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Social Factors Affecting Water and Wastewater Consumer Behavior: A Systematic Review with a Social Marketing and Behavioral Analysis Approach

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ABSTRACT

Background: Limited water resources make sustainable water consumption a major social and public health challenge. This study aimed to identify the social determinants of water and wastewater consumer behavior and develop an SDH-based conceptual model using a social marketing and behavioral analysis approach.

Methods: This systematic review employed a qualitative meta-synthesis approach. A systematic search of national and international databases was conducted for studies published between 2010 and 2024.Moreover, eligible studies were selected based on predefined inclusion and exclusion criteria, appraised using the CASP checklist, and synthesized thematically. Thirty-two studies met the eligibility criteria and were included in the final analysis.

Results: Data analysis showed that social marketing in the water and wastewater sector is influenced by 7 social dimensions and 24 components: (1) social policy, (2) cooperation and participation, (3) psychological requirements, (4) planning and analysis, (5) awareness, (6) sociological considerations, and (7) consumption culture. The findings emphasize that social and cultural factors play a pivotal role in changing behavior and promoting collective health.

Conclusion: Social marketing with a behavioral analysis approach and attention to determinants of social health can institutionalize sustainable water consumption patterns and strengthen community health.

Keywords: Social Marketing; Social Behavior; Water Conservation; Health Behavior; Water Supply

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Introduction

In the contemporary world, marketing is no longer limited to satisfying individual consumer desires but has been considered to have an impact on collective health and well-being as one of its key objectives. This paradigm shift in marketing, known as social marketing, is designed to promote desirable voluntary behaviors and enhance the well-being of society(Kotler & Zaltman, 1971). The main goal of social marketing is to create sustainable behavioral changes at the community level(Delvaux & Van den Broeck, 2023).

Social marketing applies commercial marketing principles to promote voluntary behavior change for the long-term benefit of society. From the Social Determinants of Health(SDH) perspective, water consumption behavior is influenced by social, economic, cultural, and environmental factors; therefore, effective social marketing interventions must address these broader determinants rather than focusing solely on individual behavior(Adler et al., 2016; Solar & Irwin, 2010). SDH emphasizes the interaction between structural conditions and individual agencies, highlighting that disparities in access to information, infrastructure, and social support can amplify inequalities in resource consumption and health outcomes(Solar & Irwin, 2010). Consequently, effective social marketing campaigns must integrate multi-level strategies, combining behavioral nudges with community engagement, policy incentives, and culturally sensitive educational interventions. By addressing both micro-level behavioral determinants and macro-level social structures, interventions are more likely to achieve sustainable behavior change and equitable resource management(Mtenga et al., 2016).

Iran is in a critical situation in terms of water resources; with an average annual rainfall of about 260 mm and per capita household consumption between 75 and 150 liters per day, the amount of water consumption in the household sector is almost twice the global average and in the agricultural sector more than three times the global average(Kholfi et al., 2018; Marzban et al., 2019). This situation presents the country with double pressure on water resources and a threat to public health. From the SDH perspective, improper water consumption is a direct consequence of social factors such as low awareness, insufficient cultural development, limited participation, and incorrect behavioral norms that need to be intervened(kalami et al., 2022; Sadeghi Dezaki et al., 2023).

International studies have shown that social marketing can create positive and sustainable behavioral changes, especially in the areas of energy, water, and other natural resource consumption(Ibrahim et al., 2022; Lowe et al., 2014; Sharma et al., 2019). For these interventions to be successful, consumer behavioral analysis is essential. This approach involves examining individuals' daily habits, individual preferences, and psychological and social attitudes and beliefs, and allows policymakers, planners, and water resource managers to design targeted, effective, and evidence-based programs(Cortés-Capano, 2021; Ibrahim et al., 2022) Consumer behavior analysis, using quantitative and qualitative data, identifies behavioral drivers, barriers, and pain points, and optimizes decision-making in social marketing campaigns. This approach also helps improve policymaking and long-term management of water resources(Yang et al., 2018).

In Iran, research evidence shows that social marketing can play a key role in changing the behavior of household water consumers and promoting a culture of efficient consumption. Kalami et al.(2022) identified the factors affecting social marketing in the field of water and wastewater in the form of six key dimensions of self-concept, perceived behavioral control, religiosity, subjective norms, attitude, and moral norms. The results showed that the attitude dimension has the greatest impact on consumer behavior(kalami et al., 2022). In addition, Arabpour(2021), by presenting a water governance model based on social marketing, showed that the simultaneous use of educational tools, information

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campaigns, incentive and punishment policies, family and school participation, and cooperation with non-governmental organizations can accelerate and stabilize the process of changing consumer behavior(Arabpour, 2021).

