

ASSESSMENT MODEL OF COMPETENCE CERTIFICATION FOR CONSTRUCTION WORKERS

Heru Budi Utomo¹, Slamet Prawiro Harto² and Amat Jaedun³

*Graduate Program of Research and Evaluation of Education
Yogyakarta State University, Indonesia*

¹drs.heru2015@student.uny.ac.id, ²slametph@uny.ac.id, ³jaedun@uny.ac.id

Abstract— This paper presents the assessment model of competence certification for construction workers. Based on the Law of the Republic of Indonesia number: 2 years 2017 on Construction Service that the construction worker in the field of construction Services must have a certificate of competence work. In the implementation of the certification assessment of the competence for construction workers within the Construction Service Development Board (CSDB) required standard norms or guidelines used by the competency assessor of work in the test or assess the applicant certification of competence. The research model used in this study is a systematic review consisting of 4 stages, namely Problem formulation, Search literature, literature selection, analysis and interpretation. Assessment model of competence certification consists for construction workers, test material, assessment tool, usage manual and assessment guide. With this assessment model assessors will be more helpful so that the process of competence certification for construction workers become more optimal and produce a quality work.

Keywords— Construction workers; Assessment model; Competence certification

1. INTRODUCTION

The implementation of the ASEAN Economic Community (AEC) which has been ongoing since 2015 has become a new stage of economy in the Southeast Asian region. AEC is a form of ASEAN economic integration in the sense that there is a free trade system among ASEAN countries. This is done to improve the competitiveness of the economies of ASEAN countries and can compete with developed countries such as in Europe and America. The establishment of a single market in ASEAN will liberate trade flows from one country to another. To face the AEC, then all areas of the economy in Indonesia should improve to be able to compete with foreign parties. The field of construction also includes areas that need to prepare to compete, both in the technology and labor. With the availability of sufficient human resources in Indonesia, the aspect of human resources is one part that needs to be considered in the face of the AEC. In the field of science related to construction services are the areas of: Architecture, Civil, Mechanical Electrical and Environmental order that human resources are one part of the assets compete with other parties.

In the Law of the Republic of Indonesia number: 2 year 2017 on Construction Services [1]:

- a. In Article 4 paragraph 1d that the Central Government is responsible for the increased competence, professionalism, and productivity of national construction workers.

Received: April 10, 2019
Reviewed: June 21, 2019
Accepted: June 28, 2019



- b. In Article 70 paragraph (1) Every construction worker which working in the field of Construction Services must have a Certificate of Competence Work. (2) Every Service User and/or Service Provider shall hire a construction worker who has a Work Competence Certificate as referred to in paragraph (1). (3) Certificate of Work Competence as referred to in paragraph (1) shall be obtained through a competency test in accordance with the Work Competency Standards. (4) The Work Competence Certificate as referred to in paragraph (1) shall be registered by the Minister. (5) The implementation of the competency test as referred to in paragraph (3) shall be conducted by a professional certification institution. (6) The professional certification institution as referred to in paragraph (5) shall follow the provisions of the competence test in accordance with the provisions of the legislative regulation.
- c. In Article 75 paragraph (1) The construction worker providing Construction Services must be professionally responsible for the results of his work. (2) Accountability professionally on the results of Construction Services can be done through guarantee mechanism. Responsibility is based on the principle of expertise in accordance with the rules of science, propriety, and intellectual honesty in carrying out its profession by maintaining public interest. The responsibilities of construction workers are in accordance with the codes of conduct of each profession involved. Professional accountability to the results of Construction Services can be done through guarantee mechanism that is guarantee of expertise. A construction worker providing Construction Services must be professionally responsible for his/her work. Professional accountability to the results of Construction Services can be done through the guarantee mechanism. Responsibility is based on the principle of expertise in accordance with the rules of science, propriety, and intellectual honesty in carrying out its profession by maintaining public interest. The responsibilities of construction workers are in accordance with the codes of conduct of each profession involved. Professional accountability to the results of Construction Services can be done through guarantee mechanism that is guarantee of expertise.
- d. In article 84 that the implementation of a portion of the authority of the Central Government involves the Community Construction Services undertaken through an institution established by the Minister.

