Empirical study of architect competencies in supporting the realization of sustainability in architecture

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Abstract. To be a reliable and professional architect so as to have competitiveness not only nationally but also regionally hence required a standard architect competence to support the realization of Sustainability in Architecture. This study attempts to examine the 13 competencies designed by the Indonesian Architects Association in a survey to find out the general picture of how their assessment of competencies. The research method was conducted by survey and Inferential descriptive approach to explain the approximate condition of the population of Indonesian architects through the sample glasses in Jakarta. The scale used is the Likert model with the scale range of 1 to 5. Instrument validity Competence Architect of Indonesia (Y) with construct validity approach using Item Response Theory (IRT) that is through Orthogonal Iteration. The results of the study found that Indonesian architects tend to be competent. This description of competence is able to show that Indonesian architects have good competitiveness locally, nationally and regionally.

Keywords: Architect Competencies, Sustainability in Architecture, Socio-cultural Ecology

1. Introduction

ASEAN Economic Community (AEC) is an ASEAN economic integration in the face of free trade among ASEAN countries. AEC has the goal of forming a single market and production base, realizing a competitive economic region, developing a fair economy and integrating it into the global economy [1]. AEC is a free market system among ASEAN member countries that eliminates tax or customs and the freedom of a country to enter its goods to other countries. In general, the AEC aims to establish regional economic communities among ASEAN member countries as a stable, prosperous ASEAN economic integration region with a high level of competitiveness [2], [3]. In addition, to accelerate economic growth, social progress and cultural development, especially in the ASEAN region.

The implementation of the AEC in 2015 provides a tremendous opportunity for Indonesia [4]. The implementation of AEC can be done in various fields including the field of construction and also the profession of architects. The impact of AEC on construction needs to be formulated in a policy because there are still differences in design and practice standards

and existing building codes so that they are not in accordance with the spirit of ASEAN country integration [5]. Consequently, the profession of architects is no longer just for consumption of Indonesia, but also the Profession can be accepted in the ASEAN community. The size of the acceptance, among others, from the aspect of the competence of the architect itself. The problem is, how is the condition of the competence of Indonesian architects to support the realization of Sustainability in Architecture?

2. Research Framework

Some studies do a study on how to build the competence of architects and improve it. They relate skills to learning methods throughout the disciplines both systemically, thoughtfully and creatively with the basic concepts of elegance and goodness of the architecture itself that is solid, useful and beautiful [6]. A study found the opinion that the core competence of architects more related to knowledge, process and interaction that they do through communication skills [7]. This is especially important when it is associated with user satisfaction [8]

In Indonesia, the Indonesian Institute of Architects has formulated standards of conformity so as to apply professionalism standards as a reliable architect through a variety of recommended study materials. The principle of professionalism should show behavior as an expert, independent, highly committed and accountable [9].

The Indonesian Institute of Architects formulates 13 architectural competencies such as the ability of architects to produce beautiful works and meet established technical standards, appropriate knowledge of related history, theory and art, architect's knowledge of the arts and impact on the quality of architectural designs owned, adequate knowledge and skills related to the design and planning process, a good understanding of building relationships with the community and the environment, an understanding to maximize environmental capacity through design, the ability to consider social factors, the ability to apply optimal preparation, the ability to apply between disciplines, physical and technological problems and relate them to comfort, ability to meet the basic requirements of building factors, the ability to integrate planning in the overall project and the ability to manage the project [9], [10].

3. Materials and Methods

Research method with the survey with an Inferential descriptive approach to explaining the estimated condition of the population of Indonesian architects through sample glasses in Jakarta. Techniques of collecting data by field assessment and direct observation in private. The scale of data used Likert Model with scale range 1 to 5. Instrument validity Competence Architects Indonesia (Y) with construct validity approach using Item Response Theory (IRT) that is through Orthogonal Iteration. The number of test samples of instruments as many as 10 people who represent the architects of Jakarta and West Java. Based on the Product Moment table, the r-criteria is set at 0.632. Of the 82 items planned, after being analyzed with the first Orthogonal Iteration, proved to be all valid. Calculation of reliability index with Cronbach Alpha formula and the result is 0.991.

4. Results and Discussions

In proving the condition of the competence of Indonesian architects, the researcher establishes 5 (five) categories of Indonesian architects: (a) very incompetent, (b) incompetent, (c) competent enough, (d) competent, and (e) very competent. The analysis was done with a confidence interval at a significance level of 5% and produced lower and upper boundary between 343,2262 up to 354,1621. Based on these results, it can be concluded that Indonesian architects tend to be competent as architects significantly on α <0,05.

