



# **The Maintenance Priority for Construction Reliability and Sustainability in Ampel Mosque Surabaya**

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# Introduction

The Ampel Mosque Surabaya was founded in 1421. The Ampel Mosque was built in the architecture style of Javanese and Arabic, and now has developed an expansion of the mosque building and the arrangement of Sunan Ampel's tomb area. This study aims to determine the priority of maintaining the sustainability of Ampel mosque construction. Many factors in mosque building maintenance so that priority is required to determine the important maintenance steps



**Fig. 1.** Ampel Mosque Tower



**Fig. 2.** Side of Ampel Mosque



**Fig.3.** The combination of columns with beams as the frame support



**Fig.4.** The main area of the mosque which the Ampel mosque development area

# Material and Method

**Table I.** The Previous Researches

<b>Researcher</b>	<b>Year</b>	<b>Topic</b>	<b>Method</b>	<b>Variable</b>
Komalasari	2014	Green Building assesment based on energy efficiency and conservation	Comparison study, modeling by using software, and Direct measurement	Energy Efficiency Measure, Natural and artificial Lighting, Ventilation, Climate Change Impact, Vertical transportation, and Air condition system
Adebara et. al	2014	Influence analysis of timber as building construction material	Investigated and Ranking and Quality control measures	Over cultivation, Poor irrigation practices, Domestic purposes, Deforestation, Economic productivity of the land, Resulting to the loss of biological, Water conservation, Environmental aesthetics, Air conservation, Overcome water disasters.
Sugijama	2015	Modeling at service quality in Green Open Space	Importance Performance Analysis (IPA), Focus Group Discussion (FGD), and Quality Function Deployment (QFD)	Water conservation, Environmental aesthetics, Air conservation, Overcome water disasters.
Kusumawardani , et al	2016	Component description in façade element of Great Mosque Malang	Observation, Qualitative, Descriptive	Form, dimension, Material, Color, and Texture
Sedayu	2016	Performance evaluation in green building of Islamic Boarding School	Importance-Performance Analysis (IPA) and Quality Function Deployment (QFD)	Sustainable, Eco-Earth friendly, and High performance building

# I. Importance-Performance Analysis (IPA)

Importance-Performance Analysis (IPA) is conducted to obtain the level of user importances to the maintenance of the construction reliability

