Promoting the Adoption of House-Connected Piped Water in Guinea-Bissau

Field Evidence on the Need to Develop Culturally Sensitive Behavioral Models

By

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Acknowledgements

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Abstract

Clean drinking water constitutes one of the most fundamental elements for one's health[1] and it is therefore greatly important to ensure its accessibility for everyone in the world. Unfortunately, despite efforts by public health institutions, Governments and NGOs, in many regions of the world consumers seem unable or unwilling to access clean water. That is why the ultimate goal of this study is to provide valuable insights that will help Governments, NGOs and policy makers promote the adoption of piped water services –the cleanest and safest of all water cleaning methods[2] - in developing countries, where not only the affordability but potentially also health-related beliefs and stereotypes related to piped water may interfere with the eagerness of local populations to adopt and pay for piped water services (Ashraf, Berry, and Shapiro, 2010; Kremer, 2011).

What differentiates this study from prior literature is the effort to look into this matter not only from an economic point of view using diffusion theories and pricing models, but also from a behavioral angle. Specifically, I build on the *Health Belief Model* (Rosenstock, 1974; Conner & Norman, 1996) as a theoretical basis, and explore how perceptions about the threat, susceptibility and severity of a disease, and cultural differences may play an important role on consumers' adoption of piped water services. That is, I develop theory-based expectations regarding the impact of health-related beliefs on consumers' adoption intentions and willingness-to-pay for piped water services.

To ensure the external validity of my results, I test my theory-based model using data from the field, provided by the Portuguese NGO TESE[3]. TESE gathered survey responses from 151 consumers in Bafatá, a town with approximately 35,000 inhabitants in central Guinea-Bissau, a country in West Africa with an estimated population of 1.7 million people and where access to clean water remains problematic in certain regions. As I will explain, the survey has been conducted shortly after local institutions, with support from TESE, implemented a new piped water system in

[1] *World Health Organisation, definition of Health*

[2] *WHO/UNICEF Joint Monitoring Programme (Equity, Safety and Sustainability 2008, Progress on Drinking Water and Sanitation 2012)*

[3] *http://tese.trtcode.com/en/index.php*

Bafatá. Using evidence from the field allowed me to discover and discuss valuable insights on what influences the adoption intentions and willingness to pay for piped water services across different segments of the consumer population, namely different ethnicities.

In sum, my thesis focuses on two key dependent variables; intention to adopt and willingness top pay for piped water services. TESE collected data on these dependent variables as well as consumer ethnicity and health-related beliefs. I then use the *Health Belief Model* to develop expectations about the relationships between these variables and test these expectations using two separate regression models: a binary logistic regression for intention to adopt and a linear regression for willingness-to-pay. My findings suggest that media and water quality play an important role in consumers' intention to adopt. I also find significant differences in consumers' willingness-to-pay for piped water services across different ethnicities, as well as support to the effect of alternative sources of water and the main effect predicted by the *Health Belief Model*, namely the construct perceived susceptibility and severity of disease, especially when the effect of both variables is being moderated by the ethnicity factor. These results have both theoretical (e.g. on the generalisability of the *Health Belief Model*) and practical implications for people and institutions working hard to promote the diffusion and adoption of piped water across the globe.

Keywords: *Health belief model, Cultural/ethnical differences, Consumer Marketing, International Marketing, Perceptions, Behavioural model, Water supply, Piped water, TESE, Bafatá Misti Iagu.*

1. Introduction

In a world where continuous progress has radically altered our communities and lifestyle, there are still parts of the world that face problems related to fundamental human needs, such as easy access to clean drinking water. We have managed to annihilate distances, to improve our means of communication and to facilitate our daily needs but, surprisingly, according to WHO/UNICEF Joint Monitoring Programme (2012) today there are still hundreds of millions of people who do not have access to improved source for drinking water (768 million in 2011) or rely on surface water (185 million) to meet their daily drinking-water needs.

Lack of access to clean drinking water has dire consequences. WHO's Global Analysis and Assessment of Sanitation and Drinking-Water (GLAAS) report, for instance, refers that every year there are two million diarrheal deaths related to contaminated water and low levels of sanitation and hygiene—the vast majority among children under five. The most affected are the populations in developing countries, especially those populations who live below the poverty line. Governments and NGOs –such as the one that we examine in this paper- have made remarkable efforts to reduce the number of affected people and tackle this situation. Yet, unfortunately the problem is far from being solved.

Although the risk of consuming non-improved water is significant, prior research has shown that people in developing countries have a low willingness to pay for direct access to piped water services (Ashraf, Berry & Shapiro, 2010; Kremer, 2011). Low willingness to pay for clean water results in low adoption of piped water services, which in turn, jeopardizes the health and well being of millions of consumers across the globe. At the same time, consumers' low willingness to pay for direct access to clean water also constitutes an inhibitory factor for all those involved in those ventures. Governments, policy makers, local institutions and authorities, and NGOs' efforts to promote easy access to safe water become more challenging. Unlike the development of other sectors like Industry and Agriculture, the benefits of water supply and sanitation cannot be quantified easily and even if they are quantifiable they can hardly be valued in terms of the common denominator - "money"(Collignon et. al, 2000). Hutton et al. (2007) documented that the main contributor to economic benefits

associated with better access to water and sanitation services was by far time savings, as people gained in productive time and reduced health care costs, saved due to less illness, and prevented deaths. As a result, businesses operating in developing countries and investors from the private sector also have a low incentive to enter this sector, preventing further diffusion of house-connected water.

For NGOs who still venture to make such public health interventions, there are limited guidelines on how to design successful marketing campaigns for developing countries, especially when they involve drastic or costly changes in people's behaviour. In the case of consumer adoption of piped water services, a particularly relevant set of beliefs are the health-related beliefs people have. As previous studies support, the health-related beliefs that one has, very likely influence one's decision to adopt costly (in a broad sense, meaning financial but also other opportunity costs) health–related actions, which may lead to improvement of his or her health (Hochbaum et al. 1952). As a result, and after careful consideration of its appropriateness, the *Health Belief Model*, the most widely applied theoretical foundation for the study of health behaviour change that incorporates perceptions about health, was chosen as the main theoretical framework of this study.

The *Health Belief Model* has its origins in the US in the work, first developed in the 1950s, by social psychologists like Rosenstock. An implicit assumption of the *Health Belief Model* is that the psychological mechanisms it predicts are universally valid. However, prior research is typically concentrated in the US and a few Western nations, which prevented this assumption from being effectively tested with empirical data from populations with vastly different cultural values. In contrast with this untested assumption of the *Health Belief Model*, I expect the effects of health-related beliefs on people's behaviour to vary significantly across different cultural groups and to constitute an insightful source of information, when trying to promote adoption of new life-saving technologies like house-connected piped water in developing countries that comprise of various ethnical groups. Such hypothesis, and the spirit of my work, follows the same line of reasoning of a vast literature in cross-cultural psychology (Nisbett, 2001; Triandis 1996; Hofstede 1999, Schwartz, 1990) and International Marketing (Camacho, De Jong and Stremersch, 2014; Burgess & Steenkamp, 2006; Steenkamp & De Jong, 2010; Steenkamp & Geyskens, 2013; Stremersch & Tellis,

2004; Stremersch & Lemmens, 2009; Tellis, Stremersch, & Yin, 2003; Van den Bulte & Stremersch, 2004; van Everdingen, Fok, & Stremersch, 2009) that consumer behaviour is culturally sensitive, and that culture has an important impact on the adoption and diffusion of new technologies (Van Everdingen, Fok & Stremersch, 2009; Tellis, Stremersch & Yin, 2003).

This study wishes primarily to provide valuable insights to local institutions and policy makers, Governments, NGOs, private businesses and other institutions working to improve consumers' access to piped water services. Capitalising on evidence from the field, it offers a theory-based exploration of the impact of 'cultural-ethnical differences' on the effectiveness and impact of public health campaigns in the case of adoption of piped water. It also tests whether merely economic reasons, such as low income, are the key explanation for low willingness to pay or whether other behavioural issues, namely "incorrect" health beliefs may explain a large fraction of the variance in consumers' willingness to pay. I hope this knowledge will help us move one step forward in the direction of finding a sustainable solution for the promotion of house-connected piped water across the globe.

The importance of stimulating adoption of house-connected piped water services in developing regions lies in the life-saving nature of these ventures. There is a strong need to advance our knowledge concerning consumers' intention to adopt and willingness to pay for direct access to clean water. Such knowledge will help players in the water supply and sanitation sector find sustainable solutions to address this critical matter, improve their marketing approach and help increase access to clean water across the globe. The more sustainable these ventures are for the involved stakeholders, the more people will have access to clean water and therefore the number of people dying from waterborne diseases will be further reduced.

In sum, my thesis offers the following three contributions to the literature in marketing, namely Transformative Consumer Research[4] and international marketing, and in cross-cultural psychology.

[4] *Founded within the Association for Consumer Research, Transformative Consumer Research is a growing movement that strives to encourage, support, and publicize research that benefits quality of life for all beings engaged in or affected by consumption trends and practices across the world (Mick, Pettigrew, Pechmann & Ozanne 2010).*

First, it challenges the common assumption, in psychology and consumer behaviour, that behavioural models, such as the *Health Belief Model*, are universally valid. Instead, it supports the growing view, in marketing and diffusion of innovations literature, that cultural differences matter and should be taken seriously (Steenkamp & De Jong, 2010; Burgess, 2004; Tellis, Stremersch & Yin, 2003; Camacho, De Jong & Stremersch, 2014).

Second, it suggests that we need to pay more attention to cross-cultural issues. While most of the cross-cultural work in consumer behaviour and marketing tend to adopt the 'country' as the unit of analysis for culture, it shows that in many applications, namely in multi-ethnic societies, we need to go one step further and have more granular notion of what 'culture' means, as well as how it is measured. I therefore suggest that ethnicity should be used complementary to country as a level of analysis. Although Hofstede, Steenkamp, and Wedel (1999) made few early statistical attempts to capture the essence of 'culture', their approaches were data-based post-hoc definition of cultural groups whilst I suggest that a priori segmentation, e.g. based on ethnicity, could be more directly usable by institutions in the field, as it allows rapid and effective targeting of differentiated messages and approaches.

In substantive terms, my thesis offers the following two insights:

First, it highlights the importance of gathering consumer intelligence from the field, adding to the rare but deeply needed empirical work that gathers field data (Harrison & List, 2004; DellaVigna, 2007). From doing so, valuable information from different subgroups become available, which helps us understand differences in beliefs and values. This benefit enables Governments, NGOs, private businesses and other institutions to tailor communication and marketing efforts to these different consumer groups, and therefore maximize the effectiveness of such communication strategies in boosting adoption of life saving technologies.

Second, it is important to improve health-related beliefs in general as they are one of the key drivers of adoption of piped water and potentially also of other life-saving technologies. Fellow students and researches in other disciplines could benefit from current study's findings and use them for further research. The fact that the effects predicted by the *Health Belief Model* are culturally sensitive opens at least two avenues for future research (1) explicit models that try to better understand how culture

attributes influence the *Health Belief Model* and (2) further tests of well-established psychological models whose effects may also be culturally sensitive rather than, as often assumed, universally valid throughout time (Nisbett, 2010).