Implementation of the Central Government's authority, include the registration of the Construction Service business entity, the accreditation for the association of Construction Services Company and the association of supply chain Construction Services, the registration of the business enterprise experience, the registration of expert appraisers, determines the registered expert assessor in the event of Building Failure, accreditation for the association professions and licenses for professional certification bodies, employment registration, registration of professional experience of labor as well as educational institutions and job training in the field of construction, equalization of foreign workers, establishing professional certification bodies to perform job competence certification tasks that cannot be done by professional certification agencies formed by professional associations/educational and training institutions [2-5]. What is meant by "board" is Construction Service Development Board (CSDB).

The Technical Guidelines for the Establishment of Certification and License Units shall be guided by Regulation of the Minister of Public Works No. 8/PRT/M/2012 dated April 3, 2012 and Competency Requirements for the Sub - qualification of experts and skilled personnel in Construction Services shall be regulated in Regulation of the Minister of Public Works No. 9/PRT/2013 dated September 9, 2013.

The regulation mandates that the importance of CSDB to carry out the certification process of experts and skilled workers in the field of construction services as part of preparing qualified and responsible skilled personnel. Head of the Construction

Development Agency of the Ministry of Public Works and People's Housing Hedyanto Husaini said that the main challenge of Indonesian construction service providers in facing the era of MEA is the limited number of certified professional construction personnel (Source: [http://industri. Bisnis.com](http://industri.bisnis.com)). The need for certified professional construction personnel should be balanced with quality certification that qualified. Do not be pursued only quantity other than quality. Therefore, it is necessary to establish regulations ranging from a rigorous certification process and a good valuation model to produce certified and qualified professional construction workers certification [6].

In the case of scheme of Assessment model of competence certification for construction workers at CSDB requires standard of assessment norm which become guidance of Worker Competence Assessor (WCA) in testing or appraising applicant certification. Currently there is no effective and efficient assessment tool in the Labor Management Certification Unit (LMCU) of CSDB for assessment which includes Knowledge (K), Skill (S) and Affective (A) so that a minimum standard manual or guideline used by the WCA is required for the assessment of the competence of skilled and expert workers in the field of construction according to the competence of expertise/skills applied by the applicant through a licensed professional certification body and/or professional association accredited by CSDB in order to obtain the certificate holder competent and responsible [7].

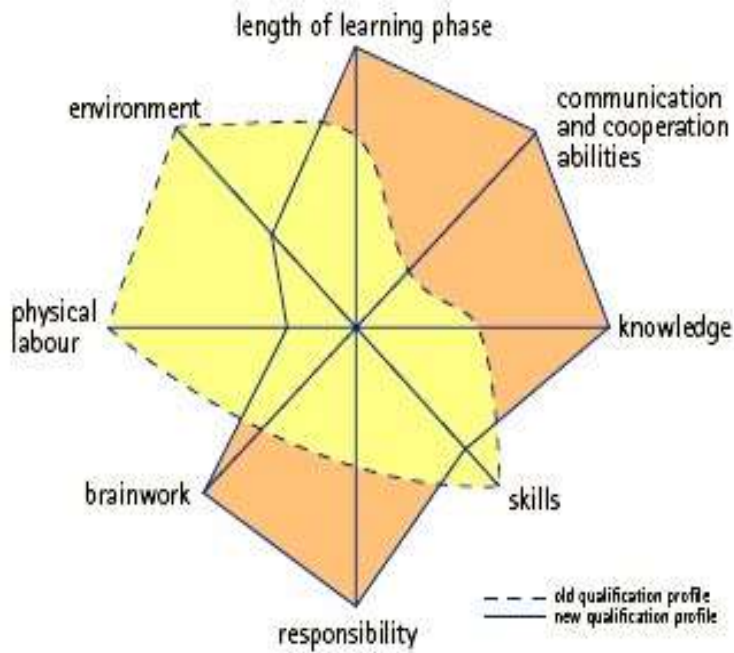
With the certification of work competence of construction workers is expected to guarantee the competence of skilled workers and Indonesian construction experts who can compete in the global level. Until now there are still problems in the implementation of the certification process of the competence of construction workers and in the application of ownership of certain skills and skills certificates for the procurement of construction services to the government.

Based on this background, there are several issues that can be identified, including:

- a. The ability and quality of construction workers in Indonesia needs to be improved.
- b. CSDB certified and registered construction workers need to be upgraded to meet the market share needs of the construction services industry.
- c. Professional Certification Board (PCB) conducting competency test which will be formed by accredited professional association and educational institution and training that fulfill the requirement in accordance with the provisions of legislative regulation there should be norm which become guidance in the assessment model of certification of work competence for construction workers which will be used by WCA of CSDB.

