The Barriers in Online Assessment for Professional Certification: A Case Study In Indonesia

Lena Citra Manggalasari[1*], Thomas Koehler[2], Anne Jantos[3], Yuliastuti Yuliastuti[4], Yureana Wijayanti[5], Oki Setyandito [6], Sutarto[7], Serafin Wisni Septiarti[8] (iD)

[1,2,3] Technische Universität Dresden (TUD), Dresden, Germany
[4,5,6] Bina Nusantara University, Jakarta, Indonesia
[7,8] Yogyakarta State University, Yogyakarta, Indonesia

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ABSTRAK

Ujian sertifikasi yang dilakukan secara online harus memiliki kualitas yang sama dengan yang dilakukan di tempat. Untuk mencapai hal tersebut, perlu dilakukan kajian dimana asesor perlu mengidentifikasi kendala-kendala dalam pelaksanaan ujian sertifikasi daring yang selama ini dilaksanakan di masa pandemi Covid-19. Studi ini bertujuan untuk menganalisis perspektif penilai untuk mengidentifikasi faktor-faktor penghalang, memahami keterkaitan di antara mereka, dan mengusulkan perbaikan pada proses aplikasi online. Metode yang digunakan adalah MICMAC (Matrix of Cross-impact Multiplications Applied to Classification), sebuah model struktural, untuk menganalisis variabel berdasarkan pengaruh dan kekuatan pendorong ketergantungannya. Sebuah studi kasus dilakukan pada Perhimpunan Insinyur Hidrolik Indonesia. Data dikumpulkan dari diskusi kelompok terarah dengan para asesor. Hasil penelitian menunjukkan bahwa faktor penghambat terdiri dari aspek teknis seperti delay koneksi internet, hacker dan virus, dan e-document yang belum terverifikasi; dan aspek sosial, seperti keterbatasan keterampilan bertanya, keterbatasan keterampilan komunikasi non-verbal, dan gangguan lingkungan. Studi ini menemukan bahwa keterlambatan koneksi internet dan keterbatasan keterampilan bertanya merupakan hambatan dengan pengaruh tertinggi melebihi hambatan lainnya dalam proses asesmen online. Selain itu, faktor keterbatasan keterampilan bertanya memiliki ketergantungan paling tinggi terhadap hambatan lain. Oleh karena itu, dapat diusulkan agar kurikulum pelatihan penilai dan/atau program sertifikasi, harus digabungkan dengan keterampilan bertanya dalam lingkungan penilaian online.

ABSTRACT

Certification exams conducted online must be of the same quality as those conducted on-site. To achieve this, it is necessary to conduct a study in which assessors need to identify obstacles in implementing online certification examinations which have been implemented during the Covid-19 pandemic. The study aims to analyze the perspective of the assessors to identify the barrier factors, understand the interrelation among them, and propose improvements to the online application process. The method applied was the MICMAC (Matrix of Cross-impact Multiplications Applied to Classification), a structural model, to analyze the variables based on their influence and dependence driving force. A case study was conducted on the Indonesia Hydraulic Engineer Association. The data was collected from a focus-group discussion with the assessors. The result revealed that the barrier factors consist of technical aspects, such as internet connection delay, hackers and viruses, and unverified e-document; and social aspects, such as questioning skills limitation, non-verbal communication skills limitation, and environment distraction. The study found that internet connection delay and questioning skill limitations are the barriers with the highest influence beyond other barriers in the online assessment process. Also, the questioning skills limitation factor has the highest dependency on other barriers. Hence, it can be proposed that the curricula of the assessors' training and/or certification program, should be incorporated with the questioning skill in an online assessment environment.

1. INTRODUCTION

Professional certification or widely called certification is created or endorsed by professional organizations or associations to assure qualification to perform a job or a task. Construction is one of the fields which require certification (Arifa & Prayitno, 2019; Barrows et al., 2020). In Indonesia, Engineering works related to construction services which consist of civil, mechanical, electrical, and environmental engineering works are regulated by Construction Services Act. By this act, an engineer shall gain a competence certificate or professional certification from any related professional association accredited

Corresponding author.
E-mail addresses: yurena90@gmail.com (Yureana Wijayanti)

by Construction Services Development Board (CSDB) (Chen et al., 2022; Ekaputri, 2020). The assessment to attain professional certification is based on industry experience that will reveal the job skills attained from previous projects (Dudzinski et al., 2000; Rusilowati & Wahyudi, 2020). The professional application process generally consists of 3 (three) phases, they are 1) Document verification: the evaluation process of applicants' self-analysis based on professional standard performance with evidence; 2) An interview: the assessment of applicants' competency based on the portfolio and evidence; 3) Decision by assessment committee on awarding the qualification or not. In Indonesia, at the beginning of the COVID-19 pandemic period, all assessment schedules temporarily were canceled (Cruz et al., 2020; Jiang et al., 2019).

