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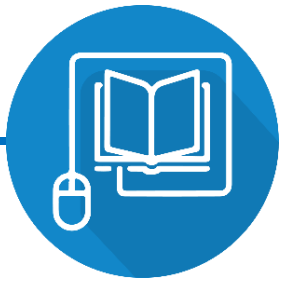

A Technology Innovation Model for the United Nations: The "TechNovation Cycle"

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Unite Papers — "Informing and Capturing UN Technological Innovation"

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Abstract

The United Nations is exploring technological innovation as it seeks to implement the principles and commitments in the Secretary-General's 2018 Strategy on New Technologies.[1] To help conceptualize and guide innovation projects, this Unite Paper offers a model, called the "Technology Innovation Cycle" or "TechNovation Cycle," to conceptualize, standardize and improve the process, including technology innovation for field operations. Using a simple diagram and well-proven stages, it describes the natural process from initial conceptualization to full implementation, through the following stages: idea, feasibility study, testing, pilot project, deployment, assessment and refinement, scaling and mainstreaming. But for any model or innovation to take root, the United Nations must accept that some exploratory projects may not reach the implementation stage, though the lessons of failure are extremely valuable and important in a learning culture. The paper looks at key innovation paradigms, such as the "Technology, Process, and People" triad, and applies key concepts such as use cases, proof of concept, prototyping, and minimum viable product. It suggests mainstreaming by adding successfully demonstrated innovations to a UN service catalogue or other portfolio. Practical insights into each innovation stage are offered, drawing upon the best practices of governments and industries. This innovation model can be aligned with existing UN project management frameworks and may help make them more effective and efficient. The challenges of introducing "disruptive" new technologies are also addressed, along with some general solutions.

"[T]here is little evidence that the UN has fully embraced innovation as a key component to reform the system and the entities within it ... Neither is it clear that efforts to introduce innovation have spread far beyond the dedicated units that have been set up."

— UN Lab for Organizational Change and Knowledge (UNLOCK), 2017[2]

Be bold, be revolutionary… and disrupt … because without innovation, there is no way we can overcome the challenges of our time.

— UN Secretary-General António Guterres, 2018

[1] United Nations Secretary-General, "Secretary-General's Strategy on New Technologies" (New York, NY: United Nations, September 2018).

2 United Nations Lab for Organizational Change and Knowledge, "The Relevance of Innovation to the United Nations: What Has Been Tried, and What Have We Learned?," *UNSCC Case Study* #2/2017 (Turin, Italy: United Nations System Staff College, April 2017), 4.

1. Introduction

The UN approach to technological innovation has, until recently, been quite haphazard and reactive. For example, the United Nations has only brought many technologies into its peace operations decades after they had been proven in the military and civilian enterprises of technologically advanced nations.[3] But the Organization is now giving technological innovation a new impetus, using principles and commitments in the Secretary-General's Strategy on New Technologies,[4] various digital cooperation initiatives, and work of the United Nations Technology Innovation Labs (UNTIL).[5]

Concepts of technology innovation processes can be helpful as the United Nations seeks to be more innovative, especially at a time of tight resources. Thus far, the UN departments and units engaged in technological innovation have not adopted a general model for technological innovation. Many governments and commercial enterprises have adopted innovation models, and many others have been explored by academics and think tanks. What can be learned from these models? Many existing models have been explored and a resulting model has been fashioned to the particulars of the Organization.

The United Nations is a large international organization with not only several governing bodies and a Secretariat with core departments, but also a constellation of affiliated but independent agencies, funds and programmes (AFP), each having a unique approach to governance and technological innovation. While coordination of all innovation efforts may make sense in theory, the range of different governing bodies, institutional priorities, and funding models makes it impossible in reality, though focused efforts and sharing of lessons and best practices are possible. However, the diversity of approaches can be a strength. Naturally, a supportive UN environment for innovation is a great catalyst.

While focused on the UN Secretariat, which is responsible for peace operations, this *Unite Paper* also draws on innovation models and approaches from various AFP in the UN system. These sources include the widely adopted "Principles of Digital Development,"[6] publications like the UNDP guide to data innovation,[7] and the World Food Programme's Innovation Accelerator.[8] This paper complements other UN innovation efforts; see the list in the "UN Innovation Resources" Section in the Annex.

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[3] For instance, the Implementation Force (IFOR) of NATO that replaced the UN Protection Force (UNPROFOR) in Bosnia in 1995 flew at least three different types of Unmanned Aerial Vehicles (UAVs) for observation. The first UAV flown by a UN mission was 18 years later (2013), contracted for the mission in the D.R. Congo. Currently, there are over 200 UAVs, of many types, in the peace operations of the United Nations.

[4] United Nations Secretary-General, "Secretary-General's Strategy on New Technologies", op. cit.

[5] United Nations Technology Innovation Labs, "United Nations Technology Innovation Labs," 2020.

[6] See: Digital Impact Alliance, Principles for Digital Development, 2020. The principles have been endorsed by some two hundred groups.

[7] United Nations Development Programme, "A Guide to Data Innovation for Development: From Idea to Proof-of-Concept" (New York, NY: United Nations, December 2016).

[8] World Food Programme, WFP Innovation Accelerator, 2020.

The Case of United Nations Peace Operations

The United Nations has been wrestling with technological innovation in peace operations from the time of its first peacekeeping forces, which deployed aerial reconnaissance, signals intercept, and high-power binoculars.[9] At the end of the Cold War, like society in general, the United Nations adapted not only politically but also technologically to the rise of the internet, search engines, cell/smart-phones, email (eventually moving from Lotus Notes to MS Outlook at UN Headquarters in 2017), the Global Positioning System (GPS), Geographical Information Systems (GIS), and cloud computing. Now it is facing the revolution in artificial intelligence, remote work (due especially to COVD-19), cybersecurity capabilities and vulnerabilities, mobile technologies, and new types of Unmanned (or Unpersonned or Uninhabited) Aerial Vehicles (UAVs), to name only a few developments.

New technologies are also being used by armed groups in conflict areas where the United Nations must operate. The United Nations Multidimensional Integrated Stabilization Mission in Mali (MINUSMA) finds itself vulnerable to hostile UAV reconnaissance and ground attacks using remotely detonated improvised explosive devices (IEDs). The United Nations Support Mission for Libya (UNSMIL[10]) works in a conflict that is "the first war fought primarily by clashing fleets of armed drones."[11] With hundreds of drone strikes a month in 2019, drones caused the majority of casualties. The United Nations will have to monitor and cope with these kinds of technology-enabled fighting. It is foreseeable that the Organization will need its own UAVs to spot and monitor the drones of opposing forces. While this may sound like science fiction, it could soon become a reality. Indeed, Karlsrud and Rosén have argued that "opting not to use drones [in peacekeeping] could indeed someday be considered a breach of IHL [International Humanitarian Law]."[12]

UN peace operations (POs), which depend on a diverse mix of national contributions from both the developed and developing world, face particular technological constraints. The

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[9] The United Nations Emergency Force (UNEF), the UN's first force, used aerial reconnaissance using dedicated propeller aircraft from Canada. The United Nations Operation in the Congo (ONUC) went further in aerial reconnaissance by deploying jets (Swedish J-29C and Indian Canberra bombers). ONUC also used signals intercept and code crackers to listen to the communications of mercenaries. See: A. Walter Dorn and David J. H. Bell, "Intelligence and Peacekeeping: The UN Operation in the Congo, 1960–64," *International Peacekeeping* 2, no. 1 (1995): 11–33.