2. RELATED WORKS

The concept of competence underwent reform in most European countries [8, 9]. Development leads to a changing competency that adjusts the needs of the labor market and work system. Changes affecting market structure, technological innovation and work management require new knowledge and development of the field of competence until now. Figure 1 illustrates the concept of competence undergoing a process of continuous change, reflecting an evolution in the demand for competence qualifications.



Source: Tippelt.2003:8

Fig. 1 Competency Concept Changes

According to [24] that competency is a list of abilities/skills possessed by a person in an environmental context. In the industrial world, competence will refer to the ability/skills used to complete a specific tasks tailored to the job title or job description [10].

Related to competency education and certification according to Slamet in [11], there are five main components in competency-based education: (1) competency standards of graduates; (2) competency-based curriculum; (3) competency-based learning; (4) assessment based on competence; and (5) certification. The five components must be interrelated and their development systematic and systematic. According to [9], a competency certificate is taken as valid if it really represents the competencies[12] that a repossessed and demonstrated by the bearer, and if it is issued by an institution that is recognition and socially valued [9, 13].

The assessment criteria are transparently and clearly arranged in the scheme rules. The issuance of a competency certificate will be awarded to a candidate who has relevant knowledge and may also demonstrate sufficient experience and expertise. In the case of certification of construction experts undertaken by the Professional Association and registration of the certificate is given by CSDB to a successful candidate or declared competent. Sira Environmental. Figure 2 shows the process of obtaining a professional competency certificate can be taken through two channels, namely training and experience path. If a trainee has achieved a qualification pass on a scope of knowledge, or an experienced participant has relevant experience with the scope of qualification of a certified competency. So, participants from both paths can undergo competency test.

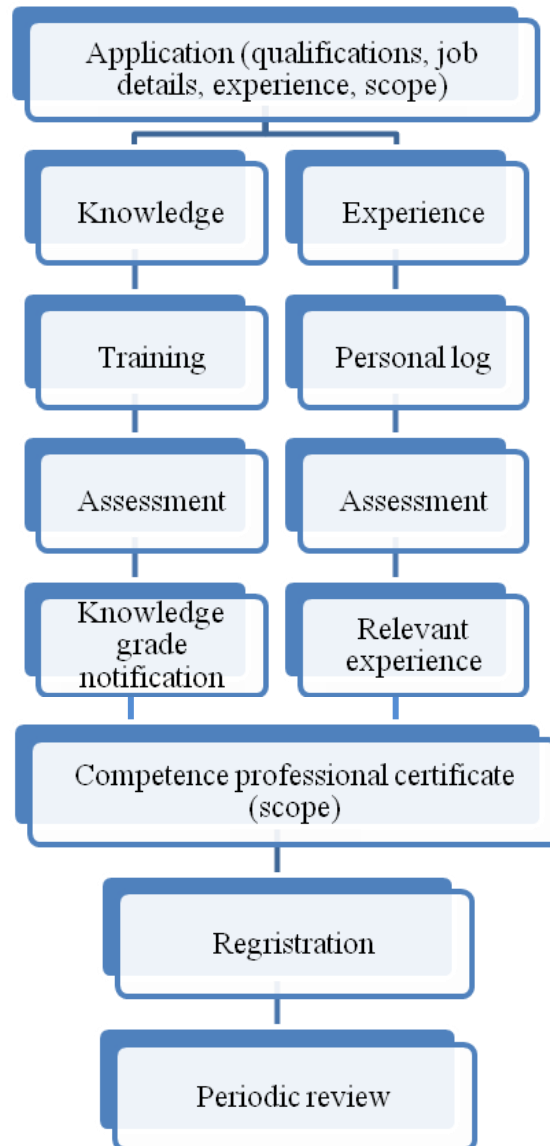
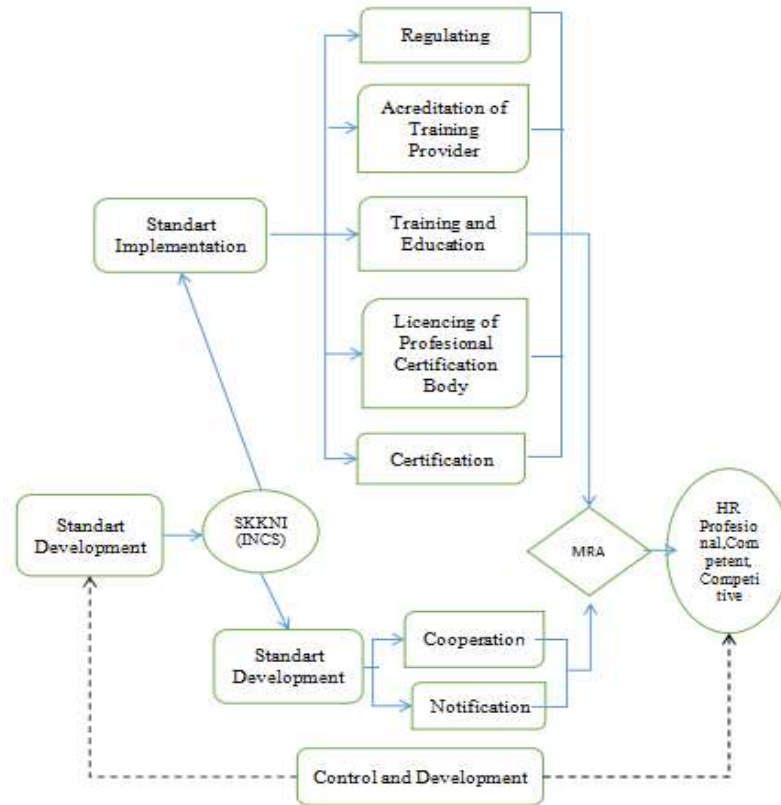