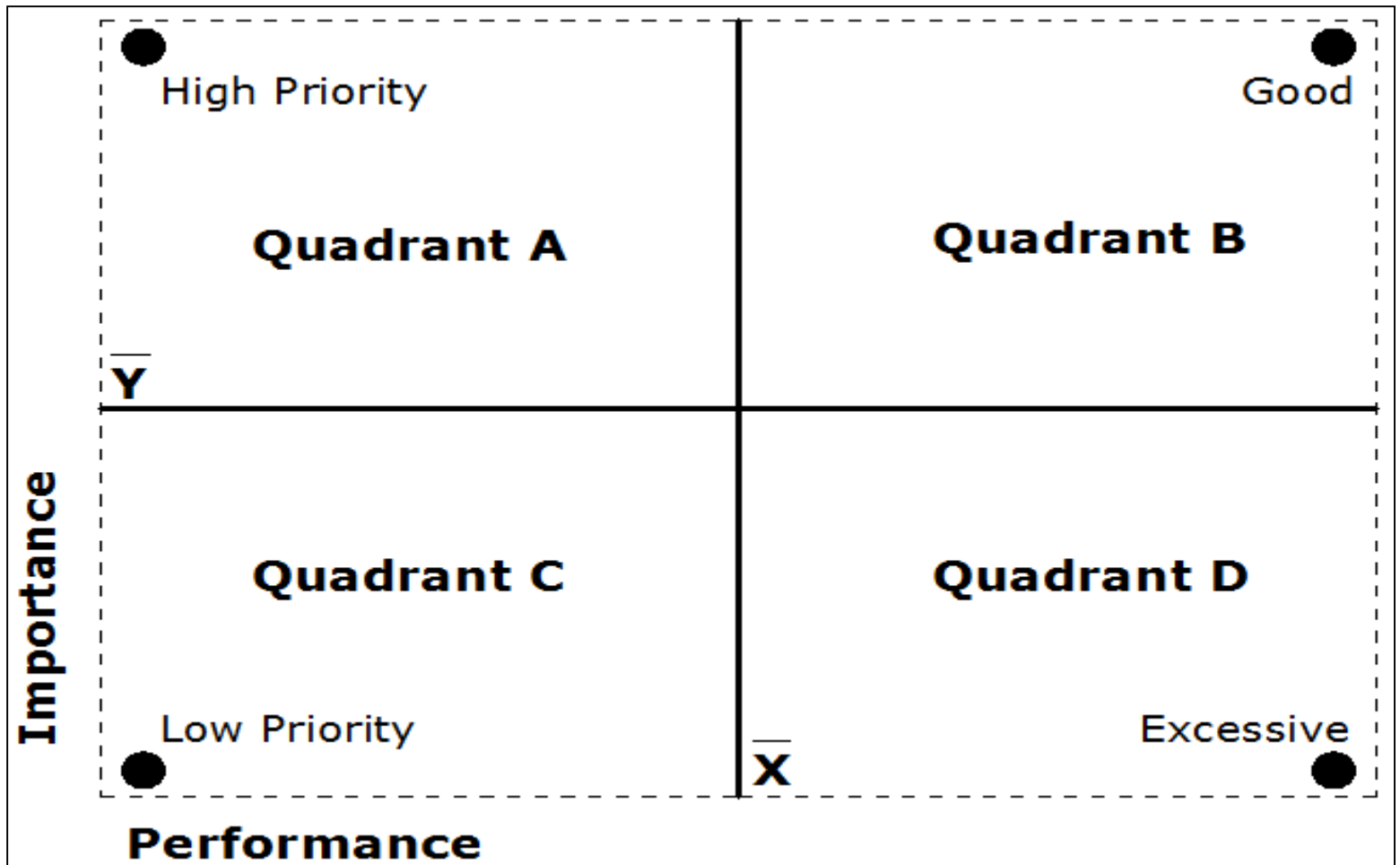