However, construction works were still taking place, and more skilled engineers were required. It means, the renewal or new application of certificates was highly in demand. Many certification associations were converting their assessment, previously on-site, into an online assessment. It was recognized that carrying out the online certification exam has many advantages, among others, it can save costs and time (Alruwais, N., Wills, G., & Wald, 2018; Doğan et al., 2020; Itani & Srour, 2016). Indonesia is an archipelagic country, and most of the assessors are living on Java Island, so if the applicants are from outside of Java Island, quite large transportation costs must be incurred for the assessors or the applicants. The assessor or applicants must also allow for the extra time caused by the trip. However, the certification examination conducted online must have the same quality as that performed onsite, in assessing the applicants' competencies. In order to achieve that, a study should be conducted where assessors need to identify the obstacles in carrying out online certification exams that have been applied during the COVID-19 pandemic (Beleulmi, 2022; Gamage et al., 2020; Joshi et al., 2020).

Previous studies on assessing professional competence have been conducted with an objective such as: evaluating the knowledge stage of professional activity (Luiz Neto et al., 2022), and developing a guideline for professional competencies (Sultan et al., 2020). Also, the professional certification application process was studied (Farozin, 2019; Leibur et al., 2021). However, only a limited study was conducted on the assessor's perception of the implementation of an online assessment. Previous study did a study with the aim to identify the readiness of assessors in the implementation of virtual assessment center in Indonesia's civil servant institutions during the Covid-19 pandemic (Ekaputri, 2020). The study revealed that there are many constraints that prevent the assessors to apply an online assessment effectively. There is no study yet on the assessor's perception of the online assessment of professional certification implementation in the engineering industry, especially in the construction sector. Therefore, this paper aims to analyze the barrier factors for the assessor in conducting e-assessment, to understand the interrelation among these factors, and to propose improvements to the online assessment process.

2. METHODS

The structural analysis approach is widely applied to study influenced factors in various studies. The Impact Matrix of Cross-impact Multiplications Applied to a Classification (MICMAC) is a structural factor analysis tool. It can be considered a qualitative system dynamics approach. MICMAC could identify the dependent and independent variables by developing a typology within direct and indirect classifications. MICMAC has been widely used to analyze barriers in various fields such as construction (Jung et al., 2021; Ribeiro et al., 2022; Wijayanti et al., 2021) agriculture, policy , energy, supply chain, knowledge management, e-learning, online assessment (Ahmad et al., 2018; Karamat et al., 2018; Nandal et al., 2019)
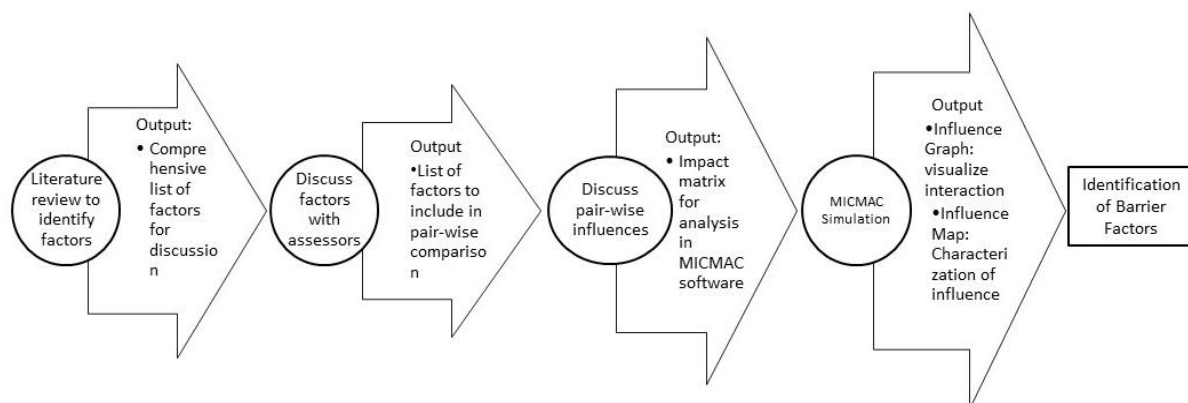

