Defining e-Portofolio Factor for Competency Certification using Fuzzy Delphi Method

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ABSTRACT
This study is introducing the e-Portfolio function as a storage, workspace and showcase to support Competency Certification in Indonesia. Thus, the mix-method approach was implemented on determining important elements of e-Portfolio as a storage, workspace and showcase for competency assesment context. The research implemented thematic analysis and Fuzzy Delphi Method to obtain the result. Therefore, 20 experts in certification competency domain were participated in the process. As resulted, this study highlighted the basic role of e-Portfolio consists; workspace, storage and showcase.

INTRODUCTION
Indonesia as the country with the largest population in the ASEAN region, should be ready to face the free flow of labor both at regional (Economic ASEAN Community) and global (China-Asian Free Trade Agreement) levels (The ASEAN Secretariat, 2015), but the condition of Indonesian workers still showed relatively low competitiveness compared to the ASEAN member countries (Biro Pusat Statistik, 2015; The ASEAN Secretariat, 2015). To raise the competitiveness, Indonesia's government try to improve quality of human resources in Indonesia (Republik Indonesia, 2003, 2012, 2007). The Government set up some policies in objective to improving the quality of Indonesian human resources in national development, set up the system, the structure, organization and guidelines for integrating education and job training and work experience in order job competence recognition awards. ("PerMenakertrans no. 14 tahun 2015," n.d.; Republik Indonesia, 2006, 2014)
In line with the process of increasing the competence of labor in the process of obtaining certification of professional competence in Indonesia, previously performed Portfolio assessment process conducted by the Board of Certification of Profession Competency (Republik Indonesia, 2004) assisted by the Certification Body (Republik Indonesia, 2004), an assessment methods against someone based on those documents. The document is evidence that the professional has had a competency. To ensure that the portfolio held information is correct, then the assessor may verify the portfolio related to documents filed with the competency test participants using four criteria rules of evidence (Valid, First, Latest, Sufficient) ("PerMenakertrans no. 14 tahun 2015," n.d.) (Republik Indonesia, 2004). However, the assessment portfolio process has a weakness, the portfolio is in paper form, the time for inspection the portfolio required a long time, there is no standard guidence to determine which one evidence must be submitted, it cannot be used to test a unit in an integrated, cannot render the evidence is not written, the reference list or index of the portfolio proposed to be set in advance, the evidence indicated must be current and valid and the election and an explanation of the evidence submitted by the participants competency tests may have an impact the expected results.

Based on the issues, e-portfolios can be the one way to solve it, where e-Portfolio as a professional profile in digital form can capture and compare the information on the level of skills and professional competence, potential for development, and career prospects (JISC, 2009; Smith, 1996; Woodbury, Addams, and Neal 2009). Besides e-Portfolio also have broad implications for public tool used by the government where they can be used to describe the services provided by the government, which is a service that is more transparent and more accountable pursuant to Presidential Instruction No. 3 of 2003, O'Brien et al, (O'Brien, Osbaldiston, & Kendall, 2014) stated e-Portfolio is a form of e-government implementation in the development of an entrepreneurial society independently.

Therefore, the functions of E-portfolio is required for develop e-portfolio model (Albert, 2006; DiMarco, 2006; Young & Morriss, 2007). This study was conducted to applying Fuzzy Delphi method to gain expert consensus for e-portfolio functions especially for competence certification in Indonesia.

THE LITERATURE STUDY

1. Certification of Competence

The key elements of professionalism are defined by Walrad in three elements, i.e. public obligation, personal integrity, responsibility, accountability and competence (Walrad, 2017). One of the elements, competence, is used as the well-accepted standards to find the professions with the good understanding of their activities (Walrad, 2017). To find those competence professions, an organization use the certification of competence through an assessment test. Certification helps to evaluate an individual's skills, knowledge and abilities to know the current level of expertise (Davies, Randall, & West, 2015). Competence is not only assessed by a certification test but also it can be evaluated by the related documents, called portfolio.

