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Willingness to Pay for PDAM's Pipe Connection: A Case Study in Kabupaten Tulungagung, East Java Province, Indonesia

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Abstrak

Penelitian bertujuan mempelajari faktor-faktor yang mempengaruhi willingness to pay *terhadap sambungan air PDAM di kabupaten Tulungagung. Untuk itu telah dilakukan survei terhadap rumah tangga pelanggan dan bukan pelanggan PDAM di wilayah Tulungagung kota dan pinggiran. Pendugaan pilihan sumber air bersih (PDAM terhadap sumur) menghasilkan elastisitas pendapatan dan luas tanah hunian sebesar 1,64 dan –0,92. Kecenderungan pilihan sumber air PDAM juga berkorelasi positif dengan pendidikan, fasilitas telepon dan peubah wilayah kota. Penelitian juga berhasil mengidentifikasi belum optimalnya mutu pelayanan air PDAM di wilayah kota sehingga rumah tangga masih memilih air sumur. Pilihan air bersih rumah tangga bukan pelanggan PDAM berasal dari sumur (100 persen), sementara pilihan pelanggan PDAM berasal dari sumur dan PDAM (63 persen) dan PDAM saja (37 persen). Lebih jauh, penelitian menghasilkan implikasi bahwa* sustainable growth *sambungan air bersih adalah sebesar 11,5 persen untuk mendukung pertumbuhan ekonomi sebesar 7 persen.*

Kata Kunci: *Persediaan Air – Evaluasi Proyek – Kesediaan membayar – Pertumbuhan yang berkelanjutan*

Key Word: *Water supply - Project evaluation – Willingness to pay – Sustainable growth*

1. INTRODUCTION

Economic valuation on a commodity should refer to price signal under an efficient market mechanism. However, the valuation on an environmental services and related commodities would not be efficient because there are benefit and cost externality in which price would not address. Those are caused the environmental commodities perform a unique characteristic, such as intangibility, bounded rationality to analyze, and a non-economic value embedded into the commodities. Therefore, it have been developed varies valuation methods based on hypothetical market to value the commodities directly and indirectly, as well (Pearce and Turner, 1990).

A well-known approach of economic valuation on water supply sector is willingness to pay (WTP). The studies on these fields have been highly intensive in the rural areas of developing countries (Briscoe *et al.* 1990; World Bank, 1993; Griffin *et al.* 1995). Social behavior was evaluated in line with the water supply development in the poverty eradication framework. The WTP was also applied to study the behavior in clean water quality improvement (Jordan and Elnagheeb, 1993). The WTP was commonly affected by (a) socio economic factor, such as income, education level, occupation, and family variable; (b) water characteristic, such as energy, time, and cost consumption to access water and to improve the quality (c) perception to government policy and function.

The WTP for clean water have been studied in direct and indirect approach. The direct approach is implemented through contingent valuation method (CVM). In a prepared questionnaire or a structured interview, respondent is asked to state his/her willingness to pay and to participate in the water supply development. The indirect WTP is directly to be implemented on pipe-connected and pipe-unconnected households so that creates benefit transfer mechanism (Griffin *et al.* 1995). The approach demonstrates a consumption behavior side of household and at the same time to show willingness to pay for the pipe connection. The study of the indirect willingness to pay in Indonesia conducted by Arianti (1999) in Bengkulu. She succeeded to identify income and education level as significant factor to affect WTP for PDAM's pipe connection.

The water supply in kabupaten Tulungagung is being developed. A service ratio has reached 9.73 percent (in 1999). During 1993 to 1999 periods, a growth level of pipe connection and metered water production were 2.9 and 2.5 percent respectively (PDAM Kabupaten Tulungagung, 1999). With population growth rate of 0.78 percent and GDP share of manufacture of 28.6 percent, this area is predicted to develop significantly and it imply on water supply development

This research aims to study factors that affect willingness to pay for PDAM's pipe connection in kabupaten Tulungagung.

2. METHODOLOGY

The research was conducted on January to November 2000 in kabupaten Tulungagung. A survey was addressed to the PDAM's pipe connected and the unconnected household, each in urban center and sub urban areas respectively (**Figure 1,page 431**). Thus, those were four categories, i.e.: (a) PDAM's pipe connected household in the urban area, (b) PDAM's pipe connected household in the sub-urban area, (c) PDAM's pipe unconnected household in the urban area, and (d) PDAM's pipe unconnected household in the sub-urban area. Random sampling was uses to determine 35 households approximately under each category. The urban area was represented by kelurahan Tamanan, and the sub-urban area was kelurahan Ringin Pitu and Rejoagung (Iwan Nugroho dan Wahyu Anny Widayati, 2002).