Table 1 summarises the contributions to be made in each discipline.

Academic Contribution	Managerial Contribution
▪ Challenges the universality of the *Health Belief Model* and opens new avenues of research	▪ Highlights the importance of field evidence in the effectiveness of marketing campaigns
▪ Puts light into cross-cultural issues and suggests that ethnicity should be used complementary to country as a level of analysis	▪ Highlights the importance of cultural differences when designing marketing strategies

Table 1. Contribution in Academic and Managerial disciplines

2. Intention to Adopt and Willingness to Pay for House-connected Piped Water

According to WHO/UNICEF Joint Monitoring Programme (Equity, Safety and Sustainability 2008, Progress on Drinking Water and Sanitation 2012), people in developing regions usually have three sources to access water for their daily needs: (i) unimproved water sources, (ii) improved water sources and (iii) house connected piped water. Unimproved water sources include unprotected dug wells, unprotected springs, carts with small tanks/drums, tanker trucks and surface-water (e.g. rivers, dams, lakes, ponds, streams, canals, irrigation channels). Improved water sources include public taps or standpipes, boreholes or tube-wells, protected dug wells, protected springs and rainwater collection. House connected water refers to piped household connection located inside the user's dwelling, plot or yard. Among the three available options, only the latter can ensure a high drinking quality standard as the unimproved water sources are exposed to all kinds of external contamination and improved water sources are prone to external contamination from leakages, transport and storage.

In 2004, the World Health Organization reported the number of deaths caused by water, sanitation and hygiene issues, in a list of the top most affected countries and regions. As the following image shows, in Guinea Bissau, the region in which this study focuses on, the number of deaths reached over two and a half thousands. Although house-connected piped water services are becoming available to developing regions and the consequences of consuming unimproved water can be fatal, there are still many consumers who decide not to adopt house-connected piped water services, even when they could afford to do so (Zug & Graefe, 2014).

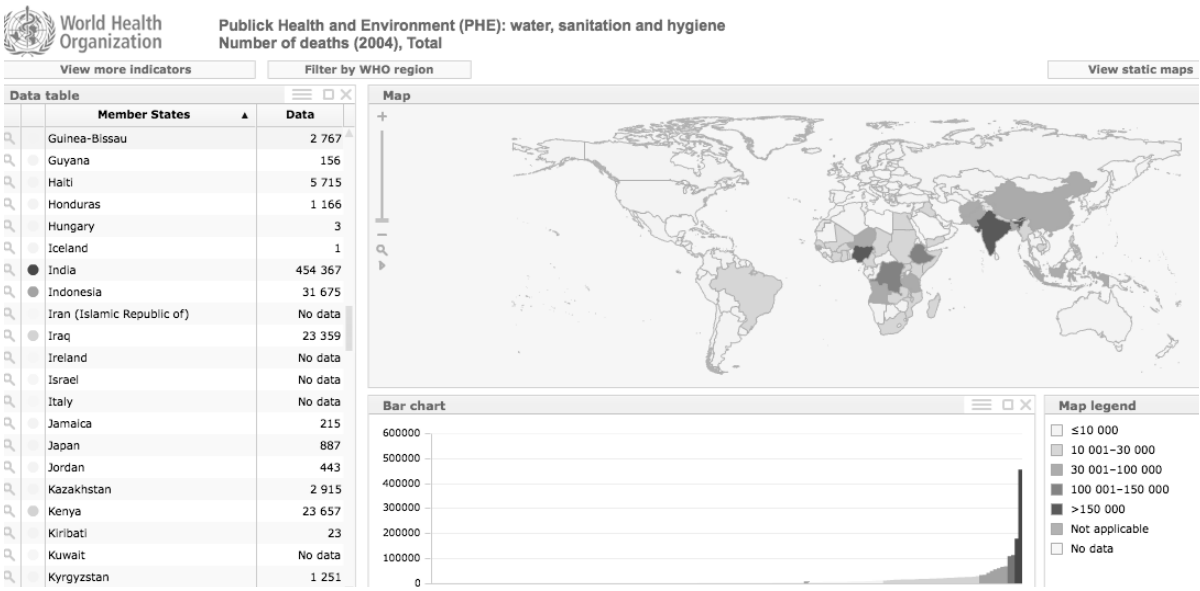

Figure 1: World Health Organization report

Consequently, it is important to investigate why people who can benefit the most out of house-connected piped water services, postpone having direct access to clean water. What are the real factors affecting people's intention to adopt and willingness to pay for house-connected piped water services? Do economic factors (e.g. price) tell the whole story? Or can cultural differences and incorrect perceptions about the likelihood of disease, the threat posed by unimproved or even improved sources of water also play a role in people's intention to adopt and willingness to pay for piped water? The goal of this thesis is to answer these questions using evidence from the field, collected and kindly shared by TESE, a Portuguese NGO working to improve the diffusion of piped water services in the city of Bafatá, in Guinea Bissau.

2.1 Intention to Adopt and Willingness to Pay: Construct definitions

Many studies suggest that intention represents plans of action in pursuit of behavioural goals (Ajzen, 1987, 1991; Fishbein & Ajzen, 1975; Triandis, 1977, 1980). In his seminal work on the theory of reasoned action and theory of planned behaviour, psychologist Icek Ajzen (1987, 1991) supports that intention is an indication of how hard

people are willing to try and of how much effort they are planning to exert, in order to perform a certain behaviour. According to Ajzen (1987, 1991), people's intentions capture the motivational factors that ultimately influence their behaviour. He also argues that intention is the attitude towards a behavior and that it is formed from salient beliefs about the outcomes of an act. As such, I define 'intention to adopt' as the indication of how ready, willing and determined is our target group to perform a behavioural change which, in our case, is a consumers' intention to adopt house-connected piped water.

Willingness can be defined as the state when someone is inclined, ready and eager to act gladly or simply happy to do something if it is needed (British Dictionary, 2014). Willingness to pay' in particular, has been defined by Knetsch et al. (1984), as the maximum amounts people will pay to avoid a loss. In other words, the maximum amount that an individual is willing to sacrifice to procure a good or avoid something undesirable. As such, 'willingness to pay' in this study will be defined as the reflection of the maximum amount that our target group thinks a product or service is worth.

Although, the two definitions can be interlinked, we will test them separately so as to compare their results and see how intention to adopt is correlated to willingness to pay for piped water services.

2.2 Drivers of intention to adopt and willingness top pay for house-connected piped water

There is a large amount of literature investigating the drivers of intention to adopt life-saving technologies in disciplines such as energy, agriculture and water supply. Some aim to improve living conditions (fight starvation) and other to improve yield. Amongst those disciplines, adoption of piped water services is perhaps he most important, as it covers one of the most fundamental human needs. Access to clean drinking water.

Prior research has already documented that low income consumers living in developing countries tend to have a very low willingness to pay for direct access to piped water services (Zug & Graefe, 2014). This is particularly true when cheaper alternative sources of water are available, which led scholars and practitioners alike to

assume that the main driver of low willingness to pay for piped water is low income. In fact, in low-income regions such as the one this study examines, people tend to choose the cheapest alternative source of water even if it means that they have to walk for 45 minutes to obtain water of dubious quality (Kremer, 2011). Existing studies have almost exclusively been conducted from an economic point of view, examining price, income and facilitation of payment as the key explanation for low willingness to pay for piped water. In short, most studies in development economics seem to explain low adoption of life saving technologies, like piped water, not with consumers' low *willingness* to pay but, more appropriately, with consumers' low *capacity* to pay.

Signaling theories offer an alternative view to this "capacity-to-pay" argument, According to signaling theorists, pricing can also be seen as an indicator of quality for newly introduced products. Studies that focused on price and payment methods show that price plays an important role since it carries information about a product (Milgrom and Roberts, 1986). Milgrom and Roberts (1986) support that especially for a product newly introduced in the market, higher prices might signal higher quality or efficacy. They also examined alternative payment methods as an alternative to those who do not have the resources to purchase the newly introduced product.

Similarly, Ashraf et al. (2010) supported that higher prices could increase (or alter) use through a higher perception of quality. Would an NGO be interested in fostering high levels of use might, initially and under these circumstances, attempt to charge high prices to highly informed segments of the population, so as to allow other segments to observe high willingness-to-pay among the informed (Ashraf et al. 2010). However, this would be the case when an innovation is about to be launched into the market. When the innovation has been for a while in the market, we expect that the diffusion is in its next level and associations regarding the product have already been established.

Factors such as quality and quantity of the water have also been examined by Ashraf et al. (2010) in Zambia. These authors suggest that the willingness to pay for water quality (measured in terms of money spent on chlorine or extra time spent collecting water) is relatively low. In contrast, Kremer et al. (2009, 2011) suggest that households in Kenya seem to be willing to pay a lot for quantity and ease of access.

Similarly, economic studies that focus on how facilitation of payment affects

their decisions and investigate the reasons behind this decision making process, suggest that households' willingness to pay for a private connection is high when it can be purchased on credit, not because a connection improves health but because it increases welfare; with welfare being translated into available time for leisure and reduction of inter and intra-household conflicts on water matters, leading to sustained improvements in well-being (Devoto et al. 2012).

Regarding socio-demographics and psychographics, there is a heated debate about their influence on consumer adoption decisions for life saving technologies, with different studies using different methodologies or focusing on different samples reaching contradictory findings. There are findings that support that socio-demographics do not seem to be important in explaining adoption intention of the adopter, whereas selected adopter psychographics and innovation characteristics do (Arts et al. 2011).

Despite studies that focus on socio-demographics and psychographics, there is a lack of research on behavioural drivers of adoption decisions. At this stage, it should be mentioned that from behavioural perspective, people's motivations for behavioural change is a critical driver of people's intentions and behaviours, especially when one attempts to promote healthy behaviours and products or services with health benefits. As observed in most of the studies above, the long-term benefit of good health seems to be particularly ineffective in achieving behavioural change, whilst more proximal and mundane factors - such as being more appealing to opposite sex or leisure - cannot be discarded as important drivers of people's behaviour. Evidence of this phenomenon, widely know as hyperbolic discounting[5], can be found in many studies that study decision making processes and intertemporal choices in the health discipline, all of which show that people tend to make choices that have immediate consequences regardless the benefit of the reward (Frederick et al. 2002; Bleichrodt & Johannesson, 2001; Odum et al., 2002). As a result, one very interesting question arises. Why are water quality and its consequence for people's health not considered as important, as drivers of adoption and willingness-to-pay intentions, as ease of access to water and welfare (health, happiness, prosperity, and well-being in general), especially in regions

[5] *Hyperbolic discounting refers to the tendency for people to increasingly choose a smaller-sooner reward over a larger-later reward as the delay occurs sooner rather than later in time*

where drinking water from unimproved or even improved water sources entails a high risk of illness or even death from waterborne diseases?

