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DEVELOPMENT OF RESEARCH ROADMAP OF THE EXCELLENCE FIELD OF SCIENCE UNESA: TSUNAMI SCIENCE

Madlazim*, Fida Rachmadiarti, Masriyah, Sifak Indana, Elok Sudibyo, and Binar Kurnia Prahani

[1]*Faculty of Mathematic and Natural Science*, *Universitas Negeri Surabaya*, *Surabaya 60231*, *INDONESIA*. *E-mail*: *madlazim@unesa.ac.id*

ABSTRACT

This research aims to produce a Research Roadmap of the Excellent Field of Science Unesa: Tsunami Science. The design of this research was Educational Design Research (EDR). The research site was chosen at the Surabaya State University (Unesa). This research was conducted using the modified ADDIE Model, with five stages including needs analysis, design, development, evaluation, and reporting. The Research Roadmap of Tsunami Early Warning (RRTEW) is an operational form of the Research Roadmap of Excellent Field of Science Unesa: Tsunami Science which is included in the Research Master Plan (RMP) and the Strategic Plan (RP) for Unesa Research in 2020-2030. RRTEW was given to 15 experts through a validation process using the Expert Validation Sheet. Research data in the form of scores from expert assessments were analyzed using a single measure interrater coefficient correlation (r_{α}) to determine validity and using Cronbach's alpha (α) to determine RRTEW reliability. In addition, the results of the validation and input from experts will be used as a reference for revising RRTEW. The evaluation of all components of RRTEW by three experts was declared valid and reliable. The implications of this research are expected to: (1) provide an example of a Research Roadmap of Excellent Field of Science Unesa: Tsunami Science in tertiary institutions; (2) contributing thoughts to policymakers regarding the development of a Research Roadmap of Excellent Field of Science Unesa: Tsunami Science; (3) contributing thoughts to the academic community in increasing research in the form of developing a Research Roadmap of Excellent Field of Science Unesa: Tsunami Science.

Keywords: *Research Roadmap, Science Tsunami, Educational Design Research (EDR)*

1. INTRODUCTION

The industrial revolution 4.0 and Society 5.0 is a fundamental change in the industrial sector which has entered a new era. The Industrial Revolution 4.0 and Society 5.0 have also forced universities to produce graduates who have superior competence in global competition. Competencies that must be owned by graduates include Critical Thinking (Atabaki et al., 2015; Birgili, 2015; Temel, 2014), Collaboration (Griffin & Care, 2015), Creativity (Dwikoranto et al., 2019; Wicaksono et al., 2019; Zulkarnaen et al., 2017), Problem Solving (Jatmiko et al., 2016; Pandiangan et al. 2017). In addition, the main pillar of the 4.0 Industrial Revolution and Society 5.0 are of course digital-based technology that college graduates must master, including Internet of Things, Big Data, Augmented Reality, Cyber Security, Artificial Intelligence, Robotic Automation, Simulation, Integrated Systems, Additive Manufacturing, and Cloud Computing. This is a challenge in itself that must be resolved by universities in Indonesia. Besides, in 2020 there are only eleven state universities in Indonesia that have the status of legal entities. There are only eleven state universities that have legal entity status, of the total state universities in Indonesia there are 122 universities. The latest news from the Ministry of Education and Culture of the Republic of Indonesia encourages state universities to become a legal entity.

This opportunity from the Ministry of Education and Culture of the Republic of Indonesia, as well as the challenges of industrial revolution 4.0 and Society 5.0, has been responded positively by Unesa as one of the State Universities with the status of a Public Service Agency to become Legal Entity University. The development of the achievement of Unesa's vision in 2020-2030 Recognize Regional Teaching University is also one of the references for preparing Unesa to change its status from Public Service Agency to become Legal Entity University. Strengthened as a campus institution, Unesa has received accreditation with a rating based on decree number 5245/SK/BAN-PT/Akred/PT/XII/2017. Besides, there is also an urgent need related to Study Program Accreditation and Accreditation of 9 criteria for Higher Education. One of the preparations that need to be carried out is that Unesa must have a Research Roadmap of Excellent Field of Science Unesa: Tsunami Science in 2020-2030.