Variables in the research cover source type of clean water and family characteristics. Analysis method used models of qualitative choice (Pindyck and Rubinfield, 1991), with the following variables that affect:

$$\ln P_1/P_2 = f(S_i, I_i)$$

$$\ln P_0/P_2 = f(S_i, I_i)$$

where 0, 1 and 2 were type of clean water of PDAM, PDAM and well, and well respectively; P_1/P_2 was a probability ratio of PDAM and well to well; P_0/P_2 was a probability ratio of PDAM to well; S_i represented a

quantitative variables, such as income, land-size, and family-size; I_i was dummy variables, such as occupation, education, property, and area variable; and i was households (1 until n)

3. RESULT AND DISCUSSION

An estimate result of factors that affect the WTP is presented in Table 1. The study result showed that the overall household (100 percent) who unconnected by PDAM"s pipe used well. Meanwhile, a 63 percent of household who connected by PDAM's pipe used both source type, each it spread in the urban and sub-urban area were 80 and 46 percent respectively. Conversely, there are 37 percent of the household whose PDAM pipe use PDAM's water only, each 20 and 54 percent in the urban and sub-urban area (Figure 2). Furthermore, the analysis was not applied in smaller urban area because it performed an unfeasible estimate. In general, the estimation yielded a G statistic test significantly, i.e. p value lesser than 0.01. This means that at least one estimate coefficient is significantly different with zero among variables that involved. In brief, the significant variables identified in the WTP estimation were income, land size, installed telephone, education level, and well's water table.

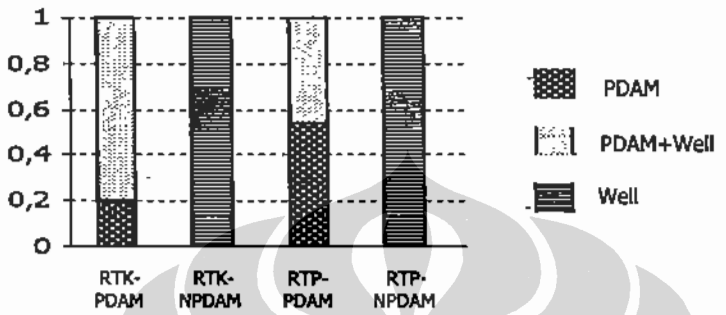
Income variable significantly affected WTP for PDAM's pipe connection. The income coefficient of (0/2) was found as amount 1,64 that also showed income elasticity. This means 10 percent increase of income would raise 16.4 percent probability of PDAM's water to well ratio. Meanwhile, the income coefficient of (0/2) consistently exceeds those (1/2). It shows that WTP of household who unconnected of PDAM's pipe is higher than that whose PDAM's pipe. Any risks that are faced by the pipe-unconnected households are relatively high, so they would compensate it with higher benefit.

The related studies have presented a various outcome. Brisco *et al.* (1990) at Parana, rural area in Brazil encountered the income elasticity 0.24. Griffin *et al.* (1995) at Kerala, India rural area found the income coefficient 0.00002. Arianti in Bengkulu, provincial city in Indonesia, obtained -0.0796. The income elasticity in this study (1.64) is above than Brazil. Thus, it showed that WTP of household in kabupaten tulungagung was relatively high. According to World Bank (1993), the income elasticity was generally very low. The increase of 10 percent

income would raise the probability of PDAM's water to well ratio into below one percent

Figure 2

Proportion of household based on water preference of PDAM, PDAM+well, and wells in kabupaten Tulungagung



Occupation variable did not influence the water preference. Justification of formal employment is important variable in water supply development. In Brazil, this variable was reported to raise the probability of clean water preference as amount 15 percent.

Household property variables influence the water preference as follows. Land size coefficient of (0/2) was -0.92. It means that a 10 percent increase of land size would decrease 9.2 percent probability of PDAM's water to well ratio. More specifically, the estimation in the sub urban area encountered land size elasticity of -2.17. This case definitely associated with the sub urban characteristic whose a suitable availability and quality of clean water, and the other side it showed land size average (186 m^2) exceeds the other (288 m^2). Meanwhile, land ownership did dot significantly influence water type preference.