This review is based on SDH framework and behavioral analysis to examine how social factors influence water consumption behavior within a social marketing approach for sustainable change. Unlike previous studies that mainly focus on isolated individual factors or interventions, it integrates evidence into a comprehensive SDH-based social marketing framework. Accordingly, the study aims to identify and synthesize key social determinants of water and wastewater consumer behavior from an integrated behavioral and social marketing perspective.

Methods

Study Design

This study was conducted as a systematic review employing a qualitative meta-synthesis approach to identify, synthesize, and interpret the social factors influencing water and wastewater consumer behavior. The review was designed and reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) guidelines, ensuring a transparent and reproducible process for literature identification, screening, eligibility assessment, study selection, quality appraisal, and data extraction(Page et al., 2021). The qualitative findings of the included studies were synthesized using the thematic synthesis approach proposed by Thomas and Harden (2008)(Thomas & Harden, 2008).

Data Synthesis

Data synthesis followed the thematic synthesis methodology proposed by Thomas and Harden (2008) (Thomas & Harden, 2008). First, the extracted findings were coded line by line. Second, similar codes were grouped into descriptive themes. Finally, analytical themes were developed through an iterative interpretive process to construct the conceptual framework of social factors influencing water and wastewater consumer behavior.

Search Strategy

International databases included Scopus, ScienceDirect, PubMed, Web of Science and Google Scholar, while national databases comprised the Scientific Information Database (SID), Magiran, and IranDoc. The search covered studies published between January 2010 and December 2024 and was completed on 15 February 2024. Moreover, a comprehensive search strategy was developed by combining controlled vocabulary and free-text keywords related to three core concepts. Representative search terms included: ("social marketing" OR "social marketing model") AND ("water consumption" OR "water conservation" OR "water management" OR "water and wastewater consumers") AND ("consumer behavior" OR "behavior analysis" OR "behavior change"). To ensure the completeness of the evidence base, the reference lists of all eligible studies were manually screened for additional relevant publications that were not identified through the electronic database search.

Sample PubMed Search Strategy*: (*Social Marketing"[Title/Abstract] OR "Social Marketing Model"[Title/Abstract]) AND ("Water Consumption"[Title/Abstract] OR "Water Conservation"[Title/Abstract] OR "Water Management"[Title/Abstract] OR "Water Supply"[Title/Abstract] OR "Wastewater"[Title/Abstract]) AND ("Consumer Behavior"[Title/Abstract] OR "Behavior Change"[Title/Abstract] OR "Behaviour Change [Title/Abstract] OR "Behavior Analysis"[Title/Abstract] OR "Health Behavior"[Title/Abstract])

Eligibility Criteria

Studies were selected according to predefined inclusion and exclusion criteria established before the literature search. The inclusion criteria were: (1) peer-reviewed original research articles published between January 2010 and December 2024; (2) studies published in English or Persian; (3) studies investigating social factors, social marketing, behavioral determinants, or consumer behavior related to water and wastewater

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consumption; (4) studies that reported sufficient methodological information; and (5) studies directly relevant to the objectives of the present review. Furthermore, no geographic restrictions were applied to maximize the comprehensiveness of the evidence. Studies that focused exclusively on technical or engineering aspects of water management without addressing consumer behavior or social determinants were excluded.

Quality Appraisal

The methodological quality of the studies included was assessed independently by two reviewers using the Critical Appraisal Skills Program (CASP) checklist (CASP, 2018). Each CASP item was scored on a five-point scale, yielding a maximum possible score of 50. Consistent with previous qualitative evidence synthesis studies, studies scoring 31 or higher (≥60% of the maximum score) were considered to have adequate methodological quality. Any disagreements between reviewers were resolved through discussion until consensus was reached.

Data Extraction

Data extraction was conducted independently by two reviewers using a standard data extraction form developed specifically for this study. The extracted information included key findings and reported social factors influencing water and wastewater consumer behavior. Any disagreements between reviewers were resolved through discussion and consensus.

Study Selection

All retrieved records were imported into EndNote and duplicate records were removed. In addition, titles and abstracts were independently screened by two reviewers according to the predefined eligibility criteria. Potentially eligible studies underwent full-text assessment. Finally, disagreements regarding study inclusion were resolved through discussion until consensus was achieved. The study selection process is illustrated in the PRISMA flow diagram (Figure 1).

