Development of Customized Balanced Readiness Level Assessment Prototype for Research Funding Instruments

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Abstract

Research and Innovation are included in the Indonesian government's medium and long-term agenda to realize Indonesia's vision as an advanced economy by 2045. However, the low research and innovation spending in Indonesia is still a critical problem. The Triple Helix arrangement model in conducting research and innovation is one of the important things for technological and economic progress. In Indonesia, there are at least three funding schemes that apply the triple helix arrangement model with their respective measurement instruments such as TKT and Katsinov. However, in the use of these instruments, there are still obstacles that are difficult for users to understand, both among researchers, industry, and practitioners. So, the researchers tried to adapt the Balanced Readiness Level Assessment (BRLa) which was previously developed in Norway through a design thinking approach into a Customized BRLa prototype to be used as a triple helix model funding assessment instrument. This prototype can still be developed up to the implementation and trial stages for funders or reviewers in assessing proposals as well as monitoring and evaluating the implementation of research funded by the triple helix model, so that in the future it is hoped that research, development and innovation funding will be mostly given by the government by taking into account its readiness can produce optimal and useful outcomes.

Keywords

Balanced Readiness Assessment, Customized, Design Thinking, Research and Innovation Funding, Triple Helix Model

1. Introduction

Technology is widely regarded as a key driver of innovation and sustainable business growth. Measurement of technology readiness has been widely discussed by several experts. Starting with the Technology Readiness Level (TRL) introduced by NASA in the 1970s and Mankin (1995) providing definitions and examples of the nine levels of TRL and the scale has been refined and elaborated by other experts (Heslop, et. al., 2001; Mankins 2009; H`eder 2017; EARTO 2014).

Referring to Nolte (2008) that technology is a multi-faceted subject, the assessment of technology readiness does not offer a comprehensive understanding of the maturity of a product or what is required for a successful technology transition. New technologies may be promising and create new possibilities, but their development and implementation are complex. Existing methods for examining and tracking innovation progress are almost exclusively focused on aspects of technological development, therefore Dent and Pettit (2011) argue that a more holistic approach is needed to assess a product. Technological maturity by introducing market readiness (Market Readiness Level, MRL) as an additional aspect, will prove beneficial.

Kobos et al (2018) developed the TRL method when building the so-called “Regulatory Readiness Level” (RRL). While TRL focuses on the technological aspects of a product, RRL addresses regulations that affect the commercialization of new technologies. They argue that even fully operational and market-ready technologies may fail without regulatory support. The underlying factors for RRL are access to, and understanding of, the regulatory process, the effectiveness and safety of regulatory support, the “do no harm” principle, and the political and social acceptability of the project or technology.

Recent research on technology readiness was conducted by Vik et al. (2021), namely developing a concept and methodology to assess the level of readiness of new agricultural technologies combined, which combines five dimensions, namely technological readiness, market readiness, regulatory readiness, organizational readiness, and social acceptance readiness level, which is called a tool for assessing balanced readiness levels (Balanced Readiness Level Assessment, BRLa).

Reflecting on conditions in Indonesia, scientific research and research is included in the government's medium and long-term agenda to realize Indonesia's vision as an advanced economy in 2045. The low research and innovation spending in Indonesia is still a critical problem. The Ministry of Research and Technology/BRIN (2019) in Pradana (2021) illustrates that in 2018 the amount of gross domestic expenditure on R&D (GERD) in Indonesia only reached around 0.28% of total GDP or IDR 41.43 trillion. The Triple Helix arrangement model in conducting research and innovation is one of the important things for technological and economic progress. In Indonesia, there are at least three funding schemes that apply the triple helix arrangement model with their respective measurement instruments such as TKT and Katsinov. However, in the use of these instruments, there are still obstacles that are difficult to understand by users, both researchers, industry, and practitioners, so the researchers tried to adapt the Balanced Readiness Level Assessment (BRLa) which was previously developed in Norway through a design thinking approach into a Customized BRLa prototype to be used as a triple helix model of funding assessment instrument.