2. E-Portfolio Function

One of e-Government implementation is e-portfolio (O'Brien et al., 2014). E-Portfolio is a workforce assessment data collection to present the individual's competence in the specific field using electronic or technology devices (Rahayu, Indra, Purwandari, Budi, & Zulkarnaim, 2016). It can be used as a solution to process the certification of individual's competence by capturing and comparing the information on e-portfolio system (Jose, 2017). It supports the government services more accountable and transparent. According to David Jose, there are five key features to reach of e-Portfolio objectives, including electronic storage, personalization, showcasing, reflection and feedback, and assessment (I Balaban, Divjak, & Mu, 2011).

Table 1: The Mapping Definition and Type of e-Portfolio, source: (Rahayu et al., 2016)

NO	AUTHOR / YEAR	DEFINITION	TYPE
1	NLII (Morrison, 2003)	A diverse collection of evidence is authentic and represents what the individual or organization to learn from time to time including the self-evaluation process and is designed to be represented by a particular purpose	Collection (storage), Showcase
2	Siemens, 2004	Products made of students shaped collection of digital artifacts to demonstrate experience, achievement and learning, where there is a process of planning, synthesis, share, discuss, evaluation, and responding to feedback.	Collection (storage), Self-development (workspace)
3	Abrami & Barrett, 2005	Set the goal of student work that tells the story of the business, student progress and / or achievements in one or more areas	Showcase, recognation
4	P Butler, 2006	A collection of evidence gathered together to show one's learning journey from time to time and to demonstrate their ability	Collection (storage)
5	European Institute For E-Learning (Haig et al., 2007)	Digital collection of personal information that describes and illustrates one's learning, career, experience and achievements	Collection (storage), showcase
6	JISC (Cambridge, 2008; Gray, 2008)	A diverse collection of evidence container, digital learning materials designed to manage learning and achievement to show the development of the self with different goals	Collection (storage)
7	NET Plan (Peters & Araya, 2010)	Products made of students shaped collection of digital artifacts to demonstrate experience, achievement and learning, where there is a process of planning, synthesis, share, discuss, evaluation, and responding to feedback.	Recognation (workspace), Showcase
8	Barrett, 2011	A virtual platform (showcase) in the form of narrative can be seen (public / private) for a variety of needs (varying permission) that supports (workspace) process or Archive Collection Digital Repository Artifact Personal Information, journals self-evaluation	Recognation (workspace), Self-Development (workspace)
9	Class, 2012	Collection of electronic evidence that shows learning from time to time with the room dynamic learning where they can capture their learning, their ideas, access to their collection of their work, reflect on their learning, share their learning, set goals, seek feedback and showcase learning and their achievements.	Recognation (workspace), Self-Development (workspace)
10	Igor Balaban, Mu,	A digital personal records that support formal learning, informal	Recognation

	& Divjak, 2013b	and non-formal and contains evidence of individual achievement in the form of artifacts and self-evaluation that can be given to whom the owner has chosen to give permission	(workspace), Showcase
11	Kim,P.,Ng,C.,&Lim ,G., 2010	an ePortfolio system design based on Private-Public (PrPl) data index system, which integrates cloud computing applications and storages with Semantic Web architecture, making semantic web-based visualisation and advanced intelligent search possible.	Recognation (workspace), Showcase

3. Fuzzy Delphi Method

The disadvantages of traditional Delphi Method (DM), including the possibility of losing the key information and time-consuming in exploration, is underlying the improvement of new method called Fuzzy Delphi Method (Saffie, Amirah, Shukor, Rasmani, & Sembilan, 2016). Combined by classic Delphi Method and Fuzzy Set Theory, FDM covers the ambiguity and repeatation technique on the old method in achieving the acceptable standard (Chen, Chen, Wang, & Tai, 2016). It is used to collect and classify the qualified expert knowledge in natural language using questionnaires with the feedback and review from them (Sayari, Yaghoobi, & Ghanaatpishe, 2014). FDM ensure the validity and verify the elements through expert opinion and consensus (Mohamad, Embi, & Nordin, 2015). Therefore, FDM is widely utilized in many fields, such as humanities, business and management, physical science and engineering including information system (Saffie, Shukor, & Rasmani, 2016).