Fig. 2 Professional Competency Certification Flow Scheme

The benefit of certification as explained in British Institute of non-destructive Testing (2010) are: “One of the many benefits of the personnel certification will be to confer wider recognition of personnel who contribute to effective plant asset management and condition-based management and predictive [14]. Condition Monitoring (CM) of machines, plant or structures improves safety, overall equipment efficiency (OEE) and the whole life cycle cost and management of the asset”.

Assessments are directed at measuring and assessing performance (aspects of knowledge, skills, and attitudes), either directly or indirectly. Assessment using a criterion reference assessment, certification is carried out through procedures and mechanisms that can develop a quality assurance and quality control system, involving stakeholders. Accurate information on competence can only be obtained through effective assessment and evaluation. Professional competence certification system in Indonesia, developed by BNSP as shown in Figure 3 below.



INCS = Indonesian National Competency Standard
 MRA = Mutual Recognition Agreement

Fig. 3 Indonesian System for National Competency Standardization

Professional human resources supervision and development and work competency standards are undertaken by National Agency for Profession Certification. Standards of competence are adjusted to other standards applicable both regionally and internationally [15]. This adjustment is done through mutual understanding.

Assessment is a general term defined as a process taken to obtain information used in order to make decisions about students, curricula, programs, and educational policies, methods or other educational instruments by an agency, agency, organization or the official institutions that organize a certain activity.

With regard to Assessment, the opinion of Linn in [16] states that “assessment is a general term that includes the full range of procedures used to gain information about student learning (observation, ratings of performances or projects, paper-and-pencil tests) and the formation for value judgment concerning learning progress”. The statement can be taken to mean that judgment is a general term that includes procedures used to obtain information about a person (observation, level of performance or project, and written test) and formation to assess decisions about learning progress. Based on these statements can be concluded that the assessment is a format to collect information about the achievement or competence of a person, the assessment can be used to see the achievements, attitudes and ethos. Assessment is a technical as well as non-technical assessment process through gathering relevant evidence to determine whether a person is competent or not competent in a particular competence or qualification unit.

Assessments should adjust the specificity of each competency. According to Embo, *et al.* in [17] that in an authentic assessment system can produce more valid information about the development and achievement of learning which the learners do, where both the process and the learning outcomes are equally important and valued in the same position. This means that the authentic assessment of learners is applied to the process and outcomes.

Referring to the characteristics of competency learning, the appropriate type of assessment to be developed in competency certification activities is authentic assessment. Authentic assessment is an assessment aimed at assessing the applicant's ability to certify in the real context of how applicants apply their knowledge, skills and affective to authentic tasks. According to [18], the authentic assessment contains the tasks and procedures by which students are required to apply their knowledge skills to solve real-world problems and provide authentic tasks.