1.1 Objectives

In this research, a prototype of Customized Balanced Readiness Level Assessment will be developed using a design thinking approach. The CBRLa will later be proposed as an instrument for assessing the readiness of research, development and innovation results carried out through a government funding program with a triple helix arrangement model so that the main objective is that research, development and innovation funding, which is mostly provided by the Indonesian government by taking into account its readiness, can produce optimal outcomes and beneficial.

2. Literature Review

Technology Readiness Level, abbreviated as TKT, is the level of maturity or readiness of a particular technology research and development result which is measured systematically according to a scale of 1 – 9 (Kemristekdikti 2016). The general objective of measuring TKT is so that the technology can be adopted by users, both by the government, industry and society. The basic principle of measuring TKT is using the level of readiness of Research and Development results with indicators that are in accordance with each type of Research and Development in Indonesia. In general, TKT is divided into 9 levels with each having different indicators for each type of Research and Development.

Referring to Permenristekdikti Number 29 of 2019 concerning Measurement and Determination of the Innovation Readiness Level, it is explained that the Innovation Readiness Level, hereinafter referred to as Katsinov, is a method for estimating the Innovation readiness of an Innovation program in Companies, Research and Development Institutes, and Universities that in terms of technology, market, organization, partnership, risk, manufacturing, and investment aspects.

In Etzkowitz and Zhou (2018), it is explained that the triple helix interaction between university-industry-government is a universal model for the development of a knowledge-based society, through innovation and entrepreneurship. In the context of research funding in Indonesia, by 2022 there will be at least three main research funding schemes that use the triple helix concept, namely Matching Fund Kedaireka, Kemendikbudristek; Productive Innovative Research (RISPRO), LPDP Ministry of Finance; and Research-Based Start-ups, National Research and Innovation Agency.

Vik et al. (2021) developed a balanced readiness level assessment, hereinafter referred to as BRLa, which is a concept and methodology for assessing a balanced readiness level, which combines five dimensions of readiness, namely technological readiness, market readiness, regulatory readiness, organizational readiness, and acceptance readiness level. BRLa links the five dimensions of technology readiness together in a five-dimensional picture, providing an overall assessment of product development, where bottlenecks may occur and where technology development needs to be the focus of attention, making it relevant for use by actors involved in consulting services, funding, investment and technology development to assess technology readiness more comprehensively.

3. Methods

The research was conducted using an exploratory qualitative method using a design thinking approach through the following stages:

1. Empathy

In this research will use the method of in-depth interviews (in-depth interview) and persona. In-depth interviews were conducted by asking general questions regarding the demographics of the users and specific questions related to the development of the Balanced Readiness Level. Persona, In this study, the preparation of personas starts from the data from in-depth interviews and then clustering analysis is carried out based on several existing variables.

2. Define

The define define stage aims to make a meaningful and actionable problem statement (point of view). All data and information collected at the empathy stage are identified, analyzed, and synthesized to determine the core of the problem. In this study, it was carried out by compiling an empathy map followed by making a point of view (POV) and how might we (HMW).

3. Ideate

The ideate stage is a mode of the design process where it concentrates on generating ideas, providing source fuel for building prototypes and obtaining innovative solutions for users. This research was conducted by conducting a focus group discussion involving five people to brainstorm ideas that might be generated in the development of a Balanced Readiness Level.

4. Prototype

Prototype is the stage for communicating design ideas from a designer to targeted users or stakeholders. At the prototype stage, it can be anything that can interact with users. In this research, a prototype of the development of BRLa into CBRLa is prepared in the form of a spreadsheet which can later be used by users to determine the level of readiness of research or innovation with the triple helix model to reach implementation/commercialization.