The difference of FDM and old DM is the use of probability theory instead of mathematical concepts to address the fuzziness of natural language in the decision making (Saffie, Shukor, et al., 2016). It means that DM uses absolute numbers in addressing the expert judgement.

FDM is initialized by Murray et al. to resolve the ambiguity in DM (Murray, Pipino, & Gigch, 1985). Then it is improved by many studies, including Ishikawa et al. who developed FDM algorithm using the implementation of the Max-Min Fuzzy Delphi Method and the new DM through Fuzzy Integration (Ishikawa et al., 1993). The improvement version proposes the weighted intuitionistic FDM to achieve the better conclusions (Garai et al., 2013).

METHODOLOGY

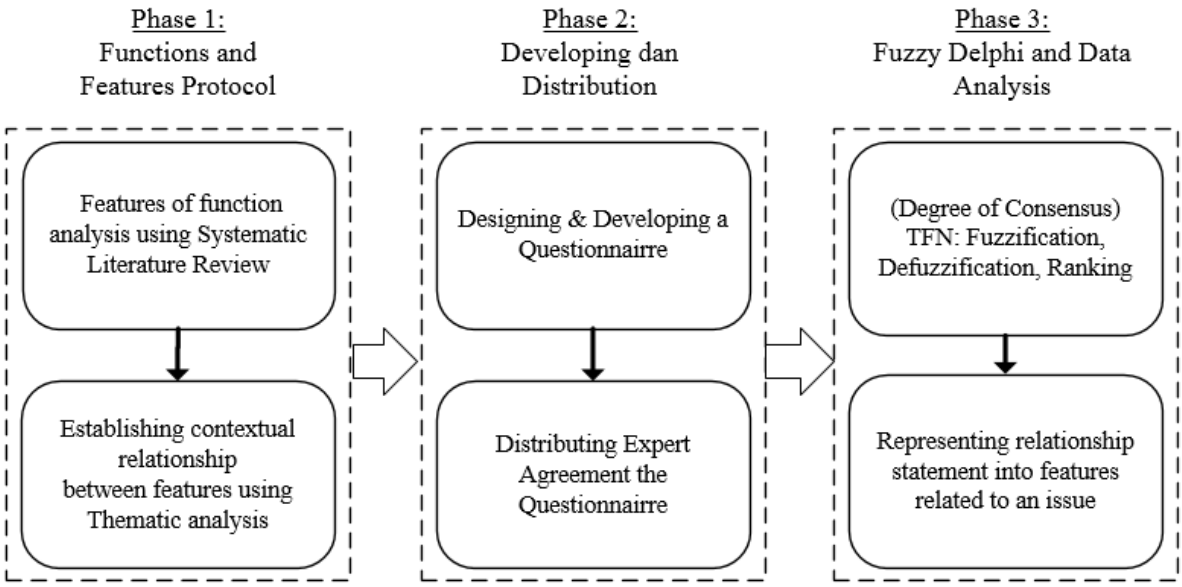

Figure 1

1. Phase 1:

The first phase of data collection involves semi-structured interviews with e-Portfolio experts from BNSP, LSP and government agencies. The thematic analysis is implemented to validate the functionality in e-portfolio obtained from the literature review. In conducting the analysis, the researcher adopted the thematic analysis

methods by Barun & Clarke (Braun & Clarke, 2006) which have proposed six steps in. The stages are shown in Figure 2.