[10] The United Nations Support Mission for Libya (UNSMIL) was established in 2011 "at the request of the Libyan authorities to support the country's new transitional authorities in their post-conflict efforts." Its mandate includes "monitoring and reporting on human rights; support for securing uncontrolled arms and counter-proliferation; and the co-ordination of international assistance … to stabilise post-conflict zones, including those liberated from ISIL." See: United Nations Department of Political and Peacebuilding Affairs, "Mandate," United Nations Support Mission for Libya, 13 October 2016.

[11] David D. Kirkpatrick, "Russian Snipers, Missiles and Warplanes Try to Tilt Libyan War," *The New York Times*, 5 November 2019.

[12] John Karlsrud and Frederik Rosén, "In the Eye of the Beholder? UN and the Use of Drones to Protect Civilians," *Stability: International Journal of Security and Development* 2, no. 2 (June 2013).

levels and types of technology vary considerably among nations and most are not technologically interoperable. Peacekeeping itself is a large enterprise, deploying more uniformed personnel on operations in actual conflict zones than any other entity in the world, including the US government or NATO.[13] But UN POs are under-funded, understaffed, and under-resourced, especially when compared to those Western organizations. When held against the ambitious mandates provided in UN Security Council resolutions, they experience a significant mandate-means gap. Technological innovation can help bridge that gap.

The United Nations seeks to be more technologically advanced, as advocated by the UN Secretary-General's Strategy on New Technologies,[14] and POs are a vital area for technological innovation, being the flagship and most expensive activity of the United Nations. Secretary-General António Guterres has frequently sought to make the organization more nimble and agile, more effective and efficient. This can be done, in part, by fostering innovation-focused mindsets while drawing on technology advances. As shown in the 2015 Technology and Innovation Panel (TIP) report, titled “Performance Peacekeeping,” technology and innovation can be leveraged to increase both the effectiveness and efficiency of peacekeeping.[15]

The TIP report made some 120 recommendations, but it did not offer any models for innovation or show how to move from an innovative idea to mainstream adoption. One of the TIP panellists, Dr Walter Dorn (the author), decided to develop such a model (“TechNovation Cycle”) which can be applied across the Organization. The model is based on his experiences and observations in government, industry, academia, and the United Nations itself, both in field missions and at UN Headquarters. It also draws from best practices literature (“the best of the best”). This paper explores similar models used by governments, industry, and academia to see what insights can be applied.

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[13] With 39 operations (26 Special Political Missions and 13 Peace Operations), as of December 2020 and some over 100,000 deployed personnel, this is far more than NATO has deployed on operations. While the US has more deployed on its overseas bases, these are not operations but stationed forces. NATO is the North Atlantic Treaty Organization, established in 1949.

[14] United Nations Secretary-General, “Secretary-General’s Strategy on New Technologies,” op. cit.

[15] United Nations, “Performance Peacekeeping: Final Report of the Expert Panel on Technology and Innovation in UN Peacekeeping” (New York, NY: United Nations, December 2014).

2. Technology Innovation Cycle

The Technology Innovation Cycle is illustrated in Figure 1. The model follows the innovation process from initial idea to full implementation, going through the stages of a feasibility study, testing, piloting, deployment, assessment & refinement, scaling and mainstreaming. It then cycles back to further innovation on the technology or related technologies. Of course, not all ideas will reach full implementation, but the cycle can end early and still be useful, with the lessons learned being used in future innovation cycles.

While represented as a logical series of stages, in practice, several stages may occur at the same time or repeatedly, and each stage may involve several mini-steps and multiple iterations, with refinements based on new ideas, stakeholder and end-user inputs, experimentation, etc.

A good process involves iteration, ongoing learning, concept refinement, validation, experimentation, and an agile mindset. Moreover, it is backstopped by supportive management.