Table 1

The estimation of nominal logistic regression on water preference

Variables Estimate	PDAM+Well to Well (1/2)		PDAM to Well (0/2)	
	Coefficient	Odds ratio	Coefficient	Odds ratio
Constant	-12.33**		-17.20**	
Ln Income (rupiah/bulan)	0.78*	2.18*	1.64**	5.13**
Occupatin (Government employee/pension=1, other=0)	-0.32	0.72	-1.04	0.36
Ln Land size (m2)	0.05	1.05	-0.92**	0.40**
House ownership (privacy=1, other=0)	0.40	1.50	-0.35	0.71
Installed telephone (yes=1, no=0)	1.53**	4.61**	1.30*	3.66*
Education (household member graduated high school above 60 % =1, other=0)	1.07*	2.92*	2.08**	8.00**
Family size	0.13	1.14	-0.13	0.88
Well's water table depth in dry season (deeper than 5 m =1, other=0)	-1.57**	0.21**	-0.24	0.79
Urban area (center=1, sub urban=0)	0.76	2.14	-0.84	0.43

** and * significantly different at 5 dan 10 percent; sample number 135

Table 2

The characteristics of PDAM's pipe connected and unconnected household in kapupaten Tulungagung

Household Characteristics	Units	PDAM's pipe connected			PDAM's pipe unconnected		
		Urban	Sub urban	Total	Urban	Sub urban	Total
Income per month	Ribu rp	551	851	701	351	218	311
Government Employee/pension	%	17	29	23	17	6	11
Family size	jiwa	5.6	4.3	5	4.9	5	4.9
Household member graduated high school above 60%	%	54	51	53	14	9	11
Land size	m2	233	217	225	138	359	249
Private house ownership	%	83	80	81	74	74	74
Installed telephone	%	40	51	46	11	6	9
Well's water table depth in dry season is deeper than 5 m	%	23	0	11	29	23	26
To approve that water could be traded	%	23	34	29	20	26	22

Telephone facility in the house stimulate preference to PDAM' water, with odds ratio 3.66 ($\beta \approx 1.3$). This shows that an installed telephone would raise probability of PDAM's water to well ratio as much as 3.66 times than the uninstalled. This could be translated that telephone infrastructure stimulates to higher quality water consumption as reported by Griffin *et al* (1995) at electricity.

Household education influenced significantly on clean water preference. More household's member graduated high school (above 60 percent) promote 8.0 times the probability of PDAM's water preference than those who graduated below 60 percent. Those who graduated above 60 percent were encountered each 11, 45 and 65 percent on the water preference of PDAM only, PDAM and well, and well only respectively. The effect of education is to promote opportunity cost in the process of clean water consumption. As a result, the household whose higher education level would be ready to pay higher price for higher water quality.

Well's water table in surround house effected significantly on water preference on both rather than well only. The coefficient and odds ratio were found as amount -1.57 and 0.21 respectively. This shows the household with well's water table deeper than 5 m was likely to be 21 percent lower than at (1/2) preference. This case means that the household would still maintain well eventhough it was deeper, as it was also enhanced by both a suitably water characteristic and pump equipment in the area. The well's water table reflects any cost, risk and uncertainty against existing water supply. More costly is to be dealt with would be higher WTP for the higher quality.

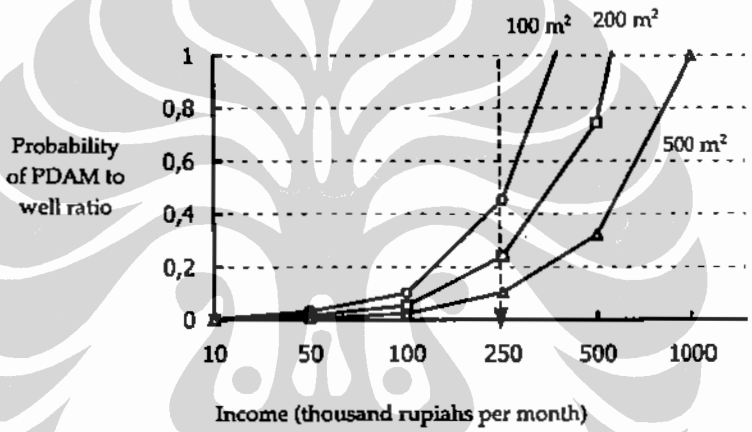
Urban center presented a significant effect on both water preferences (1/2), each with coefficient and odds ratio of -1.57 and 0.21 respectively. This shows that the household in the area is likely to be 2.14 times higher to choose both water than the another area. This condition could explain that the existing PDAM's services quality in the urban center is still under optimal rather than the another area. Consequently, the household anticipates it with water consumption from well.

The water preference of PDAM's water to well is illustrated in Figure 3. The figure is reconstructed from equation (0/2) in the Table 1. They were the household who and whose government employee, private

owned house, installed telephone, household's member graduated high school (above 60 percent), family size is 5 person, well's water table deeper than 5 m, and domicile in the urban center. The income and land size were designed to vary for recognizing the water preference. The **Figure 3** shows that at given income, the preference to PDAM's water is higher on the household whose lower land size. For example, the household with 100, 200 and 500 m2 land size and given at income 250 thousands per month would perform the probability of PDAM's water to well ratio as amount 0.45, 0.25 and 0.10 respectively.