Figure 1. A Methods Framework

The procedure of the MICMAC program has at least three main phases of 1) Classifying the variables, 2) Evaluating the correlation among the variables, and 3) determining the key variables (Bhatt et al., 2021; Rautela et al., 2022). These phases were incorporated in the study method framework (Figure 1) which consist of: *Step (1) Identify all the variables:* This phase started with a literature review to identify barrier factors. Social and technical aspects were categorized within the barrier factor. A list of barrier factors in online assessment was derived from a literature study on online learning/training assessment (Beleulmi, 2022; Joshi et al., 2020; Naveed et al., 2018), a study on assessors' role (Ekaputri, 2020; Farozin, 2019; Leibur et al., 2021) and the professional certification application process. Method framework is show in Figure 1. Then barrier factors for online assessment of professional certification are show in Table 1.

Table 1. Barrier Factors for Online Assessment of Professional Certification

No.	Aspects	Factors	Description	Short label
1.	Technical	Internet connection delay	A poor internet connection caused a gap time between sending and receiving sound	B1
2.		Hackers and viruses	A risk of the assessment system is being hacked or corrupted due to viruses	B2
3.		Unverified e-documents	The authenticity of e-documents/materials to be assessed and submitted to the cloud	B3
4.	Social	Questioning skills limitation	The assessor has insufficient skill in effective questioning (e.g. putting the candidate at ease, clear and un-leading question)	B4
5.		Non-verbal communication limitation	The assessor cannot assess the candidates' body language/expression if needed, to further evaluate signs of abnormality or dishonesty	B5
6.		Assessors' environment distraction	The disturbance from the surrounding environment, and peoples' activities/existence toward the assessor	B6

Step (2) Constructing the structural analysis matrix (description of the correlation between the variables): The factors (Table 1) were presented to eight assessors in the focus group discussion to come to a consensus on the barrier factors for online assessment of professional certification. These assessors are from Indonesia Hydraulic Engineer Association and they have conducted an online assessment during COVID-19. In the FGD workshop, assessors were asked to discuss the pairwise influence among these barrier factors. Subsequently, the authors used these factors to further analyzed them using the MICMAC structural modeling. MICMAC analysis is applied to cluster the factors based on their driving power and dependence power, to classify the interrelationship among factors (Barati et al., 2019; Lobe et al., 2020; Walters et al., 2018). An Example of structural analysis matrix is show in Table 2.

Table 2. An Example of structural analysis matrix (M)

Variables	Var1	Var2	Var3	Var4	Influence
Var1	0	0	1	3	4
Var2	1	0	1	0	2
Var3	0	2	0	0	2
Var4	0	1	3	0	4
Dependence	1	3	5	3	-

Base on Table 2, this step is classifying the variables by mapping them into a matrix of influence and dependence variables, and evaluating the correlation among the variables. A cell of this matrix consists of i, and j, where i is the row and j is the column. If there are no correlations between i and j, then a zero number or '0' was typed in the matrix cell. If there is a direct influence between i and j, then one number or '1' and two number or '2', for a low and strong relationship, respectively, was typed in the matrix cell. The structural diagram is show in Figure 2.
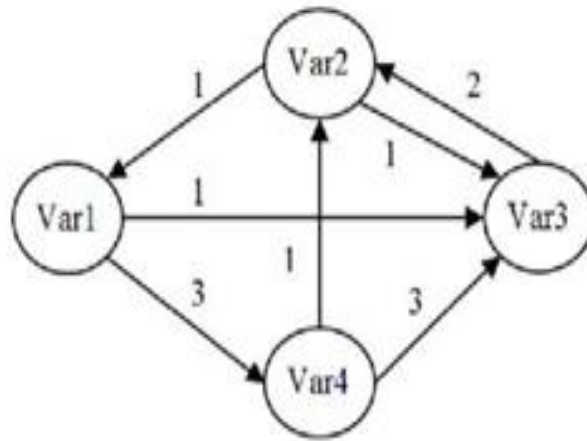
Figure 2. A Structural Diagram

Step (3) *The determination or identification of key variables performed by*: 1. Utilizing the direct classification in the dependence/influence matrix, 2. Enhancing the power of the matrix, to create a matrix of Indirect Influences (MII). The MICMAC enables the researcher to understand the distribution of the impacts by using the loops and paths. In general, the stable classification is obtained after 3,4, or 5 degrees of multiplication. The MICMAC result was utilized by the assessors to interpret the interrelation of barrier factors with peers. It helped them to be more aligned with other colleagues on important recommendation points for improvement of the online assessment process than they had once suggested.