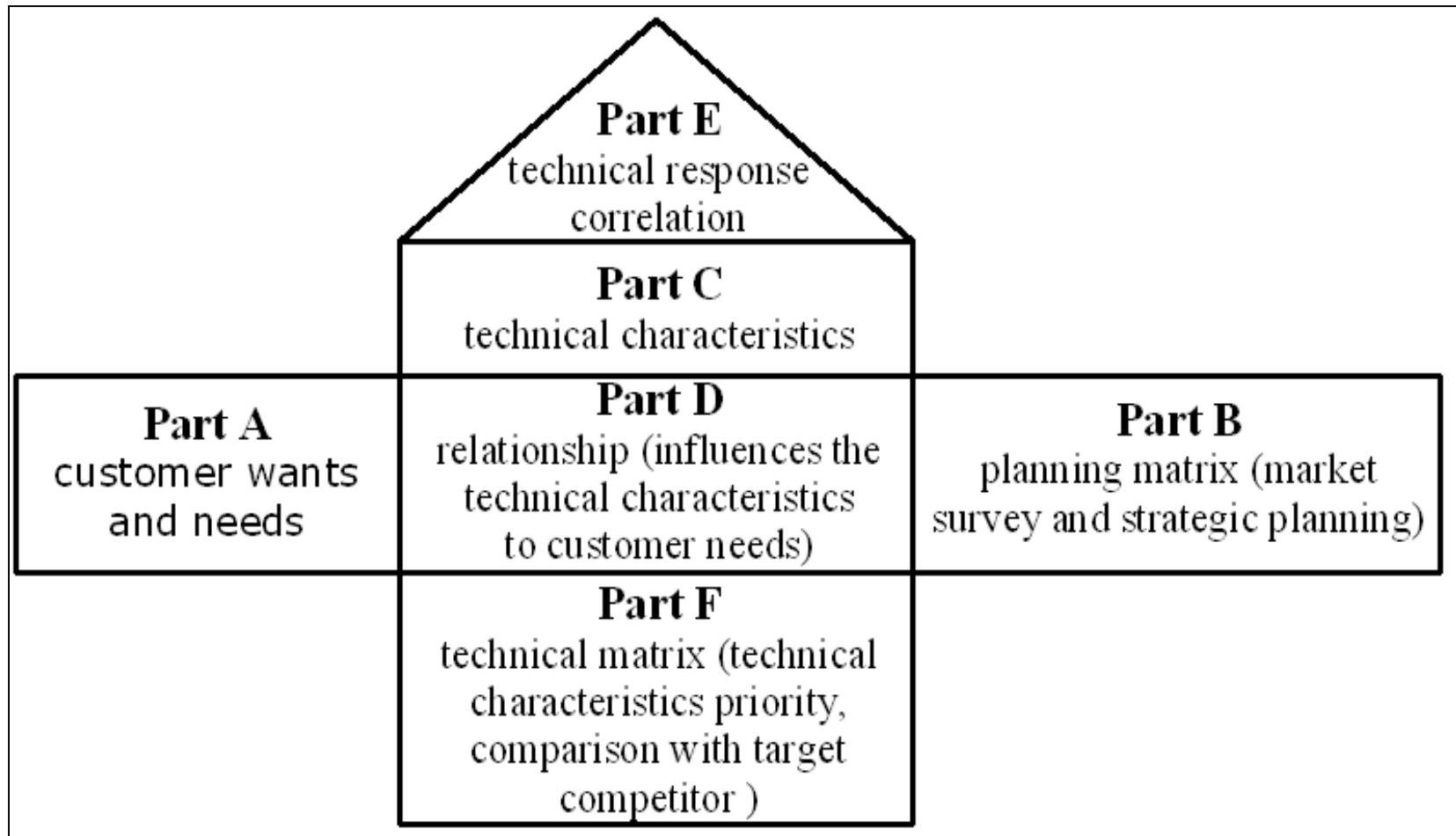


