through digital interfaces.
Full description	Data collection is the process of gathering and measuring data, information or any variables of interest in a standardized and established manner that enables the collector to answer or test hypotheses as well as evaluate outcomes. Data collection can be machine-driven (automated or machine-level) or human-mediated. The data collection tools depend on the method of data collection and may vary widely from being a simple paper-based form to complex sensor-based systems.
Key digital functionalities	• Uses different data collection devices such as mobile phones, tablets and sensors • Requires identification and authentication to ensure that the system considers only data captured by authentic sources • Customizes data collection forms to enforce data quality, integrity and business WorkFlows • Collects multimedia content (eg video, audio and photos) and records geolocation coordinates • Uses a data collection form or interface that can include access to a camera or a sensor to capture ambient information • Sets data definitions and standards such as measurement system, format and nomenclature (eg population census, definition of income groups, standards related to type of housing, and terminology such as literate and semi-literate) • Provides data analytics tools to create statistics derived from collected data • Collects data offline and synchronizes data with a central data repository once connectivity is established • Provides safeguards against data loss • Provides access to data through APIs
Examples of use in different sectors	**Agriculture sector:** • Conduct farm surveys or agriculture census, collecting data via field sensors or remote sensing through satellite or drones **Education sector** • Conduct whole school evaluation surveys by principals to ascertain school improvement needs **Health sector:** • Health census can use this in surveying demographic distribution of lifestyle habits, living conditions, disease incidence, mortality, morbidity, etc • Diagnostics and monitoring applications can use it to acquire health status and biomedical signals of patients • Real-time mapping of disease epidemics
Examples of existing software	• Open Data Kit (ODK)
Sample mappings of ICT Building Blocks to Work-Flows	• Client case management • Client communication • Data collection and reporting

Digital registries

Other names	Directories, Functional registries
Short description	Registries are centrally managed databases that uniquely identify persons, vendors, facilities, procedures, products and sites related to an organization, industry or activity.
Full description	Registries store unique identifiers of persons, vendors, facilities, procedures, products and sites and are used to record and monitor resources and assets (physical or virtual). These resources are those that are used by a person, organization or industry, or they are consumed while performing certain activities. Registries store essential information for identification and verification purposes, such as name, biometrics/photos, location/contact details and basic profile of the person (eg age, sex qualification, etc), facility (eg type of entity, specialization) or thing (eg equipment type, serial number, warranty period).
Key digital functionalities	• Stores additional demographic or geographic information to facilitate the identification and access to the persons, vendors, facilities, etc • Provides a business rules engine used for saving the data in different tables or sub-registries with a predefined relationship • Uses a messaging component for notification of events (eg data created or updated successfully) • Provides various user interfaces for data input and output
Examples of use in different sectors	**Agriculture sector:** • Farmer, farm, facility or land registries, including GS1, the Global Farm Registry **Education sector** • Registries of criminal offenders accessible to all education institutions • Registries of parent or guardian financial status with reference to school payment systems **Health sector:** • Facility registry – manages unique identifiers for health service delivery locations, including hospitals, clinics, pharmacies and standalone laboratories • Health worker registry (or provider registry) – manages unique identifiers for all types of health workers, including doctors, nurses, pharmacists, social workers, community health workers, and sometimes administrators. It is also called the Master Provider Index, which obtains provider identification information and can connect the provider to facility information • Patient registry – manages the unique identifiers of people receiving health services. It is also called the Master Patient Index (MPI), which maintains patient identification information and verifies the patient demographic data in a system
Examples of existing software	• DHIS2 • iHIRS
Sample mappings of ICT Building Blocks to Work-Flows	• Client case management • Client education • Data collection and reporting • Identification and registration • Marketplace

eLearning

Other names	Online learning, Mobile learning, Digital learning, Smart learning, Distance learning
Short description	Supports facilitated or remote learning through digital interaction between educators and students.
Full description	The ***eLearning*** ICT Building Blocks enables a learning environment that uses ICT as a platform for teaching and learning activities. With its origins in distance learning, eLearning leverages new media, such as the Internet or mobile devices, to connect learners with educators. It breaks down the barriers to learning, such as distance, especially for adult learners in higher education or learners in remote areas. eLearning applications are available in software as a service (SaaS) or platform as a service (PaaS) forms.
Key digital functionalities	• Allows educators to create, curate and publish digital learning materials and programmes, including different types of learning activities • Uses or adapts existing content and multimedia materials, and organizes those materials into courses • Allows access to learning content and courses through different channels, including web, mobile apps and SMS • Enables the access, retrieval and delivery of information from educators to students, or between the learners themselves • Allows for online assessments and evaluation of students • Displays the applicable trainings based on the user profile, such as farmers and health workers • Allows authorized staff to receive feedback on the effectiveness of capacity-building programmes • Provides training schedule information to active or registered users by SMS or email • Offers access to learning content and courses through different channels, including web, mobile apps and SMS • Collects usage analytics to evaluate trainings and determine which materials work best • Includes a terminology library (thesaurus) • Provides a virtual classroom • Displays logistical and personnel information • Provides certification for successful completion of courses • Securely identifies and authenticates learners through biometrics, digital tokens, etc for assessment and certification purposes

Examples of use in different sectors	**Agriculture sector:** • Extension workers training programmes • Massive online open courses (MOOC) for agriculture **Education sector** • Open distance and flexible learning systems (ODFL) offered by education institutions that enrol learners from remote, distant areas who can learn and submit assignments virtually, and universities offering MOOCs **Health sector:** • Continuing medical education (CME) for medical professionals and health workers • Tele-trainings for yoga or exercise • Remote training for college students in disaster management and first aid
Examples of existing software	• MIT Open Course Ware • Moodle
Sample mappings of ICT Building Blocks to Work-Flows	• Client education • Knowledge management

eMarketplace

Other names	eTrading, eCommerce, Digital marketplace
Short description	Provides a digital marketing space where provider entities can electronically advertise and sell products and services to other entities (B2B) or end-customers (B2C).
Full description	The *eMarketplace services* ICT Building Blocks enables various entities to publish their product/service catalogues and advertise their capabilities, facilities, etc on websites as well as through mobile messaging or apps. Such platforms provide many built-in capabilities for customers, such as product comparisons, electronic shopping baskets for aggregating customer selections, and order placement. The eMarketplace also helps vendors maintain a virtual inventory and manage shipments to the delivery agencies registered on the platform. This ICT Building Blocks may also enable multiple vendors to organize their products into package offerings with discounts, etc. Generally, the eMarketplace interfaces with billing and payment collection systems at the backend to ensure customers automatically obtain a price quote, complete a purchase and receive a receipt. Since the platform aggregates supply and demand, the customer is offered a wider range of choices, and vendors see their marketing overheads reduced.
Key digital functionalities	• Advertises products, services and vendors with regional tags and price tags • Allows customers to compare product offerings and make informed choices • Allows utilities to group the selection of different products from different vendors into a single order in the marketplace, and then distribute these orders to respective vendors on the backend • Provides unified billing and collection mechanisms to obtain customer payments and distribute the revenue to different vendors on the backend • Requests price quotes from suppliers to start negotiation processes • Provides statistical reports and transaction logs for audit or business intelligence services to help vendors optimize their inventory and product positioning
Examples of use in different sectors	**Agriculture sector:** • Many eMarketplaces exist for various agro-commodities managed by public entities (eg eNAM by the government of India) **Education sector** • An eLearning marketplace in education can be used to provide a range of free and open education products and services that include user reviews for learners, parents, schools, teachers, researchers and education officials **Health sector:** • Medicine supply • Bio-medical equipment sales • Patient access to services such as physical assistance, transportation, diagnostics services, therapy services, consultation and counselling services
Examples of existing software	• Esoko
Sample mappings of ICT Building Blocks to Work-Flows	• Financial services • Procurement

Geographic information services (GIS)

Other names	Geolocation services
Short description	Provides functionality to identify, tag and analyze geographic locations of an object, such as a water source, building, mobile phone or medical commodity.
Full description	The *geographic information services* ICT Building Blocks enables various applications to find and associate geographic locations with the identity of a person (eg patient, doctor, farmer, agricultural extensionist), facility (eg hospital, ambulance, lab, seed production facility), piece of equipment (eg ventilator, vaccine container), or location (eg water source, agricultural field). This association may also have a timestamp of when it was acquired and be tagged with a unique digital identifier. Applications or components using geographical information services can collect, share and use the temporal and spatial information with other applications, such as map repositories and data visualization tools, where it can be displayed on geographical maps. The data can also be combined with other data such as population, surveillance, or supply chain data sets to enable geospatial and geotemporal analysis. Country's differing data privacy policies may affect how much information geographical information services can gather.
Key digital functionalities	• Measures and tags location and timestamp information to specific data acquired from various applications • Searches and fetches data based on geospatial and geotemporal coordinates given by queries from other applications. • Allows for visualization and analysis of resources and/or human activity data by linking geographic information with descriptive information • Verifies and confirms the presence or absence of objects at specified locations or GPS coordinates
Examples of use in different sectors	**Agriculture sector:** • Critical for improving farm productivity, agri-insurance and traceability systems • Static GIS provides information about natural resource consumption and restoration (eg water harvesting) and land utilization and degradation (eg soil map) • Dynamic GIS provides information about crop sown areas to estimate productivity, crop damage to verify agri-insurance claims, and place of origin for agro-produce • GIS can keep land records, facilitate crop planning and manage the application of fertilizers based on soil conditions, water resource availability and agro-climatic conditions • Helps in crop acreage estimation, storage and logistics planning and the monitoring and forecasting of drought to help increase drought preparedness and identify and implement appropriate disaster risk reduction (DRR) measures **Education sector** • Locate every private and public education institution • Communicates student enrolment data, grade level allocation, and student travel in a municipality, district or state **Health sector:** • Improve the identification of disease outbreak sources, supply chain bottlenecks, and structures in the built environment that impact health and wellness
Examples of existing software	• Quantum GIS (QGIS)
Sample mappings of ICT Building Blocks to Work-Flows	• Data collection and reporting • Identification and registration • Supply chain management

Identification and authentication

Other names	Identity management
Short description	Enables unique identification and authentication of users, organizations and other entities.
Full description	Attribute a unique foundational ID to users, organizations or any other entities with the primary task of letting an entity prove who it is. According to the World Bank, digital foundational identity is one that is 'built in a top-down manner with the objective of bolstering national development by creating a general-purpose identification for use across sectors'.[13] It also allows for proper authentication using passwords, One-time password/pin (OTP), biometrics, digital tokens, etc.
Key digital functionalities	• Foundational IDs come with no specified purpose or attached entitlement but simply let an entity prove who it is • Captures only limited information about users, such as name, date of birth, address and gender • For a given set of credentials, fetches a corresponding ID if it exists in the registry • Uses different biometric methods to identify and authenticate users through means other than user photographs (eg fingerprints, iris scans, facial recognition) to ensure there are no duplicates or fakes, creating a highly trustworthy database • This ICT Building Blocks also uses a publicly available interface, or open API, which allows any licensed service provider to verify if users are who they claim to be • Used to enable services such as opening bank accounts, buying SIM cards, receiving entitlements from the government, signing forms electronically, investing in mutual funds and getting credit • Incorporates privacy into its design when the purpose of the authentication is not revealed if a service provider sends an authentication request.
Examples of use in different sectors	The use of a foundational ID is cross-sectoral. It can be used to verify user identity and enable any service that a user has access credentials for, such as a fertilizer subsidy or food voucher. **Health sector:** • Enterprise Master Patient Index
Examples of existing software	• Apache Syncope • Modular Open Source Identification Platform (MOSIP, currently under development)
Sample mappings of ICT Building Blocks to Work-Flows	• Client case management • Client communication • Data collection and reporting • Financial services • Identification and registration • Knowledge management • Procurement • Supply chain management • Work planning and coordination