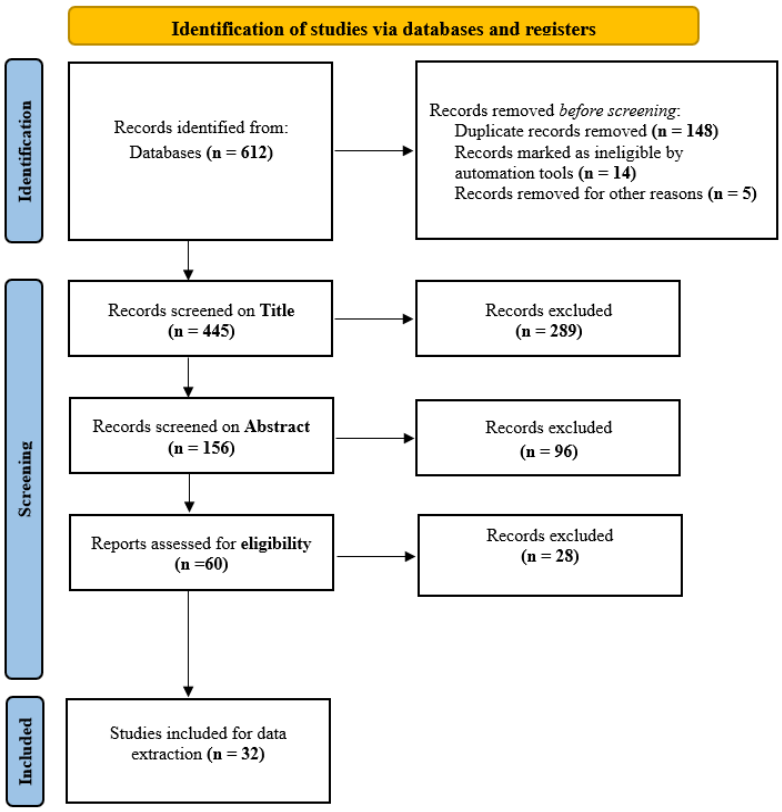


Figure 1. PRISMA digram for the process of selecting studies in the scoping review

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Results

A comprehensive search between January 2010 and December 2024 identified 612 records. After removing duplicate records and performing title and abstract screening, potentially relevant studies were subjected to full-text eligibility assessment, according to the predefined inclusion and exclusion criteria. After assessing methodological quality using the Critical Appraisal Skills Program (CASP) checklist, 32 studies met the eligibility criteria (Table 1).

Table 1. Documents Reviewed in the Field of Social Marketing

	Author / Year	Title	Quality (CASP)
1	Tizfahm Fard et al. (2023)	Designing a social marketing model with the role of social responsibility and customers' brand attitudes based on grounded theory approach	44
2	Rameshini (2022)	Systematic review of social marketing strategies in sustainable water consumption	41
3	Shahangian et al. (2022)	Explaining water-saving behaviors using the extended theory of planned behavior	43
4	Kalami et al. (2022)	Identifying and analyzing effective factors in social marketing in the water and wastewater industry	44
5	Nazari Pour and Ravan (2021)	Providing a model of factors affecting household water consumption behavior: a model for consumption reform	41
6	Arabpour (2021)	Providing a water governance model based on social marketing for changing water consumption behavior	41
7	Jafari Haftkhani and Mohseni (2020)	Factors affecting consumer behavior change toward national products using a social marketing approach	45
8	Kalami et al. (2020)	Social marketing in water and wastewater industry based on grounded theory	44
9	Mousavi Neghabi and Anousheh (2020)	model for applying social marketing approach in cultural marketing campaigns	41
10	Derafshi and Khan Nejad (2019)	Identifying factors affecting social marketing: a qualitative analysis	46
11	Astaneh et al. (2019)	Developing a model for social capacity building and socialization of the water crisis	44
12	Akhrouei and Rayat (2019)	Identifying factors affecting public participation in optimal water consumption using a social marketing approach and selecting the best scenario	44
13	Hadadian (2016)	Investigating the Impact of Social Marketing Mix on Reducing Household Water Consumption Using the Theory of Planned Behavior	44
14	Teymoori (2013)	The Impact of social marketing mix on the intention of government university employees in Isfahan to replace single-occupancy vehicles with public urban transport	42
15	Delvaux and Van den Broeck (2023)	Social marketing and sustainable development goals: a review of the last decade	44
16	Ibrahim et al. (2022)	Consumer insight on water consumption behavior change: a formative social marketing study	45
17	Domagan (2021)	Social marketing and behavior change in a systemic environment	46
18	Rodriguez-Sanchez et al. (2020)	Understanding water-saving behavior in hotels: The role of personal normative and hedonic motives in a collective tourist destination	42
19	Caldwell et al. (2019)	Social marketing - advanced education on household energy consumption and promotion of energy-saving practices	41
20	Sharma et al. (2019)	A social marketing approach to change water use behavior in Rural Punjab, India	44