3. RESULT AND DISCUSSION

Results
Table 3. Matrix of pairwise influence and dependence

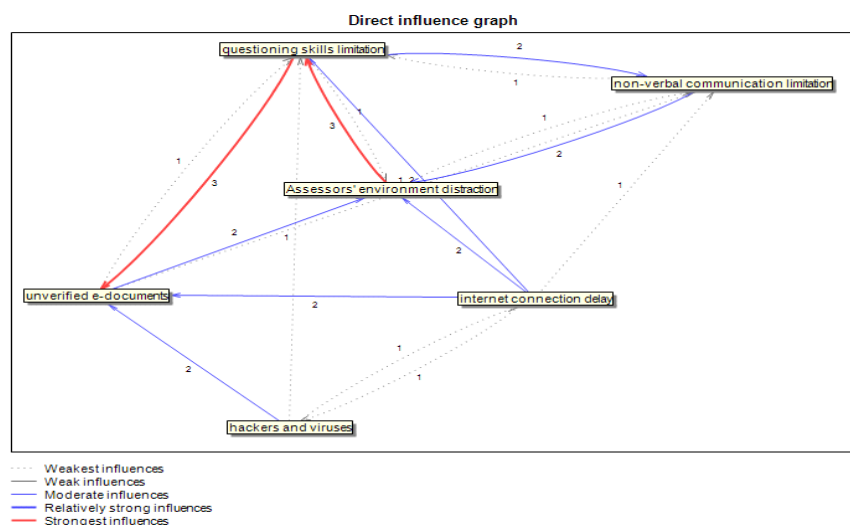|	INFLUENCE						
	B1	**B2**	**B3**	**B4**	**B5**	**B6**	**∑I**
B1	0	1	2	2	1	2	8
B2	1	0	2	1	0	0	4
B3	0	0	0	1	1	2	4
B4	0	0	3	0	2	1	6
B5	0	0	0	1	0	2	3
B6	0	0	0	3	1	0	4
∑D	1	1	7	8	5	7	

Figure 3. Graph of Direct Influence

Table 3 shows the dependence/Influence matrix which has 36 pairwise connections identified by the assessors during the workshop. The influence graph and influence map were presented to assessors to develop a discussion on the interaction among barrier factors. The discussion results were depicted to explain the graph and map, in the discussion section. There are 6 variables of barrier factors in the online assessment that were identified by the assessors (Table 1). Each of these 6 variables was evaluated to develop a 6 x 6 matrix of direct influence. A cell of this matrix consists of i, and j, where i is the row and j is the column. If there are no correlations between i and j, then a zero number or '0' was typed in the matrix cell. If there is a direct influence between i and j, then one number or '1', two number or '2', and three number or '3', for a weak, moderate and strong relationship, respectively, was typed in the matrix cell. Each pairwise comparison was computed using the LIPSOR-EPITA-MICMAC software. The relationships among variables are described in Figure 3.