Most studies, especially field studies, have adopted a microeconomic angle and ignored the behavioural drivers. In an effort to incorporate health-related behavioural drivers into this study, I used, as the main theoretical framework of this study, the *Health Belief Model*, the most widely used behavioural model that incorporates perceptions about health and which will be further explained in the theory section. However, an intrinsic and untested assumption of the *Health Belief Model* and other psychological models is that the relationships they posit are universally valid. This contrasts with the view, in cross-cultural psychology and international marketing, that cultural differences shape people's values, beliefs and perceptions. As discussed in the introduction section, the need to adapt public health interventions and marketing campaigns to the preferences, values, traditions and beliefs of different segments of the consumer population, is a fundamental issue that has been particularly overlooked. Especially as cultural differences among different ethnicities may be particularly relevant for their health-related beliefs (Hartley, 2004). There is a long tradition in marketing and cross-national psychology of studying cultural differences. According to Hofstede's (1984) study, marketing techniques that are applicable and effective in one national culture are not necessarily applicable and effective in another one. As such, in order to increase the effectiveness of such public health marketing efforts NGOs and local public health marketers need to (1) understand cultural and value differences between these ethnicities, and then (2) adapt their marketing and communication strategies to these culturally diverse populations. Therefore, this thesis wishes to examine differences in these behavioural drivers and their impact across ethnicities.

In contrast with prior literature, which tends to examine adoption for life-saving technologies from a rational microeconomics standpoint (water quality, welfare, prices, income), in this study I stress that both economics and behavioural aspects are intertwined and need to be examined simultaneously for a richer understanding of consumers' willingness to adopt and pay for piped water. The importance of this study in consolidating these two aspects lies in the fact that although previous studies have taken a more rational look at pricing and adoption, they have neglected two key drivers of people's adoption decisions for life-saving technologies: (i) incorrect perceptions

about one's likelihood to suffer from the hazards such technology is expected to prevent (perceived threat of disease), (ii) incorrect perceptions about the seriousness of such hazards (perceived seriousness) and (iii) cultural factors. My key argument is that such incorrect perceptions as well as cultural differences will significantly influence consumers' value assessment and adoption intentions. The need to incorporate these behavioural aspects arise from the belief that it can influence the perceptions of value of house-connected piped water services and consequently their willingness to adopt and pay for piped water services.

Appendix No 1 sums up all the abovementioned factors and theories.

3. Theory: *Health Belief Model* and the Adoption of Piped Water

'Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity' (World Health Organisation definition of Health).

Since the time the first human lived on the earth, health, although sometimes neglected, has been the greatest gift one could wish for. It is inextricably linked with one's well being and has always been an important consideration in human decisions. Perceptions about health in particular, have the power to influence one's decisions with regards to the intention and willingness to take a health related action (Hochbaum et al., 1952).

Moreover, we live in increasingly multicultural societies, where different subgroups of the consumer population may have distinct values and health-related beliefs, influencing their health-related behaviours (Carrillo, Green & Betancourt 1999). In fact, medical education increasingly emphasises multicultural competences for exactly this reason (Arno & Lypson 2009). Despite this, classic psychology models – such as the *Health Belief Model* used in this thesis – tend to implicitly assume their behavioural predictions are universally valid, an assumption that is rarely tested as the vast majority of studies focus on data from the U.S. or a few Western countries.

Multicultarism is particularly strong in Africa, where a turbulent colonial past led to borders being drawn by European powers, often with a lack of sensitivity for the prevailing local cultures and values. As a result, in many African countries ethnicities co-exist in geographically proximal locations, but often maintain important differences in traditions, values and perhaps in their health-related beliefs, which is what I empirically test in my thesis. If my main hypothesis – that health beliefs and their impact on consumer adoption of piped water - is not rejected this means that local authorities, NGOs and public health marketers should take these cultural differences into account when promoting the adoption of life-saving technologies, like piped water. More specifically, in this research, given that water constitutes such a fundamental factor in one's health, I wish to investigate whether perceived threat of (waterborne) diseases is a key driver of consumers' likelihood of a health related behavioural change and if so, how that differs among different ethnical groups.

Opposed to the majority of previous studies who have looked into the drivers of adoption decisions in the context of piped water services from a consumer marketing angle (Zug and Graefe, 2014; Milgrom and Roberts,1986; Ashraf et al. 2010), my ambition, with this thesis, is to advance our knowledge regarding its behavioural drivers. Aiming to examine people's intention to adopt and willingness to pay for house-connected piped water services both from marketing and consumer behaviour angle, I use the *Health Belief Model* (add source) which is one of the most often used behavioural models, to understand consumer health-related perceptions and behaviours about health. Building on the *Health Belief Model* and having adoption theories as a general framework, I investigate how consumers' perceptions about threat of water-related diseases influence their adoption of piped water, controlling for price and alternative sources of water available. Importantly, I also test whether these effects are culturally sensitive, i.e. whether cultural differences *moderate* the effect of health-related beliefs and exposure to public health campaigns on consumers' intention to adopt and willingness to pay for piped water services.

3.1 Introducing the Health Belief Model

The *Health Belief Model* is one of the most widely applied theoretical foundations for the study of health behaviour change (Hochbaum, Rosenstock, & Kegels, 1952). As Karen G. et al. (2008) mentioned in their book, the *Health Belief Model* has spawned thousands of health education and health behaviour research studies and provided the conceptual basis for many interventions in the years since it was formulated. It has been used across the health continuum, including disease prevention, early disease detection, illness and sick-role behaviour (Janz and Becker, 1984). It has also been applied and suggested as a key model for health behaviours in life science marketing literature (Stremersch & Van Dyck, 2009; Kahn, Barbara E., and Mary Frances Luce, 2003).

According to Hochbaum, Rosenstock, and Kegels (1952), the key idea behind the *Health Belief Model* is that consumers will take a health-related action - which in our case is to adopt pipes in order to have connected water in their house (instead of using other alternative source of water) - if the following conditions are met:

Condition 1 (perceived threat of the disease): Consumers feel that a negative health condition (i.e. waterborne diseases) is serious and can affect them if they do not adopt

house-connected piped water.

Condition 2 (perceived benefit of the action): Consumers have a positive expectation that by taking a recommended action (adopting and using house-connected piped water services) they will avoid a negative health condition.

Condition 3 (self-efficacy): They believe that they can successfully take a recommended health action (i.e. there are infrastructures so that they can install pipes at their houses and the price is affordable).

According to the *Health Belief Model* there are four concepts that represent the perceived threat of disease and net benefits. These are perceived susceptibility, perceived severity, perceived benefits, and perceived barriers.

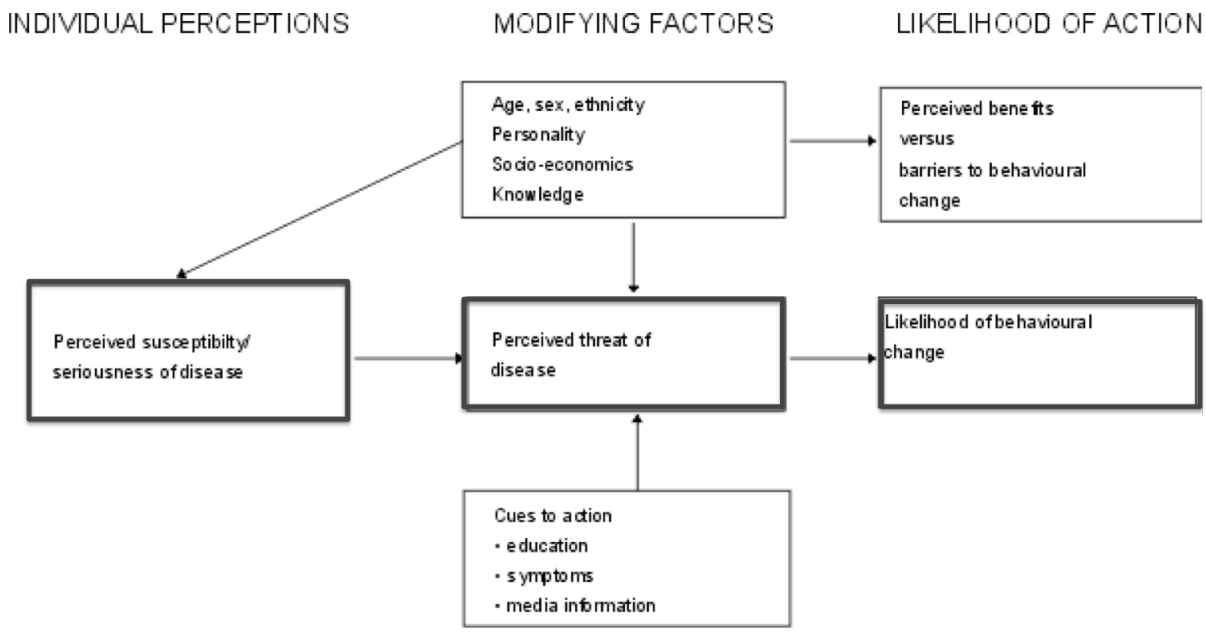

Figure 2: Health Belief Model, concepts accounting for people's 'readiness to act'

Hochbaum et al. (1952) proposed these concepts as accounting for people's "readiness to act". These concepts were used as constructs for a wide variety of studies that wanted to promote health related actions and predict health related behaviours. Few great examples of such studies are listed as per the following paragraphs.

A great example of application of the *Health Belief Model* to promote health behaviour is the Abood, Doris A. et al. (2003) study that used the model to promote

healthful dietary behaviors that reduce risks for cardiovascular disease and cancer. Menon, Usha, et al. (2007) used *Health Belief Model* variables as predictors of progression in stage of mammography adoption in order to develop appropriate stage-based interventions. Gammage, Kimberley L., et al. (2009) used the *Health Belief Model* constructs as independent variables to examine differences between high and low dietary restrainers on osteoporosis beliefs and knowledge between women and men. Moreover, the *Health Belief Model* also provided the theoretical framework to Becker, Marshall H. et al. (1977), to predict and explain mothers' adherence to a diet prescribed for their obese children. And finally, the *Health Belief Model* was used by Rosenstock, Irwin M., et al. (1994) to identify the barriers to condom use in order to provide useful data in designing and improving HIV/AIDS prevention outreach programs in Sub Saharan Africa.

Extended research in the past has also made use of the *Health Belief Model* as a main theoretical background to investigate people's perception of the threat of a health problem, their intention to take a health related action and how their intentions affect their behaviour. Ouellette et al. (1998) in particular were the ones who focused on how past behaviour may contribute to intentions, and how their behaviour is guided by their intentions. Their study suggests that in order to maintain people's intentions to adopt a healthier lifestyle, the chosen change strategies should ensure that some immediate reward or positive consequences emerge from the new healthy behaviour otherwise the chosen change strategy does not always have the desirable outcome.

All in all, the *Health Belief Model* enumerates a series of modifying factors that may predict people's perceptions about the threat of disease. As can be seen in the table 3 below, these factors are demographics such as age, sex and ethnicity, personality, socio-economics, knowledge and cues to actions such as education, symptoms and media information.