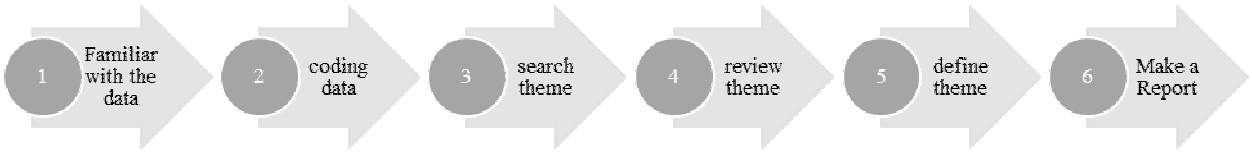

Figure 2. Thematic Analysis Stages

The interview process is conducted in the form of open questions to get expert judgement. The statements in the form of interview transcripts are processed using NVivo11 tools, to obtain themes and sub themes, so that interconnection and inter-theme relationships are obtained. The result of the thematic analysis from the 7 experts is shown in Figure 2

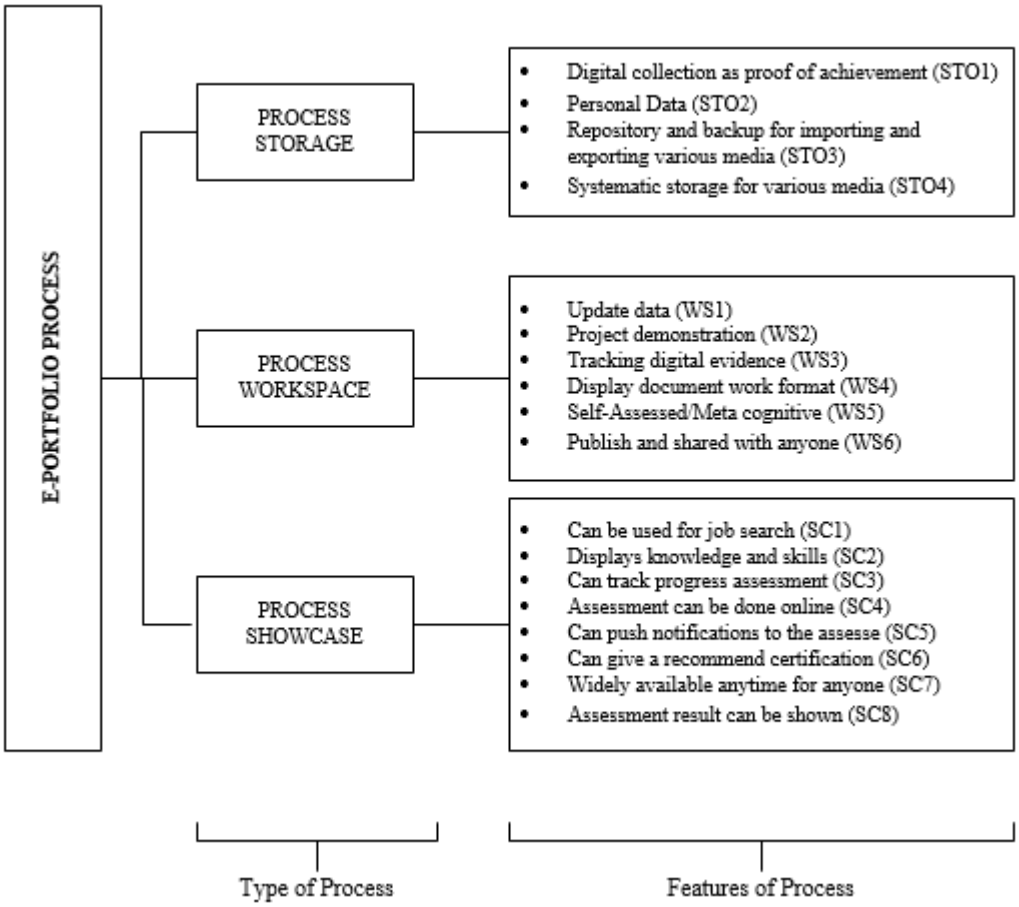

Figure 3. Theme and Sub-theme

2. Phase 2:

The FDM questionnaire was designed and administered to 25 experts. The experts came from 3 sectors: academia, government, and industry (Community of Practice). Furthermore, they had at least 5 years of working experience related to competency certification, ICT, Competen. A total of 25 copies were distributed to experts, but 20 valid copies were returned.