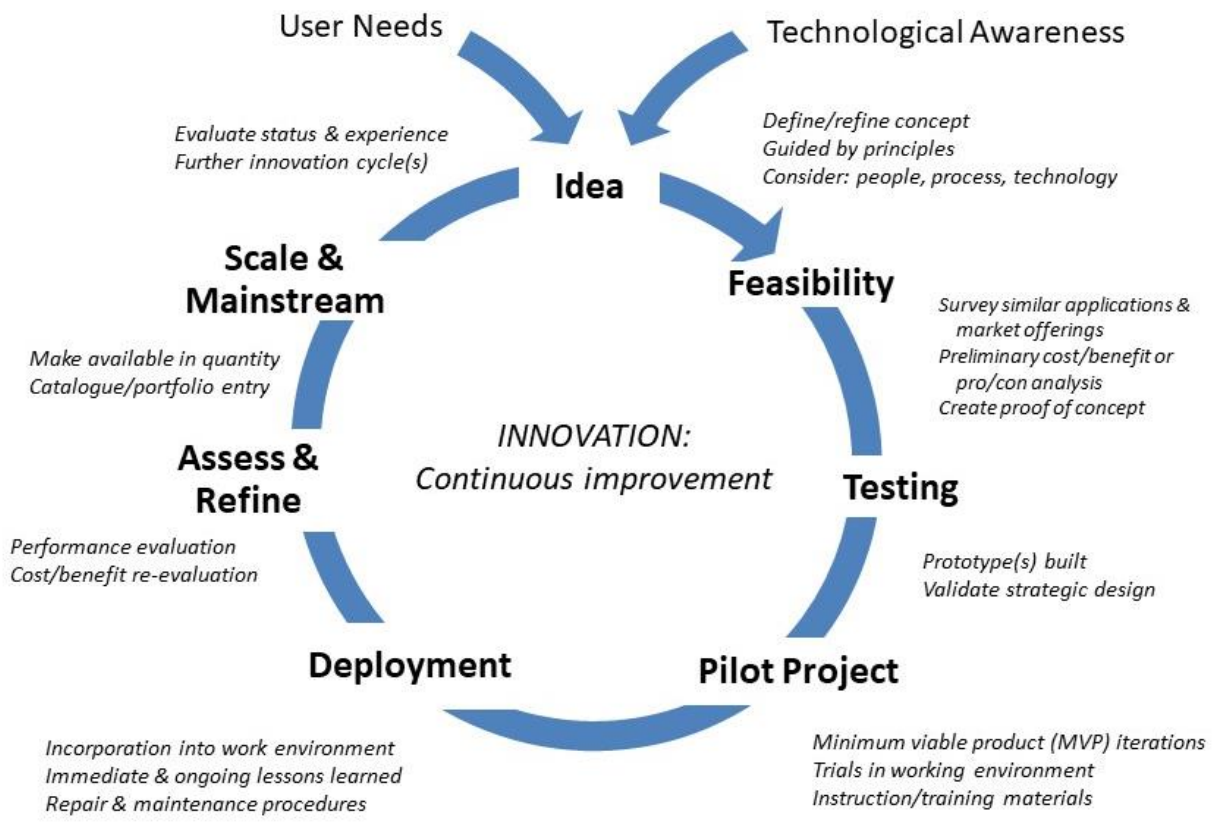

Figure 1: Technology Innovation Cycle for the United Nations

Each stage of the innovation cycle is filled with exciting opportunities, significant challenges, and potential risks. Each is now examined, including steps within stages, principles, and practical tips.

A. Idea Stage

Good ideas for technology innovation may come from users, technologists or others. Sometimes users experience a creative moment when they see that their work could be made more effective or efficient by new innovations and technologies. Sometimes technologists realize how a new technology could have useful applications. Other times, outsiders might make suggestions based on both field experience and on technological awareness. For instance, the TIP Report made over 120 recommendations, based mostly on the experience and expertise of its panellists, informed by their decades of work on and with field operations.

UN personnel often have excellent ideas for innovation in their own work. However, they may feel that innovation is not encouraged, their ideas are not being sought or that they are not getting enough feedback, especially of the positive kind. Fortunately, some UN innovation initiatives are being explored, including UN Secretary-General Awards, Unite Ideas, World Creativity and Innovation Day, the UN Innovation Network, and an Innovation Toolkit for UN personnel.[16] These are means to discuss ideas and thank those providing them. In industry, some firms even provide the idea contributor with financial incentives, such as a part (percentage) of the profits earned by an innovation, though this would be unusual for international/governmental institutions, which are not driven by financial motives.

At the early ideas stage, multiple routes can be followed to enhance creativity. Without being too formulaic, one possible sub-process can be defined by three steps: (i) Identify and Initiate, (ii) Scope, and (iii) Engage.[17]

i. Identify and Initiate

Often a problem is identified well before the solution is found. Other times a better way of doing something is discovered before the problem is even recognized. Since a useful

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[16] See respectively: United Nations Office of Information and Communications Technology, "Unite Ideas - Open Innovation for the SDGs," 2020; United Nations, "World Creativity and Innovation Day," 2020; United Nations, United Nations Innovation Network, 2020; United Nations, "UN Innovation Toolkit," 2020.

[17] This is similar to the current UNTIL process (as described by the UNTIL Finland coordinator for the peace and security pillar). Likewise, it matches quiet closely what the WFP Innovation Accelerator does when soliciting new innovative concepts. See respectively: Maria Mekri email to A. Walter Dorn, "RE: Innovation Cycle," 20 August 2019; World Food Programme, "Apply to the WFP Innovation Accelerator," WFP Innovation, 2020.

"disruptive" technology may become available anytime, an awareness of technological possibilities has to go along with an awareness of potential applications.

Innovators must understand the needs and goals of the end-users ("customers" or "clients") before suggesting specific solutions. The innovators must also understand how current processes work before proposing new ones. To help facilitate this, technology innovators are sometimes embedded within an operational team as a short-assignment, as was done by the Organization for Security and Cooperation in Europe (OSCE) as part of its work in Ukraine.[18] The early focus is on very clearly defining the problem to be solved or the benefit desired, even if certain technological means are already envisioned.

One prominent way to think about this type of challenge is with the "Jobs-to-be-Done" framework.[19] Another way to think about this challenge is with the McKinsey "Seven-Step Problem Solving Process" model.[20]

ii. Scope

Here the innovative idea or notion begins to form into a concrete concept, with specific boundaries in its application. Relevant issues and obstacles start to become clear, often showing the downside of an innovative idea. The persons with the innovative ideas may start to float the ideas to selected colleagues to get feedback to scope the project larger

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[18] Cono Giardullo, formerly with the OSCE Special Monitoring Mission in Eastern Ukraine (SMM), writes: "[E]verytime we had a problem to be solved — as we had a grant offered by a OSCE Participating State to improve the mission's GIS integrated system — we had that country's officer visiting us, but also visitors from [a GIS company] or other intergovernmental organizations visiting us for one week, and interviewing and discussing the most critical issues at hand" (for a full account of this, see the paper by Giardullo, Dorn, and Stodilka). Such external support can lead to the establishing of an intra-mission specialized position, as in the case of the OSCE SMM where for the first time a Senior Technical Project Officer vacancy was offered to "keep the Head of Operations informed on the implementation of technology-related SMM projects." See respectively: Cono Giardullo email to A. Walter Dorn, 12 November 2019; Cono Giardullo, A. Walter Dorn, and Danielle Stodilka, "Technological Innovation in the OSCE: The Special Monitoring Mission in Ukraine," in *OSCE Yearbook 2019*, ed. Institute for Peace Research and Security Policy, University of Hamburg, Vol. 25, Yearbook on the Organization for Security and Co-Operation in Europe (Baden-Baden, Germany: Nomos Verlagsgesellschaft Vertrieb, 2020), 119–137; OSCE, "Senior Technical Project Officer," OSCE Employment, 11 November 2019.

[19] The "jobs to be done" approach prioritizes discovering all the met and unmet needs users have as they work to complete a task. It is the job of the innovator to uncover these needs before proposing a solution. Without understanding the functional and psychosocial needs, an innovation may inadvertently miss a key element for success. Described in some detail: Clayton M. Christensen, "The "jobs to be done" Theory of Innovation," *Ideacast* (podcast), Cambridge, MA: Harvard Business School, 8 December 2016; Anthony W. Ulwick, "Outcome-Driven Innovation: Jobs-to-Be-Done Theory in Practice," Strategyn White Paper (Denver, CO: Strategyn, January 2017).

[20] In the seven-step model emphasis is placed on being very clear around what the uncertainties and assumptions are, defining a clear problem, disaggregating it into constituent parts, understanding where and how effort can be applied to solve the problem, all before any answer is proposed. Charles Conn, Hugo Sarrazin, and Simon London, "How to Master the Seven-Step Problem-Solving Process," *McKinsey Podcast* (McKinsey, 2019).

or smaller. This period of discovery identifies some of the key stakeholders, constraints, related processes, and concepts. The experience of others in applying such technological innovations can be particularly useful.