According to [19], that authentic assessment includes structured tasks, performance tasks, projects, portfolios, demonstrations, experiments, oral presentations, and simulations. Baard, *et al.* in [19] suggests that some authentic assessments that may be used include performance appraisal, criterion-based assessment, systematic observation by instructors or students (peer and self-assessment), portfolio, and journal. Gray (2001:8) introduces several assessment methods that can be applied including self and peer assessment, assignments and projects, memo reports, portfolios, presentation pas or displays. Authentic assessments provide more complete data about students' abilities based on learning activities, valuing products or processes equally well.

According to [20] and Linn in [16] that the assessment of individual practices and work is a feature of performance assessment, whereby individuals can demonstrate their maximum performance through their engagement in practice products produced. According to Berk that in applying performance assessment is the learner is asked to perform certain activities under the supervision of the assessor, observing the performance and making consideration to the quality of the achievement demonstrated by the learner.

According to Linn in [16] that performance appraisals are suitable for competency-based assessments. Performance appraisal refers to the direct criteria. Potential to clarify complex learning objectives so as to measure knowledge and skills directly and meaningfully. Interviews are meetings between giver and receiver of information that can be done face to face, by telephone, online, or in groups (focus groups). According to [21] that interviews are a test whose execution is carried out by holding direct questioning between the assessor and the assistant, how to interview free/open or lead/closed.

The opinions on authentic assessment above are complementary that authentic assessment includes assessment of: portfolios, written reports, instructor tasks, projects, demonstrations, oral presentations, performance appraisals, journals, self-assessment, and peers. Work Competence is a specification of each attitude, knowledge, skill and or expertise and its effective application in work in accordance with required performance standards [21].

3. MATERIAL AND METHODOLOGY

This study uses systematic review, while the stages in the systematic review of this study are:

- a. Formulation of the problem. At this stage the researcher will select a topic that suits the researcher's expertise. The selection of topics is also based on the problems that arise based on the results of the study researchers. This study looks at the absence of a truly ideal assessment model to be used when testing in the certification of the competence of construction workers.
- b. Search for literature. In this step, the researcher will search the relevant literature with the research. This step helps researchers to get an overview of the development of research related topics raised. The selected literature is the result of recent research (the last 10 years) taken from Scopus indexed journals and Thomson Reuther.
- c. Literature Selection. The journals that have been obtained are then filtered based on their relevance to the research undertaken. Journal search results are then divided into three parts, irrelevant, relevant and highly relevant.

- d. Analysis and interpretation. The journals to be analyzed are those that are relevant and highly relevant. The journals are then analyzed and interpreted. Analysis is done in several ways, among others: a) Finding the similarity (Compare), b) Looking for inequality (Contrast), c) Giving a view (Criticize), d) Comparing (Synthesize), e) Abstracting (Summarize).

4. RESULTS

The Assessment model of competence certification for construction workers is sourced from the analysis of the competencies required in the labor market. Effective assessments must be valid, systematic, and practical. Therefore, the measurement of the effectiveness of the assessment should consider three criteria, namely: valid, systematic, and practical [22]. The effectiveness of an assessment should pay attention to four things, namely: financing, efficiency, practicality, and condition of learning conditions. According to [10, 23-26], the effectiveness model of effectiveness of the assessment model is valid, practical and effective, and the design of the certification assessment model of construction work competence to be developed.

Development of Assessment Model Certification of Competency Work for Construction Workers, is expected to encourage training team/guidance of competency test to improve or improve the system of work competence certification of construction workers in CSDB environment [27]. With an authentic assessment developed incorporating written assessment methods and performance assessments, namely self-assessment, practice test, written test, and interviews. Authentic assessments that integrate self-assessment methods, practical tests, written tests, and interviews. The assessment technique is expected to color the quality in the system of competence certification of construction workers. The test model can be illustrated as shown in Figure 4 below.