[13] World Bank. Digital Identity Toolkit. June 2014

Information mediator

Other names	Integration services
Short description	Provides 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.
Full description	The *information mediator services* ICT Building Blocks enables the service consumer or requestor to connect to the correct service provider through the introduction of a reliable set of capabilities. Information mediator services act as a channel through which external applications connect to other ICT Building Blocks such as registry services, terminology services and repository services. They process, translate and log information transactions, as well as communication errors, between applications and other ICT Building Blocks. They provide the capability of services mediation and orchestration, which includes transformation, routing and protocol conversion to transport service requests from the service requester to the correct service provider. Information mediator services can expose standard APIs across the platform, reducing the need for each application or ICT Building Blocks to have its own API, thereby avoiding coding redundancy and accelerating implementation. This component does not stand alone, however; it needs to be developed in conjunction with other core components, such as registries, repositories, etc. By allowing different applications to exchange information, it can act as a mechanism to encourage or enforce best practices, clinical guidelines, and policy, in cross-facility WorkFlows and business processes.
Key digital functionalities	• Routes requests to the correct provider after necessary message transformation and protocol conversion • Connects the service requestor to the service provider and its underlying solution platforms, realizing the requested service • Discovers services and, at runtime, to support the virtualization of services, so that changes to end-points can occur without impact to service consumers and service providers • Supports the handling of transactions and associated communication errors and exceptions • Enforces access privileges and other security policies • Maintains service invocation history and monitors and tracks service invocations • Provides local caching/broadcast/multicast capabilities to reduce repeated access to databases for the same information and to speed up data exchange • Translates data from one format to another, and interoperates with handshake protocols to enable interoperability between different ICT Building Blocks and applications
Examples of use in different sectors	**Health sector:** • The Health Information Access Layer (HIAL) in Canada provides communications services, common services and supporting components to broker data and service requests from point-of-service applications • It publishes a catalogue of available services, such as services to access registries and domain repositories (eg labs, drugs, diagnostic images) • A point-of-service system requests the 'get lab results' service for a healthcare client as part of the larger business service of managing lab results and reports • The system or user requesting the service does not need to know how to interface with the registries, domain repositories and applications; it just needs to know how to request a service that is exposed through the HIAL
Examples of existing software	• OpenHIM
Sample mappings of ICT Building Blocks to Work-Flows	• Important in the integration ICT Building Blocks as part of any WorkFlow

Messaging

Other names	Instant messenger, Mobile message campaign manager, Message gateway, Mobile gateway
Short description	Facilitates notifications, alerts and two-way communications between applications and communications services, including short message service (SMS), unstructured supplementary service data (USSD), interactive voice response (IVR), email and social media platforms.
Full description	Interactive communication services help digital applications communicate messages between users using mobile or other digital devices and other mobiles/devices/ backend enterprise applications based on specific triggering events. Based on the context and needs, the communication can be offline in the form of messages using telecom infrastructure, such as SMS, MMS, USSD, WhatsApp, Messenger, emails, social media, or live, video, audio, or chat sessions in real time. The communication may be initiated by events triggered by sensory or tracking devices, user activity or backend automation applications. The communication system may be preconfigured with indexed standard messages to automatically form and send appropriate messages based on events. Data repositories can be used to store the content of messages mediated via the interactive communication.
Key digital functionalities	• Send messages based on a predefined calendar or based on external conditions or triggers • Receive incoming messages, store them and trigger actions based on rules configured to identify either keywords contained in messages, senders or other conditions • Place users into groups based on their profile or other parameters and target them with specific messages • Create message flowcharts to determine which messages should be sent and to whom, based on users' responses or external conditions • Track communication requests from external applications, along with message, message ID, and associated information that describes who to send the message to and via what type of communication method • Retrieve appropriate messages from a repository if the message index is received, then populate blank portions of the message with local contextual content, such as name, date and location • Encapsulate the content into formats based on the transmission protocols (phone or Internet) and send it securely through the appropriate corresponding backhaul infrastructure • Collect structured data for rapid analysis • Discover and connect to remote devices on the Internet, streaming real-time multimedia data with appropriate signalling protocols to ensure a timely end-to-end transfer of information that is both network failure resilient and bandwidth efficient • Measure and log metering parameters associated with the communication services used

Examples of use in different sectors	**Agriculture sector:** • Can be used for rural advisory services (RAS) operated by private and public agencies • Farmers subscribe to this service (paid or free) and receive information such as crop advisories, pest alerts and weather alerts • The information is transmitted through predesigned text or voice messages, or via queries to a data repository **Education sector** • Messages via SMS or WhatsApp to enlist potential participants for an online or blended course • Formation of WhatsApp groups among course participants and course facilitators to exchange information, share experiences, collaborate on projects or communicate alerts about upcoming events or deliverables **Health sector:** • Send patients reminders for medication, diet, activity and appointments • Remotely track medical devices or take the vital signs of patients at home or in a remote hospital • Supply chain management systems can use messaging services to notify low stocks of inventory • It can also be used to announce new programmes, report on diseases, notify the public or individuals about events, and share public awareness content over mobile phones and social media
Examples of existing software	• RapidPro • Twilio
Sample mappings of ICT Building Blocks to Work-Flows	• Client communication • Data collection and reporting • Financial services • Marketplace • Supply chain management

Mobility management

Other names	Enterprise app store, Mobile device management (MDM), Mobile application management (MAM)
Short description	Services to securely enable employees' use and management of mobile devices and applications in a business context.
Full description	Given that most organizations and governments are adopting a 'mobile first' strategy, the management of mobile devices and applications as an enterprise or work tool is becoming crucial. Enterprise mobility management (EMM) services usually encompass: mobile device management (MDM), focusing on device-level control and security; mobile application management (MAM), focusing on applications management on the device; and an enterprise app store or other self-service portal, used for applications delivery and deployment.
Key digital functionalities	• Manages mobile devices at the enterprise through a single management console • Sets policies and configures settings by integrating with APIs built into mobile operating systems; an agent app is installed on the device to enforce these policies • Sets policies for a specific app or subset of apps, rather than for the whole device • Limits access and transmission of corporate data to approved applications only • Controls how, when and where workers may use corporate apps and data • Offers some user-friendly features, such as single sign-on • Captures geolocation of devices • Adds, updates and removes applications remotely from a device or group of devices • Wipes data or blocks device access in case of theft • Provides a dashboard with information on usage metrics as well as information about where devices are, with whom, and which applications are being used • Allows the download of only enterprise-approved applications on mobile devices from the enterprise app store • Prevents unauthorized access to enterprise applications and/or corporate data on mobile devices
Examples of use in different sectors	**Agriculture sector:** • EMM services are used to remotely manage and control devices used by agriculture extension workers to add, update or remove applications and to manage field workforce **Health sector:** • EMM services are used to remotely manage and control devices used by community health workers to add, update or remove applications and to manage field workforce
Examples of existing software	• Microsoft Group Policy Management
Sample mappings of ICT Building Blocks to Work-Flows	• Client communication • Data collection and reporting • Identification and registration • Supply chain management

Payments

Other names	E-payments, Mobile wallets, Digital payments
Short description	Implements financial transactions such as remittances, insurance claims, product purchases and payments of service fees, along with the logging of related transactional information. It also provides utilities for tracking costs and extracting audit trials.
Full description	The *payments* ICT Building Blocks enables digital financial payments to be tracked, evaluated, initiated, validated, processed, logged, compared and verified against operating costs. This ICT Building Blocks also provides interoperability with connections to the various external applications that need payment services in order to trigger transitions in their own WorkFlow. Payment services generally interface through gateways to regulated financial entities such as banks, credit facilities and insurance companies. To help users easily complete payment transactions and learn if their transaction succeeded or failed, it converts heterogeneous interface protocols, formats and user interfaces to a standard set of common interfaces and formats. It can also help in tracking costs of commodity and equipment purchases to optimize budgets.
Key digital functionalities	• Allows users to seamlessly send money anywhere to other users or other service providers • Distributes social service transfers and cash safely to end users • Creates eVouchers to disburse financial subsidies in a controlled and safe manner • Provides and manages eWallets to conduct financial transactions using different payment methods, such as a mobile phone application • Offers the ability to cash-in and cash-out from eWallets in an easy and accessible manner • Responds to payers with confirmation of payment, insufficient balance or a mismatch in credentials, transfer failure, etc, based on status in the backend applications • Posts status of transactions with traceability information into transaction logs • Tracks due payment and sent payment notifications through alerting mechanisms, along with associated information • Receives triggers for payment collection, posts the amount with relevant disclaimers to payer and obtains payer approval • Securely posts the approval, user ID and associated payment information to appropriate backend (eg mobile, debit/credit card, Internet banking entities) of relevant financial applications from banks, employers, insurance; awaits transfer confirmation from those applications • Searches and provides a logged information-based query of other applications • Tracks, compares and reports the cost of products, services across vendors, and seasons and regions for optimizing expense budgets • Can be easily integrated with any app with simple coding • Able to operate in remote and inaccessible locations

Examples of use in different sectors	**Agriculture sector:** • Agriculture commodities marketplace – use online payment services to remit farmers' payment for commodity spot sales • Mobile agri-insurance enables farmers to buy insurance cover for crops via mobile payment and receive insurance claims directly to their mobile wallet or linked bank account **Education sector:** • Payment for online course enrolment • Fee payment systems for primary and secondary schools, universities, and other learning institutions • Payment for downloading proprietary electronic publications • Bursary payments to students **Health sector:** • Payment during booking of services • Downloading of electronic publications • Insurance claim settlements • Purchase of medicines or food, etc
Examples of existing software	• Apache Fineract • Electronic Funds Transfers (EFT) from banks, credit card payments, and online payment services such as PayPal
Sample mappings of ICT Building Blocks to Work-Flows	• Client case management • Client education • Financial services • Marketplace • Procurement • Supply chain management