Many nations use technology maturity scales to assess how "ready" a technology is for use. The United Nations has yet to develop such a standardized system but it should be deploying mature technologies. For instance, on the Technology Readiness Scale (see Annex, Section A) used by both the American and Canadian governments, the United Nations should deal with technology at levels 7 ("system prototype demonstrated") and higher. [21] In practice, this means advanced technologies at or near the final stage of the scale, not in the R&D stage or newly emerging on the market. In fact, most of the technologies should already have been commercialized, i.e., "Commercial-Off-The-Shelf" (COTS) technologies. Even with COTS, much creativity and tinkering may be needed to apply and modify the technology, including both hardware and software, to the unique circumstances of the United Nations. This is due to its specific goals and needs that are seldom, if ever, found in other organizations, e.g., peace mediation technologies.

For the United Nations, proven technologies are almost always the best option. The Organization does not have the capacity or funding to pioneer new technological fields that have not been already explored by other international organizations, governments or industry. Most university research and development (R&D) does not result in products ready for field deployment without copious amounts of additional work, at major cost, and with significant risk. The United Nations cannot currently afford to do scientific or product R&D for its own sake, even if payoffs for the world might be considerable (e.g., in saving lives).

iii. Engage

After a defined, concrete concept has taken shape, the UN entity must decide to expend some time and resources to explore the idea. A "Concept Note" can be developed to share the idea among colleagues, the manager(s), and a larger group of potential stakeholders. If outside funding is needed (e.g., extra-budgetary resources from Member States), a funding proposal may need to be developed for circulation. While outside funding may take some time, modest resources are already starting to be spent (time, money, personnel hours, etc.).

The "innovation team," which can be a single person with assistance from colleagues or small group or organization (e.g., a project group), pushes the innovative idea forward, requiring interactions with end-users and other potential stakeholders.

There may be resistance to new "disruptive" technologies because the process can be burdensome for users, at least during a transition period. Some may resist the innovation

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[21] Innovation, Science and Economic Development Canada, "Technology Readiness Levels," 2019.

passively or actively, especially if the innovation requires extra work for overloaded personnel and units. Also, the person or team pushing the idea often has to do the innovation work on top of a regular workload, unless the unit/team is part of a dedicated innovation cell. Dedicated innovation units can help reduce the burden, as can pulling on support from places like the UN Innovation Network[22] or the others (see Annex, Section E on UN Innovation Resources).

At this stage, the idea originator usually envisions a real possibility of implementing the idea, but the realistic workload also becomes apparent. So does the risk that the idea may not pan out.

The United Nations must accept that a significant number of ideas will not come to fruition as envisioned, but also that failed ideas may result in new and better ideas that have a major impact. The "freedom to fail" is an essential component of innovation. While repeated failures may be indicators of a systemic problem, some failures are to be expected and even encouraged. A quote in the *Harvard Business Review* demonstrates the spirit: "If we're not making mistakes, we're not trying hard enough."[23]

Focusing Efforts

Even though innovation should be tried in many areas, prioritization may be needed even at the early stage. This involves considering the balance of (a) value to the stakeholder (and management), (b) product feasibility / effectiveness and (c) readiness to scale.

For a progressive agenda where all three criteria show merit, the motto of "push what moves" serves as valuable advice. For instance, some smaller projects may not have the obstacles or difficulties experienced with larger projects. Advancing smaller projects can build momentum, experience and enthusiasm, so that the larger projects become easier to handle. It also provides some visibility and a proven track record. For instance, multidimensional peace operations have often set aside funds for "quick impact projects" that can show the local community that the mission is making a visible difference in their surroundings, if not in their lives. The same notion can apply to innovation within the United Nations.

If innovation bodies are involved, agreements, based on templates, can be produced to provide a structured administrative engagement between the innovation team and the clients. They can spell out the various stages of project development, similar to the stages proposed here.

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[22] United Nations Innovation Network, "United Nations Innovation Network," op. cit.
[23] Bill Taylor, "How Coca-Cola, Netflix and Amazon Learn from Failure," Harvard Business Review, November, 2017.

Guiding Principles

Some important principles and steps should be considered early on and throughout the innovation cycle.

One widely-used model for effective innovation was offered by Kotter (see Annex, Section B). It runs through a series of steps from creating a climate for change (including a sense of urgency, building a guiding collation, and a powerful vision), as UN Secretary-General Guterres is doing, and then enabling the planners, creating buy-in from the implementers, empowering entrepreneurs and creating short-term wins, then implementing and sustaining the change (through momentum and institutionalization).[24]

In industry, commonly used elements for technological innovation to consider are: Technology, Process and People (TPP).

Simply thinking of the technology without thinking of how it will operate within the larger work process will risk project failure, even with effective technologies. Similarly, the people or human dimension needs to be considered. How will the people adapt to the technology? How will it affect their wider work environment? What kind of education and training is necessary? How to accommodate the range of people's responses to innovation, from the early adopters to the enduring skeptics? One classic representation of this is with the 'technology adoption curve;' see, Annex, Section C.

A study by industry shows that change initiatives tend to "concentrate on the process improvement strategies and business process reengineering; while essentially ignoring the people aspect of the change initiative."[25] If this is true for well-resourced corporations in the developed-world, it is even more true for international organizations working in fragile post-conflict areas or unstable developing regions, and with constrained resources and budgets.

The three TPP elements are present to a large extent in the Principles for Digital Development.[26] The Principles were created to learn lessons from the history of digital technology initiatives in the developing world that were "fragmented, uncoordinated, siloed, and struggled to scale or sustain themselves in the long term."[27] The nine Digital Principles are "not intended to be implemented in any particular order" but have relevance

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[24] John P. Kotter, "Leading Change: Why Transformation Efforts Fail," in *HBR's 10 Must Reads on Change Management*, edited by John P. Kotter, W. Chan Kim, and Renee A. Mauborgne. 1st Ed. HBR's 10 Must Reads (Boston, MA: Harvard Business Review Press, 2011).

[25] Sreekanth Ramakrishman and Michael Testani, "People, Process, Technology – The Three Elements for a Successful Organizational Transformation," in *Society for Engineering and Management Systems Webinar* (Path Forward to Business Transformation, IBM Center for Learning and Development, 2011).

[26] Digital Impact Alliance, Principles for Digital Development.

[27] Digital Impact Alliance, "About," Principles for Digital Development, 2020.

for each specific part of a project lifecycle.[28] They are summarized in Figure 2.

Figure 2: Core Principles of Digital Development[29]

The entire initiative is supported by a community of practitioners to share knowledge,[30] and resource guides.[31] The principles map to TPP approximately as follows:

- *Technology*: Build for Sustainability; Address Privacy & Security
- *Process*: Understand the Existing Ecosystem; Design for Scale; Be Data Driven; Use Open Source (incl. Open Standards, Open Data, and Open Innovation); Reuse and Improve.
- *People*: Design with the User; Be Collaborative

The Secretary-General's Strategy on New Technologies outlines a series of similar points, providing guiding Principles & Commitments (described in Annex, Section D).

