

INVESTIGATING CONSUMERS' OBJECTIVE AND SUBJECTIVE KNOWLEDGE ON PERCEIVED HOUSEHOLD WATER ISSUES

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ABSTRACT: *This study explores Malaysian consumers' objective and subjective knowledge on household water issues using mixed method (quantitative and qualitative). From survey and in-depth interviews involving 40 willing respondents, the study found that consumers' perception of household water issues is based on their knowledge (objective and subjective) of issues in question. Consumers' knowledge on drinking water characteristics like organoleptic attributes for example is found to be mixed up between what they really know (objective facts) and what they think they do know (subjective, perceived). The findings imply that not all issues of drinking water were factually correct; as they were mainly made up of consumers' level of knowledge (what is known) as well as belief (what is perceived). New and up-to-date information also influences consumer's knowledge about household water issues. Of the two knowledges, subjective knowledge seemed to be more dominantly used by consumers when describing or authenticating supports on issues explored. The findings posed a real challenge to the government and water operators to convince Malaysian public (water consumers) on issues like safety of tap water for drinking or the usefulness of new technology such as River Bank Filtration to minimize water abstraction cost.*

Keywords: Household, Tap water; Objective knowledge; Subjective knowledge; Perception; Quality

1. INTRODUCTION

Malaysian water services industry has been plagued with water issues that affect household's consumption. Unscheduled water rations, water supply interruptions, degraded water quality and safety are not common episodes, still, when they happened, they resulted in public anger since these affected the public's quality of life. The government for instance is blamed for the inconveniences of water woes [1]. As consumers, Malaysians can perceive household water issues differently. Although the majority of consumers believed they were not provided with quality and safe household water which they expected to get [2], Penang consumers were satisfied with their overall domestic water quality; except for water taste, existence of suspended solids and chlorine content [3]. Other studies reported how water taste, uninterrupted water supply, water contamination and income as determinants of household consumers' willingness to pay for improved water services [4]; however, income category affected consumers' perception differences on water quality, color, taste, odor, chlorine content and health risk [5]. Perceived water value in addition mediated relationship between consumers' perception of water quality and willingness to pay [4]. Components that make up consumers' expectation and perceptions of water services were found to be quite similar as they focused on getting improved water services in terms of quality, continuous supply, and infrastructure; the set back is that many were not willing to pay more to get the services (showing mixed reactions of shock, anger, disbelief, disappointment, sad, and rational when asked) [1]. Another issue of concern is consumers' trust on water service providers. A study found that while water properties and price determined consumers' trust of water operators; perceived quality mediated the determinants-trust relationships [6]. Organoleptic factors- taste in particular serves as a more dominant evaluation factor than odor or water's physical appearance influence public's perception of water quality [7].

Adoption of the new method or technology is also an issue. Riverbank filtration (RBF) has been recommended for Malaysia benefiting through provision of good water resource and reduction of overall cost of water treatment; abstracting water using RBF managed to remove color and bacteria (E-Coli) from the water intake [8] that consumers seek for water safety. Poor water quality causes 80% of diseases in developing country (e.g. diarrhea, typhoid fever, and arsenicosis) and 4% worldwide deaths [9]. Malaysia has developed its own national standard of drinking water following closely The World Health Organization's (WHO) Guidelines for Drinking-Water Quality [10] to safeguard its potable water from a range of threats provided by micro bacteria, chemicals, and radiology; taste, odor, and appearance are amongst the criteria set by the Ministry of Health for acceptability of potable water. Water-borne pathogen can cause individuals with vomiting and diarrhea while chemical contamination (by nitrate and pesticides) often happens in sites close to agricultural area; 30.3% of Goro-Gutu District of Eastern Ethiopia respondents reported that their families were affected by waterborne disease [11]. Information provided on how safe water is produced through water treatment process and accessibility to such information (e.g. visit made to water treatment plants) help to build public's trust on water operators [12, 7]. Objective and subjective knowledge can be the source of how that information or knowledge is made up; as well as affecting individual's behavior [13]. Objective knowledge refers to facts; specific and accurate information about a given phenomenon while subjective knowledge is mainly based on personal knowledge or self-assessment on the phenomenon [14]. Subjective knowledge can be an overestimation of what individuals really know of an issue [15]; it can be a proxy to objective knowledge when there is consistent association between what is subjective and what is objective. Subjective knowledge was a stronger driver than objective knowledge on individual's behavior and/or decision-making [16, 13]. Knowledge is shared when individuals believe that they accomplish certain goals or personal satisfaction [17, 18],