Registration

Other names	Enrolment services
Short description	Records 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 and tracking of that entity over time.
Full description	Registration services attribute a unique functional ID to a person, place or other entity to identify and access information about it. According to the World Bank, functional IDs are those that 'evolve out of a single use-case, such as voter IDs, health records, or bank cards, [...] and are created with a specific purpose in mind, differing from foundational IDs which are created with a general purpose in mind'. Registration services can also use the foundational ID or map it to the functional ID where such an identity exists. Examples of specific registration services include immunization, disease and citizenship records, as well as birth and death registration. The ensemble of utilities for capturing, recording, profiling, searching, retrieving and verifying this identity information is encapsulated as registration services. The information itself will be deposited into and retrieved from corresponding functional registries (see the Registries ICT Building Blocks). Registration services help profile entities by enabling the registration of different categories or groups and documenting their access to various services. These services also onboard users into a programme or service offered by an organization (eg rural advisory service), capturing related demography, profile and citizen ID information.
Key digital functionalities	• Assign a unique (functional) ID and create identification pieces (eg smart card, bar code, RFID, digital token, unique number) with that ID and all related information about the entity • Map the assigned new (functional) ID to existing national (foundational) ID, if any • Populate demographic and/or geographic data of entities when registering for the first time • The complete registration information will be further used for any transaction or services later • This information can be used to complete the 'know your customer' (KYC) requirements that businesses use to assess potential clients and comply with regulations • Capture identification information from biometrics, photos, scanned images, typed input, etc, and update the relevant registry with these entries using a specific ID tag. • Determine if the specified ID exists in the registry according to a match with the given credentials • Automatically identify possible duplicate entries and merge them • Retrieve information corresponding to queries for a chosen entry, such as eligibility for subsidy, enrolment status, profile • Retrieve information of entries in the registry matching or nearly matching given credentials

Examples of use in different sectors	**Agriculture sector:** • Farmers' registration in a rural advisory service (RAS) captures information about farming and other related areas (eg government schemes) • Registration mostly happens through mobile channels such as an interactive voice response system (IVRS), SMS or mobile apps • At the time of registration, critical personal, demographic and farming profile data is collected by the system through a registration form • This data is stored and used for customization of information delivery to users (per their profile) and other analytics • In some advanced RAS, the registration data is shared and mapped with other citizen databases (eg population registry, land registry) to facilitate delivery of multiple business services (eg microfinance) **Education sector:** • Registration for online professional development courses via the web or a mobile app • During registration, personal, educational and demographic data is required to help the system ascertain qualification levels • Doing so helps the system tailor course content in accordance with user needs **Health sector:** • Pregnant women's registration into Mother Child Tracking System
Examples of existing software	• OpenSRP
Sample mappings of ICT Building Blocks to Work-Flows	• Client case management • Client communication • Data collection and reporting • Identification and registration • Marketplace • Supply chain management

Reporting and dashboards

Other names	Key performance tracker, Digital dashboard
Short description	Provides pre-packaged and custom presentations of data and summaries of an organization's pre-defined key performance metrics, often in visual format.
Full description	*Reporting and dashboard services* provide easy-to-understand aggregated key statistical data (mostly current and historical data) and summaries in visual formats such as charts, graphs and animations.
Key digital functionalities	• Allows the export and import of data and metadata that integrate with external applications through APIs • Provides different kinds of tools for data validation and improvement of data quality • Provides reports with charts and tables for selected indicators or data summaries, all of which are designed to be easy to use and create • Offers a configurable dashboard for quick access to relevant monitoring and evaluation tools, including indicator charts and links to favourite reports, maps and other key resources in the system • Constructs and runs queries by users on the underlying database to create custom reports • Allows users to share and discuss their data in charts and reports
Examples of use in different sectors	**Agriculture sector:** • Production of periodic reports for soil samples, fertilizer, seeds, pesticides, farmer registration statistics, and inspections **Education sector:** • Production of reports on educational key performance indicators, including learner performance, completion rates, retention, dropout rates, graduate passes and failure rates **Health sector:** • Production of aggregated statistics for the routine data a health facility uses for strategic planning within the health system • Management information system reports for hospitals, labs and other entities, supply chain tracking reports, patient feedback reports, medical test reports, etc
Examples of existing software	• DHIS2 • Tableau
Sample mappings of ICT Building Blocks to Work-Flows	• Client Case Management • Client Education • Content Management • Data Analysis and Business Intelligence • Data Collection and Reporting • Remote Monitoring

Scheduling

Other names	Appointment booking, Activity manager, Calendar management
Short description	Provides an engine for setting up events based on regular intervals or specific combinations of status of several parameters in order to trigger specific tasks in an automated business process.
Full description	The *scheduling services* ICT Building Blocks provides an engine for setting up events or tasks. These tasks can be simple, one-time events, such as a referral appointment at a specialist clinic. More complex events may also be defined and configured with this component. Regular, repetitive events can be set up, including on-going calendar appointments scheduled at regular intervals to automate data acquisition and the processing, distribution, presentation and backup activities involved in a business process. This type of complex event uses a predefined schedule based on a set of status indicators at specific milestones along a WorkFlow that acts as triggers for actions. These triggers may be based on positive status (completion), or negative status (non-completion) of various activities. Milestones can be set at different intervals, so the next trigger may happen after a delay if the status has not changed from negative to positive.
Key digital functionalities	• Enable external applications to define events or tasks based on a defined time period and/or intervals • Allocate time slots based on resource availability • Bind different allocated resources into events • Enable blocking and releasing subslots in events • Search/sort/fetch/populate event or task information based on queries from other applications
Examples of use in different sectors	**Agriculture sector:** • Custom hiring services for agro-machinery, which enables farmers to schedule hiring for various farm activities (eg a combine harvester) **Education sector:** • Calendar service that schedules the school timetable, exam timetable, quarterly district official meetings, subject advisor visits to schools and school evaluation meetings • Alerts are sent in advance of scheduled events as task reminders, such as reports and presentations that are due • Relevant forms required for submission of these types of documents are also sent with these alerts **Health sector:** • Booking appointments with providers • Planning medication, diet, exercise and follow-up consultations for patients and providers • Acquiring periodic measurements from medical monitoring devices • Supply chain management systems can organize shipments of medical commodities or equipment • Hospitals, public health departments, and organizations can announce new programmes or events to the public over mobile phones and social media • Facility managers can schedule regular maintenance checks on equipment or to generate periodic reports from management information systems
Examples of existing software	• Cron • Django Celery
Sample mappings of ICT Building Blocks to Work-Flows	• Client communication • Supply chain management • Work planning and coordination

Security

Other names	Information security, Privacy, Access control
Short description	Allows ICT administrators to centrally configure and manage user and group access permissions to network resources, services, databases, applications and user devices. It also enables secure information exchange between different applications.
Full description	In general, the ***information security services*** ICT Building Blocks uses a group of methods to intelligently control access to resources, enforce policies, secure information, and log/audit who has accessed what resource and for what purpose. When dealing with information security, there are several key capabilities that need to be considered. These capabilities can be implemented and leveraged at a local solution level, scaled up to an enterprise wide solution, or any combination inbetween. There are four key capabilities necessary to enable better management and use of electronic information so as to facilitate secure storage and the exchange of data between consumers, vendors and other organizations. This data exchange will need to be conducted in ways that safeguard the availability, integrity, confidentiality and accuracy of the information. **Access management:** Following identification and authentication of users, this ICT Building Blocks controls user access to resources within a system (country, network, enterprise or individual solution) by associating user rights and restrictions with the established identity. **Cryptography and digital signatures:** An essential part of any communication transmitted over an untrusted or insecure medium, including different types of networks and especially the Internet. Cryptography can serve many purposes, including: • **Authentication** – proving one's identity • **Privacy/confidentiality** – ensuring only the intended message recipient can read the message • **Integrity** – ensuring that the message has not been altered in transit from the sender to the receiver • **Non-repudiation** – ensuring neither sender nor receiver cannot deny their actions on completion **Logging, auditing and attribution:** This provides traceability and documentary evidence of a sequence of actions. This process can and should contain actions such as system login, information access and system restarts, among many others. **Single sign-on:** Allows users who have different usernames and passwords for each application to authenticate themselves for multiple applications using the same sign-in credentials.

Key digital functionalities	• Restriction of connection to only those devices and applications that have been certified as conforming to standards • Filtering of credentials to allow only authorized systems and personnel to access and perform specific operations on data • Anonymization of documents by removing personal identity information • Encryption of data in storage or transmission to prevent illegal tapping or copying of information for parties other than the authentic destination • Detection and restriction of normal and abnormal patterns in data access and operations
Examples of use in different sectors	**Agriculture sector:** • SSL digital certificate-based payment gateway to enable financial transactions in agriculture eMarketplace **Education sector:** • Multi-password management systems in schools for secure storage of passwords and sensitive data **Health sector:** • SSL digital certificate-based permission for uploading digital documents to servers from client systems • Role-based access control in hospital information systems that prevents unauthorized persons from accessing content • HL7/DICOM messaging for transmission of anonymized data • MAC-id-based access control protocols for allowing only authorized machines to access or operate medical or financial records • ePayment applications verify the digital signature of the payer, or diagnostic tests check the digital signature of doctors for authenticating medical reports in insurance claims • Biometric passwords may be used for health workers accessing eLearning tools, patient data, etc via mobile devices and computers
Examples of existing software	• OpenSSL
Sample mappings of ICT Building Blocks to Work-Flows	Security is an important consideration in all WorkFlows, but is especially critical in: • Client case management • Client education • Content management • Data analysis and business intelligence • Identification and registration • Knowledge management • Marketplace

Shared data repositories

Other names	Shared domain repositories
Short description	Shared space to store data for a specified knowledge area that external applications use, often providing domain-specific functionality and data presentations.
Full description	The *shared data repositories* ICT Building Blocks is one of the most important components, as it provides a common place to store data that external applications can use. Repositories support the storage, retrieval, management and exchange of data between different applications. The goal of repositories is to make data available for any authorized application that needs to use it. Access to repositories must follow countries' data privacy and user consent regulations. Repositories make data available and accessible through interoperable interfaces. Metadata information is used to classify data in these repositories in terms of types of data, domains of value, critical values (syntactic information) and meaning of data (semantic description).
Key digital functionalities	• Allows external applications to change (by adding, modifying or removing data) without losing the information itself • Ensures that information flows when it is needed to where it is needed, and with whom it is authorized to be shared • Enables client, or their authorized representative, with partial or full access to their own records, or to capture input from medical or mobile devices • Establishes cross relationships and linkages between different data points to enable ready access to related clusters of data stored in disparate locations • Ensures privacy through automated rules for access and operation for data sharing
Examples of use in different sectors	**Agriculture sector:** • Plant pest database, such as the US Department of Agriculture's Animal and Plant Health Inspection Service's (APHIS) new, searchable database, known as the Fruits and Vegetables Import Requirement (FAVIR) database • This database is accessed by other software such as those related to plant protection and quarantine to assess the pest risk profile of agro-commodities imported from different countries • Pest map, crop coverage and weather data are combined to create pest propensity modelling and index-based insurance packages for farmers **Education sector:** • Repositories of learner profiles and progression records accessible across government systems