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Table 1. Documents Reviewed in the Field of Social Marketing

	Author / Year	Title	Quality (CASP)
21	Salem et al. (2018)	Water consumption marketing strategies with reference to Gaza Strip, Palestine	41
22	Akpinar et al. (2018)	Assessing factors influencing water-saving attitudes in urban life on the eve of the next century: A case study from the Mediterranean region of Turkey	44
23	Kalahi (2016)	Socialization of water problems	38
24	Low et al. (2015)	Reducing household water consumption using social marketing methods	44
25	Alvarez-Garcia (2019)	The role of civil society organizations in social innovation as an example of new social marketing	46
26	Smaliukin and Mooney (2020)	Social responsibility, role of social marketing, and social attitudes	41
27	Malek Mohammadi & Mozaffari (2018)	Examining the application of social marketing in optimal water management	41
28	Ghebre Giorgis and Mehtab (2019)	The impact of social marketing and personal factors on bottled water drinking behavior in Eritrea	38
29	Wu et al. (2019)	Effectiveness of social marketing in improving knowledge, attitude, and practice regarding consumption of vitamin A-fortified oil in Tanzania	41
30	Moazzi et al. (2013)	Examining the effectiveness of strategies and influencing factors in social marketing	44
31	Yazdian et al. (2019)	creativity in internal marketing with a focus on performance improvement: A case study in water and wastewater companies	42
32	Allahyari et al. (2023)	Effective social marketing model in online services of the banking industry using grounded theory method	46

The dimensions, components, and indicators that shape the social marketing model for water and wastewater consumers were outlined. These dimensions reflect the multifaceted social, psychological, cultural, and structural factors that influence consumption behavior (Table 2).

Table 2. Indicators affecting the formation of the social marketing model for water and wastewater subscribers

Dimensions	Components	Indicators	Researchers
Policy requirements for social marketing	Understanding current consumption patterns	Assessing current awareness levels	(Ghebregiorgis and Mehreteab, 2019), (Wu et al., 2019), (Domegan, 2021)
		Identifying reasons for increased consumption	Rameshini(2022), Jafari Haftkhani and Mohseni (2020)
		Identifying key consumption drivers	Rameshini (2022), Kolahi (2016)
		Understanding customers' perception of consumption	Jafari Haftkhani and Mohseni (2020)
		Identifying consumer expectations	Wu et al.(2019), Kolahi(2016), Gbargborghis and Mehrtab (2019)
	Social marketing policy development	Determining appropriate marketing policies	Ebrahim et al. 2022), Allahyari et al.(2023)
		Long-term goal setting	Salem et al. (2018), Allahyari et al.(2023)
	Designing and implementing appropriate strategies	Developing suitable strategies	Lu et al.(2015), Darvishi and Khannazhad(2019)
		Implementing appropriate strategies	Kolahi(2016), Gbargborghis and Mehrtab(2019)

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Table 2. Indicators affecting the formation of the social marketing model for water and wastewater subscribers