B. Feasibility Stage

An idea may look good in theory but would it work in practice?

The feasibility phase entails more in-depth study than the ideas stage, beginning with defining in detail the specific problem, the specific situations, and "use cases" for the product or innovation. As in the ideas stage, the innovators again work with selected

[28] Digital Impact Alliance, sec. "Are the Principles listed in priority or process order?"
[29] United Nations Children's Fund, *Core Principles of Digital Development*, 2019.
[30] Digital Impact Alliance, "Community," Principles for Digital Development, 2020.
[31] Adele Waugaman, *From Principle to Practice: Implementing the Principles for Digital Development* (Washington, DC: Principles for Digital Development, January 2016).

stakeholders and end-users, but they are doing so in a wider fashion. In commercial language, relentless “customer discovery” is needed before moving towards a solution. Also, this is a time to develop some key metrics and criteria against which the innovation can be measured in the testing stage and later on.

A survey can be made of similar ideas to see how they are implemented in other environments. A preliminary cost/benefit analysis could also be performed. The pros and cons of an idea can be assessed.

A “proof of concept” (POC) project can be developed to examine more closely the feasibility of the idea. This involves building or designing a prototype or an elementary version of the product to test the basic elements. Some repetitive testing and tinkering will be required on a product or innovation before it is ready to be piloted in real (field) conditions. Developing a POC is usually the quickest and most accurate way to validate or invalidate assumptions about users, concepts, etc. It also helps to reduce the sense of risk for the larger organization as a POC is usually defined in terms of scope, scale, and resource commitment. It is not an open-ended invitation to a never-ending initiative. As the POC is developed, lessons and insights can be captured from end-users, with revisions and updates made to the success criteria and core assumptions.

To uncover how a proposed innovation might or might not fit within the existing system, an important approach, using technology start-up parlance, is to “fail fast.” This means to create and iterate possible solutions rapidly without investing in expensive technology only to realize it is ill-suited for the task at hand. Through POC refinement, a more appropriate product can be developed, keeping process and people in mind.

The POC or “preliminary demonstration” products can also include initial versions of the documentation that might accompany or explain a product. Sometimes writing the documentation helps clarify the service.

Ongoing engagement with end-users occurs throughout. The innovation team starts to grow, usually comprising multiple people, and pulling in more stakeholders. Project identity forms.

At this stage, without being a naysayer, it may be helpful to ask: “Are there significant reasons to say no?” before spending further time, money, and resources on the idea. At the same time, the value of innovation should not be lost. The risks should be realistically evaluated and understood. From a list of potential failures, those that are likely or of high impact can be highlighted so that potential solutions or mitigation measures can be considered. This can be done by small teams, including outside experts, in several reviews: conceptual design review, preliminary design review, hazard and risk review, and final design review.

Higher level (i.e., management) endorsement is usually required to proceed further. Management will also need to approve the project budget in accordance with the institutional procedures.

Prioritizing Projects

The process of prioritizing technology is not codified in UN doctrine or policies, especially when it comes to field operations. Rather, it is ad hoc and personality dependent, compared to many national programmes, where permanent structures and funding for innovation and development are in place, e.g., research and development (R&D) agencies. However, several departments of the UN Secretariat have structures and positions to assist with technological innovation.[32]

Much more can be done in this area, including to create technology scouts and solution farms. The United Nations also needs more capacity for technology assessment and prioritization for both the needs technology can help resolve and of the technology itself. Often technologies go unassessed, even at the testing stage.

C. Testing

Here the POC can be transformed into a *prototype*, which strongly resembles the final product, but it does not need to be complete, finished or polished. The emphasis is only on the essential features of the final product.

The testing effort is focused on validation of the strategic design. It involves early visualizations of the technology in the working environment, including TPP elements. Close collaboration with end-users helps capture inputs, lessons learned, and revisions made to the success criteria and core assumptions. Testing is done in a training environment and demonstrations are undertaken in life-like environments, though not as fully as the pilot-project phase that follows, where the innovation is applied directly in the operation.

Multiple prototypes may be developed in parallel or through an iterative process. The team works closely with end-users to develop the innovation into something that becomes obvious, at least intuitively, as a clear advance on the current state of affairs.

For some technologies, testing potential equipment and developing systems/procedures can be expensive for the United Nations. Its procurement rules do not allow it to accept free equipment from businesses, even for testing purposes. Other institutions, like some universities and think tanks (and UNTIL), are not so restricted; they could provide advice

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[32] The “UN Innovation Resources” Section at the end of the paper provides details. Specific examples of groups within the UN include, the “Emerging Technologies Unit” inside the Office of Information and Communication Technology (OICT) — some OICT organizational structure and processes can be seen in the “ICT Project Management Framework” — and the “Innovation Cell” within the Department of Political and Peacebuilding Affairs. See respectively: OICT, “Emerging Technologies,” 2020; OICT, “ICT Project Management Framework” (Internal Policy Document, accessed 15 November 2019 via UN Intranet-iSeek); United Nations Department of Political and Peacebuilding Affairs, “Innovation,” January 2020.

to the Organization on potential systems by testing them. Also, it is valuable to have outsiders provide input, given that they have new perspectives to provide. They may suggest how to do things and how *not* to do things, based on their experience.

In the future, the United Nations might consider new forms of partnership with particular governments, industries or producers. These could provide equipment, e.g., test-bed hardware or software products, advice and expertise, without binding the United Nations to specific companies for future procurement decisions. Private companies may find the Organization, including its field missions, to provide a valuable opportunity to test under real-use conditions.

Key Factors

- Primary evaluation/success criteria, as understood and updated, are developed with the prototype. Updates and refinements are made using continuous end-user feedback and testing. This can enhance the confidence of both innovation teams' and the end-users.
- Openness of UN staff, field missions or agencies to work with new innovations.

Recommendations

The United Nations currently has few places to "tinker with technology," i.e., to test and experiment with new technologies, both hardware and software. This could be a role for the Global Services Centre, e.g., creating a "sandbox" for software and/or hardware exploration.[33] UNTIL may also have a role.

To support the prototyping stage, innovation units can:

- Develop guidelines and generic prototype evaluation methodologies.
- Actively track innovation efforts to ensure they demonstrate progress and the potential for value creation against the stated evaluation methodology.
- Develop lessons-learned capture tools as a knowledge base for future innovation efforts.
- Facilitate continued funding required to enable prototype development.

[33] A "sandbox" is a feature of some innovation environments to test ideas and prototypes. For example, a sandbox program specifically designed for innovation efforts in the financial sector may provide exemptions from traditional regulatory frameworks. By providing exemptions in a contained and monitored environment —in conjunction with regulators— innovators can test ideas to ensure they provide value before working through the regulatory process.