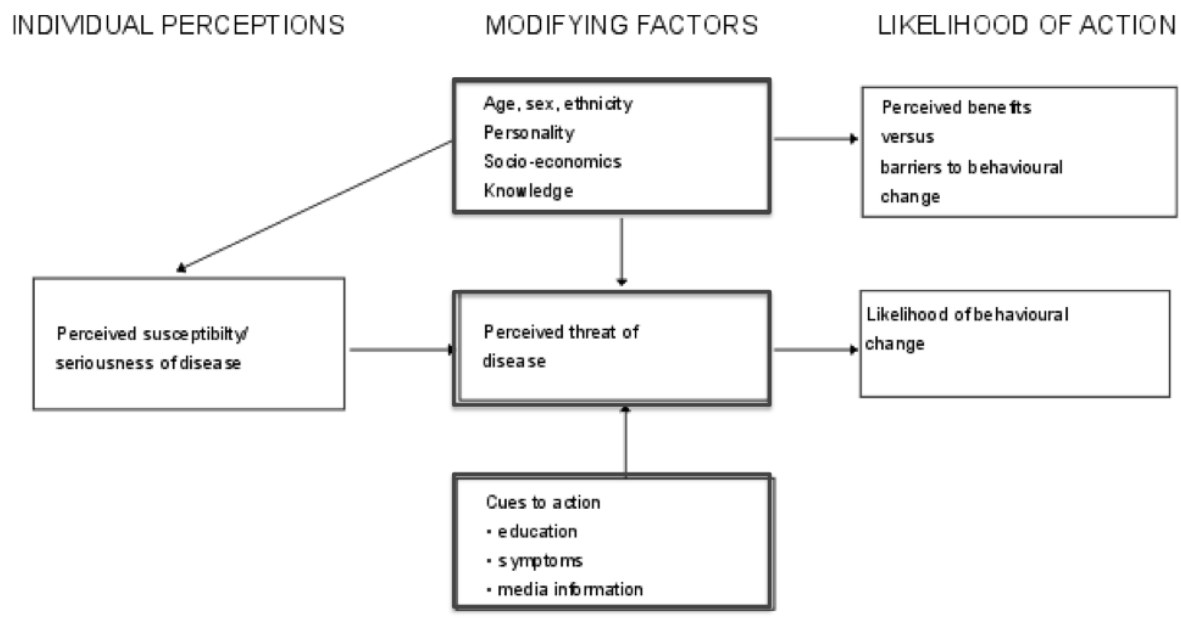

Figure 3: Health Belief Model, Modifying factors

Although this study is adopting all these modifying factors as antecedents of Perceived Threat of Disease, personality and media (apart from radio) have been excluded. The reason being that in our case personality was not included in the survey questions and the rest of the media data were missing and therefore there are measurement limitations for these variables. Additionally, perceived susceptibility and perceived severity will be tested as one consolidated concept a there is also a measurement limitation due to restricted availability of the data provided. However, all of the above will be included as limitations in the 'further research' part of this study.

3.2 Perceived Threat of Disease and Perceived Susceptibility/Severity

To start considering adopting piped water services, consumers need to be aware of the seriousness of a health condition and the negative consequences that it might have if they continue rely on alternative sources of water. Should they not feel threatened by the waterborne diseases that come with the low quality sources of water, little difference will it make in their decision making process.

Of the four constructs of the *Health Belief Model* model, two stand out for their

suitability to help capture people assessments regarding their health condition and these are the Perceived Threat of Disease and Perceived Susceptibility/Severity. In this study, Perceived Threat of Disease refers to the individual assessment of how threatened does the respondent feel from a waterborne disease and Perceived Susceptibility/Severity is a combined construct that captures both our respondents' subjective assessment of the risk to develop a waterborne disease, as well as the severity of a health problem and its potential consequences of such a disease.

These perceptions are expected to have a significant moderating effect on people's likelihood of a health related behavioural change. In this study, the likelihood of a health related behavioural change is examined by our respondent's intentions and willingness to adopt piped water services, which are known to reduce the risk of such diseases and promoted as such to consumers.

3.3 Consumers' Intentions to Adopt Piped Water

Figure 1 depicts my conceptual framework to study the adoption of piped water. The framework draws on the main constructs, identified above, of the *Health Belied Model,* Perceived Threat of Disease and Perceived Susceptibility/Severity of Diseases, and incorporates Price, Alternative Sources of Water and Ethnicity as additional drivers of consumer intentions to adopt piped water.

Price and the existence of Alternative Sources of Water are expected to be two major impediments in people's intention to adopt as most studies in development economics documented. Price, due to consumers' low capacity to pay, and Alternative Sources of Water as cheaper available alternatives sources of water. However, in cities as ethnically diverse as Bafatá, we also expect Ethnicity differences to play an important role in their intention to adopt piped water.

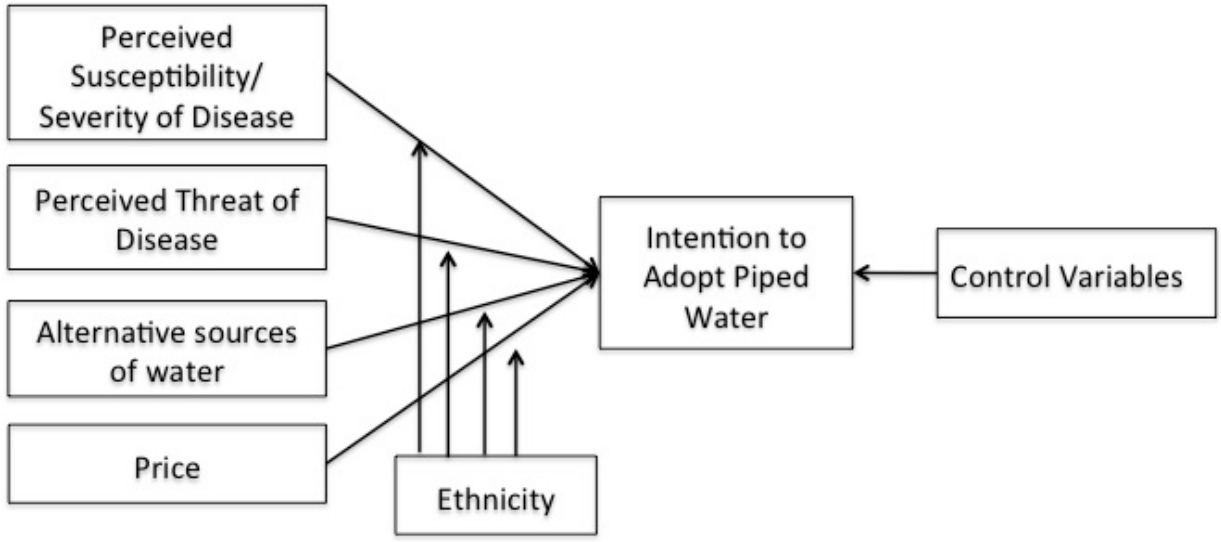

Figure 3: Conceptual Framework 1 - Intention to adopt

Figure 1 indicates that Ethnicity moderates the effect of Alternative sources of Water, Price, Perceived Threat of Disease and Perceived Susceptibility /Severity on people's intention to adopt.

3.4 Consumers' Willingness-to-Pay for Piped Water

Similarly to the Conceptual Model 1, the second conceptual model (Figure 2) of this study aims to test the same constructs apart from price on Willingness to Pay.

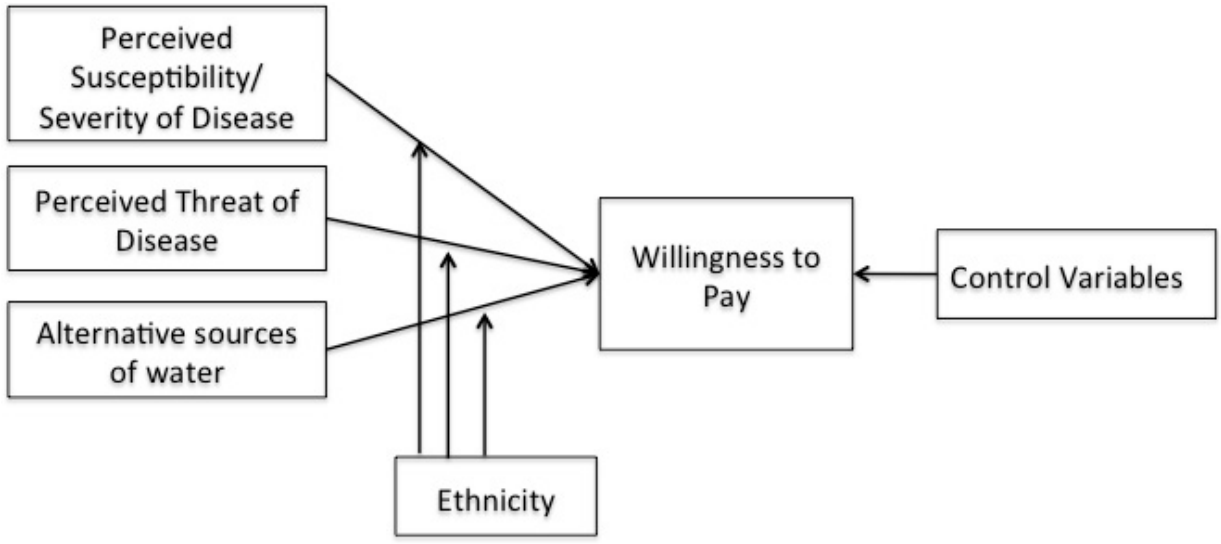

Figure 4: Conceptual Framework 2 - Willingness to pay

Figure 4 indicates that Ethnicity moderates the effect of Alternative sources of Water, Price, Perceived Threat of Disease and Perceived Susceptibility /Severity on people's intention to adopt.

4. Data and Fieldwork

4.1 Evidence from the field: Data Collection in Guinea Bissau

Aiming to find and analyze a representative sample without having to travel to one of the developing regions (due to restrictions on resources) that suffer from this lack of clean water, it soon became clear that a liaison with a NGO that operates in such developing regions would be the next optimum solution. As such, with the help of Mr Nuno Camacho, collaboration with an NGO called TESE was achieved.

TESE is a Portuguese NGO established in 2002, which uses the concept of social innovation as the "umbrella" that underpins their intervention in Portugal and in developing countries, such as Guinea Bissau. TESE Sem Fronteiras (TESE SF), a member of Engineers Without Borders International, is TESE's international development program, focusing on Environment and Development issues, and promoting sustainable access to services and social infrastructures within the Water, Sanitation and Renewable Energy sectors.

TESE with the help of EU has ventured a project called Bafatá Misti Iagu, which lasted from January 2010 to June 2012**,** to ensure sustainable access to improved water source for the population of the City of Bafatá in Guinea-Bissau. According to the vimeo video posted on 2012, TESE-SF Projecto Bafatá Misti Iagu (Guiné-Bissau) as well as the available information on the same vimeo webpage, the project was funded the European Commission, the Portuguese Cooperation, the Calouste Gulbenkian Foundation and TESE. TESE promoted this project through its international program Engineers Without Borders (TESE-SF) in partnership with the Association for Basic Sanitation, Water Protection and Environment in Bafatá (ASPAAB) - organization to whom the Government of Guinea-Bissau transferred responsibility for management of water supply in the City of Bafatá and the Regional Water Resources Delegacy in Bafatá (DRRH-B). The project also had the support of EPAL - Empresa Portuguesa das Águas Livres, SA.

Before the intervention of TESE-SF only about 20% of the 28,067 inhabitants of the city Bafatá had access to improved water sources. This Project directly benefited the population of Bafatá, increasing the access to water in a sustainable and safer way to about 45% of the population, roughly 13,375 women and men (TESE-SF Projecto Bafatá Misti

Iagu (Guiné-Bissau), 2012, Vimeo).

