

**Technology Readiness Level (TRL)**

Technology Readiness Level (TRL) is a type of measurement system used to assess the maturity level of a particular technology.

**TRL Characterisation**

|  |  |  |
| --- | --- | --- |
| **TRL LEVEL** | **DESCRIPTION** | **CHARACTERISATION** |
| **TRL 1** | Basic Principle | * Technology research * Pure science begins translation to R&D |
| **TRL 2** | Formulation of Concept | * Early studies for application formulation * Invention & Practical Application Begins |
| **TRL 3** | Experimental Proof of Concept | * Analytical validation & proof of concept * Start active research & development |
| **TRL 4** | Lab Validation | * Validation in laboratory environment * Ready to begin bridge for technology transition |
| **TRL 5** | Validation in real environment | * Validation in relevant environment * Ready to enter technology development |
| **TRL 6** | Demonstration in real environment | * Demonstrated in relevant environment * Ready to enter system development |
| **TRL 7** | Demonstration of prototype | * Demonstrated in operational environment * Ready for limited production decision |
| **TRL 8** | Product/System complete and qualified | * Compliant, qualified, & test/demo complete * Ready for operational evaluation |
| **TRL 9** | Product/System proven | * Completed operational evaluation * Ready for full-rate |

**Source:**

1. National Aeronautics and Space Administration (NASA) Technology Readiness Level (2012)
2. International Collaboration Fund Guideline, Kementerian Sains, Teknologi dan Inovasi (MOSTI) (2019)