Figure 3

Relationship between income and land size on the probability of PDAM to well ratio



In general, this study indicated into a right direction. These phenomena show that house participation in water supply development is in line with economy advancement, especially measured by income rise. The household gradually moves from an alternate water type into higher quality water, and at the same time it enhances sustainable water resource development. Those are expected to reduce well's water consumption from 50 percent household in 1999 (Susenas 1999). At other side, a small size housing development would accelerate it.

Furthermore, based on the income elasticity (=1.64) could be withdrawn an important implication. For supporting economic growth at least 7 percent as economy recovery prerequisite, it needs sustainable

growth PDAM's pipe connection 11.5 percent. This is far above existing growth 2.9 percent in kabupaten Tulungagung and 8.7 percent in East Java province (BPS, 2001)

4. CONCLUSION

The estimation of water type preference (especially PDAM's water to well) yielded income and land size elasticity as amount 1.64 and -0.92, and it positively correlated with education level, installed telephone and urban center variable. The preference to PDAM's water was also succeeded to identify an unoptimum PDAM's service in the urban center area so the households were still consume well's water. In the study, the water preference of households who unconnected PDAM's pipe was well's water (100 percent). Meanwhile the preferences of the PDAM's pipe connected households were PDAM's water only (37 percent) and both water types (63 percent). It should be supposed that the sustainable PDAM's pipe connection growth is 11.5 percent for supporting at least 7 percent economic growth.

5. LITERATURE

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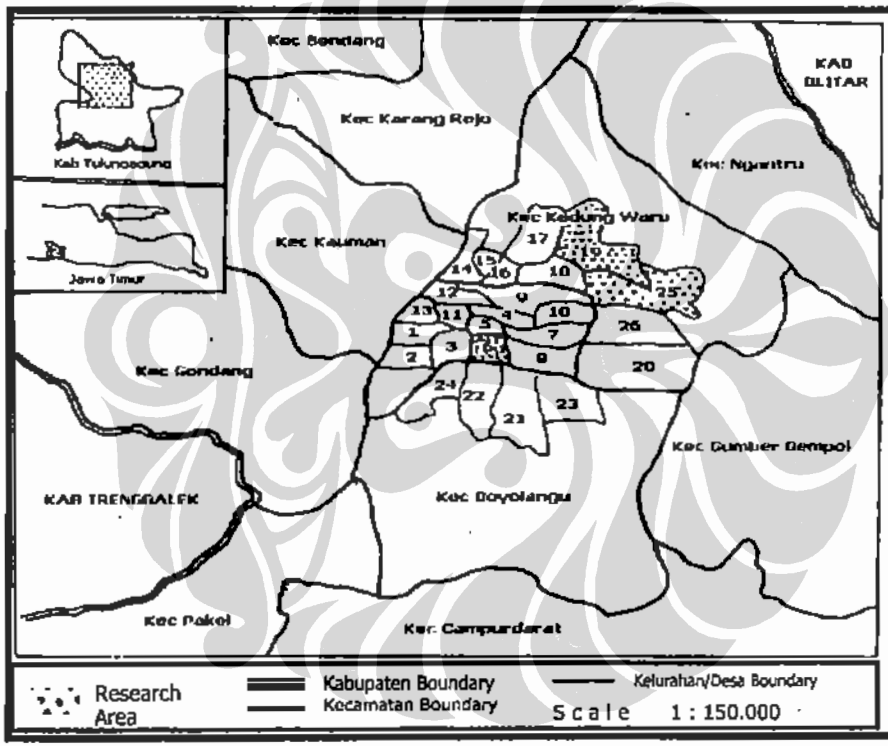
Figure 1

Research area in kabupaten Tulungagung



	Kelurahan/Desa	Family	No PDAM pipe	Percent PDAM
1	Kutoanyar	1190	172	14
2	Tertek	1051	250	24
3	Karang Waru	1297	623	48
4	Kp Dalem	777	462	59
5	Kauman	432	186	43
6	Tamanan	921	354	38
7	Bago	1613	827	51
8	Jepun	1293	144	11
9	Kenayan	1441	478	33
10	Kepatihan	1487	770	52
11	Sembung	499	83	17
12	Boteran	546	0	0
13	Panggung Rejo	668	36	5
14	Mangunsari	646	178	28
15	Tawangsari	327	59	18
16	Plandaan	413	215	52
17	Ketawon	2439	413	17
18	Kedungwaru	922	468	51
19	Rejoagung	2440	75	3
20	Plosokandang	5563	80	1
21	Beji	1327	383	29
22	Sobontoro	1436	442	31
23	Serut	1208	81	7
24	Gedang Sewu	583	61	10
25	Ringin Pitu	1313	55	4
26	Tunggulsari	980	427	44
		32812	7322	22