Geographically, Bafata is the capital of Bafatá region in northeastern Guinea-Bissau and the second capital and second biggest city of the country. Located within the country, on the river Geba, Bafatá is located 150 kms east of Bissau (Wikipedia, 2014).

Figure 5: Map of Guinea Bissau

With regards to demographics, Guinea Bissau has an estimated population of 1.72 million (World Population Review, 2014). According to the latest data available in United Nations 2010 World Population and Housing Census Programme (2009), the Bafatá region has a population of approximately 225,516 inhabitants. The city Bafatá, focus of this study, in 2010, had a population of about of 34,760 inhabitants (Wikipedia, 2014).

Guinea Bissau is a very culturally diverse region comprising of multiple ethnical groups. According to Nations Encyclopedia, the ethnicity that predominates is Fulas (40%). Fulas is one of the largest ethno linguistic groups in Africa, numbering approximately 40 million people in total. They are one of the most widely dispersed and culturally diverse of the people of Africa. A significant proportion of their number, (an estimated 13 million), are nomadic, making them the largest pastoral nomadic group in the world (Wikipedia, 2015). The majority of Fulas are Islamists and they are traditionally trading people, herding cattle, goats and sheep across the vast dry hinterlands of their domain, keeping somewhat separate from the local agricultural populations (Nations Encyclopedia.com).

Households in Guinea-Bissau are generally large. The average family in Bafatá

show a higher than the national average, averaging 11.79 per family, nearly double the amount recorded in Bissau as a whole. However, family size varies according to the different groups yield (TESE, 2010).

According to the data provided by the World Bank in 2012 (UN classification), Guinea-Bissau's GDP per capita is one of the lowest in the world and its Human Development Index is also one of the lowest on earth line (Wikipedia, 2014, List of countries by Human Development Index). More than two-thirds of the population lives below the poverty line (Wikipedia, 2014, List of countries by GDP (PPP) per capita).

For an average family whose per capita monthly expenditure is less than 10,000 CFA (=15,29€), the average household size is 15 members (TESE, 2010). In the same study it is mentioned that the number of members of an average family decreases as income increases, with the exception of the average family group with monthly income between 30,000-50,000 CFA that counteracts this tendency. The situation in Bafatá converges with the commonly accepted theory that the propensity to decrease the size of the average family as income increases (TESE, 2010).

TESE has conducted several surveys in the previous years aiming to get insights from the residents of Bafatá in Guinea-Bissau regarding water, sanitation and hygiene. From the two surveys that TESE kindly provided, one that took place in 2010 and one in August 2013, the latest one was chosen so as to have the most recent data possible. After signing a Non-disclosure agreement, they kindly shared their data for the needs of this research.

The area in which the 2013's survey took place has a total number of 28,056 residents. The total sample consisted of 195 respondents, few of which already had access to connected water. Each respondent represents one family. Each family has on average 11-12 members. There were 2,380 families in the selected study area.

In 2013's KAP survey (=knowledge, attitude and practice), TESE uses a stratified sample method. To calculate the sample size, a maximum margin of error of 7% for a 95% confidence level was considered, with probability of success of 50% for the main survey variables. To ensure sample representativeness, TESE estimated the total number of households by 'Bairro' (=neighborhood), taking into account the population of each Bairro (% relative to the total population of the Town of Bafatá). To ensure even

distribution of the number of questionnaires to be conducted within the Bairro, households were pre-selected randomly via aerial photograph (Google earth maps). However, in this case specifically, as the aim of the study was to reach women as much as possible (as being responsible for family's routine) additional selection criteria were considered such as:

- In Bairros were only one questionnaire was conducted, the woman responsible for the family's routine answered;
- In Bairros with two questionnaires, one man in charge of the household and one woman responsible for the family's routine answered;
- In Bairros where more than two questionnaires were conducted: in the first household the man in charge of the household answered, whereas in the second and third households it was the women responsible for the family routine (and so on).

The total duration of the survey lasted approximately 14 days. Hence, two questionnaires/interviews took place per day on average. However, additional time should be considered for the pre-survey preparation and post-survey data administration. In general, a mixed method research was carried out to allow triangulation of information from different sources/approaches. Here is the procedure that TESE undertook to collect the data in steps:

Step 1: Collection and analysis of information from secondary sources

1.1: Literature research

Step 2. Collection and analysis of information from primary sources

2.1 Qualitative data collection

2.1.1 Interviews

2.1.2 Focus Groups

2.2 Quantitative data collection

2.2.1 Drafting of questionnaire, interviewer's manual/guide and sampling method

2.2.2 Database design

2.2.3 Training of interviewers and testing of the questionnaire

2.2.4 Survey Implementation

2.2.5 Data entry

2.2.6 Editing and data clearing

The above procedure was conducted without my intervention. However, I observed

that TESE's procedure followed best practices in scale construction and validation, such as the one that Churchill recommends in his paper in 1979.

As soon as TESE's data became available, the first step was to examine which data were relevant to this study and could help answer our specific research questions. Aiming to eliminate the factors that this research is not investigating, a rigorous clearing process lead to the exclusion of all spare or missing data. The data clearing process is explained in detail in the data clearing part 5.3.

As a conclusion of this section, I would like to point out that Guinea Bissau, and Bafatá in particular, was the perfect location for field data collection, for two reasons. First, because adoption of piped water is a very relevant and there is high-involvement decision with serious consequences for health, which makes the sample's health beliefs crucial. Second, because it comprises of multiple ethnicities, which may have different beliefs and values and thus may required tailored approach and communication.

4.2 Additional Assumptions & Measurements

As previously mentioned in the theory part, according to the *Health Belief Model*, there are four concepts that represent the perceived threat of disease and net benefits, and these are perceived susceptibility, perceived severity, perceived benefits, and perceived barriers. This section wishes to provide a comprehensive explanation of which and how these concepts will be measured and translated into this study's constructs and finally which questions will be used to examine these constructs. In addition, few additional assumptions will be made so as to set the baseline of this research.

Based on the structure the *Health Belief Model*'s conceptual model, our area of focus will be the central line that commences with the seriousness of the disease then examines people's perceptions about the threat of a disease and concludes with people's likelihood to change their behaviours.

Assumption 1: We are taking for granted that they are answering the questions having their wellbeing and the wellbeing of their family in mind. Therefore, everyone should like to have access to piped water services.

Assumption 2: As previously stated Perceived Susceptibility and Perceived Severity will be tested as a consolidated concept[6] [PS]. As such, our target group will be asked: **'*What are the diseases that most frequently affect your family members?'*.** PS has been coded and refers to a low or high score in the following diseases: Diarrhea, Respiratory Diseases, Itch, Malaria, Yellow Fever, Typhoid Fever, Cuts.

Assumption 3: To measure perceived Threat of disease our target group were asked: '***Did someone in your family suffer from diarrhea and/or malaria in the past two weeks?',*** safely assuming that the disease is very salient in the respondent's mind and thus perceived threat is high.

Assumption 4: The likelihood of behavioural changes will be translated into their intention to adopt [DV_1_ITA] and into their willingness to pay [DV_2_WTP] for house-connected piped water services. Their intention to adopt will be tested by asking our target group the following question***: 'Would you like to have piped water at your home?'*.** Then, their willingness to pay will be captured by the question: ***'How much would you be willing to pay for the water service?'.***

The following table 2 sums up how the *Health Belief Model* concepts will be tested and presents how are the *Health Belief Model* concepts are translated into this study's constructs and finally which questions will be used to examine these constructs.

[6] *There was no question available in the survey that could be used to represent either of these two constructs. As such, this is a limitation of this study and one of the reasons that these two are examined together.*

HBM Conceptual Model	HBM Concept	Translated to	Question & Coding	Response scales
Individual Perceptions	Perceived susceptibility & perceived severity	**Perceived susceptibility & perceived severity**	What are the diseases that most frequently affect your family members? **[PS]**	Sum Score **1=Yes, 0=No** (Interval)
	Perceived threat of disease	**Perceived threat of disease**	Did someone in your family suffer from diarrhea in the past two weeks? **[PTD]** Did someone in your family have malaria in the last two weeks? **[PTD]**	Sum Score **1=Yes, 0=No** (Interval)
Likelihood of action 1	Likelihood of behavioural change	**Intention to adopt piped water services**	Would you like to have piped water at your home? **[DV_1_ITA]**	**1=Yes, 0=No** (Interval)
Likelihood of action 2	Likelihood of behavioural change (Indirect perceptions of price barriers)	**Willingness to pay for piped water services**	How much would you be willing to pay for the water service? **[DV_2_WTP]**	Any amount (ratio)

Table 2: Health Belief Model concept translated into tis study's constructs

As can be seen on the above table 2, our two dependent variables are DV_1_ITA and DV_2_WTP. The other two PTD and PS constitute our independent variables along with price and alternative sources of water. Ethnicity is the model's moderator and it is expected to be a key driver in intention to adopt and willingness to pay for piped water services. Demographics and socio-demographics are not the main interest of this study (as previous studies have repeatedly investigates these factors) and I will therefore keep them as control

variables. The following table consolidates all non dependent variables, along with their scales measurements, their questions and coding.

Independent variables	Questions & Coding	Response Scale
Alternative Sources of Water	Where do you collect water? **[AS]**	1=**Medium quality, 0=Low quality (interval)** *Low Quality = Poço tradicional, Medium Quality = Poço ou furo com bomba manual OR Poço melhorado OR Nascente OR Fontenario*
Price	How much do you pay for the water? **[Price_Water]**	Any amount (ratio)
Perceived Threat of disease	Did someone in your family have diarrhea or malaria in the last two weeks? **[PTD]**	**Sum Score 1=Yes, 0=No** (interval)
Perceived susceptibility/ severity	What are the diseases that most frequently affect your family members? **[PS]**	**Sum Score 1=Yes, 0=No** (interval)
Moderating Variable	**Questions & Coding**	**Response Scale**
Ethnicity	**[Ethnicity]** of respondent	**1 = Fulas, 0 = Other** (Interval)
Control Variables	**Questions & Coding**	**Response Scale**
Age	**[Age]** of the respondent	Any number (ratio)
Household size	**[Ln(Household size)]**	Any number (ratio)
Media	**[Media] exposure**	**1=Yes, 0=No** (interval)
Water Quality[7]	What is your opinion about the quality of the water to drink? **[WaterQuality]**	0 = Bad, 1 = Reasonable 2 = Good (Interval)
Knowledge	Do you know what causes diarrhea and/or malaria? **(Knowledge)**	**1=Yes, 0=No** (interval)

Table 3: Consolidation of independent, moderating and control variables used

[7] *For parsimony reasons I assume that this variable can be interpreted as having interval-scale properties*

4.3 Data Cleaning

To end up to the final data used for this study (see table 4 above) I tried to follow a rigorous clearing process. The first step after receiving TESE's data was to translate them in English. Then I examined carefully which questions/columns had too many missing data and could not provide sufficient information. The selection process of the remaining questions with sufficient data was made based on the variables that needed to be tested. I created a list of all *Health Belief Model* constructs and identified the relevant questions that could encapsulate the essence of the independent variables, moderators and control variables.