Research Roadmap of the Excellent Field of Science Unesa which are included in the Research Master Plan (RMP) and the Unesa Research Strategic Plan in 2020-2030. The fact that until 2020 Unesa does not have this official document. One of Unesa's excellence in science is research related to tsunami science. Tsunami is one of the most unpredictable hazards (Madlazim & Supriyono, 2014; Madlazim et al., 2020; Madlazim & Hariyono, 2020). In Indonesia, it has also been proven that areas that are often affected by the Tsunami disaster (Madlazim et al., 2020; Madlazim & Hariyono, 2020). To cultivate this, it is necessary to have a Research Roadmap of the Excellent Field of Science Unesa: Tsunami Science. One form of operation is the Research Roadmap of Tsunami Early Warning (RRTEW).

Research Urgency - Until 2020 there is no Research Roadmap of the Excellent Field of Science Unesa document that is included in the Research Master Plan and the Unesa Research Strategic Plan in 2020-2030. Therefore, it is very important to carry out specific research to produce a Research Roadmap of the Excellent Field of Science Unesa: Tsunami Science. One form of operation is the Research Roadmap of Tsunami Early Warning (RRTEW).

Research Objective - This research aims to produce a Research Roadmap of the Excellent Field of Science Unesa: Tsunami Science. One form of operation is the Research Roadmap of Tsunami Early Warning (RRTEW).

2. METHODS

The design of this research was Educational Design Research (EDR) (Plomp, 2013). It aims to produce a Research Roadmap of the Excellent Field of Science Unesa: Tsunami Science. This research will be conducted for 8 months to be exact May - December 2020. The research place is chosen at the Surabaya State University (Unesa). The Research Roadmap of Tsunami Early Warning (RRTEW) is an operational form of the Research Roadmap of the Excellent Field of Science Unesa: Tsunami Science which is included in the Research Master Plan and the Strategic Plan for Unesa Research 2020-2030. The results of this development are expected to answer the need that until 2020 Unesa does not have the official document. Including Unesa does not yet have a Research Roadmap of the Excellent Field of Science Unesa: Tsunami Science in 2020-2030. This research was conducted using the modified ADDIE Model, with five stages including needs analysis, design, development, evaluation, and reporting. The research flow diagram is shown as shown in Figure 1.

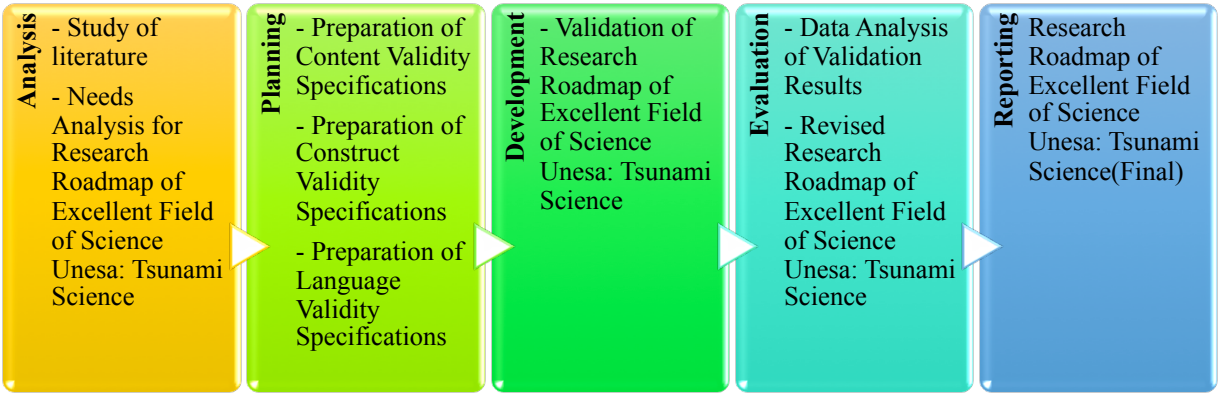


Figure 1. Development of Research Roadmap of Excellent Field of Science Unesa: Tsunami Science

RRTEW was given to 15 experts through a validation process to get suggestions and improve quality. The revision results according to input 3 validators will be used as a reference for revising RRTEW. Research data in the form of scores from expert assessments were analyzed using a single measure interrater coefficient correlation (r_{α}) to determine validity and using Cronbach's alpha (α) (Malhotra, 2011; Jatmiko et al., 2018) to determine the reliability of RRTEW. Looking for validity: If Single measure interrater coefficient correlation (r_{α}) or r count (r_{α}) > r table, then it is declared valid. Looking for Reliability: (a) If the value of Cronbach Alpha (α) > 0.60, it is declared reliable. (b) If the value of Cronbach Alpha (α) <0.60, it is declared unreliable.