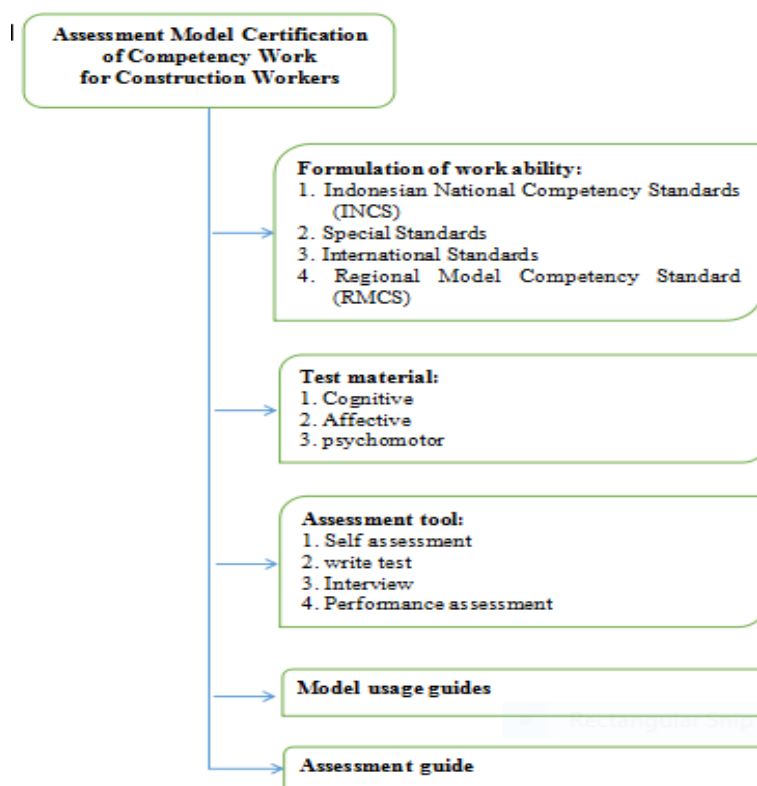


Fig. 4 Framework of Assessment model of competence certification for construction workers

5. DISCUSSION

The challenges facing the MEA in the framework of preparing professionals in construction services, both to meet national needs in the country and to export Indonesian work and challenge facing the MEA and ASEAN Mutual Recognition Arrangement (MRA) on Engineering Services hence need to increase competent human resources and certified by the authorized institution [7, 28, 29].

The agreement in the MRA is agreed upon by the Professional Regulatory Authority (PRA) in each ASEAN member country and a Registered Foreign Professional Engineer (RFPE) who will work in other ASEAN countries to work with the host country's professional engineer. In Engineering Services, the Central Production Classification (CPC) 8672 qualifies the design engineering [30] services for the construction of infrastructure / civil works (86724) that the requirements of ASEAN chartered professional engineers include [7, 28, 31]:

- a. Has graduated from a technical higher education whose study program has been accredited by an authority institution in his country.
- b. Has a Certificate of Expertise or a certificate of competence and is registered in the country as an Expert who is entitled to independent practice
- c. Have work experience at least seven years after graduation.
- d. For two years they are managing significant works of engineering.
- e. Has fulfilled the requirements of its Continuing Professional Development program as a condition of extending the validity of ASEAN Chartered Professional Engineer (ACPE).

Referring to the requirement no 2 it appears that a skill certificate or competence certificate is required for skill and experts to be able to practice individually. This shows the importance of certification of experts as part of the preparation of competent professionals. Skill certificates are issued after applicants pass through various procedures and assessments. Procedures in the certification assessment of the assessment of knowledge, skills and attitudes that must be achieved in accordance with the Indonesia National Qualification Framework (KKNI/INQF) is to determine the objectives, determine the test participants, determine the evidence used as proof of the assessment quantitatively and qualitatively for the current trace so as to justify the results of the assessment to determine competent test participants or incompetent [28].

The importance of certification of this expertise makes the appraisal process of the applicant's eligibility a work that is not easy. A credible, valid, accurate, and effective assessment process that truly reflects the applicant's competencies is required. Based on the above, it is necessary to develop a model of certification assessment [32] of the competence of construction workers. In its development adopted the principle of taxonomy of bloom as a judgment is an effort to obtain various information on a regular, continuous, and comprehensive about the process and results of growth and development of insight, knowledge, attitude and skills of learners derived from the notes and documentation of learning experience [18, 33, 34].