With regards to the number of respondents, there were a few that had not answered most of the questions, so they were removed to avoid having misleading insights. From the total sample of 195 respondents, I kept 151 respondents, which had answered all of the questions needed for this study.

From the final selected sample of 151 respondents, 96 of them were Fulas, whilst only 55 in total represented other ethnicities, namely Mandigas (N=30), Biafada (N=3), Djacanda (N=3), Djiba (N=7), Mancanhe (N=3), Nalu (N=1), Pepel (N=1) and Saraculé (N=10). As such, I divided the sample in Fulas, as the most represented ethnicity in the dataset and grouped all other ethnicities. I chose to go ahead with this division in order to make the model parsimonious. In an ideal case where a larger sample was available and all ethnicities were represented in sufficient numbers I would have tested the interaction of all ethnic group in more detail, but in this sample I would have come across multicollinearity issues, lack of statistical power and identification problems due to too less observations.

With regards to Media Exposure, the only available question that had sufficient answers was '*How frequently do you listen to the radio?*'. However, since not enough data were available for other media (which makes comparison among media means impossible) and my main interest was whether the respondents are actually exposed to any kind of media, I transformed respondents' answers into an interval scale variable with 1 being 'Yes' for all those who had radio exposure (no matter what the frequency was) and 0 being 'No' for those whose response was O frequency.

4.4 Data Descriptives

As a first step, table 4 summarises the data descriptives so as to have a better overview of all my data and collect few first insights from my sample.

As table 4 indicates, with an average family of 13 members and a maximum current spent of 250 XOF (mean 13.742 XOF) for water it is quite obvious that our sample has a low capacity to pay.

The alternative sources of water they use tends to be of low quality (.192) whilst their perception about the quality of water they consume is not the highest possible (1.298), but at least the majority seems to know what causes waterborne diseases such as malaria and/or diarrhea (.901).

Their exposure to media (radio in particular) is somewhat high with a mean .874 (tendency) and I assume that all respondents are well aware of the water situation in Bafatá and have a good understanding of the questions asked, since most of them are adults (min 14 and mean 39).

Overall, their intention to adopt tends to be high (.927) as well as their willingness to pay for piped water services (1575 XOF) regardless their low capacity to pay.

	N	Minimum	Maximum	Mean	Std. Deviation
DV_1_ITA	151	.0	1.0	.927	.2608
DV_2_WTP	151	.0	15000.0	1575.447	2480.6111
Age	151	14.0	87.0	38.914	15.6136
Fula_Ethnicity	151	.0	1.0	.636	.4828
Householdsize	151	3.0	58.0	13.550	8.6685
Media	151	.0	1.0	.874	.3328
WaterQuality	151	.0	2.0	1.298	.6511
Price	151	.0	250.0	13.742	43.5592
AS	151	.0	1.0	.192	.3952
PTD	151	.0	1.0	.702	.4589
PS	151	.0	5.0	.914	1.0890
Knowledge	151	.0	1.0	.901	.3001
Valid N (listwise)	151				

Table 4: Descriptive Statistics

5. Econometric Models

As stated in the Table 2, the likelihood of a health related behavioural change is translated into intention to adopt and willingness to pay. As each of them can be considered our dependent variable, I run a model for each dependent variable and compare their results.

In order to examine the relationship between our dependent variables (ITA and WTP) with the multiple independent variables, I run two cross-section data multiple regression models. Cross-section, as the observations refer to a single point in time for several subjects. Multiple as we have more than one observation that we wish to test.

5.1 Model 1: Intention to Adopt Piped Water Services

I model intention to adopt piped water services using a binary logistic regression model with product terms included to capture the moderating effects discussed above, namely the moderating effect of ethnicity on the relationship between the *Health Belief Model* perceptions and intention to adopt (and similarly, later, for the WTP model). Table 5.1 summarizes this Intention to Adopt model.

Dependent	Intention to Adopt Piped Water Services [DV_1_ITA]
Independent	Price [Price], Alternative Sources of Water [AS], Perceived Threat of Disease [PTD], Perceived susceptibility/ severity [PS]
Moderators	Ethnicity [Fulas or others]
Control	Demographics [Age, Household size], Socio-economics [Media, Water Quality, Knowledge]
Estimation	Logistic Regression estimated through maximum likelihood

Table 5.1: Research variables of ITA model

Equation 1, below, describes my model specification for the Adoption Intentions model.

Model 1, Intention to Adopt: $DV\_1\_ITA_i = \log\frac{Y}{1-Y} = \beta_0 + \beta_1 *$ LnAge $+ \beta_2 *$ LnHouseholdsize $+$

$\beta_3 *$ Media $+ \beta_4 *$ WaterQuality $+ \beta_5 *$ Knowledge $+ \beta_6 *$ Price_Water
$+ \beta_7 * PS + \beta_8 * AS + \beta_9 * PTD + \beta_{10} *$ Fula_Ethnicity
$+ \beta_{11} *$ Fula_Ethnicity_X_PTD $+ \beta_{12} *$ Fula _Ethnicity_X_AS
$+ \beta_{13} *$ Fula _Ethnicity_X_PS $+ \beta_{14} *$ Fula_Ethnicity_X_Price $+ \varepsilon_{i1}$

Equation 1

Given that my dependent variable is binary, I estimate a logistic regression as the maximum likelihood of our respondents to adopt piped water services. The Equation 1 establishes the probability that our dependent variable DV_1_ITA will be either 1 (respondents would like to have piped water in their house) or 0 (respondents would not like to have piped water in their house) depending on the predictive variables second part of the equation.

5.2 Model 2: Willingness-to-Pay for Piped Water Services

Given that Willingness to Pay (WTP) is a continuous measure, I model WTP for piped water services using an OLS regression. The right side of the equation follows the same specification used above for intention to adopt (see Table 5.1 and Equation 1) apart from the price factor, which has been excluded.

Dependent	Willingness to Pay for Piped Water Services [DV_2_WTP]
Independent	Alternative Sources of Water [AS], Perceived Threat of Disease [PTD], Perceived susceptibility/ severity [PS]
Moderators	Ethnicity [Fulas or others]
Control	Demographics [Age, Household size], Socio-economics [Media, Water Quality, Knowledge]
Estimation	OLS Regression

Table 5.2: Research variables of WTP model

Equation 2, below, describes my model specification for the Willingness to Pay model.

Model 2, Willingness to Pay: $DV\_2\_WTPi = \beta_0 + \beta_1 * \text{LnAge} + \beta_2 * \text{LnHouseholdsize} +$
$\beta_3 * \text{Media} + \beta_4 * \text{WaterQuality} + \beta_5 * \text{Knowledge} + \beta_6 * PS$
$+ \beta_7 * AS + \beta_8 * PTD + \beta_9 * \text{Fula\_Ethnicity}$
$+ \beta_{10} * \text{Fula\_Ethnicity\_X\_PTD} + \beta_{11} * \text{Fula\_Ethnicity\_X\_AS}$
$+ \beta_{12} * \text{Fula\_Ethnicity\_X\_PS} + \varepsilon_{i2}$

Equation 2

I estimate an OLS regression to investigate the relationship (if any) between DV_2_WTP and my independent variables.

6. Results & Interpretation

6.1 Determinants of the Intention to Adopt Piped Water across Ethnical Groups

Running a binary regression I can see that the *p* value equals 0.012 (< 0.05), which means that I can reject the hull hypothesis, and be confident that my findings are statistically significant and have a strong relationship with our dependent variable, Intention to Adopt. The Nagelkerke R^2 is .423 (can reach a maximum of 1) and the Cox & Snell R Square is .172 (cannot reach a maximum value of 1). Overall the model has a satisfactory fit.

		Chi-square	df	Sig.
Step 1	Step	28.491	14	**.012**
	Block	28.491	14	**.012**
	Model	28.491	14	**.012**

Table 6: Omnibus Tests of Model Coefficients

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	50.314a	**.172**	**.423**

a. Estimation terminated at iteration number 7 because parameter estimates changed by less than .001.

Table 7: Model Summary

As can be seen in the following SPSS output, Media and Water Quality are the only variables that play an important role in our sample's intention to adopt piped water services. Specifically:

Media: With a *p*-value = .024, it seems that when respondents listen to the radio are better informed and therefore are more likely to have a positive intention to adopt piped water services. For every one-unit increase in media exposure, we expect a 2.587 increase in the log-odds of the respondents' intention to adopt piped water services, holding all other independent variables constant. As such increasing radio announcements and

advertisements may have a positive impact on our sample's intention to adopt piped water services.

Water Quality: Likewise, water quality seems to significantly increase respondents' intention to adopt piped water services (*p*-value = .001). The better the quality of the water they are currently consuming the more willing they are to adopt piped water services. One-unit increase in the perceived water quality (*their perception about the water quality they are currently using*), leads to an increase in the predicted log odds of adoption of piped water of 2.486, holding all other variables constant. It seems like people who value the quality of the water now are more likely to value the quality of the water in the future and are therefore more willing to adopt an even healthier and more convenient source of water such as piped water services in this case.

		B	S.E.	Wald	df	Sig.	Exp (B)
Step 1[a]	LnAge	-.299	1.019	.086	1	.769	.742
	Fula_Ethnicity	1.938	2.283	.721	1	.396	6.947
	LnHouseholdsize	1.108	1.055	1.102	1	.294	3.027
	Media	**2.587**	**1.146**	**5.095**	**1**	**.024**	**13.284**
	WaterQuality	**2.486**	**.770**	**10.428**	**1**	**.001**	**12.015**
	Price	.001	.010	.005	1	.945	1.001
	AS (Alternative Sources of Water)	.030	2.079	.000	1	.989	1.030
	PTD (Perceived Threat of Disease)	-.036	1.880	.000	1	.985	.965
	PS (Perceived Susceptibility)	2.181	1.701	1.643	1	.200	8.856
	Knowledge	-.223	.805	.077	1	.782	.800
	Fula_Ethnicity_X_PTD	-.798	1.995	.160	1	.689	.450
	Fula_Ethnicity_X_PS	-1.776	1.755	1.025	1	.311	.169
	Fula_Ethnicity_X_AS	-.792	2.328	.116	1	.734	.453
	Fula_Ethnicity_X_Price	-.348	.496	.493	1	.482	.706
	Constant	-4.032	4.741	.723	1	.395	.018

a. Variable(s) entered on step 1: LnAge, Fula_Ethnicity, LnHouseholdsize, Media, WaterQuality, Price, AS, PTD, PS, Knowledge, Fula_Ethnicity_X_PTD, Fula_Ethnicity_X_PS, Fula_Ethnicity_X_AS, Fula_Ethnicity_X_LnPrice.

Table 8: Variables in the Equation

Opposed to what one would assume, perceived threat of disease [PTD] and perceived susceptibility/severity [PS] do not have a significant effect on respondents'

intention to adopt. This confirms previous studies according to which, health improvement does not constitute a significant factor to make people especially in developing countries more willing to adopt an innovation that would improve their health. An interpretation for this phenomenon could be that they have become immune to the threat of disease or that they do not value its consequences as much as they value other factors.

The rest of the control variables (Age, Household size, Knowledge) a s well as Price do not have a significant relationship with our dependent variable for our sample and they cannot be considered significant drivers of their intention to adopt piped water services.