Examples of use in different sectors	**Health sector** – shared data/domain repositories can include: • *Shared health record:* Collection of patient records typically provided by many clinically related systems, made available for consumption by those who have the necessary rights and need to see the information. The systems or applications used by insurers or payers of subsidized care may be given partial access to shared health records in order to approve payment for services • *Encounter:* Data pertaining to an interaction between a patient and healthcare provider for the purpose of assessing the health status of a patient or for providing patient services • *Clinical documentation:* Component of the patient's medical record that documents clinical observations and services • *Medications:* Information pertaining to a patient's medication history. This includes those medications taken at home, prescribed medications, and also those administered in care settings such as a hospital or an outpatient clinic • *Immunizations:* Records of a patient's immunization history • *Laboratory:* Contains the results of laboratory tests performed on clinical specimens • *Imaging:* Contains records of diagnostic imaging as well as clinician notes and other information stored with the images • There may also be repositories of insurance claims, subsidies, or out-of-pocket payments linked to health service records
Examples of existing software	• World Bank Open Data
Sample mappings of ICT Building Blocks to Work-Flows	• Client case management • Client education • Content management • Data analysis and business intelligence • Knowledge management

Terminology

Other names	Thesaurus, Ontology services
Short description	Registry of definitions and terms with defined nomenclature standards, metadata, synonyms and sometimes a knowledge map for a particular domain of knowledge (eg agriculture), used to facilitate semantic interoperability.
Full description	The *terminology* services ICT Building Blocks helps ensure that data passed through applications in the system are coded and classified in the same way. These services help establish, search, verify and view the vocabulary stored in codified reference lists according to standardized nomenclature and data formats. Terminology services components can disseminate standards and facilitate the management of changes in standards over time. Many applications use their own local terminologies, but these may need to be mapped to the standard reference terminologies in a time-consuming manual process. Terminology services may use push or pull interfaces to other applications, depending on the implementation, to ensure data exchanged through them is interpreted, aggregated, analyzed and compared without loss in accuracy. This ICT Building Blocks lets users of an application make use of codes and value sets without having to become experts in the fine details of a particular coding system and terminologies.[14]
Key digital functionalities	• Allows external applications to access or search for standard terminology along with explanations and cross-mapping to local terminologies, if any • Offers source-related terminologies for a given term in the dictionary • Provides metadata and meta-description for the terms • Ensures interoperability of data between cross-sectoral applications (eg vector pest data between agriculture and health)
Examples of use in different sectors	**Agriculture sector:** • FAO Agrovoc is the main terminology standard in agriculture • It is a controlled vocabulary covering all areas of interest including food, nutrition, agriculture, fisheries, forestry and environment • It is published by FAO and edited by a community of experts • Apart from Agrovoc, Pesticide Environmental Stewardship (PES) by Cornwell University has a glossary of terms related to pesticides • Population census (definition of income group, standards related to type of housing, and terminology such as literate and semi-literate) **Health sector:** • Several terminology reference standards such as DICOM, HL7, ICD-10/PCT, LOINC, etc are used widely for payments and insurance claims processing as well as different supply chain applications
Examples of existing software	• Open Concept Lab
Sample mappings of ICT Building Blocks to Work-Flows	• Client education • Data analysis and business intelligence

[14] http://fhir-ru.github.io/terminology-service.html Accessed 14 March 2019

Workflow and algorithm

Other names	Business process automation services
Short description	Helps to optimize business processes by specifying rules that govern the sequence of activities to be executed as well as the type of information exchanged in order to orchestrate the process flow from its initiation to completion.
Full description	The *WorkFlow* and algorithm services ICT Building Blocks helps automate and control the flow of information and activities within various services based on predefined protocols. In some cases, these protocols may include directives for end users, such as treatment guidelines or operating procedures. In other cases, these WorkFlows may guide software systems to automate data exchange based on certain events or conditions. By allowing different applications to exchange information, it can support cross-facility WorkFlows and business processes. In addition to accelerating and automating information flow, it can be used as a mechanism to encourage or enforce best practices, clinical guidelines and policy.
Key digital functionalities	• Provides digital definitions of various WorkFlows as a sequence of various transactions and tasks executed by specific user roles as well as the combination of events that should trigger transition from one task or user to another • Captures events and inputs from external applications and then groups these into specific assessment pools as specified by WorkFlow transition rules • Evaluates trigger conditions for movement of WorkFlow through specific task or user transitions based on predefined rules • Notifies changes in activities or changes of users to other applications • Supplies the contextual information needed to effect the transition of tasks or users
Examples of use in different sectors	**Agriculture sector:** • Farm management systems use many WorkFlows related to various agronomic activities, such as fertilizer application and irrigation **Health sector:** • Worklist tracking and reminding • Clinical decision support algorithms • Evaluation and processing of financial subsidy or insurance claims • Electronic collection or remittance of payments
Examples of existing software	• Drools • Zapier
Sample mappings of ICT Building Blocks to Work-Flows	• Client case management • Data analysis and business intelligence • Problem diagnosis • Procurement • Work planning and coordination

5. SDGs, TARGETS AND INDICATORS

This section provides an exhaustive list of the Sustainable Development Goals (SDGs), targets and indicators, sourced from https://sustainabledevelopment.un.org/sdgs, for reference. The SDGs comprise 17 goals and 169 targets representing global priorities for investment to achieve sustainable development.

This information is provided here to allow this document to be self-contained, and does not provide any additional content from the online version hosted at un.org.

SDG1: END POVERTY IN ALL ITS FORMS EVERYWHERE	
1.1 By 2030, eradicate extreme poverty for all people everywhere, currently measured as people living on less than US$ 1.25 a day	**1.1.1** Proportion of population below the international poverty line, by sex, age, employment status and geographical location (urban/rural)
1.2 By 2030, reduce at least by half the proportion of men, women and children of all ages living in poverty in all its dimensions according to national definitions	**1.2.1** Proportion of population living below the national poverty line, by sex and age **1.2.2** Proportion of men, women and children of all ages living in poverty in all its dimensions according to national definitions
1.3 Implement nationally appropriate social protection systems and measures for all, including floors, and by 2030 achieve substantial coverage of the poor and the vulnerable	**1.3.1** Proportion of population covered by social protection floors/systems, by sex, distinguishing children, unemployed persons, older persons, persons with disabilities, pregnant women, newborns, work-injury victims and the poor and the vulnerable
1.4 By 2030, ensure that all men and women, in particular the poor and the vulnerable, have equal rights to economic resources, as well as access to basic services, ownership and control over land and other forms of property, inheritance, natural resources, appropriate new technology and financial services, including microfinance	**1.4.1** Proportion of population living in households with access to basic services **1.4.2** Proportion of total adult population with secure tenure rights to land, (a) with legally recognized documentation, and (b) who perceive their rights to land as secure, by sex and type of tenure
1.5 By 2030, build the resilience of the poor and those in vulnerable situations and reduce their exposure and vulnerability to climate-related extreme events and other economic, social and environmental shocks and disasters	**1.5.1** Number of deaths, missing persons and directly affected persons attributed to disasters per 100,000 population **1.5.2** Direct economic loss attributed to disasters in relation to global gross domestic product (GDP) **1.5.3** Number of countries that adopt and implement national disaster risk reduction strategies in line with the Sendai Framework for Disaster Risk Reduction 2015–2030 **1.5.4** Proportion of local governments that adopt and implement local disaster risk reduction strategies in line with national disaster risk reduction strategies
1.a Ensure significant mobilization of resources from a variety of sources, including through enhanced development cooperation, in order to provide adequate and predictable means for developing countries, in particular least developed countries, to implement programmes and policies to end poverty in all its dimensions	**1.a.1** Proportion of domestically generated resources allocated by the government directly to poverty reduction programmes **1.a.2** Proportion of total government spending on essential services (education, health and social protection) **1.a.3** Sum of total grants and non-debt-creating inflows directly allocated to poverty reduction programmes as a proportion of GDP

1.b Create sound policy frameworks at the national, regional and international levels, based on pro-poor and gender-sensitive development strategies, to support accelerated investment in poverty eradication actions	**1.b.1** Proportion of government recurrent and capital spending to sectors that disproportionately benefit women, the poor and vulnerable groups
SDG2: END HUNGER, ACHIEVE FOOD SECURITY AND IMPROVED NUTRITION AND PROMOTE SUSTAINABLE AGRICULTURE	
2.1 By 2030, end hunger and ensure access by all people, in particular the poor and people in vulnerable situations, including infants, to safe, nutritious and sufficient food all year round	**2.1.1** Prevalence of undernourishment **2.1.2** Prevalence of moderate or severe food insecurity in the population, based on the Food Insecurity Experience Scale (FIES)
2.2 By 2030, end all forms of malnutrition, including achieving, by 2025, the internationally agreed targets on stunting and wasting in children under 5 years of age, and address the nutritional needs of adolescent girls, pregnant and lactating women and older persons	**2.2.1** Prevalence of stunting (height for age <-2 standard deviation from the median of the World Health Organization (WHO) Child Growth Standards) among children under 5 years of age **2.2.2** Prevalence of malnutrition (weight for height >+2 or <-2 standard deviation from the median of the WHO Child Growth Standards) among children under 5 years of age, by type (wasting and overweight)
2.3 By 2030, double the agricultural productivity and incomes of small-scale food producers, in particular women, indigenous peoples, family farmers, pastoralists and fishers, including through secure and equal access to land, other productive resources and inputs, knowledge, financial services, markets and opportunities for value addition and non-farm employment	**2.3.1** Volume of production per labour unit by classes of farming/pastoral/forestry enterprise size **2.3.2** Average income of small-scale food producers, by sex and indigenous status
2.4 By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality	**2.4.1** Proportion of agricultural area under productive and sustainable agriculture

2.5 By 2020, maintain the genetic diversity of seeds, cultivated plants and farmed and domesticated animals and their related wild species, including through soundly managed and diversified seed and plant banks at the national, regional and international levels, and promote access to and fair and equitable sharing of benefits arising from the utilization of genetic resources and associated traditional knowledge, as internationally agreed	**2.5.1** Number of plant and animal genetic resources for food and agriculture secured in either medium- or long-term conservation facilities **2.5.2** Proportion of local breeds classified as being at risk, not at risk or at unknown level of risk of extinction
2.a Increase investment, including through enhanced international cooperation, in rural infrastructure, agricultural research and extension services, technology development and plant and livestock gene banks in order to enhance agricultural productive capacity in developing countries, in particular least developed countries	**2.a.1** The agriculture orientation index for government expenditures **2.a.2** Total official flows (official development assistance plus other official flows) to the agriculture sector
2.b Correct and prevent trade restrictions and distortions in world agricultural markets, including through the parallel elimination of all forms of agricultural export subsidies and all export measures with equivalent effect, in accordance with the mandate of the Doha Development Round	**2.b.1** Agricultural export subsidies
2.c Adopt measures to ensure the proper functioning of food commodity markets and their derivatives and facilitate timely access to market information, including on food reserves, in order to help limit extreme food price volatility	**2.c.1** Indicator of food price anomalies
SDG3: ENSURE HEALTHY LIVES AND PROMOTE WELL-BEING FOR ALL AT ALL AGES	
3.1 By 2030, reduce the global maternal mortality ratio to less than 70 per 100,000 live births	**3.1.1** Maternal mortality ratio **3.1.2** Proportion of births attended by skilled health personnel
3.2 By 2030, end preventable deaths of newborns and children under 5 years of age, with all countries aiming to reduce neonatal mortality to at least as low as 12 per 1,000 live births and under-5 mortality to at least as low as 25 per 1,000 live births	**3.2.1** Under-5 mortality rate **3.2.2** Neonatal mortality rate