social respect [19]. Willingness to share information is driven by intrinsic benefits (social recognition) believed to be gained from the behavior [20]; particularly as social recognition is considered more meaningful than pecuniary rewards [21] and that increased community's recognition was found the primary motive for sharing and contributing towards knowledge [22]. A survey on public's water consumption behavior and on their capacity to react and communicate effectively ("to raise the alarm") in a case of a crisis found that not only the public has fairly low level of knowledge on public water distribution system and its stakeholders but they were poor alarm raisers too [23].

These findings indicate that consumers' perception of water issues has potential to affect the credibility of the government and water services industry alike; thus how public perceptions are developed (true/false) needed to be investigated. This study explores whether various water issues in Malaysia raised by the public are actually real and based on facts; whether they are undermined by objective knowledge and/or subjective knowledge; and whether objective or subjective is the dominant source over the other in developing the perceptions.

2. METHOD

This study was designed to be exploratory; household water consumers were the population and paid water consumers as samples of interest. Mixed method applied allowed for data to be collected using both structured questionnaire and in-depth interview (quantitative and qualitative approaches). This study utilized closed and open ended questionnaire. Apart from respondent's background information, 11 items were on household water issues (adapted from past study [3]). Respondent's level of (dis)agreement to statements was measured using a 3 point Likert-type scale, namely (1) I disagree, (2) I have no opinion to offer, to (3) I agree differing from to the 5 point scales used in past study [3]. Using a 3-point Likert scale minimize the time needed for respondents to give their feedback to issues measured. In-depth interview questions were aimed to identify whether respondent's perceptions were developed based on objective and/or subjective knowledge; this method allows researchers to explore and probe deeper into respondent's thoughts and opinions on the meanings they attached to issues and phenomenon investigated [23].

The study utilized 40 respondents following suggestion that sample size can vary from 10 to 40 samples [24] for exploratory or pilot study regardless the study's quantitative or qualitative purposes. Participating respondents were chosen based on the facts that they are paid water users; willingness to spend at least half an hour to fill in the survey and participate in interview session (approximately 10 and 20 minutes respectively); willingness to be recorded for interview session; and allowing for the contents to be used for research and publication. Simple frequency analysis was chosen to explain quantitative results while thematic analysis was for interpreting qualitative data from in-depth interview sessions.

3. DISCUSSION

Results of the respondent's profile indicate the domination of males (65%), those aged forty years old and below (80%), those with higher education from diploma onwards (85%), those with income below RM9000 per month (80%), and household size of up to eight people (80%). Majority respondents paid RM6 or below for their per water bill (30%). As in Malaysia, water bill is paid once every two months, the finding indicates that on average, their bill is only RM3 and below per month per household which matches the average of RM3.19 monthly domestic bill per capita reported by The Malaysian Water Industry Guide (2010). Some states in Malaysia practice giving water for free for household consumers whose water bill is RM20 and below, so this finding indicates that there are many consumers who are consuming their potable or tap water for free.

Table 1 displays consumers' feedback on perceived household water issues (quantitative results).

