TRL	Stage	Definition	Exit Criteria to achieve the given TRL
1.	**Discovery**	**Review of Scientific Knowledge Base** **(i) Scope**: Fundamental research begins, postulating basic principles having no experimental proof, which can be translated into applied R&D. This may include: a. Surveying published research of a technology's basic properties. b. Identifying essential characteristics & behaviours of systems & architectures using mathematical formulations or algorithms. **(ii) Activities**: a. State the challenges that the industry or other users face and the need for a new kind of innovation such as variety, practice, or other technology solution. b. Estimate the value of the innovative solution compared to the existing variety, practice, or other technologies, and where the solution fits in the overall supply chain.	Peer reviewed publication of research underlying the proposed concept/application. (i) Do basic scientific principles support the concept? (ii) Has the technology development methodology or approach been developed?
2.	**Application identification**	**Technology concept formulation and application identification.** (i) **Scope**: Applied research on how technology could be applied in the market. Potential of the prospective system applications is speculative and inferred from general assumptions or some analytical data obtained from publications or other references. ii) **Activities**: a. Based on the competitor analysis & patent landscaping, characteristics of the applications are described (future viability, risks involved and required efforts to advance to next TRL etc.) b. Analytical tools are developed for simulation or analysis of the application.	Documented description of the application/concept that addresses feasibility and benefit. (i) Are potential system applications identified? (ii) Are system components and the user interface at least partly described? (iii) Do preliminary analyses or experiments confirm that the application might meet the user need?
3.	**Proof-of-Concept**	**Proof-of-concept demonstrated, analytically and/ or experimentally**	Analytical/experimental proof-of-concept results validating predictions of key parameters.

		(i) Scope: Active research & development on proof-of-concept development, analytically and/ or experimentally at a lab scale. (ii) **Activities:** Analytical studies and laboratory scale studies to physically validate the analytical predictions of separate elements of the technology (example includes components that are yet not integrated or representatives).	(i) Are system performance metrics established? (ii) Is system feasibility fully established? (iii) Do experiments or modelling and simulation validate performance predictions of system capability? (iv) Does the technology address a need or introduce an innovation?
4.	**Lab Prototype**	**Technology basic validation in a laboratory environment** **(i) Scope:** A low fidelity system/component breadboard is built in close consultation with end-user and operated to demonstrate basic functionality **(ii) Activities:** Estimation using lab-prototype: a. High-level performance and/or operations-oriented metrics. b. Expected operational environments c. financial metrics (cost-benefit analysis) Predictions are defined relative to the final operating environment.	Documented Test performance results using lab prototype demonstrating agreement with analytical predictions and definition of relevant environment. (i) Are end-user requirements documented? (ii) Does a plausible draft integration plan exist, and is component compatibility demonstrated? (iii) Were individual components successfully tested in a laboratory environment (a fully controlled test environment where a limited number of critical functions are tested)
5.	**Technology Development**	**Technology basic validation in a relevant environment.** **Scope:** Testing a high-fidelity Lab-scale system in a simulated/ representative environment. **Activities:** a. The basic technological components are integrated in simulated environment so that the system configuration (at the component-level, sub-system level, and/or system-level) is similar to the final applications in almost all respect.	Documented results of laboratory testing in simulated environment. Identified barriers for target performance goals and plans to overcome them. (i) Are external and internal system interfaces documented? (ii) Are target and minimum operational requirements developed? (iii) Is component integration demonstrated in a laboratory environment

		b. Technology assessment could be organized and implemented by either the customer organization, or the technology development organization. c. An assessment to be conducted as part of a critical design review (CDR), or a preliminary design review (PDR) for the system project. Such an assessment effort should also involve where possible those technologists and engineers who were involved in demonstrating the new technology earlier, as well as and independent reviewers representing the management of system project organization.	(i.e., fully controlled setting)?
6.	**Market Driven Specifications**	Technology model or prototype demonstration in a relevant environment. **Scope**: Testing an engineering-scale fully-functional prototype system in a simulated/ representative environment with full-scale realistic problems. **Activities**: An assessment of technology readiness must involve not only the technologists and engineers involved in demonstrating the new technology and independent reviewers representing the management of their organization, it must also involve technically competent representatives of prospective customers for the new technology. This technology assessment should be organized and implemented by the customer organization, rather than the technology organization.	Documented test performance in simulated lab environment demonstrating agreement with analytical predictions. (i) Is the operational environment (i.e., user community, physical environment, and input data characteristics, as appropriate) fully known? (ii) Was the prototype tested in a realistic and relevant environment outside the laboratory? (iii) Does the prototype satisfy all operational requirements when confronted with realistic problems?
7.	**Product Prototype**	**Technology prototype demonstration in an operational environment.** **Scope**: Demonstration of an actual system prototype in an operational environment (e.g., in the field, on aircraft, in a vehicle, or in space). **Activities**: a. Extensive field trials (Multi-location or hotspots) or other technology performance	Documented test performance in operational environment demonstrating agreement with analytical predictions. (i) Are available components representative of production components? (ii) Is the fully integrated prototype demonstrated in an operational environment (i.e., real-world conditions,

		experiments to be conducted to determine the potential yield, product quality etc. b. Manufacturing lines established or such facility identified.	including the user community)? (iii) Are all interfaces tested individually under stressed and anomalous conditions?
8.	**Reliability Test**	**Actual technology/ System completed and qualified through test and demonstration** **Scope:** Produce certified planting materials or other kinds of technologies and ensure that these can be sourced or are workable for full-scale production. Also, operational efficiency, costs and returns or resource quality improvements that would result from the innovation are established. The system, fully integrated with operational H/w & S/w, is qualified through test and demonstration and Technology has been proven to work in its final form and under expected conditions. **Activities:** a. All functionality tested in simulated and operational scenario. b. Verification & Validation (V&V) and Evaluation completed. c. Commercial manufacturing license obtained, or arrangement done in this regard.	Documented Results of testing in its final configuration. Assessment of it meeting its operational requirements. (i) Are all system components form-, fit-, and function-compatible with each other and with the operational environment? (ii) Is the technology proven in an operational environment (i.e., meet target performance measures)? (iii) Was a rigorous test and evaluation process completed successfully? (iv) Does the technology meet its stated purpose and functionality as designed
9.	**Production**	**Actual technology qualified through successful mission operations or in market.** **Scope:** Commercial-scale production by producers or manufacturers occurs with delivery of products to producers, handlers, processors, distributors, or other supply chain participants to market outlets and for meeting user demand. **Activities:** a. Commercialization initiated and sustaining engineering support in place. b. All documentation completed.	Report on performance of actual operation of the product / technology in its final form, under the full range of operating conditions. (i) Is the technology deployed in its intended operational environment? (ii) Is information about the technology disseminated to the user community? (iii) Is the technology adopted by the user community?