Fig.5. Importance Classification Diagram

## 2. Quality Function Deployment (QFD)

Quality Function Deployment (QFD) to know the improvement target of mosque construction reliability according to the user



**Fig.6.** House of Quality in QFD

# Result and Discussion

**Table 2.** The Research variables in Voice of User

<b>No</b>	<b>Research variables</b>	<b>Mean</b>	<b>Rank</b>
1	Ease of construction work (workability) with easy and cheap technology	3,821	3
2	Serviceability that is reliable and expert in construction supporting	3,774	6
3	Durability of building construction within the service life	3,795	5
4	Security and safety are guaranteed during the functioning of the building	3,818	4
5	Aesthetics visual architectural systems and building construction materials	3,726	7
6	Comfort and regularity in psychical aspects during the functioning of building construction	3,723	8
7	Ease and affordability in maintenance (Maintainability) of construction components	3,927	1
8	Quality of maintenance performed on architectural and structural components of buildings	3,877	2

**Table 3. Results of IPA on the importance and satisfaction of Ampel Mosque**

No	Maintenance Factors of Reliability Construction	Mean Value		Gap
		KP	TK	
1	Construction work	3,703	3,631	0,072
2	Construction equipment	3,630	3,547	0,083
3	Construction Labor	3,852	3,832	0,020
4	Financing the implementation	3,878	3,856	0,022
5	Management of work	3,885	3,926	-0,041
6	Equilibrium system of construction	3,614	3,566	0,048
7	Stability of construction system	3,619	3,875	-0,256
8	Strength of construction system	3,832	3,669	0,163
9	Proportional and configuration in construction system	3,729	3,768	-0,039
10	Durability to functional destruction level	3,591	3,879	-0,288
11	Service time or work function	3,878	3,772	0,106
12	Level of visual destruction	3,626	3,837	-0,211
13	Guarantee from physical and psychological dangers of construction	3,419	3,729	-0,310
14	Non-hazardous building materials	3,498	3,974	-0,476
15	Design and configuration of non-hazardous construction systems	3,544	3,958	-0,414



**Table 4. Results of IPA on the importance and satisfaction of Ampel Mosque**

No	Maintenance Factors of Reliability Construction	Mean Value		Gap
		KP	TK	
16	Implementation and maintenance of non-hazardous construction	3,489	3,867	-0,378
17	Aesthetics of structural materials	4,014	3,782	0,232
18	Aesthetics in system and construction configuration	3,648	3,733	-0,085
19	Aesthetics of architectural material	3,872	3,845	0,027
20	Aesthetic of construction craft details	3,858	3,878	-0,020
21	Convenience and regularity of building physical and psychological	3,699	3,832	-0,133
22	Regularity in configuration system and building construction	3,576	3,866	-0,290
23	Regularity of building construction material system	3,915	3,658	0,257
24	Regularity of non-structural materials in construction systems	3,845	3,815	0,030
25	Comfort and regularity of outdoor design	3,496	3,911	-0,415
26	Ease and affordability of maintenance	3,673	3,725	-0,052
27	Availability of maintenance labor	3,832	3,754	0,078
28	Availability of maintenance costs	3,612	3,644	-0,032
29	Management of maintenance	3,842	3,846	-0,004
30	Maintenance methods are easy to understand and apply	3,667	3,851	-0,184