D. Pilot Project

Pilot projects are an advanced form of testing, done in the actual environment where the innovation is to be used, e.g., field operations. The fundamental idea is to test core functions and demonstrate the value the innovation provides, in a minimal and usable form, in interaction with end-users. Pilot projects are often phased through increasingly complex Minimum Viable Product (MVP) iterations.

Multiple pilot projects can be launched simultaneously or in sequence, based on iterative examples of the MVP, previous pilot project experience and learning, and critical end-user feedback. There should be an ongoing way to capture lessons learned, revision and updating of the success criteria and other core assumptions. Compared to POC, the shift is towards testing and demonstration in final form, under expected conditions, to determine whether the innovation meets operational requirements.[34]

Hopefully, the innovation team will gain feedback and see enthusiasm build among clients as the pilot project starts to demonstrate the benefits (and drawbacks) of the innovation.

At this stage, overall costs can be more accurately estimated. Detailed budgets, informed by the pilot project, can be developed, including fixed vs projected/variable costs and liabilities. Whereas seed funding might be used at first, funding may increasingly come from field missions or agencies that are to be the recipients of the innovation.

The potential options for final delivery of the product into the field can also be considered, whether as UN-owned equipment (UNOE), Contingent-Owned Equipment (COE) through a Memorandum of Understanding (MOU) or Letter of Assist (LOA), or through a contractor.

Key Factors

- Confirm that primary/evaluation criteria, as they were updated through feedback from prototyping and ongoing end-user testing, have been achieved. Receive ongoing feedback about met and unmet needs.
- Pilot projects, repeated if necessary, examine the applicability under different circumstances, including difficult ones.

Recommendations

- Active tracking of innovations to demonstrate progress and measure the potential for value-creation against stated evaluation criteria.
- Continued development of lessons-learned capture tools from initiatives as a knowledge base for future innovation efforts.

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[34] Language from: Innovation, Science and Economic Development Canada, “Technology Readiness Levels,” op. cit.

E. Deployment

Once pilot projects have demonstrated the suitability and success of the innovation in a given location, the United Nations can begin the roll-out (e.g., in the entire field mission).

Program rollout is accompanied by ongoing assessment of use in each deployment. The lessons learned should be captured, particularly by noting them at the time of discovery. The success criteria can be revised and updated, as well as the core assumptions. The met and unmet user needs are continually identified based on ongoing end-user feedback. There is increased attention to future scaling, rather than the rapid iteration in the prototyping stage.

Along with implementation of the innovation, there is a need for documentation, e.g., instruction manuals, Concept of Operations (CONOPS) and Standard Operating Procedures (SOPs). As well, innovation involves upgrading processes, training people, and maintenance and repair of equipment. Additionally, there is a need for quality assurance (QA) and for sunset provisions so that the equipment can be properly disposed when the equipment lifecycle has been completed.

Key Factors

- Customization for specific use environments/contexts.
- Feedback on unmet needs, new problems and unintended consequences provided for the innovation system.

Recommendations

- High-level endorsement for engagement between innovation teams and end-users. A well-supported partnership increases the chance of success.
- Ongoing testing and feedback, capturing lessons-learned as a knowledge base for future innovation efforts.
- Increasingly program-based funding to deploy innovation.

F. Assess & Refine

Assessment is actually done throughout the innovation cycle, but it is the central activity as the innovation moves through to mainstreaming, when it is about to become widely available to many users, e.g., across field missions. Performance measurement and evaluation is provided, not only of the technology but also the process and the people (TPP) aspects. It is key to understand the impact the innovation has where it is being used, including effectiveness, efficacy and limitations at achieving its stated objectives. Program evaluation and use of data created by the new systems can provide a window into its degree of success.

As technology continues to evolve, one of the assessment criteria is the resulting change in effectiveness of the UN work. Interviews, surveys or other comments from the users can be important. Other forms of assessment are possible.[35]

Because of the importance of environmental sustainability, and since the United Nations is a major promoter of it, the organization should make sustainability assessments for its own technologies. For instance, in UN peace operations, this means “greening the blue,” i.e., promote sustainability within field operations. Sustainability assessments are already widely used in industry.

It is also important to keep a watch for any newer technologies on the horizon that could be adopted to further improve and innovate the system, including to increase environmental sustainability. This helps push the innovation cycle forward.

G. Scale & Mainstream

As stated in the Principles for Digital Development: “achieving scale requires adoption beyond an initiative’s pilot population and often necessitates securing funding or partners that take the initiative to new communities or regions.” Trade-offs between rapid initial deployment versus long-term sustainment considerations may be made, as well as understanding what elements of a pilot cannot be scaled versus those that can (i.e., if in-person training was provided initially, e-learning software may need to be used instead).[36]

Once the technology has proven to be to be successful and sustainable in the actual environment, like a field operation, it can scaled up and placed in standard service catalogues. Systems contracts can be developed for sustained use of the technology. Ongoing maintenance and improvements must be considered. The Organization can perform continued assessment of technology use, including through end-user feedback, lessons-learned, etc.

As an innovation enters the mainstream, its form and functions have stabilized. Likely, many months, or even years, have passed from the Idea Stage to here, but the Tech Innovation Cycle continues. Opportunities for further innovation may become apparent. Advances in technology, the skills of people, and evolving processes may give rise to new

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[35] Typically, there are two main assessments on products: “Life Cycle Assessment” and "Life Cycle Costing” (calculating all costs related to a product, activity or process during its lifetime). Then the integrated assessment helps decision-makers. Applicable to products in peace operations include: “Risk analysis and Uncertainty analysis,” “Vulnerability analysis,” “Cost-benefit analysis,” and “Impact assessment.”Marco Taisch et al., “Sustainability Assessment Tools – State of Research and Gap Analysis,” in *Advances in Production Management Systems. Sustainable Production and Service Supply Chains*, ed. Vittal Prabhu, Marco Taisch, and Dimitris Kiritsis (Berlin, Heidelberg: Springer, 2013), 426–434.

[36] Digital Impact Alliance, “Design for Scale,” Principles for Digital Development, 2020.

innovations. Openness to ongoing revisions, to improvements, and to learning about new ways of doing things will help to develop an "innovation mindset."

This keeps the innovation cycle going. More than a circle or cycle, the innovation can be viewed as a spiral (upwards) of constantly improving technology use.

Once a technology has been scaled to the currently right number of clients (or field operations), it should be mainstreamed so it is available to future clients who might want it. This usually involves making the technology available in a service catalogue or portfolio.

Key Factors

- Receive feedback on both met and unmet needs from first employment / deployment of the technology innovation.
- Consider options for widespread adoption or "niche markets" for targeting.
- Examine trade-offs between rapidly serve a few clients vs large-scale production for many potential clients.
- Include lesson-learned from innovation efforts in training materials.

With this last step, the cycle comes back to its point of origin, where new ideas and new technologies meet. Continuous innovation is required.