The influence graph in Figure 3 shows a visual depiction of how assessors described factor interaction. The lines in this graph indicate interactions among the factors. The thick connecting line shows a strong connection as identified by the assessors. The arrowheads indicate the directionality of each connection. For example, during the workshop, the assessors revealed that the Assessors' Environment Distraction influences the Questioning Skill Limitation, so the graph shows the arrow between two factors (red thick line). This interaction is also highly influential. Another finding is the Questioning Skill Limitation influences the Unverified e-document, where the experts noted that they sometimes have insufficient ability to determine the authenticity of a candidate's portfolio. The network represents the interactions between the barrier factors. It enabled assessors to identify which factors that highly influential (driving the systems' behavior) and highly dependent (very sensitive to the evolution of other factors). For example, Internet Connection Delay has three outgoing lines and no incoming line, indicating that it is an influent variable. Another example is the Questioning Skill Limitation has two outgoing lines and two incoming lines, indicating that it is an influent variable and also a dependent variable. Direct influence/dependence map is show Figure 4.
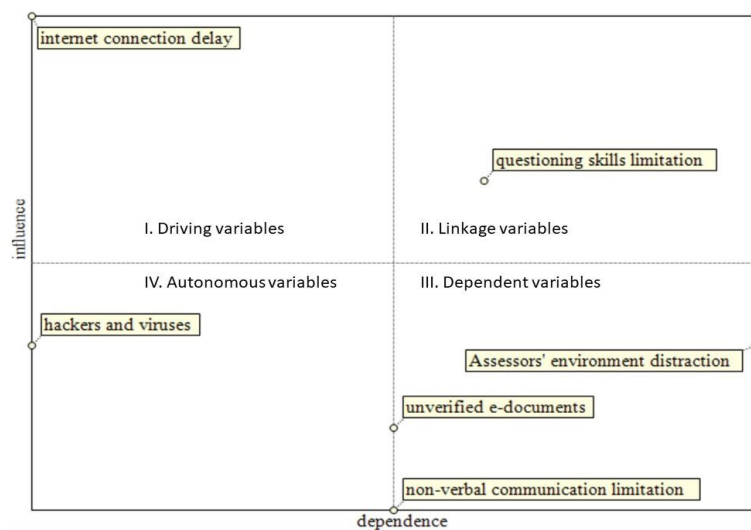

Figure 4. Direct Influence/Dependence Map

Base Figure 4, the MICMAC analysis result shows the calculation result of a matrix of direct influence in a direct influence/dependence map using LIPSOR-EPITA-MICMAC. This map classifies the barrier factors into four quadrants. The first quadrant is defined as the driving variable, which consists of internet connection delay. Factors in this quadrant have a strong influence and low dependency on other barrier factors. The second quadrant, a linkage variable, where there is also only one factor of questioning skills limitation fall under this category. It has the strongest direct influence on online assessment. Also, the questioning skills limitation factor has the highest dependency on other barriers. Its level of impact as the barrier in the online assessment depends on the situation of other barrier factors. The third quadrant is a dependent barrier, consisting of non-verbal communication limitations, assessors' environment distraction, and unverified e-document. The barriers under quadrant three have the characteristics of low influence as the barrier to online assessment but have a strong dependency on other factors. Hence, if there is an increase of problems in other factors such as internet connection delay, hackers and viruses, and questioning skills limitation, then the factors in the third quadrant, will be affected right away. The

autonomous barrier variable or fourth quadrant consists of the barrier factor of hackers and virus problems. The factor within this quadrant has low influence and low dependence among other barrier variables.

Discussion

    Based on the influence graph (Figure 3), Internet Connection Delay has the highest overall influence. The assessors remarked, "the poor internet connection that causes the gap or delay of responses during the interview frequently occurs. It prevented us to understand the candidate's responses clearly, and sometimes distracted the assessment". This remark is also shown in the influence graph, where internet connection delay has a moderate influence line toward the Assessor Environment Distraction variable because only a few assessors reported being distracted by this factor. Internet connection delay is also one of the most influential issues in online assessment, especially in developing countries (Alruwais, N., Wills, G., & Wald, 2018; Crews & Curtis, 2011; Osuji, 2012; Pokhrel & Chhetri, 2021). Previous study found in Indonesia, internet connection quality improvement is quite a challenging effort, especially in the eastern islands of Indonesia e.g., Sulawesi, Maluku (Maruanaya & Köhler, 2020), Nusa Tenggara, and Papua Island where communication infrastructures are still in development. Other study state the government has been improving the technology infrastructure, legislation, regulation, and data infrastructure, strategies, and governance for digital transformation in Indonesia (Kusmiarto et al., 2021). The effect of internet connection delay may not visible directly but it indirectly has an effect of all other barrier factors. The Unverified e-document factor has a low influence on other factors, but a strong dependency on other factors (Figure 4). As assessors revealed that some skills written or stated in the applicants' e-documents were difficult to be assessed for their authenticity based on the explanation given during the interview. It might due to insufficient ability to communicate effectively. This challenge was revealed in previous study related to soft skills for entry-level engineers compare to the Accreditation Board of Engineering and Technology (ABET) standard (Hirudayaraj et al., 2021). Thus, this obstacle often caused an uncomfortable atmosphere for the candidates throughout the interview and influence the interview outcome. Both assessors and candidates need to adopt a new assessment system and sometimes they are not prepared for it (Itani & Srour, 2016; Pokhrel & Chhetri, 2021), hence the assurance of the authenticity of candidate documents is crucial. Also, these finding obliques that engineering faculties or universities need to focus on strengthening students' soft skills such as oral communication skills (Akyazi et al., 2020; Chen et al., 2022; Cruz et al., 2020).