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **PRGS 2.0**  **TECHNOLOGY READINESS LEVEL [TRL]**  **EVALUATION FORM**  ***Borang Penilaian***  ***Tahap Kesediaan Teknologi*** | | | | | | | | | | | |
| **A.** | **PARTICULARS OF RESEARCH & RESEARCHER**  *MAKLUMAT PENYELIDIKAN & PENYELIDIK* | | | | | | | | | | | | |
| **(i)** | **Name of Product:**  *Nama Produk:* | | | | | | | | | | | | |
| **(ii)** | **Name of Lead Researcher:**  *Nama Ketua Penyelidik:* | | | | | | | | | | | | |
| **(iii)** | **Name of Co-Researcher:**  *Nama Penyelidik Bersama:* | | | | | | | | | | | | |
| **(iv)** | **School/Institute/Centre/Unit:**  *Pusat Pengajian/Institut/Pusat/Unit:* | | | | | | | | | | | | |
| **B.** | **CONTACT INFORMATION**  *Maklumat Perhubungan* | | | | | | | | | | | | |
| **(i)** | **Email:**  *Emel:* | | | | | | | | | | | | |
| **(ii)** | **Office No:**  *No Pejabat:* | | | | | | | | | | | | |
| **(iii)** | **H/P No:**  *No H/P:* | | | | | | | | | | | | |
| **C.** | **BRIEF EXPLANATION OF THE INVENTION**  (Provide a brief explanation of the invention. Use diagrams if it gives better understanding of the product)  ***Penerangan Ringkas Ciptaan***  *(Berikan penerangan ringkas berkaitan ciptaan ini. Gunakan gambar rajah jika ia boleh memberi penerangan yang lebih jelas berkaitan produk)* | | | | | | | | | | | | |
| **D.** | **LEVEL OF KNOWLEDGE** | | | | | | | | | | | | |
|  |  | | | | | | | | | | | | |
|  |  | | **Yes** | | |  | | **No** | | |  | | |
| **(i)** | Basic scientific principles observed | |  | | |  | |  | | |  | | |
| **(ii)** | Possible application exists | |  | | |  | |  | | |  | | |
| **(iii)** | Paper studies confirm basic principles | |  | | |  | |  | | |  | | |
| **(iv)** | Paper studies show that application is feasible | |  | | |  | |  | | |  | | |
| **(v)** | Physical laboratory experimental evidence confirms basic principles | |  | | |  | |  | | |  | | |
| **(vi)** | Laboratory experiments verify feasibility of application | |  | | |  | |  | | |  | | |
| **(vii)** | Rigorous analytical studies confirm basic principles | |  | | |  | |  | | |  | | |
| **(viii)** | Physics underlying the technology is well understood | |  | | |  | |  | | |  | | |
| **(ix)** | Overall system requirements for end user’s application are known | |  | | |  | |  | | |  | | |
| **(x)** | Science known to extent that mathematical and/or computer models and simulations are possible | |  | | |  | |  | | |  | | |
| **(xi)** | System interface requirements known | |  | | |  | |  | | |  | | |
| **(xii)** | Operating environment for eventual system known | |  | | |  | |  | | |  | | |
|  |  | |  | | | | |  | | |  | | |
| **E.** | **Has analytical and experimental proof-of-concept been demonstrated in a laboratory environment?**  *(Answer the following questions based on the current research outcome)* | | | | | | | | | | | | |
|  |  | |  | |  | | | |  | | |  | |
|  |  | | **Yes** | |  | | | | **No** | | |  | |
| **(i)** | Have experiments validated the predicted capability of technology components? | |  | |  | | | |  | | |  | |
|  |  | |  | |  | | | |  | | |  | |
| **(ii)** | Paper studies indicated that system components ought to work together? | |  | |  | | | |  | | |  | |
|  |  | |  | |  | | | |  | | |  | |
| **(iii)** | Did the technology fulfill the necessity or introduceding innovations towards the related field? | |  | |  | | | |  | | |  | |
|  |  | |  | |  | | | |  | | |  | |
|  |  | |  | |  | | | |  | | |  | |
| **F.** | **Has lab-scale testing of equipment been completed in a laboratory environment?**  *(Answer the following questions based on the current research outcome)* | | | | | | | | | | | | |
|  |  | |  | | |  | | |  | | |  | |
|  |  | | **Yes** | | |  | | | **No** | | |  | |
| **(i)** | Have system requirements been finalised and documented? | |  | | |  | | |  | | |  | |
|  |  | |  | | |  | | |  | | |  | |
| **(ii)** | Have end user’s requirements been finalised and documented? | |  | | |  | | |  | | |  | |
|  |  | |  | | |  | | |  | | |  | |
| **(iii)** | Laboratory experiments with available components show that they work together | |  | | |  | | |  | | |  | |
|  |  | |  | | |  | | |  | | |  | |
| **(iv)** | Available components assembled into a prototype | |  | | |  | | |  | | |  | |
|  |  | |  | | |  | | |  | | |  | |
|  |  | |  | | |  | | |  | | |  | |
| **G.** | **Has pilot-scale testing been demonstrated in a relevant environment?**  *(Answer the following questions based on the current research outcome)* | | | | | | | | | | | | |
|  |  | |  | | | |  | |  | | |  | |
|  |  | | **Yes** | | | |  | | **No** | | |  | |
| **(i)** | Have system interface (internal & external) requirements been documented? | |  | | | |  | |  | | |  | |
|  |  | |  | | | |  | |  | | |  | |
| **(ii)** | Does the pilot-scale operate under realistic conditions in a relevant environment? | |  | | | |  | |  | | |  | |
|  |  | |  | | | |  | |  | | |  | |
| **(iii)** | Has integration of modules/functions been demonstrated in a relevant environment? | |  | | | |  | |  | | |  | |
|  |  | |  | | | |  | |  | | |  | |
| **H.** | **Prototype**  *(Answer the following questions based on the current research outcome)* | | | | | | | | | | | | |
|  |  | |  | | | |  | |  | | |  | |
|  |  | | **Yes** | | | |  | | **No** | | |  | |
| **(i)** | Does the prototype solve the problems? | |  | | | |  | |  | | |  | |
|  |  | |  | | | |  | |  | | |  | |
| **(ii)** | Can you show how the prototype solved the said problems? | |  | | | |  | |  | | |  | |
|  |  | |  | | | |  | |  | | |  | |
| **(iii)** | Can you show the important elements inside the prototype? | |  | | | |  | |  | | |  | |
|  |  | |  | | | |  | |  | | |  | |
| **I.** | **Demonstration**  *(Answer the following questions based on the current research outcome)* | | | | | | | | | | | | |
|  |  | |  |  | | | | | |  | | |  |
|  |  | | **Yes** |  | | | | | | **No** | | |  |
| **(i)** | Can you demonstrate the prototype? | |  |  | | | | | |  | | |  |
|  |  | |  |  | | | | | |  | | |  |
| **(ii)** | Can you show all the prototype function if demonstrated? | |  |  | | | | | |  | | |  |
|  |  | |  |  | | | | | |  | | |  |
| **(iii)** | Does the prototype have the metrics to conclude that the prototype confirms the basic principle? | |  |  | | | | | |  | | |  |
|  |  | |  |  | | | | | |  | | |  |
| **J.** | **Evidence**  Please provide evidences through email (picture, report, video, etc.). You also can book a Webex session to explain further and to demonstrate your prototype.  ***Bahan Bukti***  *Sila berikan bahan bukti menerusi emel (gambar, laporan, video, dll.). Anda juga boleh menempah sesi Webex untuk memberi penerangan lanjut dan membuat demonstrasi prototaip anda.*  **Khairul Syahmi Brahim**  ksyahmi@usm.my  syahmibrahim@gmail.com  **Webex Session (subject to availability and first come first serve)**  Date:  Time: | | | | | | | | | | | | |
| **K.** | **OTHER ISSUES**  Please state other comments that you would like to make on your research/invention/ product.  ***Lain-lain isu***  *Sila nyatakan ulasan lain yang ingin dibuat terhadap penyelidikan/ciptaan/produk anda.* | | | | | | | | | | | | |

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Signature of Researcher Date**

*Tandatangan Penyelidik*  Tarikh