3. RESULTS AND DISCUSSION

The Research Roadmap of Tsunami Early Warning (RRTEW) which had been developed was then validated by 15 experts. The results of the Roadmap Content, Construction, and Language Validation are presented in Table 1.

Table 1. Validation of Research Roadmap of Tsunami Early Warning (RRTEW)

Aspects of RRTEW Assessment	Validity and Reliability			
	Score	Validity	r_a	α
Content Validity				
1. RRTEW has a novelty according to the R&D aspect	3.80	VV	0.45	0.88
2. RRTEW has a novelty according to the Technology Aspect	3.70	VV		
3. RRTEW has a novelty according to Product aspects	3.70	VV		
4. RRTEW has a novelty according to the stages of Product Design, Product Prototype, and Product Commercialization	3.80	VV		
5. RRTEW meets the demands of the times according to the R&D aspect	3.85	VV		
6. RRTEW meets the demands of the times according to the Technology Aspect	3.70	VV		
7. RRTEW meets the demands of the times according	3.70	VV		
8. RRTEW meets the demands of the times according to the stages of Product Design, Product Prototype, and Product Commercialization	3.80	VV		
Conclusion: The results of the RRTEW content validity can be used.				
Construct Validity				
1. RRTEW is developed logically according to the R&D Aspect	3.70	VV	0.40	0.87
2. RRTEW is developed logically according to the Technology Aspect	3.80	VV		
3. RRTEW is developed logically according to the Product Aspect	3.70	VV		
4. RRTEW is developed logically according to the stages of Product Design, Product Prototype, and Product Commercialization	3.80	VV		
5. RRTEW has a logical and reasonable physical size	3.60	VV		
6. RRTEW has interesting and easy to read fonts	3.80	VV		
7. Consistency of RRTEW layout	3.80	VV		
8. RRTEW has elements of a harmonious layout	3.75	VV		
9. RRTEW has a complete layout element	3.80	VV		
10. RRTEW has a layout that can speed up understanding	3.80	VV		
11. Typography of RRTEW content is relatively simple	3.80	VV		
12. Typography of RRTEW Unesa is easy to read	3.80	VV		
13. Typography of RRTEW content makes it easy to understand	3.80	VV		
14. The illustration of RRTEW content is considered appropriate	3.70	VV		
Conclusion: The results of the RRTEW construct validity can be used.				
Language Validity				
1. RRTEW has precise sentence structure	3.90	VV	0.38	0.89
2. RRTEW has sentence effectiveness	3.50	VV		
3. RRTEW has a standardized term	3.80	VV		
4. RRTEW makes it easier to understand messages or information	3.80	VV		
5. RRTEW has a precise language	3.75	VV		
6. RRTEW can correct spelling	3.90	VV		
7. RRTEW has a consistent use of terms	3.80	VV		
8. RRTEW has consistent use of symbols or icons	3.80	VV		
Conclusion: The results of the RRTEW language validity can be used.				

Keterangan: r_a = *Single measure interrater coefficient correlation;* α = *Cronbach's alpha ;* VV = Very Valid