The Assessment model of competence certification for construction workers is sourced from the analysis of the competencies required in the labor market. Effective assessments must be valid, systematic, and practical. Therefore, the measurement of the effectiveness of the assessment should consider three criteria, namely: valid, systematic, and practical. The effectiveness of an assessment should pay attention to four things, namely: financing, efficiency, practicality, and condition of learning conditions. According to [35, 36], the effectiveness of the assessment model can be formulated: valid, practical and effective.

6. CONCLUSION

The Assessment model of competence certification for construction workers developed consists of the competence of skills, test materials, appraisal tools, usage guides and assessment guides. Skill or skill competencies are drawn from in-depth analysis of INCS in certain skill or skill fields, International labor competency [8, 17, 37, 38] standards and special standards. The test material includes assessment of cognitive, affective and psychomotor competence. Assessment tool is a tool used to assess competence. The tools consist of self-assessment, written assessment, interviews, portfolios and performance assessments [39, 40]. The usage guide is a set of guides for the use of developed models. In addition, this assessment model also provides assessment guides for assessors to facilitate the certification process.

Development of Assessment model of competence certification for construction workers, is expected to encourage the training team / guidance of competency test to improve or improve the work competency certification system within the CSDB environment. Developed assessments that incorporate written assessment methods, performance appraisals, self-assessment, practical tests, written tests, and interviews are expected to optimize and colorize the quality of the workforce competence certification system [28].

ACKNOWLEDGEMENT

This work is supported by the Graduate Program, Research and Evaluation of Education, Yogyakarta State University with student number 15701261001 and the help of Ir. Sofiati Luhuri is also sincerely appreciated.

REFERENCES

- [1] "Law of the Republic of Indonesia Number: 2 Year 2017 on Construction Service", (2017).
- [2] Abdullah, Z., et al., "Mining significant association rules from educational data using critical relative support approach", *Procedia-Social and Behavioral Sciences*, 28, (2011): 97-101.
- [3] Dutt, A., M.A. Ismail, and T. Herawan, "A Systematic Review on Educational Data Mining", *IEEE Access*, (2017).
- [4] Aghabozorgi, S., et al., "An approachable analytical study on big educational data mining", *International Conference on Computational Science and Its Applications*, (2014): 721-737.
- [5] Suhirman, S., et al., "Data Mining for Education Decision Support: A Review", *International Journal of Emerging Technologies in Learning (iJET)*, 9(6), (2014): 4-19.
- [6] Hadfield, D., "Professional certification", *American Music Teacher*, (2004): 54-57.
- [7] Yue, C.S., "Free Flow of Skilled Labor in the ASEAN Economic Community", *Toward A Competitive ASEAN Single Market: Sectoral Analysis*, (2011): 205.
- [8] Butova, Y., "The history of development of competency-based education", *European Scientific Journal*, (2015).
- [9] Blázquez, M., A. Herrarte, and R. Llorente-Heras, "Competencies, occupational status, and earnings among European university graduates", *Economics of Education Review*, 62, (2018): 16-34.
- [10] Ghaderi, I., et al., "Technical skills assessment toolbox: a review using the unitary framework of validity", *Annals of surgery*, 261(2), (2015): 251-262.
- [11] Slamet, P., "Pengembangan SMK Model untuk Masa Depan", *Jurnal Cakrawala Pendidikan*, 5(1), (2013).
- [12] Mansfield, B. and J. Burke, "Competence and standards", *Competency based education and training*, (1989): 26-38.
- [13] Pavlin, S. Ivan Svetlik, and R. Leoni, "Graduate employability and the development of competencies. The incomplete reform of the "Bologna Process"", *International Journal of Manpower*, 35(4), (2014): 448-469.
- [14] Belanger, C.H. and J. Mount, "Prior learning assessment and recognition (PLAR) in Canadian universities", *Canadian Journal of Higher Education*, 28(2/3), (1998): 99-119.
- [15] Chino, N., "Certification and measuring competency in Japan, South Korea, and the Philippines", *Archives of physical medicine and rehabilitation*, 81(9), (2000): 1248-1249.
- [16] Linn, R.L., "Assessments and accountability", *Educational researcher*, 29(2), (2000): 4-16.
- [17] Embo, M., et al., "Integrating learning assessment and supervision in a competency framework for clinical workplace education", *Nurse education today*, 35(2), (2015): 341-346.