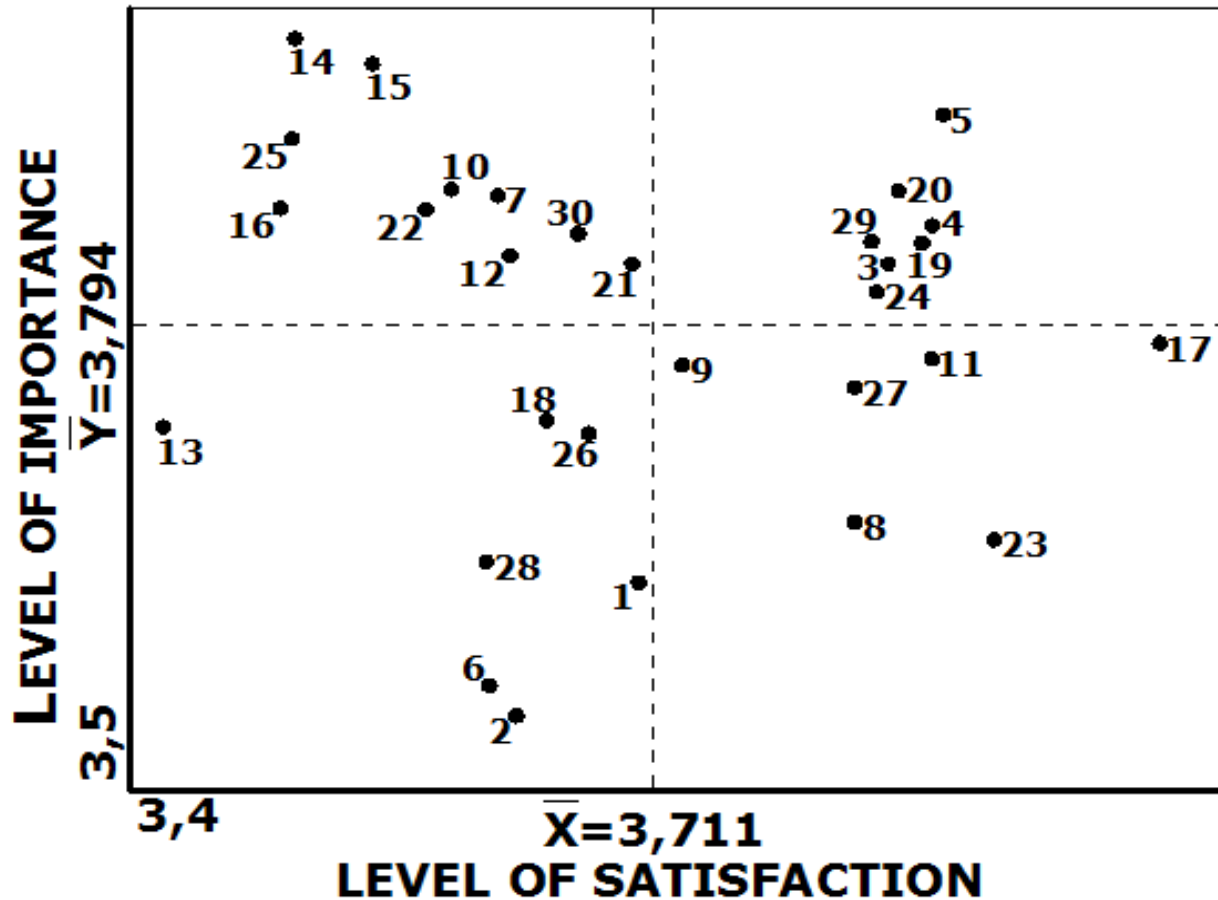
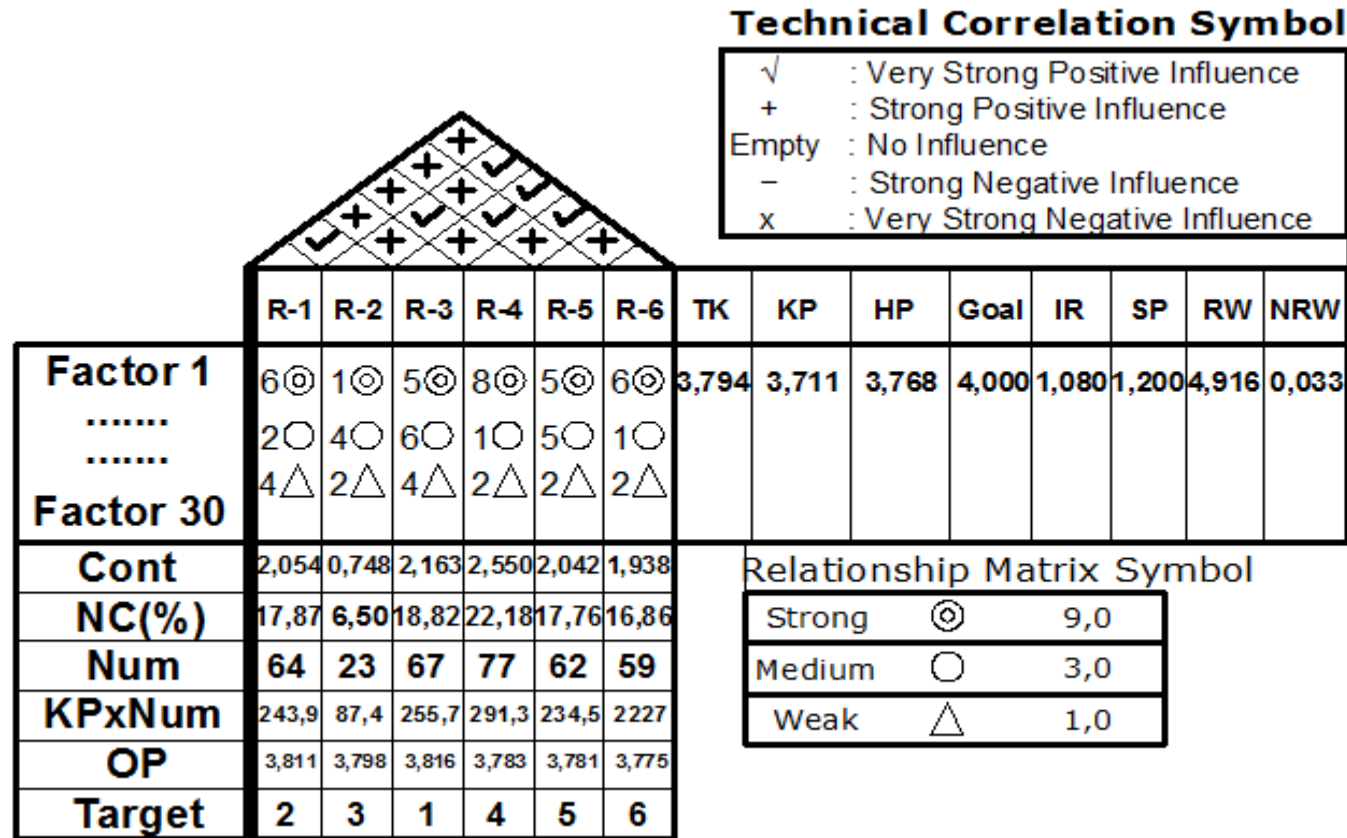