6.2 Determinants of Willingness-to-Pay for Piped Water across Ethnical Groups

Although, R square equals with .195, which means that 19,5% of the variance of the output is explained by our predictive variables, and the predictive power of the equation is 12,5% (Adjusted R Square = .125), I think that the fit of this model remains satisfactory, as the main goal of his paper is not to predict the sample's behaviour but to understand and if possible to explain it. Furthermore, explaining willingness to pay for water using cross-sectional survey data is a difficult endeavor and so that fact that the *p*-value equals .002 (<0.05), makes me confident that the model fits the data well.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.442[a]	**.195**	**.125**	2.756377513815029

a. Predictors: (Constant), Fula_Ethnicity_X_AS, Knowledge, Fula_Ethnicity_X_PS, Media, PTD, WaterQuality, LnHouseholdsize, LnAge, Fula_Ethnicity, PS, AS, Fula_Ethnicity_X_PTD

b. Dependent Variable: DV_2_LnWTP

Table 9: Model Summary

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	254.191	12	21.183	2.788	**.002[b]**
	Residual	1048.471	138	7.598		
	Total	1302.662	150			

a. Dependent Variable: DV_2_LnWTP

b. Predictors: (Constant), Fula_Ethnicity_X_AS, Knowledge, Fula_Ethnicity_X_PS, Media, PTD, WaterQuality, LnHouseholdsize, LnAge, Fula_Ethnicity, PS, AS, Fula_Ethnicity_X_PTD

Table 10: ANOVA[a]

In general, the patterns in the data (see appendix No 2 for more details) seemed to satisfy the minimum criteria for normality of the residuals. Although there are some deviations from normality I believe they are non-harmful for my results.

The below SPSS output (table 11) shows that opposed to the findings of their intention to adopt, all the key variables highly depend on cultural differences when it comes to their willingness to pay for piped water services. Specifically:

Keeping all other parameters constant, consumers from the Fula ethnicity have a willingness-to-pay for piped water services, on average, 233.8% lower than consumers from other ethnicities (*p*-value= .022).

For the average non-Fula consumer, an increase of one in the quality of alternative sources of water (AS) available (e.g., a movement from a low quality to a medium quality alternative source of water), leads to a 198% decrease in the willingness to pay for piped water services (*p*-value= .041), keeping all other variables constant. Probably this happens because they believe that the quality of water they use is sufficient and no improvement is necessary. Interestingly, alternative sources of water (AS) seem to have a significant interaction effect (*p*-value = .006) on Fulas' willingness to pay for piped water services. For Fula consumers, the effect of an increase of one in the quality of alternative sources of water (AS) available is 344% higher than for other ethnicities. In other words, for the average non-Fula consumer, an increase of one in the quality of alternative sources of water (AS) available, leads to a 146% increase in the willingness to pay for piped water services, all else constant. This finding suggests that other ethnicities are less willing to pay for piped water services when they have the option to use lower quality alternative sources of water to meet their daily water needs, whilst Fulas are more willing to pay for an improved water source like piped water.

Similarly, for the average non-Fula consumer, an increase of one in Perceived susceptibility/severity (PS) (with 5 being the maximum sum score of diseases that most frequently affect the members of each family), leads to a 137% decrease in the willingness to pay for piped water services (*p*-value = .000), keeping all other variables constant. However, for Fula consumers, the effect of an increase of one in Perceived

susceptibility/severity (PS) is 175% higher than for other ethnicities keeping all other variables constant whilst for the average non-Fula consumer, an increase of one in in Perceived susceptibility/severity (PS), leads to a 38% increase in the willingness to pay for piped water services, keeping all other variables constant (*p*-value = .000). This finding could be interpreted as Fulas being much more sensitised to the idea of having family members frequently affected by diseases, than the rest of the ethnicities, and constitute a better target group to promote adoption of piped water services in Bafatá. An alternative interpretation could be that direct marketing techniques targeting Fulas should stress more the perceived susceptibility/severity of disease while for other ethnicities different drivers of willingness to pay need to be found.

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.881	2.301		1.252	.213
	LnAge	.408	.418	.080	.975	.331
	Fula_Ethnicity	**-2.338**	**1.013**	**-.383**	**-2.309**	**.022**
	LnHouseholdsize	**.904**	**.438**	**.172**	**2.066**	**.041**
	Media	.583	.702	.066	.831	.407
	WaterQuality	.547	.369	.121	1.484	.140
	AS (Alternative Sources of Water)	**-1.981**	**.959**	**-.266**	**-2.065**	**.041**
	PTD (Perceived Threat of Disease)	-.509	.821	-.079	-.619	.537
	PS (Perceived Susceptibility)	**-1.366**	**.315**	**-.505**	**-4.338**	**.000**
	Knowledge	-.197	.804	-.020	-.244	.807
	Fula_Ethnicity_X_PTD	.328	1.055	.056	.311	.757
	Fula_Ethnicity_X_PS	**1.749**	**.423**	**.545**	**4.138**	**.000**
	Fula_Ethnicity_X_AS	**3.445**	**1.229**	**.380**	**2.803**	**.006**

a. Dependent Variable: DV_1_LnWTP

Table 11: Coefficients[a]

Another factor that seems to be important in their willingness to pay is the household size (*p*-value = *.041)*. A 100% increase in Ln Household size increases the family's willingness to pay for piped water services by 90%, *ceteris paribus*. It seems that the more members a family has, the more willing the family is to pay for piped water

services and that is probably due to the fact that more members generate income for the family.

Perceived Threat of Disease [PTD] once again, just like we noticed in their intention to adopt piped water services, does not have a significant effect on people's willingness to pay for piped water services no matter which their ethnicity is.

The rest of the variables (Media, Water Quality and Knowledge) have no significant relationship with our sample's willingness to pay for piped water services and they cannot be considered significant drivers of their willingness to pay for piped water services.

7. Conclusions & Implications

Two conclusions stem from the findings of the two regressions. First, media and water quality play an important role in respondents' intention to adopt piped water services and can be therefore used to make effective marketing campaigns. Second, ethnicity plays a crucial role in people's decision making when it comes to their willingness to pay for a life changing technology such as piped water. Having shown that alternative sources of water and perceived susceptibility/severity have a significant effect on this study's respondents' willingness to pay, my findings suggest that the effect is magnified when the ethnicity interferes.

Overall, this study has demonstrated the importance of tailoring public health campaigns, in terms of content and media channels used, to different ethnical groups. As such, the findings in my thesis cast doubt on the implicit and often untested assumption that psychological models, like the *Health Belief Model*, are universally valid. In contrast, they reinforce a growing view, in cross-cultural psychology (Nisbett, 2001; Triandis 1996; Hofstede 1999, Schwartz, 1990) and in international marketing (Camacho, De Jong and Stremersch, 2014; Stremersch and Lemmens 2009; Stremersch, Tellis and Yin 2004; Fok, van Everdingen and Stremersch 2009) that culture matters and that cultural differences can strongly influence diffusion of new technologies. These findings have important theoretical and substantive implications.

7.1 Theoretical Implications

As a first theoretical implication, my findings support the importance of taking cultural differences into account when promoting piped water services and perhaps other health related innovations. NGOs and public health marketers should consider cultural effects in adoption and diffusion. They could benefit from these interesting interactions when designing their marketing strategies, as by incorporating cultural differences into their campaigns, they can make them more targeted and therefore more effective.

As a second theoretical implication, I encourage fellow students and researchers to consider and examine the sensitivity of the *Health Belief Model* and other psychological

models to such cultural effects.

Last but not least, my results suggest that, in certain contexts, it may be interesting to complement current cross-cultural studies, which typically use the country as their unit of analysis, with cultural studies that adopt more granular units of analysis for cultural inferences. This may be particularly insightful in strongly multicultural countries or regions. In such instances, researchers may be able to form strong a priori expectations regarding cultural differences between sub-groups of the population within a certain country, which may help generating new insights. Scholars in cross-cultural psychology have indeed started to debate this issue recently (Fischer & Schwartz, 2011; Schwartz, 2011). While there are obvious cultural differences between countries (i.e. the values of the average citizen of China are still significantly different from the values of the average German or British citizen), in certain applications (e.g. adoption of culturally-charged products or services), scholars may consider examining within-country cultural differences.

7.2 Substantive Implications

In the case of Bafatá, an interesting observation stems from this study. When it comes to intention to adopt, people are more likely to let theoretical concepts such as media information and water quality influence their decision, whilst in the case of willingness to pay people are taking into account more practical factors such as household size, alternative sources of water and perceived susceptibility of a disease. However, both concepts are highly interlinked and interpretations must be based on a combination of their results.

In theory, investing in radio and improving perceptions about the water quality of piped water, might increase the intention to adopt piped water services. In practice, few ideas that could help boost adoption of piped water in Bafatá are (1) to use key opinion leaders and local influencers (2) to produce marketing collateral that focus on different culturally relevant things in each ethnicity, (3) to offer reduced packages/pricing or facilitation of payment to families with small household size (fewer income generators), (4) to organise promotions in key touch locations (e.g. places that the target group is gathered) aiming to educate on water quality and the benefits of consuming improved water sources.

Similarly, the findings of this study might be somehow applicable in multicultural

societies in the West, namely New York, Munich, Rotterdam and many more. Rotterdam for instance is a hub of multicultural communities such as Turkish and Moroccan, who most likely will have vastly different beliefs and values than people in hip districts (e.g. Witte da Witte Straat), expat communities (e.g. Kralingen area around the university) or more Dutch-populated suburbs (e.g. Capelle). Hence, pointing out the importance of evidence from the field, my findings and my recommendation of taking cultural differences among subgroups of the population seriously could be also valid and generalisable in Western societies with multi-cultural social structure to.

8. Limitations & Future research

As a first limitation of this study, and having highlighted the importance of field data, I would point out the difficulty of actually travelling to Guinea Bissau. Such a trip would be a valuable source of information not only because of the possibility to interact with locals but also because it would provide an opportunity to conduct an actual experiment, given that sufficient funds were available. Although, by collecting data from the field, I aimed at making the findings of this study as realistic as possible, an experiment would possibly be much more effective with regards to behaviour change. An idea would be to place a clean water container closer to their houses and charge it at a lower price. That way one could see how important clean water is to these people and whether piped water and the benefits that come with it, is of significant value to them.

As a second limitation, I would recommend to fellow researches, looking into the *Health belief Model'*s constructs that were not examined in this study due to missing data. Personality, for instance, could be an important driver of behavioural change, as similarly to ethnicity, its traits vary significantly from one person to another. As Ozer and Benet-Martinez (2006) and Ormel et al. (2013), mention in their studies, the term "personality trait" refers to lasting personal characteristics that are revealed in a particular pattern of behaviour in a variety of situations. Individual differences in personality have many real life consequences. Ergo, one would expect different effects on behavioural chance among people with different personalities.

Other constructs of the *Health belief Model* that were not adequately examined in this study, is perceived susceptibility and perceived severity. As there was no question available in the survey that could be used to represent either of these two constructs separately, I examined them as one consolidated concept. Should there be sufficient data to represent those constructs separately, it would be interesting to explore if and how differently each would affect people's intention to adopt as well as their willingness to pay.