Descriptives

			Statistic	Std. Error
Competence_Y	Mean		348.6941	2.74964
	95% Confidence Interval for Mean	Lower Bound	343.2262	
		Upper Bound	354.1621	
	5% Trimmed Mean		349.6699	
	Median		350.0000	
	Variance		642.643	
	Std. Deviation		25.35041	
	Minimum		253.00	
	Maximum		405.00	
	Range		152.00	
	Interquartile Range		28.00	
	Skewness		-.739	.261
	Kurtosis		1.974	.517

Figure 1. Condition of the Competence of Indonesian Architects

In proving the condition of the Indonesian architect's ability in architectural design (X1), the researcher establishes 5 (five) categories, namely: (a) very inadequate, (b) incapable, (c) sufficient, (d) capable, and (e) very capable. The analysis was done with a confidence interval at 5% significance level and produced lower and upper bound between 29.9620 up to 30,3321. Based on these results, it can be concluded that Indonesian architects tend to have the ability in architectural design significantly on α <0.05.

Descriptives

			Statistic	Std. Error
Planning_X1	Mean		29.6471	.34451
	95% Confidence Interval for Mean	Lower Bound	28.9620	
		Upper Bound	30.3321	
	5% Trimmed Mean		29.8072	
	Median		30.0000	
	Variance		10.088	
	Std. Deviation		3.17620	
	Minimum		15.00	
	Maximum		35.00	
	Range		20.00	
	Interquartile Range		4.00	
	Skewness		-1.273	.261
	Kurtosis		4.325	.517

Figure 2. Condition of the Capability of Indonesian Architects

In proving the condition of the Indonesian architect's knowledge of architecture (X2), the researcher establishes 3 (three) categories: (a) lacks knowledge, (b) has enough, and (c) has knowledge. The analysis was done with the confidence interval at a significance level of 5% and produced lower and upper boundary between 27,7847 up to 29,0623. Based on these results, it can be concluded that Indonesian architects tend to have enough knowledge of architecture significantly at $\alpha < 0,05$.

Descriptives

			Statistic	Std. Error
ArchitectCog_X2	Mean		28.4235	.32123
	95% Confidence Interval for Mean	Lower Bound	27.7847	
		Upper Bound	29.0623	
	5% Trimmed Mean		28.5752	
	Median		29.0000	
	Variance		8.771	
	Std. Deviation		2.96157	
	Minimum		17.00	
	Maximum		35.00	
	Range		18.00	
	Interquartile Range		3.00	
	Skewness		-.961	.261
	Kurtosis		2.872	.517

Figure 3. Condition of the Knowledge of Indonesian Architects

In proving the condition of ownership of knowledge of art by Indonesian architects (X3), the researcher establishes 3 (three) categories: (a) not having, (b) having enough, and (c) owning. The analysis was done with the confidence interval at 5% significance level and produced lower and upper bound between 12.2964 up to 12.9036. Based on these results, it can be concluded that Indonesian architects tend to have enough knowledge of art significantly at $\alpha < 0,05$.

Descriptives

			Statistic	Std. Error
Art_X3	Mean		12.6000	.15266
	95% Confidence Interval for Mean	Lower Bound	12.2964	
		Upper Bound	12.9036	
	5% Trimmed Mean		12.6111	
	Median		13.0000	
	Variance		1.981	
	Std. Deviation		1.40746	
	Minimum		10.00	
	Maximum		15.00	
	Range		5.00	
	Interquartile Range		2.00	
	Skewness		-.196	.261
	Kurtosis		-.783	.517

Figure 4. Condition of Ownership of Knowledge of Art by Indonesian Architects

In proving the condition of the ability in planning and design of the city by the Indonesian architects (X4), the researchers set 5 (five) categories: (a) very inadequate, (b) not able, (c) (e) very capable. Analysis is done with confidence interval at 5% significance level, and produced lower and upper bound between 24,3465 up to 25,5124. Based on these results,

it can be concluded that Indonesian architects tend to be quite capable of planning and designing the city significantly on $\alpha < 0.05$.