Table 2: Fuzzy Delphi Technique

Phase	**Total Expert**	**Instrument Design**
First step (Establishment of survey instrument)	6 Experts	Structured Interviewed (open questions)
Second step (Obtain consensus)	20 Experts	Survey Instruments

3. Phase 3: Fuzzy Delphi and Step-By-Step Data Analysis

Step 1: Determining the experts. Twenty Ex8 or Table 3? perts are invited to answer a list of questions, to decide the importance of the evaluation criteria and the ratings of alternatives with respect to various criteria using variables (Table 1).

Table 8: Variable for the importance weight of criteria

No	Variables	Scale Fuzzy		
1	Strongly agree	0.6	0.8	1
2	Disagree	0.4	0.6	0.8
3	Not Sure	0.2	0.4	0.6
4	Agree	0	0.2	0.4
5	Strongly Agree	0	0	0.2

Step 2: Experts determine the importance weight of criteria.

The researchers chose five variables for importance weight of criteria ranging from 'Strongly Agree', 'Agree', 'Not sure', 'Disgree', 'Strongly Disagree'.

Step 3: Get an average rating.

The average value is determined accordingly the formula specified. Here is the formula used to get the average value:

Step 4: Specifies the value of 'd' (Threshold value).

If the value d is d <0.2, then all experts have reached a consensus agreement

If the value of d is d> 0.2, the researchers have to repeat the procedure.

Step 5: Gain 75% consensus.

At this point, researchers have come to a decision or agreement on a group of experts is known as a consensus group. Past decided that a 75% consensus would occur should show agreement among expert. If the consensus is less than 75%, researchers should repeat the procedure to ensure there is at least 75% consensus among the experts.

Step 6: Conduct a Fuzzy evaluation.

Evaluation is one of the most reliable methods of ranking. In its implementation This process is quite difficult because it involves complex numbering and alternative methods using mathematical formulas to rank.

Step 7: Defuzzified (process to determine the weights).

Three formulas can be used in the defuzzification process to rank / print items:

1. Amax = 1/3 * (a1 + am + a2)
2. Amax = 1/4 * (a1 + a2 + 2am)
3. Amax = 1/6 * (4am + a1 + a2)

For this study, researchers chose formula 1: Amax = 1/3 * (a1 + am + a2)

FINDINGS

In the development of e-portfolio model, there is a questionnaire that constructed using ANT methodology and Institutional Theory. These questionnaires are composed by a few components which are Internal ANT, Internal and External. Then, each component contains significant factors that construct the e-portfolio model, which uses ANT methodology and Institutional Theory. Factors will be explained individually in the following section.

This section is constructed using the Institutional Theory methodology. This internal section has 3 factors, which are storage, workspace, and showcase. Analysis of each factor will be explained in the subsequent sub-sections.

1) Storage

Storage Process have 4 features,description of each feature and rank in the Storage Process as shown in Table 7.

According to the table 7, “Digital collection as proof of achievement” is the highest rank in the storage factor, while “Systematic storage for various media” is in the lowest ranking. Next, the storage factor has the threshold values (d), expert consensus percentage and defuzzification from each item show in Table 8.

Table 8: Features Description and Rank of Storage Process

Description	Rank
Digital collection as proof of achievement	1
Personal data	2
Repository and backup for importing and exporting various media	2
Systematic storage for various media	4

In the storage process, all features have the threshold value (d) ≤ 0.2 and the percentage of the expert consensus is 80%. So, in general, Storage Process has achieved the consensus with the percentage more than 75%. Defuzzification value from storage factor also shows that each item has exceeded the α-cut value which is 0.5.