Table (1) Results on Consumers' Perceptions on Household Water Issues Feedback

Item	Results		
	Likert scale ^a	Unit	%
Tap water at home			
1. Overall quality is good	1 2 3	8 8 24	20 20 60
2. follows WHO standard and Ministry of Health M'sia	1 2 3	8 8 24	20 20 60
3. has unpleasant taste	1 2 3	16 4 20	40 10 50
4. consists of suspended solids	1 2 3	20 8 12	50 20 30
5. contains too much chlorine	1 2 3	18 10 12	45 35 30
6. has unpleasant smell/odor	1 2 3	24 8 8	60 20 20
7. Tap water at home has unusual color	1 2 3	22 6 12	55 15 30
8. has dangerous contaminants	1 2 3	22 10 8	55 25 20
9. has water borne bacteria	1 2 3	24 10 6	60 25 15
10. I install water filtration system at home	1 2 3	16 0 24	40 0 60
11. is unsafe to drink	1 2 3	20 0 20	50 0 50

a. 1= I disagree with statement (ID); 2= I offer no opinion on the statement (IN); 3= I agree with statement (IA)

The statistics show that majority of the 40 household consumers surveyed perceived that overall, water quality provided to their home is good (60% - item 1); believing that their tap water adheres to the standard set by both the World

Health Organization (WHO) and Malaysia's Ministry of Health (60% - item 2). Except for taste (item 3), majority of respondents agreed that other water quality organoleptic characters evaluated like suspended solids, chlorine content, odor and color were not problematic (items 4-7). Majority of respondents believed that their tap water has no dangerous contaminants (e.g. lead) or with waterborne bacteria (items 8-9). These findings seem to be in support of past studies [3, 4]. It was found that majority of respondents (60%) admitted to installing filtering system in their home (item 10); this act may be linked to their feedback on the last item statement asked whereby the respondents were divided on whether they perceive tap water at home is safe or unsafe to drink (item 11); 50% believed it is safe compared to the other 50% who think that it is not.

Overall, the in-depth interview results on perceived household water issues revealed that each of evaluations made on the issues by the forty respondents were indeed made up of both objective and subjective knowledges. For some respondents, their feedbacks on water issues were observed to be made entirely on subjective knowledge rather than being supported by facts. In some instances, the explanations provided were over exaggerated; and overestimated just like what the literature noted [15, 13]. However, fortunately, there were other respondents who were observed to be knowledgeable although the amount and level of knowledge vary from one person to another. Some of these respondents were found to be mixing both what they know with what they perceived they know in line with previous studies on objective and subjective knowledges [13, 14]. In addition, from the descriptions and examples given by respondents on the issues, the study conclude that subjective knowledge to be dominant than objective knowledge supporting findings of past studies [16, 13].

Taking households' overall perception on water quality as an example, the study found that for respondents evaluation based on objective knowledge (statement for item 1), they reasoned out their responses by referring to the number of times (which was found very seldom) when they encountered problems with any of the water quality aspects measured like taste, odor, and color. An example of an excerpt is: "I don't think I encounter problems ... more than five times (and) I have been (staying) here (referring to his residential area) for more than 20 years." (IDR 3).

On the contrary, respondents evaluating based on subjective knowledge differ as they did not support their evaluation with facts or statistical figures. Instead, they referred to other sources of information which they themselves could not verify the authentication of the source which can be seen from two sample examples of responses given on statement for item 1: "My colleague said ... " (IDR 7); and "No excuse to even have one instance of bad episode (he did not tell what he meant by bad episode) ... do we want to wait until people die before we take action?" (IDR 13).

In the first example, IDR 7 did not identify the authority or knowledge level of his friend about water quality issue that he made this friend of his as his reference point; while in the second example IDR 13 did not refer to anyone's experience

for support but instead used his own belief and perceived knowledge to explain the issue.

The study found that quite a number of respondents did not have the level of or basic knowledge on some of the issues measured in particular, statement for item no 2 where the names of specific organizations that are responsible for setting up related water quality standards, namely the World Health Organization (WHO) and the Ministry of Health were mentioned. Few respondents did not have a clue as to what WHO or the Ministry is; so they fail to provide the full name of World Health Organization (WHO). An example of an excerpt related to this cluelessness is: "... I cannot give my opinion as I don't know, I have no idea what WHO stands for. ... I have to be honest" (IDR 1).