Descriptives

			Statistic	Std. Error
Planology_X4	Mean		24.9294	.29315
	95% Confidence Interval for Mean	Lower Bound	24.3465	
		Upper Bound	25.5124	
	5% Trimmed Mean		24.9902	
	Median		25.0000	
	Variance		7.304	
	Std. Deviation		2.70268	
	Minimum		17.00	
	Maximum		30.00	
	Range		13.00	
	Interquartile Range		3.50	
	Skewness		-.364	.261
	Kurtosis		.211	.517

Figure 5. Condition of Ability in Planning and Designing of Cities by Indonesian Architects

In proving the condition of the ability of architects to establish a harmonious relationship between human, building and environment (X5), the researcher establishes 5 (five) categories: (a) very inadequate, (b) unable, (c) capable, and (e) very capable. The analysis was done with a confidence interval at 5% significance level l and produced lower and upper bound between 46,7149 up to 48,4851. Based on these results, it can be concluded that Indonesian architects tend to be quite capable of building a harmonious relationship between human, building and environment significantly at $\alpha < 0.05$.

Descriptives

			Statistic	Std. Error
Build_Eco_X5	Mean		47.6000	.44508
	95% Confidence Interval for Mean	Lower Bound	46.7149	
		Upper Bound	48.4851	
	5% Trimmed Mean		47.7712	
	Median		48.0000	
	Variance		16.838	
	Std. Deviation		4.10342	
	Minimum		34.00	
	Maximum		55.00	
	Range		21.00	
	Interquartile Range		6.50	
	Skewness		-.564	.261
	Kurtosis		.335	.517

Figure 6. The Condition of the Ability of Architects to Build A Harmonious Relationship Between Human, Building and Environment

In proving the condition of knowledge ownership in terms of environmental carrying capacity (X6), the researcher establishes 3 (three) categories: (a) not having the knowledge, (b) having enough, and (c) having knowledge. The analysis was conducted with a confidence interval at 5% significance level and produced lower and upper bound between 20.2148 to 21.2676. Based on these results, it can be concluded that Indonesian architects tend to have enough knowledge in terms of environmental carrying capacity significantly at $\alpha < 0.05$.

Descriptives

			Statistic	Std. Error
Environment_X6	Mean		20.7412	.26471
	95% Confidence Interval for Mean	Lower Bound	20.2148	
		Upper Bound	21.2676	
	5% Trimmed Mean		20.8497	
	Median		21.0000	
	Variance		5.956	
	Std. Deviation		2.44050	
	Minimum		12.00	
	Maximum		25.00	
	Range		13.00	
	Interquartile Range		3.00	
	Skewness		-.763	.261
	Kurtosis		1.431	.517

Figure 7. Condition of Knowledge Ownership in Terms of Environmental Carrying Capacity

In proving the condition of the architect's ability to portray the architecture in society (X7), the researcher establishes 5 (five) categories: (a) very inadequate, (b) unable, (c) enough, (d) able, able. The analysis was done with a confidence interval at a significance level of 5% and produced lower and upper boundary between 28,9079 until 30,1274. Based on these results, it can be concluded that Indonesian architects tend to be able to portray the architecture in the community significantly on α <0,05.

Descriptives

			Statistic	Std. Error
Arch_Com_X7	Mean		29.5176	.30661
	95% Confidence Interval for Mean	Lower Bound	28.9079	
		Upper Bound	30.1274	
	5% Trimmed Mean		29.5654	
	Median		30.0000	
	Variance		7.991	
	Std. Deviation		2.82679	
	Minimum		18.00	
	Maximum		35.00	
	Range		17.00	
	Interquartile Range		3.00	
	Skewness		-.529	.261
	Kurtosis		2.214	.517

Figure 8. The Condition of the Architect's Ability to Play the Architecture in The Community

In proving the condition of the ability of the architect in preparing the design work (X8), the researcher establishes 5 (five) categories: (a) very inadequate, (b) unable, (c) very capable. The analysis was done with a confidence interval at significance level of 5% and produced lower and upper bound between 21,7753 until 22,6247. Based on these results, it can be concluded that Indonesian architects tend to be able to prepare significant extra design work on α <0,05.