3.3 By 2030, end the epidemics of AIDS, tuberculosis, malaria and neglected tropical diseases and combat hepatitis, water-borne diseases and other communicable diseases	**3.3.1** Number of new HIV infections per 1,000 uninfected population, by sex, age and key populations **3.3.2** Tuberculosis incidence per 100,000 population **3.3.3** Malaria incidence per 1,000 population **3.3.4** Hepatitis B incidence per 100,000 population **3.3.5** Number of people requiring interventions against neglected tropical diseases
3.4 By 2030, reduce by one third premature mortality from non-communicable diseases through prevention and treatment and promote mental health and well-being	**3.4.1** Mortality rate attributed to cardiovascular disease, cancer, diabetes or chronic respiratory disease **3.4.2** Suicide mortality rate
3.5 Strengthen the prevention and treatment of substance abuse, including narcotic drug abuse and harmful use of alcohol	**3.5.1** Coverage of treatment interventions (pharmacological, psychosocial and rehabilitation and aftercare services) for substance use disorders **3.5.2** Harmful use of alcohol, defined according to the national context as alcohol per capita consumption (aged 15 years and older) within a calendar year in litres of pure alcohol
3.6 By 2020, halve the number of global deaths and injuries from road traffic accidents	**3.6.1** Death rate due to road traffic injuries
3.7 By 2030, ensure universal access to sexual and reproductive health-care services, including for family planning, information and education, and the integration of reproductive health into national strategies and programmes	**3.7.1** Proportion of women of reproductive age (aged 15–49 years) who have their need for family planning satisfied with modern methods **3.7.2** Adolescent birth rate (aged 10–14 years; aged 15–19 years) per 1,000 women in that age group
3.8 Achieve universal health coverage, including financial risk protection, access to quality essential health-care services and access to safe, effective, quality and affordable essential medicines and vaccines for all	**3.8.1** Coverage of essential health services (defined as the average coverage of essential services based on tracer interventions that include reproductive, maternal, newborn and child health, infectious diseases, non-communicable diseases and service capacity and access, among the general and the most disadvantaged population) **3.8.2** Proportion of population with large household expenditures on health as a share of total household expenditure or income

3.9 By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination	**3.9.1** Mortality rate attributed to household and ambient air pollution **3.9.2** Mortality rate attributed to unsafe water, unsafe sanitation and lack of hygiene (exposure to unsafe Water, Sanitation and Hygiene for All (WASH) services) **3.9.3** Mortality rate attributed to unintentional poisoning
3.a Strengthen the implementation of the World Health Organization Framework Convention on Tobacco Control in all countries, as appropriate	**3.a.1** Age-standardized prevalence of current tobacco use among persons aged 15 years and older
3.b Support the research and development of vaccines and medicines for the communicable and non-communicable diseases that primarily affect developing countries, provide access to affordable essential medicines and vaccines, in accordance with the Doha Declaration on the TRIPS Agreement and Public Health, which affirms the right of developing countries to use to the full the provisions in the Agreement on Trade-Related Aspects of Intellectual Property Rights regarding flexibilities to protect public health, and, in particular, provide access to medicines for all	**3.b.1** Proportion of the target population covered by all vaccines included in their national programme **3.b.2** Total net official development assistance to medical research and basic health sectors **3.b.3** Proportion of health facilities that have a core set of relevant essential medicines available and affordable on a sustainable basis
3.c Substantially increase health financing and the recruitment, development, training and retention of the health workforce in developing countries, especially in least developed countries and small island developing States	**3.c.1** Health worker density and distribution
3.d Strengthen the capacity of all countries, in particular developing countries, for early warning, risk reduction and management of national and global health risks	**3.d.1** International Health Regulations (IHR) capacity and health emergency preparedness
SDG4: ENSURE INCLUSIVE AND EQUITABLE QUALITY EDUCATION AND PROMOTE LIFELONG LEARNING OPPORTUNITIES FOR ALL	
4.1 By 2030, ensure that all girls and boys complete free, equitable and quality primary and secondary education leading to relevant and effective learning outcomes	**4.1.1** Proportion of children and young people (a) in grades 2/3; (b) at the end of primary; and (c) at the end of lower secondary achieving at least a minimum proficiency level in (i) reading and (ii) mathematics, by sex

4.2 By 2030, ensure that all girls and boys have access to quality early childhood development, care and pre-primary education so that they are ready for primary education	**4.2.1** Proportion of children under 5 years of age who are developmentally on track in health, learning and psychosocial well-being, by sex **4.2.2** Participation rate in organized learning (one year before the official primary entry age), by sex
4.3 By 2030, ensure equal access for all women and men to affordable and quality technical, vocational and tertiary education, including university	**4.3.1** Participation rate of youth and adults in formal and non-formal education and training in the previous 12 months, by sex
4.4 By 2030, substantially increase the number of youth and adults who have relevant skills, including technical and vocational skills, for employment, decent jobs and entrepreneurship	**4.4.1** Proportion of youth and adults with information and communications technology (ICT) skills, by type of skill
4.5 By 2030, eliminate gender disparities in education and ensure equal access to all levels of education and vocational training for the vulnerable, including persons with disabilities, indigenous peoples and children in vulnerable situations	**4.5.1** Parity indices (female/male, rural/urban, bottom/top wealth quintile and others such as disability status, indigenous peoples and conflict-affected, as data become available) for all education indicators on this list that can be disaggregated
4.6 By 2030, ensure that all youth and a substantial proportion of adults, both men and women, achieve literacy and numeracy	**4.6.1** Proportion of population in a given age group achieving at least a fixed level of proficiency in functional (a) literacy and (b) numeracy skills, by sex
4.7 By 2030, ensure that all learners acquire the knowledge and skills needed to promote sustainable development, including, among others, through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship and appreciation of cultural diversity and of culture's contribution to sustainable development	**4.7.1** Extent to which (i) global citizenship education and (ii) education for sustainable development, including gender equality and human rights, are mainstreamed at all levels in (a) national education policies; (b) curricula; (c) teacher education; and (d) student assessment
4.a Build and upgrade education facilities that are child, disability and gender sensitive and provide safe, non-violent, inclusive and effective learning environments for all	**4.a.1** Proportion of schools with access to (a) electricity; (b) the Internet for pedagogical purposes; (c) computers for pedagogical purposes; (d) adapted infrastructure and materials for students with disabilities; (e) basic drinking water; (f) single-sex basic sanitation facilities; and (g) basic handwashing facilities (as per the WASH indicator definitions)

4.b By 2020, substantially expand globally the number of scholarships available to developing countries, in particular least developed countries, small island developing States and African countries, for enrolment in higher education, including vocational training and information and communications technology, technical, engineering and scientific programmes, in developed countries and other developing countries	**4.b.1** Volume of official development assistance flows for scholarships by sector and type of study
4.c By 2030, substantially increase the supply of qualified teachers, including through international cooperation for teacher training in developing countries, especially least developed countries and small island developing States	**4.c.1** Proportion of teachers in: (a) pre-primary; (b) primary; (c) lower secondary; and (d) upper secondary education who have received at least the minimum organized teacher training (e.g. pedagogical training) pre-service or in-service required for teaching at the relevant level in a given country
SDG5: ACHIEVE GENDER EQUALITY AND EMPOWER ALL WOMEN AND GIRLS	
5.1 End all forms of discrimination against all women and girls everywhere	**5.1.1** Whether or not legal frameworks are in place to promote, enforce and monitor equality and non-discrimination on the basis of sex
5.2 Eliminate all forms of violence against all women and girls in the public and private spheres, including trafficking and sexual and other types of exploitation	**5.2.1** Proportion of ever-partnered women and girls aged 15 years and older subjected to physical, sexual or psychological violence by a current or former intimate partner in the previous 12 months, by form of violence and by age **5.2.2** Proportion of women and girls aged 15 years and older subjected to sexual violence by persons other than an intimate partner in the previous 12 months, by age and place of occurrence
5.3 Eliminate all harmful practices, such as child, early and forced marriage and female genital mutilation	**5.3.1** Proportion of women aged 20–24 years who were married or in a union before age 15 and before age 18 **5.3.2** Proportion of girls and women aged 15–49 years who have undergone female genital mutilation/cutting, by age
5.4 Recognize and value unpaid care and domestic work through the provision of public services, infrastructure and social protection policies and the promotion of shared responsibility within the household and the family as nationally appropriate	**5.4.1** Proportion of time spent on unpaid domestic and care work, by sex, age and location

5.5 Ensure women's full and effective participation and equal opportunities for leadership at all levels of decision-making in political, economic and public life	**5.5.1** Proportion of seats held by women in (a) national parliaments and (b) local governments **5.5.2** Proportion of women in managerial positions
5.6 Ensure universal access to sexual and reproductive health and reproductive rights as agreed in accordance with the Programme of Action of the International Conference on Population and Development and the Beijing Platform for Action and the outcome documents of their review conferences	**5.6.1** Proportion of women aged 15–49 years who make their own informed decisions regarding sexual relations, contraceptive use and reproductive healthcare **5.6.2** Number of countries with laws and regulations that guarantee full and equal access to women and men aged 15 years and older to sexual and reproductive healthcare, information and education
5.a Undertake reforms to give women equal rights to economic resources, as well as access to ownership and control over land and other forms of property, financial services, inheritance and natural resources, in accordance with national laws	**5.a.1 (a)** Proportion of total agricultural population with ownership or secure rights over agricultural land, by sex; and (b) share of women among owners or rights-bearers of agricultural land, by type of tenure **5.a.2** Proportion of countries where the legal framework (including customary law) guarantees women's equal rights to land ownership and/or control
5.b Enhance the use of enabling technology, in particular information and communications technology, to promote the empowerment of women	**5.b.1** Proportion of individuals who own a mobile telephone, by sex
5.c Adopt and strengthen sound policies and enforceable legislation for the promotion of gender equality and the empowerment of all women and girls at all levels	**5.c.1** Proportion of countries with systems to track and make public allocations for gender equality and women's empowerment
SDG6: ENSURE AVAILABILITY AND SUSTAINABLE MANAGEMENT OF WATER AND SANITATION FOR ALL	
6.1 By 2030, achieve universal and equitable access to safe and affordable drinking water for all	**6.1.1** Proportion of population using safely managed drinking water services
6.2 By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations	**6.2.1** Proportion of population using (a) safely managed sanitation services and (b) a hand-washing facility with soap and water
6.3 By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally	**6.3.1** Proportion of wastewater safely treated **6.3.2** Proportion of bodies of water with good ambient water quality