For long-term development, the United Nations needs a strategic view of future needs and technologies. UN headquarters rarely produces a plan for its future equipment/technology needs beyond the short-term, though OICT did have an admirable five-year ICT Strategy.[37] By contrast, most militaries and alliances (e.g., NATO) have plans for the next 10-20 years for "force development," major acquisitions and new R&D programmes. While the United Nations cannot operate at the level of nation-states and acquire expensive (billion-dollar) systems, there would be value to a guiding document for technology acquisition over the next one or two decades, especially for systems of medium-to-high cost. One such example is for major UAV acquisitions, perhaps for service in multiple UN peace operations.[38]

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[37] United Nations Secretary-General. "Information and communications technology in the United Nations" (A/69/517). Report of the Secretary-General. New York, NY: United Nations, 10 October 2014.

[38] The United Nations deployed its first UAVs as mission assets in 2013 in the D.R. Congo (MONUSCO mission). The UN contracted SELEX ES to fly five Falco drones over DRC in 2013 for surveillance and intelligence-gathering purposes. The contract was for an initial three years with an option to renew for a further two years. Unfortunately, for extended periods of time, the company (by then called Leonardo) was unable to have more than one UAV in the air at a time. The UN has also implemented other UAV innovations in Central African Republic, with the deployment of Orbiter UAVs and over 40 UN-owned micro-UAVs for UN military observers. Currently the United Nations has over 200 UAVs deployed and a plan is needed for the longer term. For further discussion, see: A. Walter Dorn and Stewart Webb, "Eyes in the Sky for Peacekeeping: The Emergence of UAVs in UN Operations," Intelligence and National Security, 32, no. 4 (June 2017): 413–417.

3. Conclusion

Each of the above stages in the Tech Innovation Cycle requires consideration of key factors, principles, elements, constraints, etc. The model is summarized above in Figure 1 and spelled out in Table 1 below.

Stage	Step	
Idea	Idea for a potentially useful technology innovation for UN. Gradually evolves. Initial relationships are formed within or between innovators and users	
	Identify & Initiate	Problem & solution identified, with potential application of a new tool, approach, or idea
	Scope	Idea becomes a concrete concept/proposal
	Engage	Create initial relationships between innovators and users
Feasibility	Determine feasibility of idea through a proof of concept (POC)	
	Design	Define in detail the specific problem and proposed innovation specific issue "and use case(s)," working with stakeholders and end-users. Key metrics and criteria developed to measure effectiveness of innovation
	Create	Develop POC to determine the feasibility of the innovation against the evaluation criteria
Testing	Prototype built & tested, based on the POC. Focus on validation of the strategic design	
Pilot Project	Pilot Project (one or more) to demonstrate operational use of the innovation under realistic conditions	
Deployment	Finalize product/innovation for actual use Roll-out to one or more selected clients Use and update metrics for performance measurements Provide first drafts of SOPs, CONOPs, training materials	
Assess & Refine	Ongoing lessons learned; life cycle assessment and costing Continuing assessment of practice, including end-user feedback, etc.	
Scale & Mainstream	Innovation made available as a standard item/procedure (e.g., in service catalogue/portfolio), with appropriate maintenance & training Cycle begins anew with improvements made	

Table 1: Technology Innovation Cycle for the United Nations

Throughout the process, end-user engagement is ongoing, as are broad interactions with the ecosystem of partners. Depending on the nature of the innovation, partnerships can be created with outside actors, including governments, industry, academia, civil society organizations (CSOs) and international organizations. For instance, with peace operations, the United Nations is no longer the only player. New players may demonstrate significant innovations in technology that can be tracked and considered for adoption, e.g., from NATO, EU, AU and OSCE operations. For example, in the case of UAV and satellite observation, lessons can be learned from a wide range of actors, including CSOs like Amnesty International, Human Rights Watch, and Bellingcat, or regional organizations like the OSCE Special Monitoring Mission (SMM).[39]

This model should assist with the design and development of a technological innovation. However, it does not currently deal with:

- The UN's internal bodies required for project approvals and reporting. These can be found in existing UN documents, e.g., ICT Project Management Framework.[40]
- Administrative and managerial elements for project management (e.g., PRINCE2[41]).

While institutional procedures are needed to administer and manage projects, the proposed stages in the Technology Innovation Cycle can provide some overall direction. This would help innovation proceed coherently from original idea to sustainable implementation for improved effectiveness. The TechNovation Cycle, or parts of it, can be incorporated into UN plans, procedures and strategies.

As technology becomes increasingly integrated into both the developing and developed world, the United Nations will need to increase the resources devoted to technological innovation. Using the example of developed nations and leading companies, a part of available funds should be allocated to technology innovation. For instance, a given

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[39] Respectively: Amnesty International, "Satellite Imagery Offers Glimpse on Sri Lankan War Zone," *Amnesty International USA*, 12 May 2009; Isha Salian, "How AI Helps Human Rights Watch Investigate from the Sky," *NVIDIA Blog*, 4 April 2019; Steven Livingston and Sushma Raman, "Technology & Human Rights in the 21st Century," Conference Report (Cambridge, MA: Carr Center for Human Rights Policy, Harvard Kennedy School, February 2017); Giardullo, Dorn, and Stodilka, "Technological Innovation in the OSCE: The Special Monitoring Mission in Ukraine," op. cit.; A. Walter Dorn and Cono Giardullo, "Analysis for Peace: The Evolving Data Tools of UN and OSCE Field Operations," *Security and Human Rights*, 2020.

[40] "The ICT Project Management Framework defines an ICT initiative, gives an overview of the ICT investment review process, the role of the governance bodies, and recommends a project management methodology and tools for managing ICT projects." OICT, "ICT Project Management Framework." See also: A. Walter Dorn and Cono Giardullo, "Technology Investments Paying Off in Peace Operations," *Security and Human Rights Monitor*, 8 June 2020.

[41] PRINCE2 (PRojects IN Controlled Environments, 2nd edition) is a generic project management method, originally developed as a UK government standard and now widely used across the UN system. It not specifically for technology innovation and so does not include the detailed type of stage formulation provided here but one of the Prince2 principles is "manage by stages."

percentage (e.g., 5%) of the technology budget should be allocated to technology innovation improvement.

In our technological age, the issue is not whether the United Nations can afford to innovate, but whether it can afford *not* to innovate. Lack of innovation means lost lives and more human suffering in the field. Innovation requires dedicated initiatives, structures and procedures. The guidance offered in this Technology Innovation Model may help the United Nations regularize and systematize innovation. This should help the United Nations succeed in its essential mission of world assistance.