Descriptives

			Statistic	Std. Error
Prepare_X8	Mean		22.2000	.21355
	95% Confidence Interval for Mean	Lower Bound	21.7753	
		Upper Bound	22.6247	
	5% Trimmed Mean		22.2712	
	Median		22.0000	
	Variance		3.876	
	Std. Deviation		1.96880	
	Minimum		16.00	
	Maximum		25.00	
	Range		9.00	
	Interquartile Range		3.50	
	Skewness		-.344	.261
	Kurtosis		-.279	.517

Figure 9. Condition of the Ability of the Architect in Preparing the Design Work

In proving the condition of the ability of architects in constructing the meaning of problems between disciplines of science (X9), the researchers set 5 (five) categories: (a) very inadequate, (b) unable, (c) capable, (e) very capable. The analysis was done with a confidence interval at 5% significance level and produced lower and upper boundary between 33.0639 up to 34,9361. Based on these results, it can be concluded that Indonesian architects tend not to be able to build the meaning of problems among disciplines significantly on $\alpha < 0.05$.

Descriptives

			Statistic	Std. Error
Inter_Deciple_X9	Mean		34.0000	.47071
	95% Confidence Interval for Mean	Lower Bound	33.0639	
		Upper Bound	34.9361	
	5% Trimmed Mean		33.8824	
	Median		34.0000	
	Variance		18.833	
	Std. Deviation		4.33974	
	Minimum		23.00	
	Maximum		57.00	
	Range		34.00	
	Interquartile Range		4.00	
	Skewness		1.492	.261
	Kurtosis		8.480	.517

Figure 10. Condition of the Ability of Architects in Building the Meaning of Problems Between Disciplines

In proving the condition of good knowledge of architect about physical and physics of building (X10), researcher specify 3 (three) categories that are: (a) do not have the knowledge, (b) have enough, and (c) have knowledge. The analysis is done with a confidence interval at significance level 5% and produced lower and upper boundary between 20,7340 until 21,6896. Based on these results, it can be concluded that Indonesian architects tend to have enough knowledge about physical and building physics significantly at $\alpha < 0{,}05$.

Descriptives

			Statistic	Std. Error
Physical_X10	Mean		21.2118	.24027
	95% Confidence Interval for Mean	Lower Bound	20.7340	
		Upper Bound	21.6896	
	5% Trimmed Mean		21.2974	
	Median		21.0000	
	Variance		4.907	
	Std. Deviation		2.21518	
	Minimum		12.00	
	Maximum		25.00	
	Range		13.00	
	Interquartile Range		3.00	
	Skewness		-.799	.261
	Kurtosis		2.496	.517

Figure 11. Good Knowledge Condition of Architect About Physical and Physics of Building

In proving the condition of the ability of architects in synergizing between budget constraints and building codes (X11), the researcher establishes 5 (five) categories: (a) very inadequate, (b) incapable, (c) and (e) very capable. The analysis was done with a confidence interval at significance level of 5% and produced lower and upper bound between 21,3420 until 22,2109. Based on these results, it can be concluded that Indonesian architects tend to be quite able to synergize between the budget constraints with building regulations significantly on $\alpha < 0.05$.

Descriptives

			Statistic	Std. Error
Synergy_X11	Mean		21.7765	.21846
	95% Confidence Interval for Mean	Lower Bound	21.3420	
		Upper Bound	22.2109	
	5% Trimmed Mean		21.8170	
	Median		22.0000	
	Variance		4.057	
	Std. Deviation		2.01410	
	Minimum		17.00	
	Maximum		25.00	
	Range		8.00	
	Interquartile Range		3.00	
	Skewness		-.116	.261
	Kurtosis		-.794	.517

Figure 12. Condition of the Ability of the Architect in Synergizing Between Budget Constraints and Building Regulations

In proving the condition of the architect's knowledge about the construction industry in the planning (X12), the researcher establishes 3 (three) categories: (a) lack of knowledge, (b) enough possession, and (c) knowledge. The analysis was conducted with a confidence interval at significance level of 5% and produced lower and upper boundary between 29.6209 up to 30,6849. Based on these results, it can be concluded that Indonesian architects tend to have enough knowledge of the construction industry in planning significantly at $\alpha < 0.05$.

Descriptives

			Statistic	Std. Error
Industry_X12	Mean		30.1529	.26753
	95% Confidence Interval for Mean	Lower Bound	29.6209	
		Upper Bound	30.6849	
	5% Trimmed Mean		30.1634	
	Median		30.0000	
	Variance		6.083	
	Std. Deviation		2.46647	
	Minimum		24.00	
	Maximum		35.00	
	Range		11.00	
	Interquartile Range		4.00	
	Skewness		.025	.261
	Kurtosis		-.336	.517

Figure 13. Condition of the Architect's Knowledge of the Construction Industry in the Planning

In proving the condition of the architect's knowledge of project management (X13), the researcher establishes 3 (three) categories: (a) not having the knowledge, (b) having enough, and (c) having knowledge. The analysis was done with a confidence interval at 5% significance level and produced lower and upper bound between 25.2904 up to 26,4978. Based on these results, it can be concluded that Indonesian architects tend to have knowledge of project management significantly on $\alpha < 0.05$.