There was one interesting feedback from IDR 5 who responded by asking on why he needed to know about WHO and/or any other organizations as this was not his responsibility: "Should I know them? I am just a (water) user." There were few cases where although respondents managed to recall the names of these organizations, the names were all they knew; these respondents admitted that they did not know what the standards are or explained the components of the said standards which indicates that responses given to item 2 statement were based on subjective knowledge; what they personally believe instead of relying on facts. The following excerpts are examples of various responses given: "No, I cannot help you. I just knew Ministry of Health. Does it (the Ministry) have a department that looks after the standard (looked puzzled)? Is it true?" (IDR 30); "... the (water) pH I think is the standard (used). ... Smell should be (included) too, water not clear (referring to color), ... I don't know, these are what I think should be in the standard ..." (IDR 28); "These standards are technical (in nature), ... it is impossible for me to explain ... (as) this (the knowledge) is not my level or any public member for that matter. ... I trust the government will do everything it takes to ensure we (referring to the public) are safe from harm, right?" (IDR 15); and "My brother's friend works in one of the companies that took care of water quality standards. I have seen the sheet used to monitor the water quality but I cannot recall what they were. He showed me when he was working at our home area. I don't know much about it though. What I am sure of is that we follow some sort of standards ..." (IDR 14).

Some respondents were observed to have problems expressing their feelings and emotions on some of the items measured, namely for item statements no. 3, no. 4, no. 6 and no. 7. For instance, for item no. 3 that asked respondents to describe the unpleasant taste of tap water, the existence of the problem can be identified from the following two sample excerpts of the in-depth interviews: "Unpleasant is unpleasant. It just tasted unpleasant, how can I describe it more?" (IDR 10); "Errhmmm, mmm ... (eyes wide opened and hands flailing in the air trying to find words to describe item) ... like really not tasty." (IDR 15)

Difficulty for respondents in identifying and/or describing suspended solids in tap water as required when investigating item no. 4 can be seen from this sample excerpt, i.e. "I can see some particles (without mentioning what that particle is or the description) floating in the water" (IDR 12). Similar

problem was observed for item no. 6 when respondents were asked to explain the unpleasant smell/odor of tap water they claimed they experienced, e.g. "I don't know how to describe the smell but I don't like it" (IDR 24), and for item no. 7 when respondents were asked to describe the unusual color of tap water of organoleptic characters of tap water they claimed they experienced at home; e.g. "... not the color we normally see in water *laaa* ..." (IDR 36).

These findings indicate that whenever respondents were clueless, or having difficulty in expressing themselves, their responses will be built upon perception and/or expectations that they made themselves about the issue (e.g. "I think"; "should be") or upon perception they developed based on other people's experiences (the individual(s) that they respect) that were shared with them at one point or another in their lives they feel can help them understand or describe the issues better (e.g. "my brother's friend"; "my colleague"). These perceptions are all subjective in nature (subjective knowledge).

The study found some respondents who can express their emotions, attitude, and feelings on water issues. Many of these respondents were also observed to have some objective knowledge on them hence the various and type of descriptions provided. Respondents' description of the unpleasant taste asked in item no. 3 for example show varying explanations starting from "... taste like metal" (IDR 13), "... like chlorine all over, you can even smell the chlorine" (IDR 27), and "brackish" (IDR 5). Similar observations were found for other items measured like suspended solids in item 4 (e.g. "sand" (IDR 37) to "clay" (IDR 18)); and unusual color explored in item 7 (e.g. from "murky color" (IDR 37); to "not clear water color (*bukan warna air jernih*)" (IDR 5), and "cloudy, yellowish to brownish ..." (IDR 19)). Interestingly, for descriptions of odor as required in item 6, responses were observed to be streamlined towards chlorine smell rather than other smells (e.g. "chlorine smell" (IDR 37, IDR 13), "smell like chlorine" (IDR 27))