6.4 By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity	**6.4.1** Change in water-use efficiency over time **6.4.2** Level of water stress: freshwater withdrawal as a proportion of available freshwater resources
6.5 By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate	**6.5.1** Degree of integrated water resources management implementation (0–100) **6.5.2** Proportion of transboundary basin area with an operational arrangement for water cooperation
6.6 By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes	**6.6.1** Change in the extent of water-related ecosystems over time
6.a By 2030, expand international cooperation and capacity-building support to developing countries in water- and sanitation-related activities and programmes, including water harvesting, desalination, water efficiency, wastewater treatment, recycling and reuse technologies	**6.a.1** Amount of water- and sanitation-related official development assistance that is part of a government-coordinated spending plan
6.b Support and strengthen the participation of local communities in improving water and sanitation management	**6.b.1** Proportion of local administrative units with established and operational policies and procedures for participation of local communities in water and sanitation management
SDG7: ENSURE ACCESS TO AFFORDABLE, RELIABLE, SUSTAINABLE AND MODERN ENERGY FOR ALL	
7.1 By 2030, ensure universal access to affordable, reliable and modern energy services	**7.1.1** Proportion of population with access to electricity **7.1.2** Proportion of population with primary reliance on clean fuels and technology
7.2 By 2030, increase substantially the share of renewable energy in the global energy mix	**7.2.1** Renewable energy share in the total final energy consumption
7.3 By 2030, double the global rate of improvement in energy efficiency	**7.3.1** Energy intensity measured in terms of primary energy and GDP
7.a By 2030, enhance international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology	**7.a.1** International financial flows to developing countries in support of clean energy research and development and renewable energy production, including in hybrid systems

7.b By 2030, expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries, in particular least developed countries, small island developing States and landlocked developing countries, in accordance with their respective programmes of support	**7.b.1** Investments in energy efficiency as a proportion of GDP and the amount of foreign direct investment in financial transfer for infrastructure and technology to sustainable development services
SDG8: PROMOTE SUSTAINED, INCLUSIVE AND SUSTAINABLE ECONOMIC GROWTH, FULL AND PRODUCTIVE EMPLOYMENT AND DECENT WORK FOR ALL	
8.1 Sustain per capita economic growth in accordance with national circumstances and, in particular, at least 7 per cent gross domestic product growth per annum in the least developed countries	**8.1.1** Annual growth rate of real GDP per capita
8.2 Achieve higher levels of economic productivity through diversification, technological upgrading and innovation, including through a focus on high-value added and labour-intensive sectors	**8.2.1** Annual growth rate of real GDP per employed person
8.3 Promote development-oriented policies that support productive activities, decent job creation, entrepreneurship, creativity and innovation, and encourage the formalization and growth of micro-, small- and medium-sized enterprises, including through access to financial services	**8.3.1** Proportion of informal employment in non-agriculture employment, by sex
8.4 Improve progressively, through 2030, global resource efficiency in consumption and production and endeavour to decouple economic growth from environmental degradation, in accordance with the 10-Year Framework of Programmes on Sustainable Consumption and Production, with developed countries taking the lead	**8.4.1** Material footprint, material footprint per capita, and material footprint per GDP
8.5 By 2030, achieve full and productive employment and decent work for all women and men, including for young people and persons with disabilities, and equal pay for work of equal value	**8.5.1** Average hourly earnings of female and male employees, by occupation, age and persons with disabilities **8.5.2** Unemployment rate, by sex, age and persons with disabilities
8.6 By 2020, substantially reduce the proportion of youth not in employment, education or training	**8.6.1** Proportion of youth (aged 15–24 years) not in education, employment or training

8.7 Take immediate and effective measures to eradicate forced labour, end modern slavery and human trafficking and secure the prohibition and elimination of the worst forms of child labour, including recruitment and use of child soldiers, and by 2025 end child labour in all its forms	**8.7.1** Proportion and number of children aged 5–17 years engaged in child labour, by sex and age
8.8 Protect labour rights and promote safe and secure working environments for all workers, including migrant workers, in particular women migrants, and those in precarious employment	**8.8.1** Frequency rates of fatal and non-fatal occupational injuries, by sex and migrant status **8.8.2** Level of national compliance with labour rights (freedom of association and collective bargaining) based on International Labour Organization (ILO) textual sources and national legislation, by sex and migrant status
8.9 By 2030, devise and implement policies to promote sustainable tourism that creates jobs and promotes local culture and products	**8.9.1** Tourism direct GDP as a proportion of total GDP and in growth rate **8.9.2** Proportion of jobs in sustainable tourism industries out of total tourism jobs
8.10 Strengthen the capacity of domestic financial institutions to encourage and expand access to banking, insurance and financial services for all	**8.10.1 (a)** Number of commercial bank branches per 100,000 adults and (b) number of automated teller machines (ATMs) per 100,000 adults **8.10.2** Proportion of adults (15 years and older) with an account at a bank or other financial institution or with a mobile-money-service provider
8.a Increase Aid for Trade support for developing countries, in particular least developed countries, including through the Enhanced Integrated Framework for Trade-related Technical Assistance to Least Developed Countries	**8.a.1** Aid for Trade commitments and disbursements
8.b By 2020, develop and operationalize a global strategy for youth employment and implement the Global Jobs Pact of the International Labour Organization	**8.b.1** Existence of a developed and operationalized national strategy for youth employment, as a distinct strategy or as part of a national employment strategy
SDG9: BUILD RESILIENT INFRASTRUCTURE, PROMOTE INCLUSIVE AND SUSTAINABLE INDUSTRIALIZATION AND FOSTER INNOVATION	
9.1 Develop quality, reliable, sustainable and resilient infrastructure, including regional and transborder infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all	**9.1.1** Proportion of the rural population who live within 2 km of an all-season road **9.1.2** Passenger and freight volumes, by mode of transport

9.2 Promote inclusive and sustainable industrialization and, by 2030, significantly raise industry's share of employment and gross domestic product, in line with national circumstances, and double its share in least developed countries	**9.2.1** Manufacturing value added as a proportion of GDP and per capita **9.2.2** Manufacturing employment as a proportion of total employment
9.3 Increase the access of small-scale industrial and other enterprises, in particular in developing countries, to financial services, including affordable credit, and their integration into value chains and markets	**9.3.1** Proportion of small-scale industries in total industry value added **9.3.2** Proportion of small-scale industries with a loan or line of credit
9.4 By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities	**9.4.1** CO2 emission per unit of value added
9.5 Enhance scientific research, upgrade the technological capabilities of industrial sectors in all countries, in particular developing countries, including, by 2030, encouraging innovation and substantially increasing the number of research and development workers per 1 million people and public and private research and development spending	**9.5.1** Research and development expenditure as a proportion of GDP **9.5.2** Researchers (in full-time equivalent) per million inhabitants
9.a Facilitate sustainable and resilient infrastructure development in developing countries through enhanced financial, technological and technical support to African countries, least developed countries, landlocked developing countries and small island developing States	**9.a.1** Total official international support (official development assistance plus other official flows) to infrastructure
9.b Support domestic technology development, research and innovation in developing countries, including by ensuring a conducive policy environment for, inter alia, industrial diversification and value addition to commodities	**9.b.1** Proportion of medium and high-tech industry value added in total value added
9.c Significantly increase access to information and communications technology and strive to provide universal and affordable access to the Internet in least developed countries by 2020	**9.c.1** Proportion of population covered by a mobile network, by technology

SDG10: REDUCE INEQUALITY WITHIN AND AMONG COUNTRIES	
10.a 10.1 By 2030, progressively achieve and sustain income growth of the bottom 40 per cent of the population at a rate higher than the national average	**10.1.1** Growth rates of household expenditure or income per capita among the bottom 40 per cent of the population and the total population
10.2 By 2030, empower and promote the social, economic and political inclusion of all, irrespective of age, sex, disability, race, ethnicity, origin, religion or economic or other status	**10.2.1** Proportion of people living below 50 per cent of median income, by sex, age and persons with disabilities
10.3 Ensure equal opportunity and reduce inequalities of outcome, including by eliminating discriminatory laws, policies and practices and promoting appropriate legislation, policies and action in this regard	**10.3.1** Proportion of population reporting having personally felt discriminated against or harassed in the previous 12 months on the basis of a ground of discrimination prohibited under international human rights law
10.4 Adopt policies, especially fiscal, wage and social protection policies, and progressively achieve greater equality	**10.4.1** Labour share of GDP, comprising wages and social protection transfers
10.5 Improve the regulation and monitoring of global financial markets and institutions and strengthen the implementation of such regulations	**10.5.1** Financial Soundness Indicators
10.6 Ensure enhanced representation and voice for developing countries in decision-making in global international economic and financial institutions in order to deliver more effective, credible, accountable and legitimate institutions	**10.6.1** Proportion of members and voting rights of developing countries in international organizations
10.7 Facilitate orderly, safe, regular and responsible migration and mobility of people, including through the implementation of planned and well-managed migration policies	**10.7.1** Recruitment cost borne by employee as a proportion of yearly income earned in country of destination **10.7.2** Number of countries that have implemented well-managed migration policies
10.a Implement the principle of special and differential treatment for developing countries, in particular least developed countries, in accordance with World Trade Organization agreements	**10.a.1** Proportion of tariff lines applied to imports from least developed countries and developing countries with zero-tariff
10.b Encourage official development assistance and financial flows, including foreign direct investment, to States where the need is greatest, in particular least developed countries, African countries, small island developing States and landlocked developing countries, in accordance with their national plans and programmes	**10.b.1** Total resource flows for development, by recipient and donor countries and type of flow (e.g. official development assistance, foreign direct investment and other flows)

10.c By 2030, reduce to less than 3 per cent the transaction costs of migrant remittances and eliminate remittance corridors with costs higher than 5 per cent	**10.c.1** Remittance costs as a proportion of the amount remitted
SDG11: MAKE CITIES AND HUMAN SETTLEMENTS INCLUSIVE, SAFE, RESILIENT AND SUSTAINABLE	
11.1 By 2030, ensure access for all to adequate, safe and affordable housing and basic services and upgrade slums	**11.1.1** Proportion of urban population living in slums, informal settlements or inadequate housing
11.2 By 2030, provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons	**11.2.1** Proportion of population that has convenient access to public transport, by sex, age and persons with disabilities
11.3 By 2030, enhance inclusive and sustainable urbanization and capacity for participatory, integrated and sustainable human settlement planning and management in all countries	**11.3.1** Ratio of land consumption rate to population growth rate **11.3.2** Proportion of cities with a direct participation structure of civil society in urban planning and management that operate regularly and democratically
11.4 Strengthen efforts to protect and safeguard the world's cultural and natural heritage	**11.4.1** Total expenditure (public and private) per capita spent on the preservation, protection and conservation of all cultural and natural heritage, by type of heritage (cultural, natural, mixed and World Heritage Centre designation), level of government (national, regional and local/municipal), type of expenditure (operating expenditure/ investment) and type of private funding (donations in kind, private non-profit sector and sponsorship)
11.5 By 2030, significantly reduce the number of deaths and the number of people affected and substantially decrease the direct economic losses relative to global gross domestic product caused by disasters, including water-related disasters, with a focus on protecting the poor and people in vulnerable situations	**11.5.1** Number of deaths, missing persons and directly affected persons attributed to disasters per 100,000 population **11.5.2** Direct economic loss in relation to global GDP, damage to critical infrastructure and number of disruptions to basic services, attributed to disasters
11.6 By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management	**11.6.1** Proportion of urban solid waste regularly collected and with adequate final discharge out of total urban solid waste generated, by cities **11.6.2** Annual mean levels of fine particulate matter (e.g. PM2.5 and PM10) in cities (population weighted)