Descriptives

			Statistic	Std. Error
Management_X13	Mean		25.8941	.30358
	95% Confidence Interval for Mean	Lower Bound	25.2904	
		Upper Bound	26.4978	
	5% Trimmed Mean		26.0556	
	Median		26.0000	
	Variance		7.834	
	Std. Deviation		2.79891	
	Minimum		16.00	
	Maximum		30.00	
	Range		14.00	
	Interquartile Range		4.00	
	Skewness		-.713	.261
	Kurtosis		.848	.517

Figure 14. Condition of the Architect's Knowledge of Project Management

5. Conclusion

The need for competent architects to support the realization of Sustainability in Architecture is higher especially for a company because of the potential challenges that increasingly require development. And the architect's role is becoming an interesting topic because of the need to improve the safety, safety system by analyzing prevention efforts and utilizing technology.

Competencies that are not only related to knowledge but also skills both technically, socially and culturally. The results of the study found that Indonesian architects tend to be competent as architects will be able to produce architects that are globally competitive. This study proves that the competencies designed by IAI can be fulfilled by the architects themselves. With the fulfilment of this standard, it is possible for Indonesian architects to compete in ASEAN.

References

[1] S. Chia, "The ASEAN Economic Community: Progress, Challenges, and Prospects," 2013
[2] L. Jones, "Explaining the failure of the ASEAN economic community: the primacy of domestic political economy," *Pacific Rev.*, vol. 2748, no. March, pp. 37–41, 2015

[3] J. Dosch, *The ASEAN Economic Community: Progress, Challenges, and Prospects*, no. June. 2013
[4] J. Menon and A. C. Melendez, "Realizing An Asean Economic Community: Progress And Remaining Challenge," *Singapore Econ. Rev.*, vol. 62, no. 03, pp. 681–702, 2017
[5] S. Kanjanabootra and B. Corbitt, "Re-contextualizing extra-national policy in the Thai construction industry within the new ASEAN economic community," *Eng. Proj. Organ. J.*, vol. 6, no. 1, pp. 45–59, 2016
[6] T. McDermott and A. Salado, "Improving the Systems Thinking Skills of the Systems Architect via Aesthetic Interpretation of Art," *INCOSE Int. Symp.*, vol. 27, no. 1, pp. 1340–1354, 2017
[7] T. Besker, R. Olsson, and K. Pessi, "The Enterprise Architect profession : An empirical study," *ECIME2015-9th Eur. Conf. IS Manag. Eval. ECIME 2015*, pp. 21–22, 2015
[8] S. Amos-Abanyie, E. Ayebeng Botchway, and T. E. Kwofie, "The Relationship between Level of Architect's Professional Competencies and Client Satisfaction Level," *Eng. Manag. Res.*, vol. 3, no. 2, pp. 10–19, 2014
[9] A. S. Mutaqi, "Architecture Studio Learning : Strategy to Achieve Architects Competence," *SHS Web Conf.*, vol. 41, no. 04004, pp. 1–8, 2018
[10] I. A. Indonesia, "13 Butir Kompetensi - Sertifikat Keahlian Arsitek IAI."
[11] M. Kumwenda and N. Sciences, "Enterprise Architect Roles and Competencies Within Medium to Large Scale Organizations," 2017
[12] M. Galster, S. Angelov, M. Meesters, and P. Diebold, "A Multiple Case Study on the Architect ' s Role in Scrum," in *In International Conference on Product-Focused Software Process Improvement*, 2016, no. November, pp. 432–447
[13] G. Muller, "The Role of the Architect in a Turbulent World," 2018. [Online]. Available: www.gaudisite.nl
[14] S. Wijaksono, Sasmoko, Y. Indrianti, and S. A. Widhoyoko, "Jakarta socio-cultural ecology: a sustainable architecture concept in urban neighbourhood," *IOP Conf. Ser. Earth Environ. Sci.*, vol. 109, pp. 1–9, 2017
[15] G. Hohpe, I. Ozkaya, U. Zdun, and O. Zimmermann, "The Software Architect 's Role in the Digital Age," *IEEE Softw.*, vol. 33, no. 6, pp. 30–39, 2016