4. Data Collection

Data collection starts from the empathize stage by involving 35 respondents who have different roles in a funding with a triple helix model, namely 5 people from the element of researchers, 5 people from funding institutions, 5 people managing funding at research institutions, 5 experts TKT, 5 Katsinov Experts, 5 RRL experts, and 5 people from industry elements. Furthermore, 5 user personas were formed from the respondents involved and defined points of view and how might we from these 5 user personas. Next, enter the third stage, namely Ideate, 5 users who describe personas are involved in conducting focus group discussions to brainstorm ideas that might be generated in developing the Balanced Readiness Level. Then at the prototype stage, researchers rearrange BRLa into a CBRLa prototype in a spreadsheet.

5. Results and Discussion

Based on the methods and data collection that has been carried out through a design thinking approach, the following results and discussions are obtained:

1. Empathy Stage

A total of 35 respondents were involved with the following demographics 9figure 1):

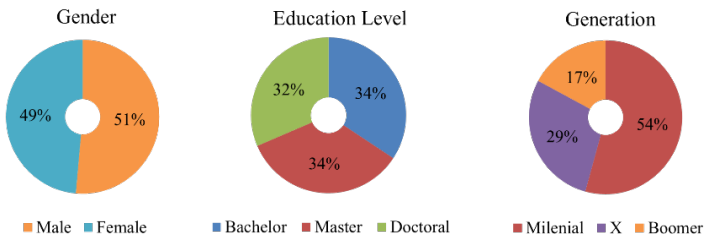


Figure 1. Demographics Responden

From the demographics, clustering for personas is carried out with K-Modes Clustering Non-Hierarchical Method as follows on Table 1.

Table 1. Persona Characterization

Variables	Clusters				
	1	2	3	4	5
Education Level	Doctoral	Master	Bachelor	Doctoral	Bachelor
Generation	Boomer	Milenial	Boomer	Gen X	Milenial
Gender	Male	Male	Male	Male	Female
Role	TKT Assessor	RRL Assessor	Industrial Practitioner	Researcher	Research Institutions Staff
Instrument	TKT	RRL	TKT	TKT, Katsinov	TKT, Katsinov
Knowledge of Instrument	Good	Good	Enough	Good	Poor

The description of the persona is explained as follows in figure 2:

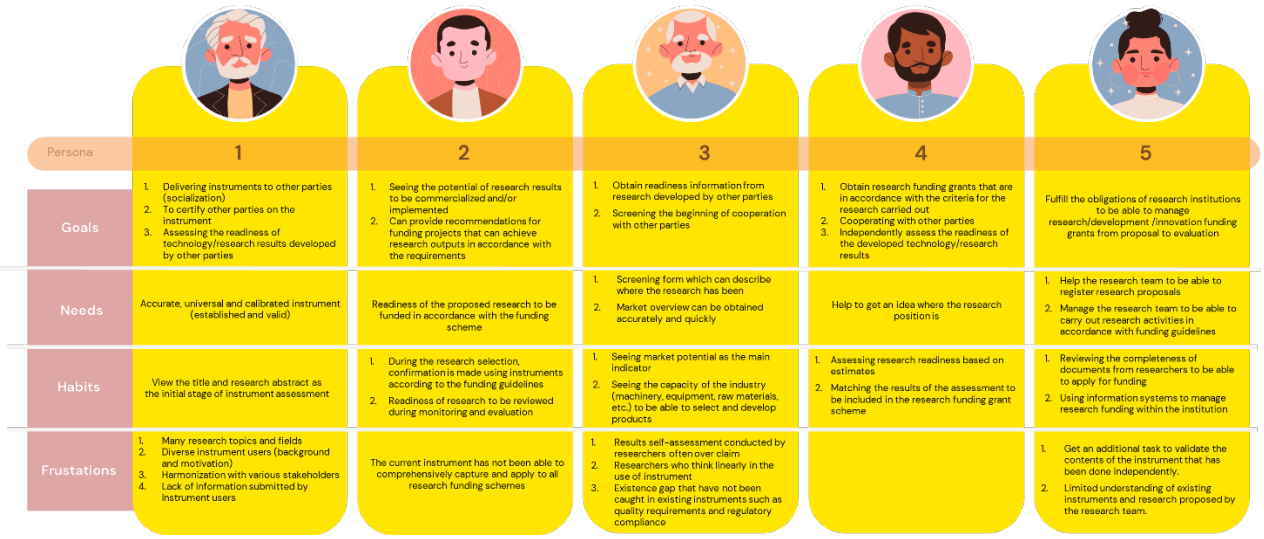


Figure 2.Personas

2. Define stage

The point of view (POV) of the persona is that researchers, research institutes, reviewers, funders, and partners/industry need one standard and can be validated tools to be able to see the readiness of research/development/innovation so that the current picture and suggested improvements can be obtained so the output of funding can be commercialized/implemented well. As for how might we (HMW) are:

1) How might we make standard tools that can be used for funding with the triple helix model
2) How might we make a guide to the use of tools that can facilitate understanding so that it can be used by researchers, research institutions, reviewers, funders, and partners/industry
3) How might we make tools that can provide recommendations for the development of research/development/innovation that can be commercialized/implemented properly

3. Ideation Stage

Through focus group discussions, ideas are explored that focus on the point of view and how might we that have been compiled in the previous stage with the production of mind maps that answer the 5W + 1 H (what, who, when, why, where, and how) questions for CBRLa development as follows in figure 3:

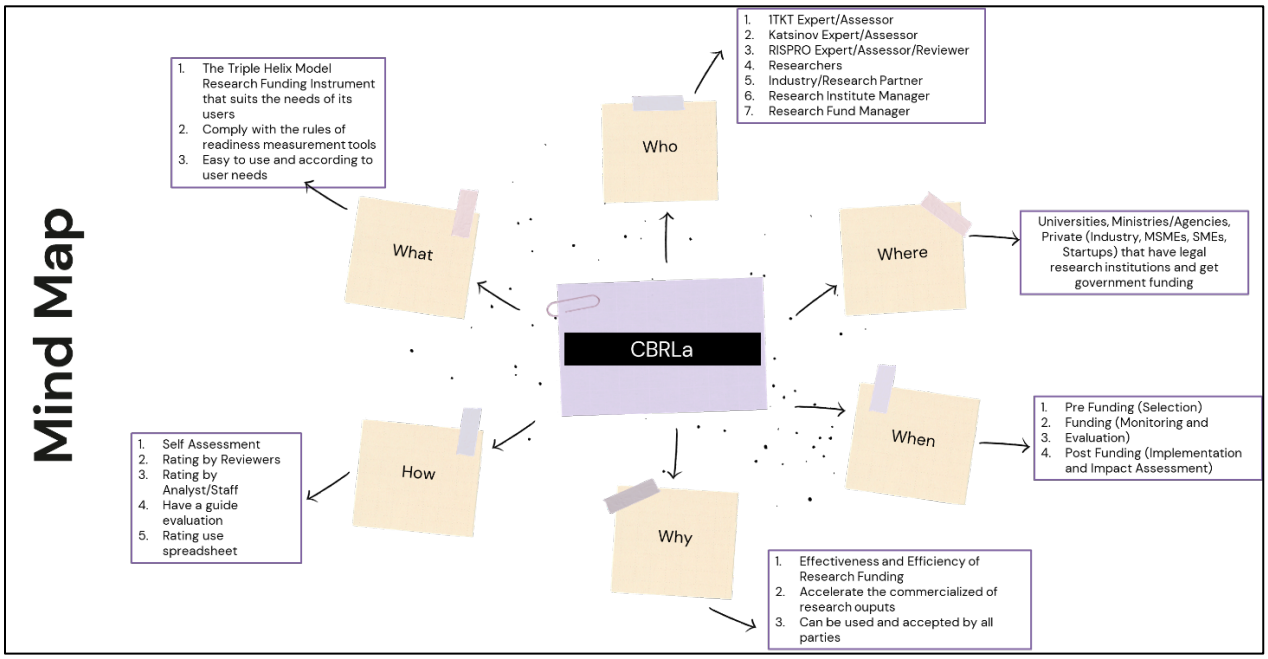
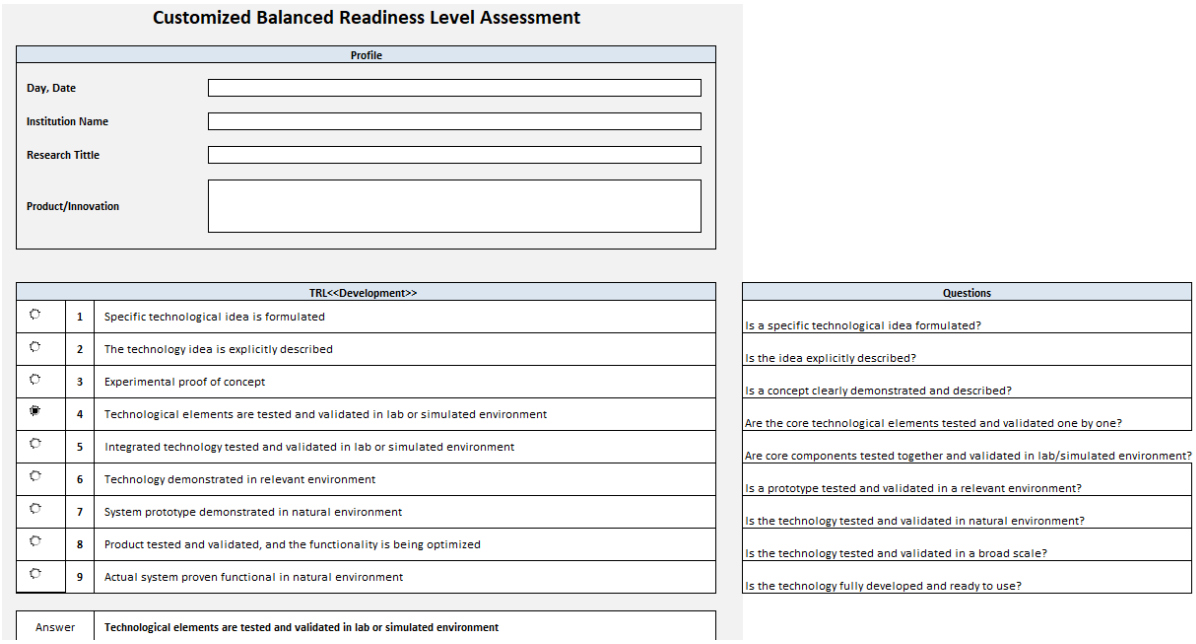


Figure 3. Mind Map of CBRLa FGD Ideation Stage

4. Prototyping Stage

At this stage the researcher begins to develop a CBRLa prototype based on the input in the previous stages, the figure 4 is an overview of the CBRLa spreadsheet (Figure 4)



Customized Balanced Readiness Level Assessment

Profile	
Day, Date	
Institution Name	
Research Tittle	
Product/Innovation	

		TRL<<Development>>	Questions
○	1	Specific technological idea is formulated	Is a specific technological idea formulated?
○	2	The technology idea is explicitly described	Is the idea explicitly described?
○	3	Experimental proof of concept	Is a concept clearly demonstrated and described?
◉	4	Technological elements are tested and validated in lab or simulated environment	Are the core technological elements tested and validated one by one?
○	5	Integrated technology tested and validated in lab or simulated environment	Are core components tested together and validated in lab/simulated environment?
○	6	Technology demonstrated in relevant environment	Is a prototype tested and validated in a relevant environment?
○	7	System prototype demonstrated in natural environment	Is the technology tested and validated in natural environment?
○	8	Product tested and validated, and the functionality is being optimized	Is the technology tested and validated in a broad scale?
○	9	Actual system proven functional in natural environment	Is the technology fully developed and ready to use?