    The Non-Verbal Communication Limitation factor has a low influence on other factors (Figure 3). Assessors highlighted that the body language of the candidate would not be needed to be assessed if the interview smoothly took place (the information in the e-document was explained clearly and fluently by the candidates, with easy access to all evidence needed). Therefore, a clearer and more accessible verification system of the e-documents for online assessment must be prioritized. The assessors noted that during the online interview session, some information on the documents was not in alignment with the explanation given during the interview. Thus, this situation often caused an uncomfortable atmosphere for the candidates throughout the interview and influence the interview outcome. Both assessors and candidates need to adopt a new assessment system and sometimes they are not prepared for it, hence the assurance of the authenticity of candidate documents is crucial (Doğan et al., 2020; Pokhrel & Chhetri, 2021). Non-verbal Communication Limitation is categorized as a dependent barrier. Assessors expressed that during the face-to-face online assessment due to poor connection, candidates need to turn the camera off and the microphone on to keep the internet connectivity in place. In some circumstances, video is not feasible because it might decrease the sound quality. This condition prevents the assessors to evaluate the Non-Verbal Communication factor, such as facial expression or body language (Al-Rawi et al., 2022; Gamage et al., 2020; Kaddoura & Gumaei, 2022), to detect any possibility of fraud or dishonest behavior.

    The assessor's perceptions of different interview media, with the camera on and off, will be different. It is due to factors that influence and shape assessors' perceptions of the contextual suitability of particular media (Montenegro-Rueda et al., 2021; Tucker & Parker, 2019). Therefore, it is necessary to turn the camera on so that the assessment proctoring using an online meeting platform can be an effective and valid tool (Hollister, K. K., & Berenson, 2009; Linden & Gonzalez, 2021; Milone et al., 2017). Also, there is a possibility of utilizing artificial intelligence (AI) to analyze body language, as it is applied in COVID-19 detection in a patient (Abdulghafor et al., 2022; Kharbat & Abu Daabes, 2021). The Questioning Skill Limitation variable has the strongest direct influence on other factors (Figure 3) and the highest dependency on other barriers (Figure 4). This finding is agreed upon by the assessors who mentioned that their limitations on questioning skills, such as: how to create a comfortable environment for the assessment so that the candidates could perform better, and how to elucidate the information efficiently,

have been the highest challenge during the online assessment. Even though all assessors have long professional experience (minimum 15 to 20 years) in engineering work and have received training to obtain certificates as assessors, they feel that online assessment requires different skills than onsite assessment, especially during the candidates' interview process. Therefore, the questions should be carefully developed to cover the competencies that will be assessed and the assessors' competence should be enhanced to further increase their professionalism (Damek et al., 2022; Farozin, 2019). Moreover, the questioning skill should be incorporated into the curricula of the assessors' training and/or certification program. The study found that internet connection delay and questioning skill limitations are the barriers with the highest influence beyond other barriers in the online assessment process. Also, the questioning skills limitation factor has the highest dependency on other barriers. Therefore, assessors proposed revisiting the curricula in the assessor training and/or certification program by enhancing the questioning skill of assessors. A limitation of this study is that the relationships between online assessment barrier factors are based on the opinions of eight assessors picked from one professional association who have experience in online assessment of certification. In addition, only 6 factors were considered to develop an understanding of the relationship between the barrier factors of online assessment in the professional certification process. Therefore, in future research, a structural literature review to select more factors and more participants from various professional certification associations in the focus group discussion workshop.

4. CONCLUSION

This research studied the contextual relationship among the barrier factors of online assessment for professional certification using the Matrix of Cross-impact Multiplication Applied to a Classification (MICMAC) analysis approach. Six barrier factors were identified from the focus group discussion with the assessors from Indonesia Hydraulic Engineer Association. The identification and understanding of these barriers were drawn from the analysis result of the MICMAC research method interpreted using the assessor's knowledge and experiences. The barrier factors identified are as follows: technical aspects, such as internet connection delay, hackers and viruses, unverified e-documents, and social aspects, such as questioning skill limitation, non-verbal communication limitation, and assessors' environment distraction.

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