Table 8: Threshold Values (d), Expert Consensus Percentage and Defuzzification of Storage Factor

Features	STO1	STO2	STO3	STO4
Features d≤0.2	0.15	0.13	0.10	0.13
Construct d≤0.2	0.13			
% Features d≤0.2	100	70	80	70
Expert Group Consensus Percentage %d≤0.2 (80%)				
Defuzzification	0.72	0.74	0.76	0.74

2) Workspace

Table 9 contains the items description and rank from the workspace function that contains 6 features.

Table 9: Items Description and Rank of Workspace Factor

Description	Rank
Update data	1
Project demonstration	2
Digital document display	3
Display digital work format	4
Self-Assessed/Meta cognitive	5
Publish and shared with anyone	6

The highest rank in the workspace function is "Update data" and "published and shared with anyone" is at sitting at the lowest rank. While the threshold values (d), expert consensus percentage and defuzzification from each of the item in workspace factor can be seen in Table 10.

Table 10: Threshold Values (d), Expert Consensus Percentage and Defuzzification of Workspace Factor

Features	WS1	WS2	WS3	WS4	WS5	WS6
Features d≤0.2	0.183	0.171	0.153	0.122	0.147	0.147
Construct d≤0.2	0.13					
% Features d≤0.2	90	50	100	60	60	100
Expert Group Consensus Percentage %d≤0.2 (77%)						
Defuzzification	0.68	0.66	0.7	0.6	0.64	0.72

The threshold values (d) in the workspace factor has the value of ≤ 0.2 for all of the items. While the expert consensus got the value of 77%. So, the workspace factor has reached the expert's consensus because it exceeds 75%. Other than that, defuzzification values from workspace factor also shows that each item has exceeds the α-cut value which is 0.5.

3) Showcase

In the showcase factor, there are 8 items. Description of each items and rank can be seen at Table 11.

Table 11: Features Description and Rank of Showcase Process

Description	Rank
Can be used for job search	1
Displays knowledge and skills	2
Can track progress assessment	2
Assessment can be done online	4
Can push notifications to the assesse	4
Can give a recommend certification	6
Widely available anytime for anyone	7
Assessment result can be shown	7

In the showcase process, the feature "Can be used for job search" had the highest expert consensus and "assessment result can be shown" had the lowest score. Meanwhile, the threshold values (d), expert consensus percentage and defuzzification from each item from the showcase factor can be seen in Table 12.

Table 12: Threshold Values (d), Expert Consensus Percentage and Defuzzification of Showcase Factor

Features	SC1	SC2	SC3	SC4	SC5	SC6	SC7	SC8
Features d≤0.2	0.25	0.10	0.00	0.13	0.25	0.10	0.13	0.18
Construct d≤0.2	0.14							
% Features d≤0.2	90	80	100	70	90	80	70	90
Expert Group Consensus Percentage %d≤0.2 (84%)								
Defuzzification	0.69	0.76	0.8	0.74	0.69	0.76	0.74	0.7

In the showcase process, there are 6 out of 8 items that have the threshold values (d) ≤ 0.2, which is 2, 3, 4 and 6-8. Item 1 and 5 have the threshold value (d) that exceeds 0.2 ((d) =0.2). Expert consensus result from the showcase process is 84%, hence making the showcase process passed the expert consensus test. Then, the defuzzification value from the showcase process also shows that each item reached above α-cut value which is 0.5.

DISCUSSION
CONCLUSIONS

The findings indicate that there are 3 functions and 18 features of e-portfolio that are needed by competency assessment in certification competency in Indonesia based on the consensus of expert jugdement. Motivation is the basic element and the first choice of the experts. This study has enabled the identification features of the assessment competency. This information will help competency body and assessor

prepare activities that are suitable for assese in effectively and efficiently with an eye towards meeting the needs of industry. This study also provides a clear picture for institutions of competency body that are required to prepare develop e-portfolio model for competency certification .

Information and feedback from industry can help in the preparation of a model e-portfolio for certification competency. Feedback from the ministry (government agencies) on the measures and the functions that need improvement will also help to assese who are ready to take their place in industry, thus reducing the unemployment rate among manpower in Indonesia.

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