

IIT Roorkee defines Technology Readiness Level (TRL) as follows:

TRL	Phase	Description	Key Indicators
1	Research Phase	<p>Basic principles observed and reported</p> <p>Lowest level of technical readiness.</p> <p>Examples might include paper studies of technology's basic principles.</p> <p>Study of published research that identifies the principles underlying the technology.</p>	Basic identification of opportunity.
2	Research Phase	<p>Technology concept and / or application formulated</p> <p>Invention begins. Once basic principles are observed, practical applications can be invented.</p> <p>Applications are speculative and there may be no proof or detailed analysis to support the assumptions.</p>	<p>Concept formulation.</p> <p>Technology review leading to understand market position of technology</p>
3	Research Phase	<p>Analytical and experimental critical function and / or characteristic proof of concept</p> <p>R&D underway. This includes analytical studies and laboratory studies to physically validate the analytical predictions of separate elements of the technology.</p>	Research results support concept.
4	Developmental Phase	<p>Component validation in a Laboratory environment</p> <p>Successful integration of basic components. Core technical risk of the system is reduced. System concepts supported by laboratory trials.</p>	<p>Industry engagement in project.</p> <p>Value proposition stated.</p>
5	Developmental Phase	<p>Component validation in a Relevant environment</p> <p>Resolution for the operation and implementation of the technology increases significantly.</p> <p>The basic technology components are integrated with reasonably realistic supporting elements so they can be tested in a simulated environment.</p> <p>Results from testing a laboratory system are integrated with other supporting elements in a simulated operational environment.</p>	<p>Industry provides specifications and/or materials.</p> <p>Competitive advantages of technology specified</p>
6	Developmental Phase	<p>System / subsystem or prototype demonstration in a relevant environment</p> <p>Representative model or prototype system which is well beyond TRL 5 is tested in a relevant environment. Represents a major step up in a technologies demonstrated readiness.</p> <p>Results from laboratory testing of prototype system that is near the desired configuration in terms such as performance, weight and volume.</p>	<p>Prototype meets industry expectations.</p> <p>Prototype meets external stakeholder requirements.</p>

7	Industry Utilization Phase	<p>System prototype Demonstration in a simulated operational environment</p> <p>Prototype near or at planned operational system. Represents a major step up from TRL 6 by requiring demonstration of an actual system prototype in an operational environment (e.g., in an aircraft, in a vehicle, or in space).</p> <p>Results from testing a prototype system in an operational environment.</p>	<p>Industry undertakes testing.</p> <p>Customer undertakes testing.</p>
8	Industry Utilization Phase	<p>System qualified through test and demonstration in a simulated operational environment</p> <p>Technology has been proven to work in its final form and under expected conditions. In almost all cases, this TRL represents the end of true system development.</p> <p>Results of testing the system in its final configuration under the expected range of environmental conditions in which it will be expected to operate.</p> <p>Assessment of whether it will meet its operational requirements</p>	<p>Certification by external party.</p> <p>Customer acceptance. R&D ceased.</p>
9	Industry Utilization Phase	<p>System qualified through mission operations</p> <p>Actual application of the technology in its final form and under mission conditions, such as those encountered in operational test and evaluation (OT&E).</p>	<p>Industry controls technology.</p> <p>Customer controls technology.</p> <p>Product for sale.</p> <p>Practice routinely used in production.</p>

Technology Product Evolution Timeline

Technology Readiness Levels "TRL" – Market Readiness Levels "MRL"

TRL Evolution Schedules and Capabilities	TRL /MRL Implementation		Scientific Evidence Level
	Factor %	Risk %	
TRL 1-3 = IDEA = basic principles, technology concept formulated	0-1%	100%	Theoretical Assumptions
TRL 4 = Technology validated in laboratory	3%	97%	
TRL 5-6 = PILOT technology validated and demonstrated in relevant environment MRL5-6 = validate revenue model & market fit high technical risk/full commercial risk	25%	90%	
TRL 7= PROTOTYPE demo in operational environment MRL 7 = prototype viable product	60-75%	40-70%	Prototype demonstrated
TRL8 = FIELD DEMO system complete and qualified MRL8 = validate value delivery	75-90%	15-25%	Industrial validated
TRL 9 = actual system proven in operational environment, full scale industrial replication model ready for market competitive commercial deployment. MRL 9 = identify and validate metrics	95-99%	1-5%	Market validated commercial replication