Fig.7. Importance Classification Diagram to Ampel Mosque

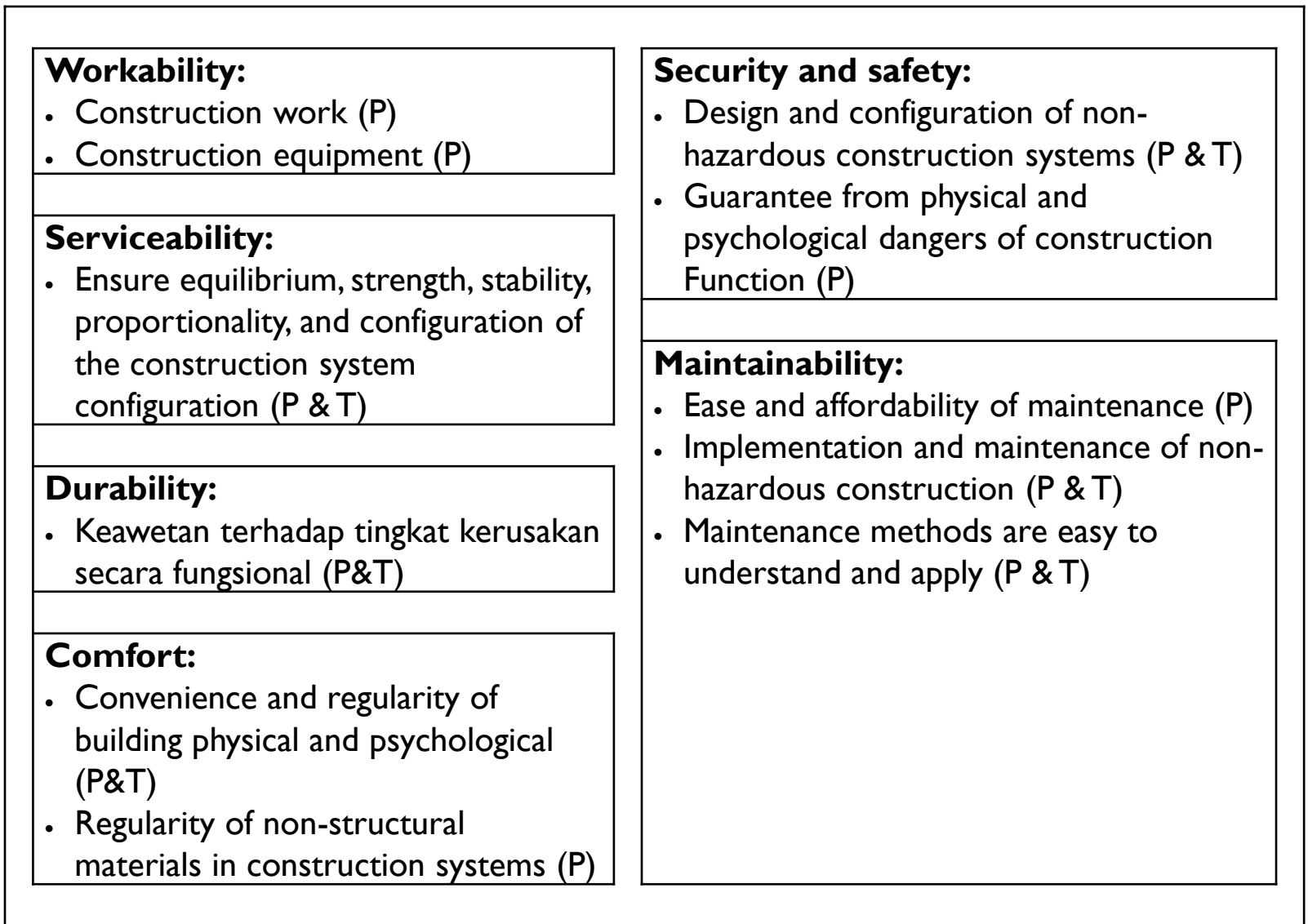
Ten variables have a high priority for improvement ie Non-hazardous building materials (no.14), Design and configuration of non-hazardous construction systems (no.15), Comfort and regularity of outdoor design (no. 25), Durability to functional destruction level (no.10), Stability of construction system (no.7), Implementation and maintenance of non-hazardous construction (no.16), Regularity in configuration system and building construction (no.22), Maintenance methods are easy to understand and apply (no.30), Level of visual destruction (no.12), and Convenience and regularity of building physical and psychological (no.21).



**Fig.8.** House of quality for quality improvement target at Ampel mosque Surabaya

**Table 8.** The improvement target of maintenance quality of Ampel mosque

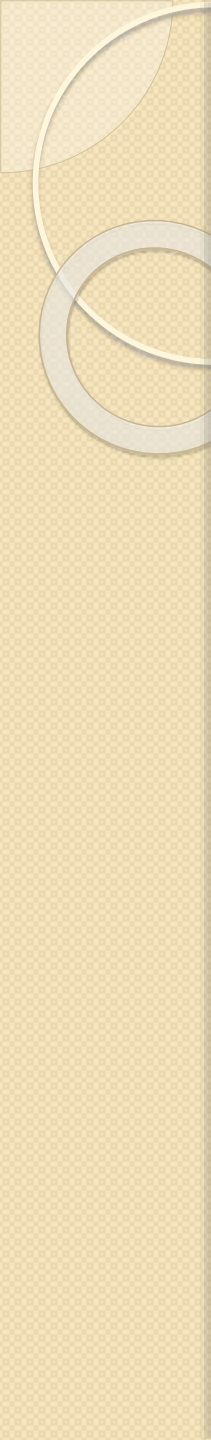
Target	Technical Response	OP
1	Ensure the design and configuration of non-hazardous construction systems (R-3)	3,816
2	Ensure equilibrium, strength, stability, proportionality, and configuration of the construction system (R-1)	3,811
3	Maintaining the durability of the structure against destruction in function and visual (R-2)	3,798
4	Ensure the implementation and maintenance of non-hazardous construction (R-4)	3,783
5	Maintain the comfort and regularity of indoor and outdoor of building physically and psychically (R-5)	3,781
6	Implement maintenance methods that are easy to understand and apply an easy to apply (R-6)	3,775