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Annex

A. Technology Readiness Levels (TRL)[42]

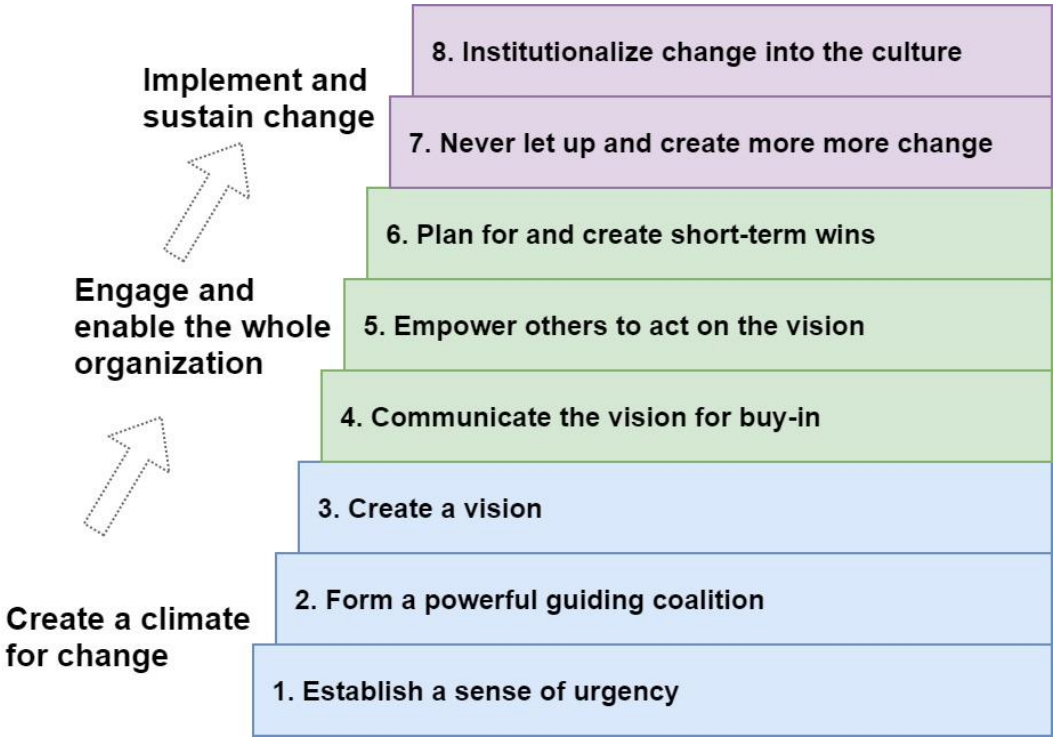
TRL as described by the Government of Canada. Similar concept, albeit with modified specific phrasing, used certain US government agencies, European Commission, and others.

TRL	Description of TRL
1	**Basic principles of concept are observed and reported** Scientific research begins to be translated into applied research and development. Activities might include paper studies of a technology's basic properties.
2	**Technology concept and/or application formulated** Invention begins. Once basic principles are observed, practical applications can be invented. Activities are limited to analytic studies.
3	**Analytical and experimental critical function and/or proof of concept** Active research and development is initiated. This includes analytical studies or laboratory studies. Activities might include components that are not yet integrated or representative.
4	**Component and/or validation in a laboratory environment** Basic technological components are integrated to establish that they will work together. Activities include integration of "ad hoc" hardware in the laboratory.
5	**Component and/or validation in a simulated environment** The basic technological components are integrated for testing in a simulated environment. Activities include laboratory integration of components.
6	**System/subsystem model or prototype demonstration in a simulated environment** A model or prototype that represents a near desired configuration. Activities include testing in a simulated operational environment or laboratory.
7	**Prototype ready for demonstration in an appropriate operational environment** Prototype at planned operational level and is ready for demonstration in an operational environment. Activities include prototype field testing.
8	**Actual technology completed and qualified through tests and demonstrations** Technology has been proven to work in its final form and under expected conditions. Activities include developmental testing and evaluation of whether it will meet operational requirements.

[42] Innovation, Science and Economic Development Canada, "Technology Readiness Levels," op. cit.

9	**Actual technology proven through successful deployment in an operational setting** Actual application of the technology in its final form and under real-life conditions, such as those encountered in operational tests and evaluations. Activities include using the innovation under operational conditions.

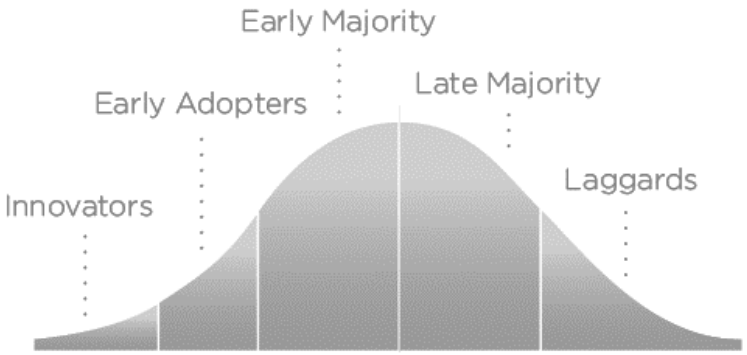
B. Kotter's Eight Steps for Innovation Change in Organizations[43]



C. Innovation adoption Lifecycle[44]

Shows who adopts innovations during its evolution. No brief: not everyone will immediately adopt every possible innovation, no matter how revolutionary it may be.

[43] Based on figure in John P. Kotter, "Leading Change: Why Transformation Efforts Fail," op. cit.
[44] See, "Pnautilus," *Innovation Adoption Lifecycle*, 30 December 2011. Adapted from: Everett M. Rogers, Diffusion of Innovations, 5th ed. (Simon and Schuster, 2003).



D. Secretary-Genera's Strategy on New Technologies, Principles and Commitments[45]

The Secretary-General's Strategy on New Technologies outlines "how the United Nations system will support the use of these [advanced] technologies to accelerate the achievement of the 2030 Sustainable Development Agenda and to facilitate their alignment with the values enshrined in the UN Charter, the Universal Declaration of Human Rights and the norms and standards of International Laws."[46] Then spells out core principles and commitments (see table).

Principles	Commitments
(1) Protect and promote global values (2) Foster inclusion and transparency (3) Work in partnership (4) Build on existing capabilities and mandate (5) Be humble and continue to learn	(1) Deepening the UN's internal capacities and exposure to new technologies (2) Increasing understanding, advocacy and dialogue (3) Supporting dialogue on normative and cooperation frameworks (4) Enhancing UN system support to government capacity development

E. UN Innovation Resources

There are a range of resources to support innovation within the UN system. Some of these include:

- Innovation in the UN: Quick Guide: www.research.un.org/innovation

[45] United Nations Secretary-General, "Secretary-General's Strategy on New Technologies," op. cit.
[46] Ibid., 3.

- Principles for Digital Development: www.digitalprinciples.org
- Unite Ideas (OICT website): www.ideas.unite.un.org
- United Nations Innovation Network: www.uninnovation.network
- United Nations Innovation Toolkit: www.un-innovation.tools
- United Nations Technology Innovation Labs: www.until.un.org