

Technology Development Stage	TRL	Definition	Description	Methods	Checklist	Yes	No	Not Relevant
Fundamental research	1	Basic principles observed	Scientific research begins with properties of a potential technology observed in the physical world.	<ul style="list-style-type: none"> <li>• Desk research</li> <li>• Interview</li> <li>• Survey</li> <li>• Observation</li> </ul>	Basic research activities have been conducted and basic principles have been defined.			
					Principles and findings have been published in the literature.			
	2	Technology concept formulated	Applied research begins with identification of practical applications of basic scientific principles.		Applications of basic principles have been identified.			
					Applications and supporting analysis have been published in the literature.			
Research and development	3	Experimental proof of concept	Active research and development begin. The applications are being moved beyond the paper stage to experimental work.	<ul style="list-style-type: none"> <li>• Co-creating workshop</li> <li>• Interview</li> <li>• Hackathon</li> <li>• Design sprint</li> <li>• Concept and feasibility testing</li> </ul>	Proof of concept and/or analytical and experimental critical function has been developed.			
					Separate components have been validated in a laboratory environment.			
	4	Technology validated in lab	Basic technological components are integrated “ad-hoc” to establish that they will work together in a laboratory environment.		“Ad-hoc” integrated components, sub systems and/or processes have been validated in a laboratory environment.			
					It is understood how “ad-hoc” integration and test results differ from the expected system goals.			

					Semi-integrated component(s)/ subsystems or processes have been validated in a simulated environment.			
	5	Technology validated in relevant environment	The integrated basic technological components are performing for the intended applications in a simulated environment.		It is understood how the simulated environment differs from the expected operational environment and how the test results compare with expectations.			
Pilot and demonstration	6	Technology demonstrated in relevant environment	A model or prototype, that represents a near desired configuration, is being developed at a pilot scale, generally smaller than full scale. Testing of the model or prototype is being conducted in a simulated environment.	<ul style="list-style-type: none"> <li>• In-house testing</li> <li>• Unit testing</li> <li>• Expert opinions</li> <li>• Usability testing</li> <li>• Integration testing</li> <li>• System level and large-scale piloting</li> <li>• Clinical trials</li> </ul>	Pilot scale model or prototype is developed.			
					Pilot scale model or prototype system is near the desired configuration in performance, and volume but generally smaller than full scale.			
					Pilot scale prototype or model system has been demonstrated in a simulated environment.			
					It is understood how the simulated environment differs from the operational environment, and how results differed from expectations.			
	7	System prototype demonstrated in relevant environment	A full-scale prototype is being demonstrated in an operational environment but under limited conditions (i.e., field tests). At this stage, the final design is very close to completion.		Full-scale prototype with ready form, fit and function is developed.			
					Full-scale prototype demonstrated in an operational environment but under limited conditions.			

					Final configuration of the technology is developed.			
					Final configuration successfully tested in an operational environment.			
	8	System complete and qualified	Technology is being proven to work in its final form and under expected conditions. This stage commonly represents the end of technology development. At this stage, operations are well understood, operational procedures are being developed, and final adjustments are being made.		Technology's ability to meet its operational requirements has been assessed and problems documented; plans, options, or actions to resolve problems have been determined.			
Early adoption	9	Actual system proven in operational environment	Actual application of the technology in its final form is being conducted under a full range of operational conditions.	<ul style="list-style-type: none"> <li>• Interview</li> <li>• Survey</li> <li>• Observation</li> </ul>	The technology has been successfully deployed and proven under a full range of operational conditions.			
					Operational, test and evaluation reports have been completed.			
Commercially available		Technology development is complete	Technology is openly available in the marketplace and/or has been sold directly to a buyer in the public or private sector, in its current state or service offering for non-testing or development purposes.	<ul style="list-style-type: none"> <li>• Interview</li> <li>• Survey</li> <li>• Observation</li> </ul>	The technology is openly available in the marketplace and/or has been sold in its current state of service offering for non-testing or development purposes.			