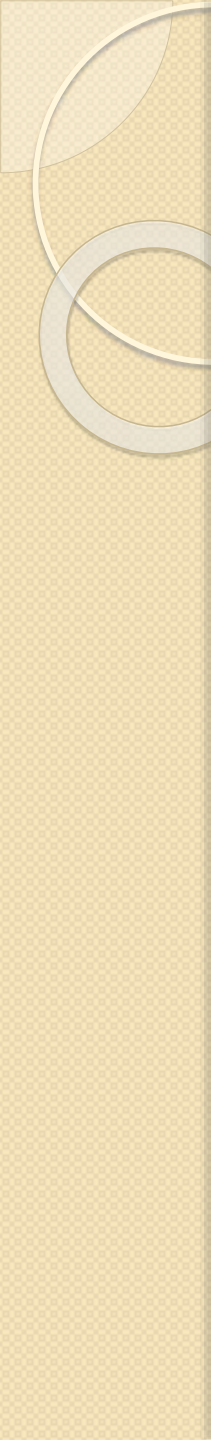


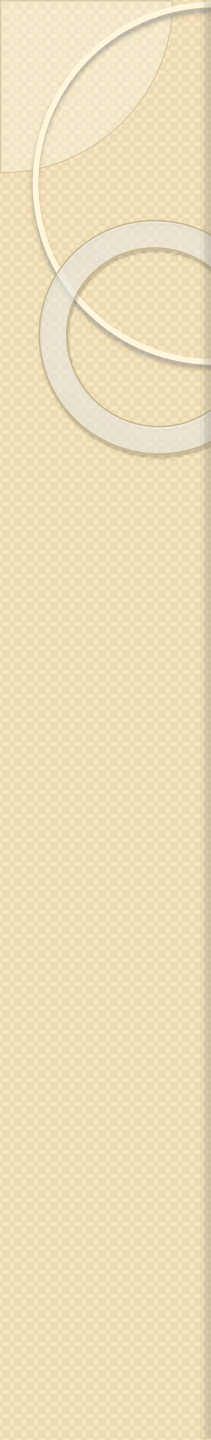
**Fig. 9.** Affinity diagram for improving maintenance quality Ampel of mosque Surabaya

# Conclusion

- Research variables influenced the maintenance quality include Ease of workability, Serviceability, Durability, Security and safety, Aesthetic of architectural system visual and building construction materials, Comfort and regularity (Comfort and Regularity), and Ease and affordability in maintenance (Maintainability)

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- Ten variables that received high priority for improvement ie Non-hazardous building materials, Design and configuration of non-hazardous construction systems, Comfort and regularity of outdoor design, Durability to functional destruction level, Stability of construction system, Implementation and maintenance of non-hazardous construction, Regularity in configuration system and building construction, Maintenance methods are easy to understand and apply, Level of visual destruction, and Convenience and regularity of building physical and psychological.

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- Six technical responses to become improvement target to increase the maintenance effort of Ampel mosque building construction covers Ensure the design and configuration of non-hazardous construction systems, Ensure equilibrium, strength, stability, proportionality, and configuration of the construction system, Maintaining the durability of the structure against destruction in function and visual, Ensure the implementation and maintenance of non-hazardous construction, Maintain the comfort and regularity of indoor and outdoor of building physically and psychically, and Implement maintenance methods that are easy to understand and apply an easy to apply.

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- Non-hazardous building material is the highest priority factor for improved maintenance. The second priority to be improved is the design and construction of a non-hazardous construction system
  - Ensure the design and configuration of non-hazardous construction systems is the highest target for improvement, while technical response of Ensure equilibrium, strength, stability, proportionality, and configuration of the construction system is the second target to be improved.



Thank you.....