Answer	Technological elements are tested and validated in lab or simulated environment

Figure 4. Snapshot CBRLa Spreadsheet

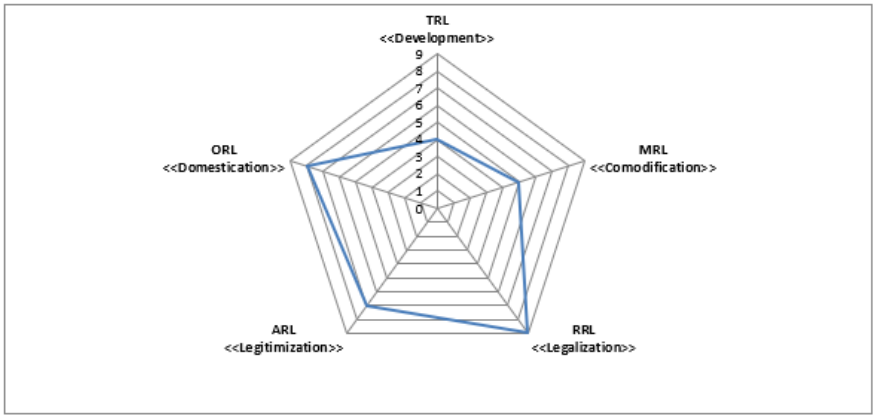
And the following is an illustration of the output of CBRLa filling (Figure 5):

Customized Balanced Readiness Level Assessment

Profile	
Day, Date	5/12/2022
Institution Name	LPDP
Research Tittle	Development of Customized Balanced Readiness Level Assessment Prototypes for
Product/Innovation	CBRLa

Customized BRLa Index	73	Promising

Dimensions	Statement	Notes
TRL<<Development>>	Technological elements are tested and validated in lab or simulated environment	Technological elements are tested and validated in lab or simulated env
MRL<<Comodification>	Business model described	Business model described
RRL<<Legalization>>	Use and production are regulatory unproblematic	Use and production are regulatory unproblematic
ARL<<Legitimization>>	The technology is seen as controversial in parts of the sector	The technology is seen as controversial in parts of the sector
ORL<<Domestication>>	A concrete plan for integration with existing work processes is formulated	A concrete plan for integration with existing work processes is formulate



Recommendation

Figure 5. Illustration of the output of CBRLa

From the prototype that has been made, briefly the features that have been built have adapted to the needs of its users as follows:

1) Has 5 Dimensions
2) Has 9 Scales for each Dimension
3) Arranged in Automatic Spreadsheet (Filling with checklist)
4) Rating from lowest to highest scale questions (ensures no level of readiness is missed)
5) There is an assessment index to be considered in decision making
6) Statements and Questions adapted for general use in research projects
7) Can see progress, assessment more than once (different time/different rater)
8) The assessment guide is prepared to be guided by CBRLa users
9) Provided in two languages (English | Bahasa)
10) Can provide notes on each achievement level of readiness

6. Conclusion

Based on the prototype development which was carried out through the design thinking stage starting from the empathy stage which resulted in 5 user personas of users of research readiness instruments funded by the triple helix model, namely Researchers, Research Institutes, Reviewers, Funders, and Partners/Industry. Furthermore, it is defined that the user needs a standard tool that can be validated to be able to see the readiness of research/ development/innovation so that an overview of the current position and recommended improvement points can be obtained so that the results of research/development/innovation can be commercialized/implemented properly. This prototype can still be developed up to the implementation and trial stages for funders or reviewers in assessing proposals as well as monitoring and evaluating the implementation of research funded by the triple helix model.

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Biography

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