11.7 By 2030, provide universal access to safe, inclusive and accessible, green and public spaces, in particular for women and children, older persons and persons with disabilities	**11.7.1** Average share of the built-up area of cities that is open space for public use for all, by sex, age and persons with disabilities **11.7.2** Proportion of persons victim of physical or sexual harassment, by sex, age, disability status and place of occurrence, in the previous 12 months
11.a Support positive economic, social and environmental links between urban, peri-urban and rural areas by strengthening national and regional development planning	**11.a.1** Proportion of population living in cities that implement urban and regional development plans integrating population projections and resource needs, by size of city
11.b By 2020, substantially increase the number of cities and human settlements adopting and implementing integrated policies and plans towards inclusion, resource efficiency, mitigation and adaptation to climate change, resilience to disasters, and develop and implement, in line with the Sendai Framework for Disaster Risk Reduction 2015–2030, holistic disaster risk management at all levels	**11.b.1** Number of countries that adopt and implement national disaster risk reduction strategies in line with the Sendai Framework for Disaster Risk Reduction 2015–2030 **11.b.2** Proportion of local governments that adopt and implement local disaster risk reduction strategies in line with national disaster risk reduction strategies
11.c Support least developed countries, including through financial and technical assistance, in building sustainable and resilient buildings utilizing local materials	**11.c.1** Proportion of financial support to the least developed countries that is allocated to the construction and retrofitting of sustainable, resilient and resource-efficient buildings utilizing local materials
SDG12: ENSURE SUSTAINABLE CONSUMPTION AND PRODUCTION PATTERNS	
12.1 Implement the 10-Year Framework of Programmes on Sustainable Consumption and Production Patterns, all countries taking action, with developed countries taking the lead, taking into account the development and capabilities of developing countries	**12.1.1** Number of countries with sustainable consumption and production (SCP) national action plans or SCP mainstreamed as a priority or a target into national policies
12.2 By 2030, achieve the sustainable management and efficient use of natural resources	**12.2.1** Material footprint, material footprint per capita, and material footprint per GDP **12.2.2** Domestic material consumption, domestic material consumption per capita, and domestic material consumption per GDP
12.3 By 2030, halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses	**12.3.1** Global food loss index

12.4 By 2020, achieve the environmentally sound management of chemicals and all wastes throughout their life cycle, in accordance with agreed international frameworks, and significantly reduce their release to air, water and soil in order to minimize their adverse impacts on human health and the environment	**12.4.1** Number of parties to international multilateral environmental agreements on hazardous waste, and other chemicals that meet their commitments and obligations in transmitting information as required by each relevant agreement **12.4.2** Hazardous waste generated per capita and proportion of hazardous waste treated, by type of treatment
12.5 By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse	**12.5.1** National recycling rate, tons of material recycled
12.6 Encourage companies, especially large and transnational companies, to adopt sustainable practices and to integrate sustainability information into their reporting cycle	**12.6.1** Number of companies publishing sustainability reports
12.7 Promote public procurement practices that are sustainable, in accordance with national policies and priorities	**12.7.1** Number of countries implementing sustainable public procurement policies and action plans
12.8 By 2030, ensure that people everywhere have the relevant information and awareness for sustainable development and lifestyles in harmony with nature	**12.8.1** Extent to which (i) global citizenship education and (ii) education for sustainable development (including climate change education) are mainstreamed in (a) national education policies; (b) curricula; (c) teacher education; and (d) student assessment
12.a Support developing countries to strengthen their scientific and technological capacity to move towards more sustainable patterns of consumption and production	**12.a.1** Amount of support to developing countries on research and development for sustainable consumption and production and environmentally sound technologies
12.b Develop and implement tools to monitor sustainable development impacts for sustainable tourism that creates jobs and promotes local culture and products	**12.b.1** Number of sustainable tourism strategies or policies and implemented action plans with agreed monitoring and evaluation tools
12.c Rationalize inefficient fossil-fuel subsidies that encourage wasteful consumption by removing market distortions, in accordance with national circumstances, including by restructuring taxation and phasing out those harmful subsidies, where they exist, to reflect their environmental impacts, taking fully into account the specific needs and conditions of developing countries and minimizing the possible adverse impacts on their development in a manner that protects the poor and the affected communities	**12.c.1 A**mount of fossil-fuel subsidies per unit of GDP (production and consumption) and as a proportion of total national expenditure on fossil fuels

SDG13: TAKE URGENT ACTION TO COMBAT CLIMATE CHANGE AND ITS IMPACTS	
13.1 Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries	**13.1.1** Number of deaths, missing persons and directly affected persons attributed to disasters per 100,000 population **13.1.2** Number of countries that adopt and implement national disaster risk reduction strategies in line with the Sendai Framework for Disaster Risk Reduction 2015–2030 **13.1.3** Proportion of local governments that adopt and implement local disaster risk reduction strategies in line with national disaster risk reduction strategies
13.2 Integrate climate change measures into national policies, strategies and planning	**13.2.1** Number of countries that have communicated the establishment or operationalization of an integrated policy/strategy/plan which increases their ability to adapt to the adverse impacts of climate change, and foster climate resilience and low greenhouse gas emissions development in a manner that does not threaten food production (including a national adaptation plan, nationally determined contribution, national communication, biennial update report or other)
13.3 Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning	**13.3.1** Number of countries that have integrated mitigation, adaptation, impact reduction and early warning into primary, secondary and tertiary curricula **13.3.2** Number of countries that have communicated the strengthening of institutional, systemic and individual capacity-building to implement adaptation, mitigation and technology transfer, and development actions
13.a Implement the commitment undertaken by developed-country parties to the United Nations Framework Convention on Climate Change to a goal of mobilizing jointly $100 billion annually by 2020 from all sources to address the needs of developing countries in the context of meaningful mitigation actions and transparency on implementation and fully operationalize the Green Climate Fund through its capitalization as soon as possible	**13.a.1** Mobilized amount of United States dollars per year between 2020 and 2025 accountable towards the $100 billion commitment

13.b Promote mechanisms for raising capacity for effective climate change-related planning and management in least developed countries and small island developing States, including focusing on women, youth and local and marginalized communities	**13.b.1** Number of least developed countries and small island developing States that are receiving specialized support, and amount of support, including finance, technology and capacity-building, for mechanisms for raising capacities for effective climate change-related planning and management, including focusing on women, youth and local and marginalized communities
SDG14: CONSERVE AND SUSTAINABLY USE THE OCEANS, SEAS AND MARINE RESOURCES FOR SUSTAINABLE DEVELOPMENT	
14.1 By 2025, prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution	**14.1.1** Index of coastal eutrophication and floating plastic debris density
14.2 By 2020, sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts, including by strengthening their resilience, and take action for their restoration in order to achieve healthy and productive oceans	**14.2.1** Proportion of national exclusive economic zones managed using ecosystem-based approaches
14.3 Minimize and address the impacts of ocean acidification, including through enhanced scientific cooperation at all levels	**14.3.1** Average marine acidity (pH) measured at agreed suite of representative sampling stations
14.4 By 2020, effectively regulate harvesting and end overfishing, illegal, unreported and unregulated fishing and destructive fishing practices and implement science-based management plans, in order to restore fish stocks in the shortest time feasible, at least to levels that can produce maximum sustainable yield as determined by their biological characteristics	**14.4.1** Proportion of fish stocks within biologically sustainable levels
14.5 By 2020, conserve at least 10 per cent of coastal and marine areas, consistent with national and international law and based on the best available scientific information	**14.5.1** Coverage of protected areas in relation to marine areas
14.6 By 2020, prohibit certain forms of fisheries subsidies which contribute to overcapacity and overfishing, eliminate subsidies that contribute to illegal, unreported and unregulated fishing and refrain from introducing new such subsidies, recognizing that appropriate and effective special and differential treatment for developing and least developed countries should be an integral part of the World Trade Organization fisheries subsidies negotiation	**14.6 1** Progress by countries in the degree of implementation of international instruments aiming to combat illegal, unreported and unregulated fishing

14.7 By 2030, increase the economic benefits to small island developing States and least developed countries from the sustainable use of marine resources, including through sustainable management of fisheries, aquaculture and tourism	**14.7 1** Sustainable fisheries as a proportion of GDP in small island developing States, least developed countries and all countries
14.a Increase scientific knowledge, develop research capacity and transfer marine technology, taking into account the Intergovernmental Oceanographic Commission Criteria and Guidelines on the Transfer of Marine Technology, in order to improve ocean health and to enhance the contribution of marine biodiversity to the development of developing countries, in particular small island developing States and least developed countries	**14.a.1** Proportion of total research budget allocated to research in the field of marine technology
14.b Provide access for small-scale artisanal fishers to marine resources and markets	**14.b.1** Progress by countries in the degree of application of a legal/regulatory/policy/ institutional framework which recognizes and protects access rights for small-scale fisheries
14.d 14.c Enhance the conservation and sustainable use of oceans and their resources by implementing international law as reflected in the United Nations Convention on the Law of the Sea, which provides the legal framework for the conservation and sustainable use of oceans and their resources, as recalled in paragraph 158 of "The future we want"	**14.c.1** Number of countries making progress in ratifying, accepting and implementing through legal, policy and institutional frameworks, ocean-related instruments that implement international law, as reflected in the United Nations Convention on the Law of the Sea, for the conservation and sustainable use of the oceans and their resources
SDG15: PROTECT, RESTORE AND PROMOTE SUSTAINABLE USE OF TERRESTRIAL ECOSYSTEMS, SUSTAINABLY MANAGE FORESTS, COMBAT DESERTIFICATION, AND HALT AND REVERSE LAND DEGRADATION AND HALT BIODIVERSITY LOSS	
15.1 By 2020, ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands, in line with obligations under international agreements	**15.1.1** Forest area as a proportion of total land area **15.1.2** Proportion of important sites for terrestrial and freshwater biodiversity that are covered by protected areas, by ecosystem type
15.2 By 2020, promote the implementation of sustainable management of all types of forests, halt deforestation, restore degraded forests and substantially increase afforestation and reforestation globally	**15.2.1** Progress towards sustainable forest management
15.3 By 2030, combat desertification, restore degraded land and soil, including land affected by desertification, drought and floods, and strive to achieve a land degradation-neutral world	**15.3.1** Proportion of land that is degraded over total land area