Dimensions	Components	Indicators	Researchers
	Legal Considerations	Identifying existing legal issues	Allahyari et al.(2023)
		Efforts to reform existing laws	Ebrahim et al.(2022), Wu et al.(2019)
Collaboration & Participation Requirements in Social Marketing	Trust Building	Establishing trust	Caldwell et al.(2019)
	Communication & Interaction	Effective communication	Salem et al.(2018)
		Industry-academia collaboration	Allahyari et al.(2023), Akhrovi and Rayat(2019)
		Expanding social interactions	Wu et al.(2019)
	Encouraging Participation	Involvement of NGOs	Rameshini(2022), Lu et al.(2015)
		Motivating public participation	Kolahi(2016), Arabpour(2021)
		Stakeholder participation	Astaneh et al.(2019)
		Encouraging collective participation	Sharma et al.(2019)
	Developing Incentive Tools	Establishing reward-punishment systems	Gbargborghis and Mehrtab(2019)
		Encouraging responsible water usage	Rameshini(2022), Jafari Haftkhani and Mohseni(2020)
		Promoting energy-saving methods	Caldwell et al.(2019)
		Encouraging positive consumption behaviors	Lu et al.(2015), Astaneh et al.(2019), Darvishi and Khannazhad(2019)
Psychological Requirements for Water Consumption in Social Marketing	Considering Consumer Attitudes	Attitudes toward water conservation	Salem et al.(2018), Delvaux and Van den Brock(2023), Hadian(2016)
	Behavioral Aspects of Water Consumption	Behavior change based on a structured roadmap	Wu et al.(2019), Allahyari et al. (2023), Akhrovi and Rayat(2019)
		Addressing consumption behavior change	Ebrahim et al.(2022), Salem et al. (2018), Mazzi et al.(2013)
		Considering behavioral beliefs	Lu et al.(2015), Delvaux and Van den Brock(2023)
		Assessing current water consumption behaviors	Alvarez-Garcia (2019), Malekmohammadi and Mozafari (2018), Arabpour (2021)
		Changing policymakers' behavior	Rodriguez-Sanchez et al.(2020), Jafari Haftkhani and Mohseni(2020)
		Facilitating consumer behavior change	Smaliychuk and Mooney(2020), Jafari Haftkhani and Mohseni (2020)
	Motivational Aspects of Consumers	Creating social willingness to reduce water usage	Rameshini(2022), Lu et al. (2015), Duman(2021)
		Considering motivational approaches	Lu et al.(2015), Smaliychuk and Mooney(2020)
Analytical & Planning Requirements in Social Marketing	Addressing Consumer Needs & Desires	Considering consumer demands	Sharma et al.(2019), Akhrovi and Rayat(2019)
		Customer-centric approach	Ebrahim et al.(2022), Hadian(2016)
		Managing customer experience	Gbargborghis & Mehrtab(2019), Arabpour(2021)
		Considering vital trends in social marketing	Alvarez-Garcia(2019), Allahyari et al.(2023)

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Dimensions	Components	Indicators	Researchers
	Economic Aspects of Water Industry	Economic perspective on the water industry	Smaliychuk and Mooney(2020), Arabpour(2021)
		Considering economic benefits of consumption	Rodriguez-Sanchez et al. (2020), Rameshini(2022), Jafari Haftkhani and Mohseni (2020)
		Cost adjustments	Wu et al.(2019)
		Appropriate pricing strategies	Sharma et al.(2019)
		Rationing mechanisms	Alvarez-Garcia(2019), Hadian (2016)
		Household size considerations	Smaliychuk and Mooney(2020)
		Reducing inequalities	Lu et al.(2015)
	Designing & Implementing Social Marketing programs	Designing participatory marketing programs	Delvaux and Van den Brock (2023), Astaneh et al.(2019), Jafari Haftkhani and Mohseni (2020)
		Incentive programs for consumers	Rameshini(2022), Kolahi (2016), Mazzi et al.(2013)
		Planning for potential challenges	Malekmohammadi and Mozafari (2018), Jafari Haftkhani and Mohseni(2020)
		Implementing appropriate social marketing programs	Hadian(2016), Astaneh et al. (2019), Arabpour(2021)
	Market analysis	Customer-based market research	Kolahi(2016), Alvarez-Garcia(2019)
		Audience analysis	Nazaripour and Ravand(2021), Ebrahim et al.(2022), Caldwell et al.(2019), Jafari Haftkhani and Mohseni (2020)
		Embracing new ideas	Sharma et al.(2019), Kolahi (2016), Lu et al.(2015), Darvishi and Khannazhad(2019)
		Market segmentation	Mazzi et al.(2013), Hadian (2016), Mousavi Naghabi and Anousheh (2020)
		Analyzing advertising channels	Nazaripour & Ravand(2021), Allahyari et al.(2023), Akhrovi and Rayat(2019)
Awareness requirements in social marketing	Education and empowerment	Educational campaigns	Yazdian et al. (2019), Darvishi and Khannazhad(2019), Arabpour (2021)
		Continuous education	Nazaripour and Ravand (2021), Hadian(2016)
		Improving water literacy	Akpinar et al.(2018)
		Empowerment	Allahyari et al.(2023)
	Raising awareness	Enhancing awareness	Caldwell et al.(2019), Sharma et al.(2019)
		Awareness campaigns	Rodriguez-Sanchez et al. (2020)
		Awareness of water crisis	Yazdian et al. (2019)