Similar conclusions were made for items no. 8 and 9. Respondents with objective knowledge support their explanation about dangerous contaminants (item 8) and bacteria (item 9) with correct examples of the contaminants, for instance, lead, nitrate and/or pesticides. Some even went further to identify possible cause(s) of the contaminants; explaining correctly that lead contamination in tap water for instance can be caused by corrosive water, lead pipes or lead solder (e.g. IDR 37, IDR 18 and IDR 19). Few respondents came up with correct suggestions on how to solve lead contamination problem, namely via replacement of plumbing (e.g. IDR 37, IDR 18 and IDR 19), reverse osmosis (e.g. IDR 37, IDR 18) or distillation (e.g. IDR 37). On close inspection, the few respondents found to be very knowledgeable about water contaminant issues were also from those who install water filter system in their homes, and read a lot (e.g. IDR 37 and IDR 18). On the contrary, many respondents were observed to have only subjective knowledge on water contaminant issues.

Majority of respondents' comments made on statement for item 11 were subjective in nature rather than objective. For

many respondents, their responses were very much focused on what is meant by "unsafe" and "drinking" (water safety), discussing the role of the government on ensuring the public's safety at all times and on providing clean, safe and affordable water to the public in line with past studies [4, 6], identifying who the responsible water operators and/or authority are to provide the public with clean, quality, affordable water and on the extent of their roles, their hopes on quality of water they wanted to be provided with (what they expected to get in comparison to what they think they are currently provided), water standards, what it meant by contaminants (and the types of), and on possible solutions for the issues. The in-depth interviews reveal many respondents not familiar or have no knowledge about related laws and regulations pertaining to water services in Malaysia (e.g. SPAN Act, WSIA Act) or Suruhanjaya Perkhidmatan Air Negara (SPAN) that regulates and oversees the management of water services industry in Malaysia. Respondents were also found to display lack of knowledge on specific water operator for the states in Malaysia. As respondents come from different states in the country with each state has its own water operator (e.g. Penang has Perbadanan Bekalan Air or PBA; Perak has Lembaga Air Perak or LAP; Johor has Syarikat Air Johor or SAJ), the lack of knowledge on these organizations is understandable.

Although some respondents proposed suggestions on how to ensure water quality, health, and public's safety (e.g. changing old, rusty pipes with new ones; installing water filter for each home; water education campaign, finding new and safe technology to ensure water quality, consistent monitoring), the new and useful method like RBF that can help to abstract water with cost that is cheaper and safer (as claimed by Abd. Rashid et al., 2016) or the process and techniques that can be applied for water treatment process before water is delivered to the public, did not emerged in the interviews.

4. CONCLUSION

In conclusion, Malaysian consumers' perceptions on household water issues are made up of both objective and subjective knowledge. These perceptions can result from consumers processing factual information on issues in question and/or based on their own realm of personal perspective and belief. The study also concludes that consumers built their perception based on subjective knowledge more than objective knowledge. These conclusions mean that not all perception about household water issues by consumers are correctly made (due to failure to verify type of information and reference source) but still they are shared with other individuals they know. The repercussion of this act is false information on water issues being disseminated amongst the public at large; particularly when many of the consumers lack knowledge on responsible bodies managing water issues and on the issues themselves. The main challenge for the government and water operators is on finding ways to communicate accurate information about water issues to the public convincingly that the public trusts what's being communicated as the truth rather than continuing with their own beliefs on the issues. This calls for

continuous water education campaign on the public which can also be proposed as a topic for future research. More research on how objective and subjective knowledges affect the beliefs, attitude, cognitive and affective behavior of individuals on water issues (e.g. water quality, health risk, social recognition, water policy, water regulations, pricing, models on information dissemination and adoption) should also be conducted.

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