- [18] Brockmann, M., L. Clarke and C. Winch, "Knowledge, skills, competence: European divergences in vocational education and training (VET)—the English, German and Dutch cases", *Oxford review of education*, 34(5), (2008): 547-567.
- [19] Baard, S.K., T.A. Rench, and S.W. Kozlowski, "Performance adaptation a theoretical integration and review", *Journal of Management*, (2013): 0149206313488210.
- [20] Krathwohl, David R., and Lorin W. Anderson, "A taxonomy for learning, teaching, and assessing: A revision of Bloom's taxonomy of educational objectives", Longman, (2009).
- [21] Baker, E.L. and H.F. O'Neil Jr, "Performance assessment and equity: A view from the USA", *Assessment in Education: principles, policy & practice*,(1994). 1(1): p. 11-26.
- [22] Zlatkin-Troitschanskaia, O. and H.A. Pant, "Measurement Advances and Challenges in Competency Assessment in Higher Education", *Journal of Educational Measurement*, 53(3), (2016): 253-264.
- [23] Williams, C., "The discursive construction of the 'competent' learner-worker: from key competencies to 'employability skills'1", *Studies in Continuing Education*, 27(1), (2005): 33-49.
- [24] Bartram, D. and R.A. Roe, "Definition and Assessment of Competences in the Context of the European Diploma in Psychology", *European psychologist*, 10(2), (2005): 93.
- [25] Bok, H.G., et al., "Programmatic assessment of competency-based workplace learning: when theory meets practice", *BMC medical education*, 13(1), (2013): 1.
- [26] Sureda-Demeulemeester, E., C. Ramis-Palmer, and A. Sesé-Abad, "The assessment of medical competencies", *Revista Clínica Española (English Edition)*, (2017).
- [27] Rachlin, S., et al., "Continuous certification within residency: an educational model", *Academic radiology*, 22(10), (2015): 1294-1298.
- [28] "ASEAN Qualification Reference Framework Endorsed by the ASEAN Economic Ministers in August 2014; the ASEAN Education Ministers in September 2014; and the ASEAN Labour Ministers through Ad-referendum from November 2014 to May 2015", (2015).
- [29] Stefanidis, D., et al., "Simulation in surgery: what's needed next?", *Annals of surgery*, 261(5), (2015): 846-853.
- [30] Adeli, Hojjat, "Expert systems in construction and structural engineering", CRC Press, (1988).
- [31] Ličen, S. and N. Plazar, "Identification of nursing competency assessment tools as possibility of their use in nursing education in Slovenia—A systematic literature review", *Nurse education today*, 35(4), (2015): 602-608.
- [32] Ghoddousi and, P., et al., "Implementing the international benchmarking labour productivity theoretical model: The case of Iranian construction projects", *Benchmarking: An International Journal*, 21(6), (2014): 1041-1061.
- [33] Zirkel, S., J.A. Garcia, and M.C. Murphy, "Experience-sampling research methods and their potential for education research", *Educational Researcher*, 44(1), (2015): 7-16.
- [34] Ajzen, I. and M. Fishbein, "Attitude-behavior relations: A theoretical analysis and review of empirical research", *Psychological bulletin*, 84(5), (1977): 888.
- [35] Sedlack, R.E., W.J. Coyle, and A.R. Group, "Assessment of competency in endoscopy: establishing and validating generalizable competency benchmarks for colonoscopy", *Gastrointestinal endoscopy*, 83(3), (2016): 516-523. e1.
- [36] McClarty, K.L. and M.N. Gaertner, "Measuring Mastery: Best Practices for Assessment in Competency-Based Education. AEI Series on Competency-Based Higher Education", American Enterprise Institute for Public Policy Research, (2015).
- [37] Franklin, N. and P. Melville, "Competency assessment tools: An exploration of the pedagogical issues facing competency assessment for nurses in the clinical environment", *Collegian*, 22(1), (2015): 25-31.
- [38] Hauer, K.E., et al., "Reviewing residents' competence: A qualitative study of the role of clinical competency committees in performance assessment", *Academic Medicine*, 90(8), (2015): 1084-1092.
- [39] Modi, J.N., P. Gupta, and T. Singh, "Competency-based medical education, entrustment and assessment", *Indian pediatrics*, 52(5), (2015): 413-420.
- [40] Byrne, M., et al., "The professional portfolio: an evidence-based assessment method", *The Journal of Continuing Education in Nursing*, 40(12), (2009): 545-552.