As a result of this study, media exposure (radio), seem to have a significant effect in people's intention to adopt piped water services. Thus, future research could focus on increasing the effectiveness of different media techniques. Either by creating more targeted campaigns, or by using different means of communication, or even by investigating whether frequency alters the outcome of the media effect.

Another limitation of this study is the fact that my ethnicity sample was limited and uneven, and may not reflect the true proportion of different ethnical subpopulations. As such, future studies should strive to gather a large scale, balanced and representative sample of all populations of interest, to enhance our capacity to make strong and robust inferences about differences between subgroups and ensure generalisability. Even though it is very hard to get data from the field, and it was already very costly to get the current dataset, sample limitations may influence the inferences we make. Hence, in a subsequent study on cross-ethnical differences, I would advise for a more thorough job in ensuring that all ethnicities are equally represented in the sample.

As previously mentioned in the substantive implications part, the findings of this study might be also applicable in multicultural Western societies as well. It would be therefore interesting to see if the same degree of cultural sensitivity can be found in multicultural social tissue such as Rotterdam.

Future research could also go beyond exploring and showing that there are differences between ethnicities in a specific set of health beliefs and, instead, delve deeper in the values and beliefs of different ethnicities proposing a set of values and beliefs that helps classify them according to deep sociological and cross-cultural psychology theories like the ones Triandis, Schwartz and Hofstede have suggested in the past.

Apart from the *Health Belief Model* there are other behavioural and psychological models that should become more culturally sensitive. Theory of Planned Behaviour and Reasoned Action (Ajzen, 1991) is one of them. Baker et al. (2003) and Bilic (2005), shrewdly observed that since perceptions about health may differ significantly among different cultural background, it is therefore crucial to have as heterogeneous and culturally different samples as possible when using Theory of Planned Behaviour and Reasoned Action.

Last but not least, I suggest that future studies take the interdependence of intention to adopt and willingness to pay more explicitly into account, by conducting a conjoint study on adoption of piped water.

To conclude, I would like to point out that, what matters most, is for people to remain as motivated and sensitised as all those who devote their lives into improving the living conditions of people in developing countries, and governments NGOs and

institutions to continue exploring ways to increase clean water accessibility, along with other life-saving technologies, to all parts of this world.

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World Bank, 2012, Least developed countries: UN classification: http://data.worldbank.org/region/LDC

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TESE-ESF Projecto Bafatá Misti Iagu (Guiné-Bissau), Vimeo video: http://vimeo.com/52093049

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Plan Bafatá Programme Unit: http://plan-international.org/where-we-work/africa/guinea-bissau/where-we-work/bafata/

Appendix

Appendix No 1

Indicating the factors of developing populations' intention to adopt house connected piped water services (Literature Review)

Category	Factors	Source	Main findings
Economic	**Cost of water & Alternative sources of water**	+++ Milgrom and Roberts (1986)	High costs of water supply systems can lead to issues of sustainability, which contribute to a reduced willingness to pay. At the same time, in low-income regions people tend to choose the cheapest alternative source of water even if it means that they have to walk for 45 minutes for low quality water.
	Price & Facilitation of payment	Ashraf et al. (2010)	For a product newly introduced in the market, higher prices might signal higher quality or efficacy and increase use through a higher perception of quality. At the same time, alternative payment methods and facilitation of payment positively affects their decisions.
Socio-demographics vs. Psychographics	**Socio-demographics vs. Psychographics**	Arts et al. 2011	Socio-demographics do not seem to be important in explaining adoption intention of the adopter, whereas selected adopter psychographics and innovation characteristics do.
		Hofstede's (1984)	Marketing techniques that are applicable and effective in one national culture are not necessarily applicable and effective in another one.
Characteristics of the product/service	**Quality of water vs Quantity &ease of access**	Ashraf, Berry, and Shapiro (2010)	Willingness to pay for water quality is relatively low. In contrast, households seem to be willing to pay a lot for quantity and ease of access.
		Kremer et al. (2009, 2011)	
Beliefs	**Health vs welfare**	Devoto et al. (2012)	Households' willingness to pay for a private connection is high when it can be purchased on credit, not because a connection improves health but because it increases welfare.
		TESE	Experience shows that promoting health benefits hardly achieves behaviour change; on the other hand, factors such as being more appealing to the opposite sex by using perfumed soap cannot be discarded.
Cultural differences		Hartley (2004)	Cultural differences among different ethnicities may be particularly relevant for their health-related beliefs
		Hofstede (1984)	Marketing techniques that are applicable and effective in one national culture are not necessarily applicable and effective in another one.

Appendix No 2

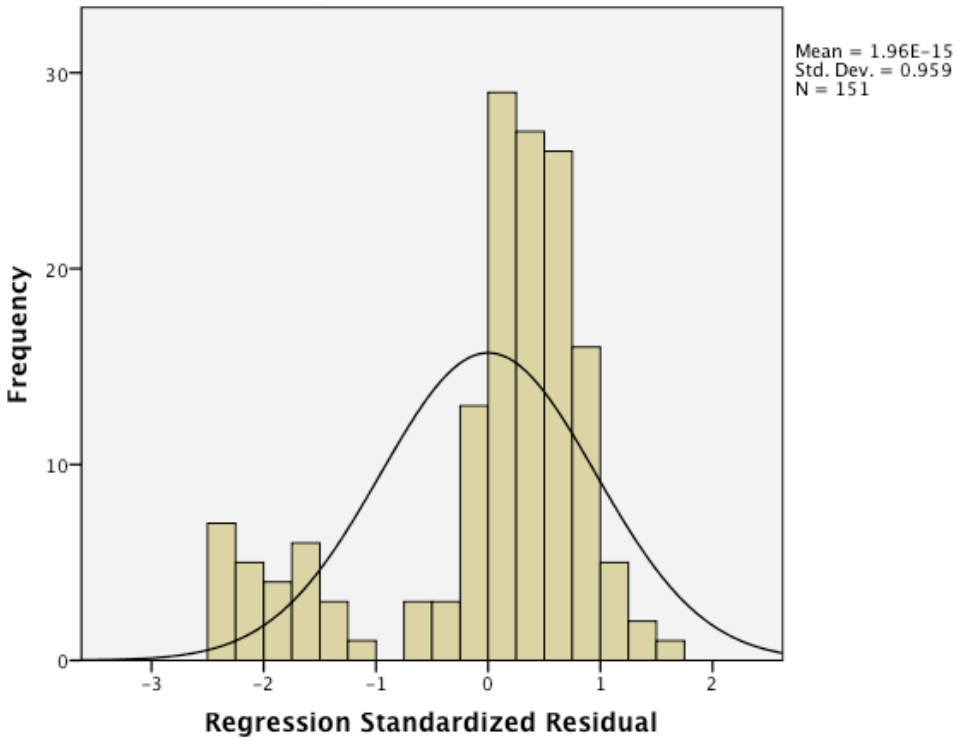

Figure 6: Histogram

Although there are few disturbances around -1, in the right part of the histogram the residuals look somewhat normal. Similarly, in the scatter plot (Figure 7), although there are some discrepancies between the left bottom and right to, there is a clear pattern on the top right side, and therefore these residuals are fairly normally distributed.

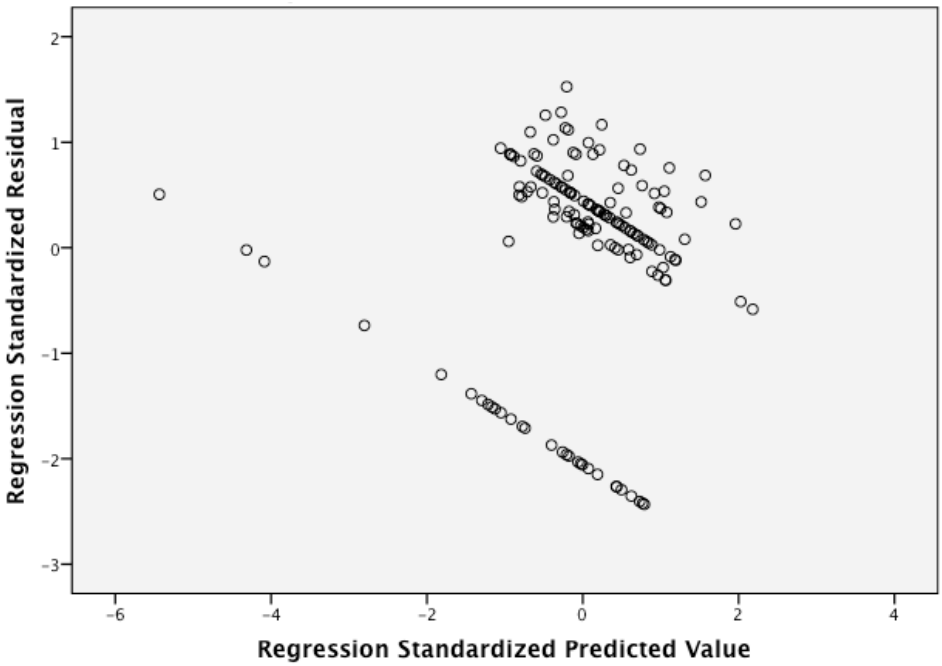

Figure 7: Scatter plot of respondents' willingness to pay

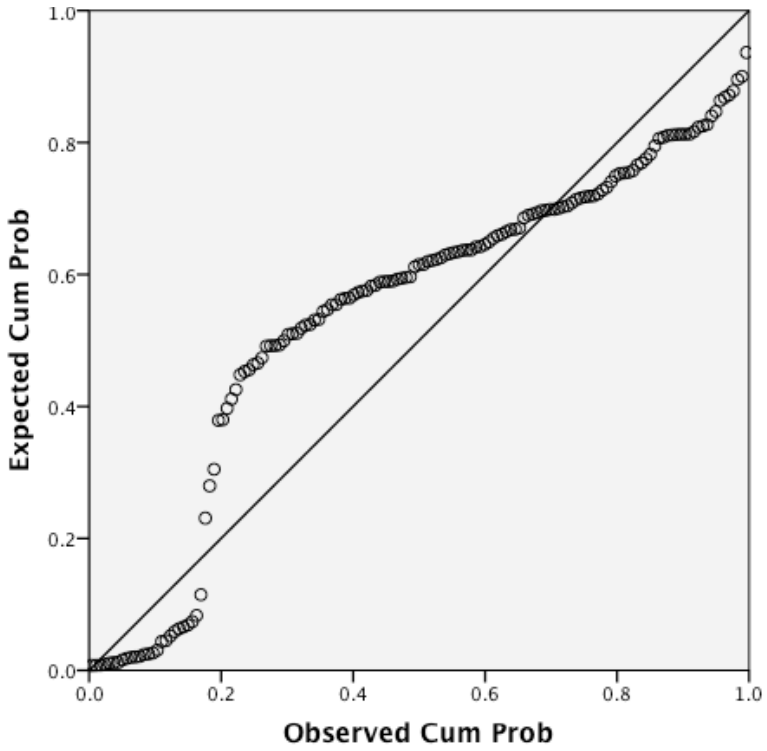

Figure 8: Normal P-P Plot of Regression Standardised Residual Dependent Variable: DV_1_LnWTP

In the P-P plot (figure 8), although there are some deviations, the data points in the upper part are somehow close to the least square fit line, which indicates a fair normality of the data.