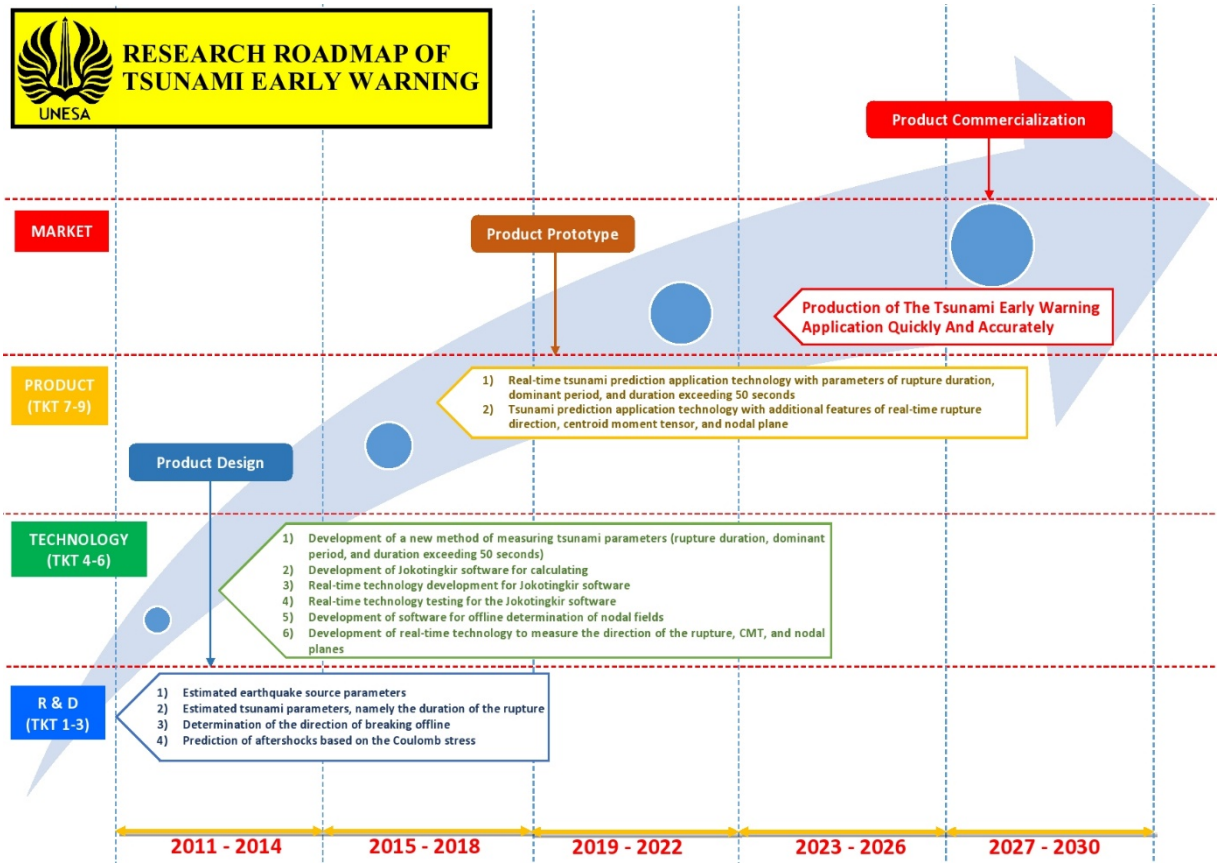


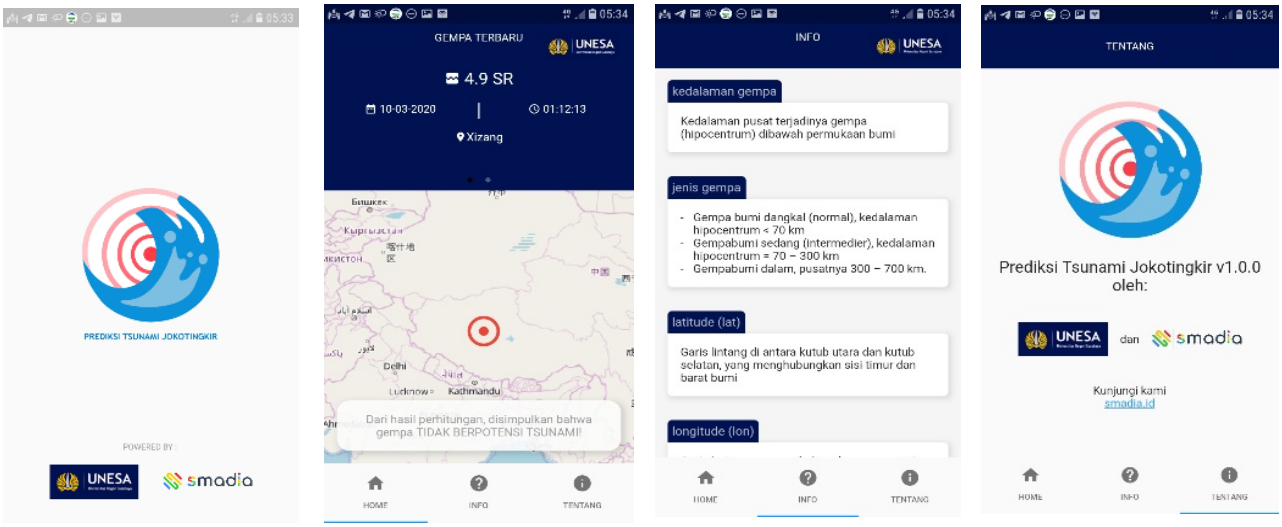
Figure 2. *Research Roadmap of Tsunami Early Warning* (RRTEW)

The evaluation of all RRTEW components by 15 experts was declared valid and reliable. The implications of RRTEW can then be used as a reference in the development of Unesa 2020-2030. The results of this validity are supported by the opinion of Plomp (2013) which states that a good product must meet the validity requirements. The product validity can be tested by testing the content validity and construct validity. The content validity is there is a need for the intervention and its design is based on state-of-the-art (scientific) knowledge. (Nieveen et al., 2007). Construct validity is the intervention is "logically" designed (Nieveen et al., 2007). One of the operational forms of Unesa's flagship is Tsunami Early Warning.