15.4 By 2030, ensure the conservation of mountain ecosystems, including their biodiversity, in order to enhance their capacity to provide benefits that are essential for sustainable development	**15.4.1** Coverage by protected areas of important sites for mountain biodiversity 15.4.2 Mountain Green Cover Index
15.5 Take urgent and significant action to reduce the degradation of natural habitats, halt the loss of biodiversity and, by 2020, protect and prevent the extinction of threatened species	**15.5.1** Red List Index
15.6 Promote fair and equitable sharing of the benefits arising from the utilization of genetic resources and promote appropriate access to such resources, as internationally agreed	**15.6.1** Number of countries that have adopted legislative, administrative and policy frameworks to ensure fair and equitable sharing of benefits
15.7 Take urgent action to end poaching and trafficking of protected species of flora and fauna and address both demand and supply of illegal wildlife products	**15.7.1** Proportion of traded wildlife that was poached or illicitly trafficked
15.8 By 2020, introduce measures to prevent the introduction and significantly reduce the impact of invasive alien species on land and water ecosystems and control or eradicate the priority species	**15.8.1** Proportion of countries adopting relevant national legislation and adequately resourcing the prevention or control of invasive alien species
15.9 By 2020, integrate ecosystem and biodiversity values into national and local planning, development processes, poverty reduction strategies and accounts	**15.9.1** Progress towards national targets established in accordance with Aichi Biodiversity Target 2 of the Strategic Plan for Biodiversity 2011–2020
15.a Mobilize and significantly increase financial resources from all sources to conserve and sustainably use biodiversity and ecosystems	**15.a.1** Official development assistance and public expenditure on conservation and sustainable use of biodiversity and ecosystems
15.b Mobilize significant resources from all sources and at all levels to finance sustainable forest management and provide adequate incentives to developing countries to advance such management, including for conservation and reforestation	**15.b.1** Official development assistance and public expenditure on conservation and sustainable use of biodiversity and ecosystems
15.c Enhance global support for efforts to combat poaching and trafficking of protected species, including by increasing the capacity of local communities to pursue sustainable livelihood opportunities	**15.c.1** Proportion of traded wildlife that was poached or illicitly trafficked

SDG16: PROMOTE PEACEFUL AND INCLUSIVE SOCIETIES FOR SUSTAINABLE DEVELOPMENT, PROVIDE ACCESS TO JUSTICE FOR ALL AND BUILD EFFECTIVE, ACCOUNTABLE AND INCLUSIVE INSTITUTIONS AT ALL LEVELS	
16.1 Significantly reduce all forms of violence and related death rates everywhere	**16.1.1** Number of victims of intentional homicide per 100,000 population, by sex and age **16.1.2** Conflict-related deaths per 100,000 population, by sex, age and cause **16.1.3** Proportion of population subjected to (a) physical violence, (b) psychological violence and (c) sexual violence in the previous 12 months **16.1.4** Proportion of population that feel safe walking alone around the area they live
16.2 End abuse, exploitation, trafficking and all forms of violence against and torture of children	**16.2.1** Proportion of children aged 1–17 years who experienced any physical punishment and/or psychological aggression by caregivers in the past month **16.2.2** Number of victims of human trafficking per 100,000 population, by sex, age and form of exploitation **16.2.3** Proportion of young women and men aged 18–29 years who experienced sexual violence by age 18
16.3 Promote the rule of law at the national and international levels and ensure equal access to justice for all	**16.3.1** Proportion of victims of violence in the previous 12 months who reported their victimization to competent authorities or other officially recognized conflict resolution mechanisms **16.3.2** Unsentenced detainees as a proportion of overall prison population
16.4 By 2030, significantly reduce illicit financial and arms flows, strengthen the recovery and return of stolen assets and combat all forms of organized crime	**16.4.1** Total value of inward and outward illicit financial flows (in current United States dollars) **16.4.2** Proportion of seized, found or surrendered arms whose illicit origin or context has been traced or established by a competent authority in line with international instruments
16.5 Substantially reduce corruption and bribery in all their forms	**16.5.1** Proportion of persons who had at least one contact with a public official and who paid a bribe to a public official, or were asked for a bribe by those public officials, during the previous 12 months **16.5.2** Proportion of businesses that had at least one contact with a public official and that paid a bribe to a public official, or were asked for a bribe by those public officials during the previous 12 months

16.6 Develop effective, accountable and transparent institutions at all levels	**16.6.1** Primary government expenditures as a proportion of original approved budget, by sector (or by budget codes or similar) **16.6.2** Proportion of population satisfied with their last experience of public services
16.7 Ensure responsive, inclusive, participatory and representative decision-making at all levels	**16.7.1** Proportions of positions (by sex, age, persons with disabilities and population groups) in public institutions (national and local legislatures, public service, and judiciary) compared to national distributions **16.7.2** Proportion of population who believe decision-making is inclusive and responsive, by sex, age, disability and population group
16.8 Broaden and strengthen the participation of developing countries in the institutions of global governance	**16.8.1** Proportion of members and voting rights of developing countries in international organizations
16.9 By 2030, provide legal identity for all, including birth registration	**16.9.1** Proportion of children under 5 years of age whose births have been registered with a civil authority, by age
16.10 Ensure public access to information and protect fundamental freedoms, in accordance with national legislation and international agreements	**16.10.1** Number of verified cases of killing, kidnapping, enforced disappearance, arbitrary detention and torture of journalists, associated media personnel, trade unionists and human rights advocates in the previous 12 months **16.10.2** Number of countries that adopt and implement constitutional, statutory and/or policy guarantees for public access to information
16.a Strengthen relevant national institutions, including through international cooperation, for building capacity at all levels, in particular in developing countries, to prevent violence and combat terrorism and crime	**16.a.1** Existence of independent national human rights institutions in compliance with the Paris Principles
16.b Promote and enforce non-discriminatory laws and policies for sustainable development	**16.b.1** Proportion of population reporting having personally felt discriminated against or harassed in the previous 12 months on the basis of a ground of discrimination prohibited under international human rights law

SDG17: STRENGTHEN THE MEANS OF IMPLEMENTATION AND REVITALIZE THE GLOBAL PARTNERSHIP FOR SUSTAINABLE DEVELOPMENT	
FINANCE	
17.1 Strengthen domestic resource mobilization, including through international support to developing countries, to improve domestic capacity for tax and other revenue collection	**17.1.1** Total government revenue as a proportion of GDP, by source **17.1.2** Proportion of domestic budget funded by domestic taxes
17.2 Developed countries to implement fully their official development assistance commitments, including the commitment by many developed countries to achieve the target of 0.7 per cent of gross national income for official development assistance (ODA/GNI) to developing countries and 0.15 to 0.20 per cent of ODA/GNI to least developed countries; ODA providers are encouraged to consider setting a target to provide at least 0.20 per cent of ODA/GNI to least developed countries	**17.2.1** Net official development assistance, total and to least developed countries, as a proportion of the Organization for Economic Cooperation and Development (OECD) Development Assistance Committee donors' gross national income (GNI)
17.3 Mobilize additional financial resources for developing countries from multiple sources	**17.3.1** Foreign direct investment (FDI), official development assistance and South-South cooperation as a proportion of total domestic budget **17.3.2** Volume of remittances (in United States dollars) as a proportion of total GDP
17.4 Assist developing countries in attaining long-term debt sustainability through coordinated policies aimed at fostering debt financing, debt relief and debt restructuring, as appropriate, and address the external debt of highly indebted poor countries to reduce debt distress	**17.4.1** Debt service as a proportion of exports of goods and services
17.5 Adopt and implement investment promotion regimes for least developed countries	**17.5.1** Number of countries that adopt and implement investment promotion regimes for least developed countries
TECHNOLOGY	
17.6 Enhance North-South, South-South and triangular regional and international cooperation on and access to science, technology and innovation and enhance knowledge-sharing on mutually agreed terms, including through improved coordination among existing mechanisms, in particular at the United Nations level, and through a global technology facilitation mechanism	**17.6.1** Number of science and/or technology cooperation agreements and programmes between countries, by type of cooperation **17.6.2** Fixed Internet broadband subscriptions per 100 inhabitants, by speed

17.7 Promote the development, transfer, dissemination and diffusion of environmentally sound technologies to developing countries on favourable terms, including on concessional and preferential terms, as mutually agreed	**17.7.1** Total amount of approved funding for developing countries to promote the development, transfer, dissemination and diffusion of environmentally sound technologies
17.8 Fully operationalize the technology bank and science, technology and innovation capacity-building mechanism for least developed countries by 2017 and enhance the use of enabling technology, in particular information and communications technology	**17.8.1** Proportion of individuals using the Internet
CAPACITY-BUILDING	
17.9 Enhance international support for implementing effective and targeted capacity-building in developing countries to support national plans to implement all the Sustainable Development Goals, including through North-South, South-South and triangular cooperation	**17.9.1** Dollar value of financial and technical assistance (including through North-South, South-South and triangular cooperation) committed to developing countries
TRADE	
17.10 Promote a universal, rules-based, open, non-discriminatory and equitable multilateral trading system under the World Trade Organization, including through the conclusion of negotiations under its Doha Development Agenda	**17.10.1** Worldwide weighted tariff-average
17.11 Significantly increase the exports of developing countries, in particular with a view to doubling the least developed countries' share of global exports by 2020	**17.11.1** Developing countries' and least developed countries' share of global exports
17.12 Realize timely implementation of duty-free and quota-free market access on a lasting basis for all least developed countries, consistent with World Trade Organization decisions, including by ensuring that preferential rules of origin applicable to imports from least developed countries are transparent and simple, and contribute to facilitating market access	**17.12.1** Average tariffs faced by developing countries, least developed countries and small island developing States
SYSTEMIC ISSUES	
POLICY AND INSTITUTIONAL COHERENCE	
17.13 Enhance global macroeconomic stability, including through policy coordination and policy coherence	**17.13.1** Macroeconomic Dashboard

17.14 Enhance policy coherence for sustainable development	**17.14.1** Number of countries with mechanisms in place to enhance policy coherence of sustainable development
17.15 Respect each country's policy space and leadership to establish and implement policies for poverty eradication and sustainable development	**17.15.1** Extent of use of country-owned results frameworks and planning tools by providers of development cooperation
MULTI-STAKEHOLDER PARTNERSHIPS	
17.16 Enhance the Global Partnership for Sustainable Development, complemented by multi-stakeholder partnerships that mobilize and share knowledge, expertise, technology and financial resources, to support the achievement of the Sustainable Development Goals in all countries, in particular developing countries	**17.16.1** Number of countries reporting progress in multi-stakeholder development effectiveness monitoring frameworks that support the achievement of the sustainable development goals
17.17 Encourage and promote effective public, public-private and civil society partnerships, building on the experience and resourcing strategies of partnerships	**17.17.1** Amount of United States dollars committed to (a) public-private partnerships and (b) civil society partnerships
DATA, MONITORING AND ACCOUNTABILITY	
17.18 By 2020, enhance capacity-building support to developing countries, including for least developed countries and small island developing States, to increase significantly the availability of high-quality, timely and reliable data disaggregated by income, gender, age, race, ethnicity, migratory status, disability, geographic location and other characteristics relevant in national contexts	**17.18.1** Proportion of sustainable development indicators produced at the national level with full disaggregation when relevant to the target, in accordance with the Fundamental Principles of Official Statistics **17.18.2** Number of countries that have national statistical legislation that complies with the Fundamental Principles of Official Statistics **17.18.3** Number of countries with a national statistical plan that is fully funded and under implementation, by source of funding
17.19 By 2030, build on existing initiatives to develop measurements of progress on sustainable development that complement gross domestic product, and support statistical capacity-building in developing countries	**17.19.1** Dollar value of all resources made available to strengthen statistical capacity in developing countries **17.19.2** Proportion of countries that (a) have conducted at least one population and housing census in the last 10 years; and (b) have achieved 100 per cent birth registration and 80 per cent death registration

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