Technology/Business Readiness Levels for the WTBC and UWYO

TRL/ BRL	Technology Readiness Description[1]	Business Readiness Description[2]
1	Basic principals observed and reported. Scientific or engineering knowledge defines a plausible product concept. Scientific research begins to be translated into applied research and development. Examples might include paper studies of a technology's basic properties.	Exploration begins considering new business or product concepts without a defined outcome. A plausible problem is identified that might translate to a viable business. A market, "Problem Statement," and proposed, "Solutions," are proposed.
2	Invention begins – Once basic principles are observed, practical applications can be invented. Applications are speculative and there may be no proof or detailed analysis to support the assumptions. Examples are limited to analytic studies.	The "Problem" statement is validated with potential users/customers. Evaluation of a general market, customers, product target, and scale of potential business begins to be objectively examined.
3	Active research and development targeted at a defined outcome is initiated. This includes analytical studies and laboratory studies to physically validate analytical predictions of separate elements of the technology. Examples include components that are not yet integrated or representative. Intellectual Property (IP) protection is examined.	Customer and market segments are identified and validation of those segments commences. IP licensing (if appropriate) is evaluated.
4	Basic technological components are integrated to establish that the pieces will work together in a working Proof of Concept device, breadboard, or code. Provisional patent protection is considered.	Validation of the market and/or customer segments for a defined business offering is completed. The product/offering is generally defined. A preliminary *pro forma* P&L is built based on initial customer/market validation data (Question: Can this make money?).
5	Fidelity of technology improves significantly – The basic technological components are integrated with reasonably realistic supporting elements so it can be tested in a simulated environment.	The Market Requirements Spec (MRS) defining customer/user requirements for a final product is begun. Market price point is examined objectively based on both value proposition and validation data. A cash flow analysis is completed. The complete Business Model is defined. The company (LLC, etc.) is established.
6	Representative model or prototype system is tested in a relevant environment. Represents a major step up in a technology's demonstrated readiness. An Engineering Requirements Specification (ERS) defining the relevant final concept is begun, modeled directly from the MRS (from BRL). Design for Manufacturing and Maintenance (DFM) and Design for Six Sigma (DFSS) concepts are considered. Non-Provisional patent and/or copyright (for software) filings are determined.	The Market Requirements Specification (MRS) defining the customer/user experience is completed. Market price point is validated and the MRS and ERS are examined against one another. An alpha product test plan is built and executed, one that challenges the "first article" or prototype test units in relevant environments. Sales channels are defined.
7	An Engineering Requirements Specification (ERS) is completed and implemented which defines the final product design. Prototype operational system or product demonstrated in an operational environment. Manufacturing/Operations models, building the product, are exercised and validated.	Any differences in the MRS and ERS deliverables are fully reconciled, including target gross margins, dependent on both required vs. wanted features and inclusive costs to design and build. A beta test plan of the "final article" in actual customer environments is implemented. IP licensing is finalized. Final pricing is determined along with gross and net margins. Financial controls are put in place.
8	Technology is proven to work – Actual technology completed and qualified through test and demonstration. The product is put under Change Management control in Engineering – the final form is rigorously defined and controlled.	Beta test plan is completed validating the product meets or exceeds both operational and customer requirements. A product lifecycle plan is examined. A Product portfolio, defined by features, function, and customer segments is built, examining the need to expand the product offering.
9	Technology/product proven through successful operations and user experience.	Product is launched and is in rigorous change management control. Changes outside of safety and health or obsolete subcomponents are only allowed through defining new external product names/numbers. Marketing strategy is fully launched. Sales channels are fully implemented. Initial sales growth is seen.

These TRL and BRL criteria run in parallel, not sequentially.

[1] Adapted from DOE, NASA, and DoD Technology Readiness Level (TRL) guidelines.

[2] Adapted from Lean Launchpad, Business Model Canvas, Product Lifecycle, and experiential learning.