Figure 2 shows the 2020-2030 Research Roadmap of Tsunami Early Warning at the R&D stage consisting of: (1) Estimated earthquake source parameters; (2) Estimated tsunami parameters, namely the duration of rupture; (3) Determination of the direction of breaking offline; (4) prediction of aftershocks based on the Coulomb stress. The technology stage consists of: (1) Development of new method of measuring tsunami parameters (rupture duration, dominant period, and duration exceeding 50 seconds); (2) Development Jokotingkir software for calculating; (3) Real-time technology development for Jokotingkir software; (4) Real-time testing technology for Jokotingkir software; (5) Development of software for offline determination of nodal fields; (6) Development of real-time technology to measure the direction of the rupture, CMT, and nodal planes.

The Product Stage consists of: (1) Real-time tsunami prediction application technology with parameters of rupture duration, dominant period, and duration exceeding 50 seconds; (2) Tsunami prediction application technology with additional features of real-time rupture direction, centroid moment tensor, and nodal plane. The Market section consists of: Production of the Tsunami Early Warning Application Quickly and Accurately. The results of this development answer the need that until 2020 Unesa does not have this official document. Including Unesa does not yet have a Research Roadmap of Excellent Field of Science Unesa: Tsunami Science in a concrete operational form as presented in Figure 2. Figure 2 is supported by the results of research on the theme of Tsunami which is still a favorite in the last 10 years (Gusman et al., 2017; Heidarzadeh et al., 2019; Jayaratne et al., 2016; Kuswandi & Triatmadja, 2019; Lomax & Michelini, 2013; Lomax & Michelini, 2011; Lomax & Michelini, 2012 Madlazim et al., 2020; Mikami et al., 2012; Newman et al., 2011; Ozaki, 2011; Power et al., 2017; Socquet et al., 2019; Suppasri et al., 2013; Takabatake et al., 2019; Triatmadja & Benazier, 2014; Triatmadja & Nurhasanah, 2012; Tsushima et al., 2011; Ulrich et al., 2019; Watkinson & Hall, 2017; Yeh et al., 2013).

Several international-level studies and publications examining tsunamis in Indonesia (Bisri & Sakurai, 2017; Esteban et al., 2013; Giachetti et al., 2012; Hamzah et al., 2000; Seng, 2013; Taubenböck et al., 2009; Watkinson & Hall, 2017; Widiastuti et al., 2019; Omira et al., 2019; Sassa & Takagawa, 2019; Suppasri et al., 2015; Kongko and Hidayat, 2014), this shows that the trend of Tsunami research in Indonesia has still become a topic of interest to the international community. One of the trends generated by researchers based on the Research Roadmap of Tsunami Early Warning (RRTEW) is Joko Tingkir's Tsunami Prediction. Tsunami Prediction Joko Tingkir will provide a warning through notification if there is a potential earthquake (Madlazim et al., 2020) in Figure 3.



(Source: Playstore/PrediksiTsunamiJokotingkir)

Figure 3. Tsunami Prediction Joko Tingkir

The implications of this research are expected to: (1) provide an example of a Research Roadmap for Excellent Field of Science: Tsunami Science in tertiary institutions; (2) contributing thoughts to policymakers regarding the development of a Research Roadmap of Excellent Field of Science Unesa: Tsunami Science; (3) contributing thoughts to the academic community in increasing research in the form of developing a Research Roadmap of Excellent Field of Science Unesa: Tsunami Science.

4. CONCLUSIONS

One of the operational forms of the Unesa Research Roadmap for Excellent Science: Tsunami Science is the Research Roadmap of Tsunami Early Warning (RRTEW) has been declared valid and reliable. The Unesa Research Roadmap for Excellent Science: Tsunami Science can be used in the development of Unesa in 2020-2030. This research implies that it is necessary to socialize the Unesa Research Roadmap for Excellent Science: Tsunami Science to the entire Unesa academic community. In addition, each lecturer is also conditioned to have a Research Roadmap individually or in clumps so that research in the Unesa environment can progress rapidly. The benefit for other researchers is that it can be used as a comparison in developing a research roadmap related to tsunami science in their country.

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