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Table 2. Indicators affecting the formation of the social marketing model for water and wastewater subscribers

Dimensions	Components	Indicators	Researchers
Sociological requirements for water consumption	Ethical norms of consumers	Ethical considerations in water consumption	Mazzi et al. (2013), Duman (2021)
		Activating norms	Rodriguez-Sanchez et al. (2020), Salem et al. (2018), Alvarez-Garcia (2019)
		Considering ethical norms	Rodriguez-Sanchez et al. (2020), Mazzi et al. (2013)
		Addressing control beliefs	Hadian (2016), Lu et al. (2015), Darvishi and Khannazhad (2019), Arabpour (2021)
	Religious and spiritual beliefs of consumers	Considering normative beliefs	Akpinar et al. (2018), Mousavi Naghabi and Anousheh (2020)
		Considering religious beliefs of consumers	Kolahi (2016), Gbargborghis and Mehrtab (2019)
		Religious teachings	Alvarez-Garcia (2019), Lu et al. (2015), Darvishi and Khannazhad (2019)
	Subjective norms of consumers	Considering subjective norms	Yazdian et al.(2019), Mousavi Naghabi and Anousheh(2020)
		Overcoming mental barriers	Yazdian et al.(2019)
	Sociological aspects of water consumption	Engaging society in water-related issues	Duman(2021), Hadian(2016)
		Developing water-related theories and discourse	Smaliychuk and Mooney (2020), Akhrovi and Rayat(2019)
		Understanding sociology of water issues	Malekmohammadi and Mozafari (2018), Arabpour(2021)
		Considering social benefits of consumption	Caldwell et al.(2019), Delvaux and Van den Brock (2023)
		Addressing anxiety about water scarcity	Allahyari et al.(2023), Jafari Haftkhani and Mohseni(2020)
		Considering long-term societal benefits	Akpinar et al.(2018), Delvaux and Van den Brock(2023)
Cultural Requirements for Water Consumption	Promoting desirable consumption behavior	Encouraging desirable social behavior	Akhrovi and Rayat (2019), Astaneh et al.(2019)
		Suggesting desirable behavior	Caldwell et al. (2019), Mousavi Naghabi and Anousheh (2020)
		Encouraging voluntary change	Salem et al.(2018), Allahyari et al.(2023)
		Promoting sustainable energy use	Delvaux and Van den Brock (2023)
		Reviving the cultural value of water	Duman(2021)
		Perceived behavioral control	Akpinar et al.(2018), Jafari Haftkhani and Mohseni(2020)
		Considering cultural norms	Caldwell et al.(2019)
		Promoting proper water consumption	Hadian(2016), Astaneh et al.(2019)
	Role of social responsibility	Complementary role of social responsibility	Sharma et al.(2019), Mousavi Naghabi and Anousheh (2020)
		Enhancing collective solidarity	Lu et al.(2015), Darvishi and Khannazhad(2019)
		Promoting social	Gbargborghis and Mehrtab(2019)

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Dimensions	Components	Indicators	Researchers
		responsibility	
		Addressing social issues in marketing	Akhrovi and Rayat (2019), Arabpour(2021)
		Considering environmental changes	Astaneh et al.(2019)
	Utilizing media role and function	Leveraging social media capacity	Yazdian et al.(2019), Jafari Haftkhani and Mohseni(2020)
		Using media tactics	Caldwell et al.(2019)
		Digital campaigns	Gbargborghis and Mehrtab(2019), Yazdian et al.(2019)
		Developing virtual social campaigns	Malekmohammadi and Mozafari(2018), Jafari Haftkhani and Mohseni(2020)
		Designing, implementing, and promoting online advertising platforms	Malekmohammadi and Mozafari (2018), Delvaux and Van den Brock(2023), Arabpour(2021)
		Digital technologies	Allahyari et al.(2023), Akhrovi and Rayat (2019)
		Selecting impactful media	Akpinar et al.(2018), Mousavi Naghabi and Anousheh (2020)
		Media engagement	Allahyari et al.(2023), Jafari Haftkhani and Mohseni(2020)

This framework presents a non-causal, evidence-based synthesis showing that water and wastewater consumer behavior is shaped by interconnected structural, social, psychological, and analytical factors within social marketing. Policy and sociocultural contexts provide the macro structure, while awareness, education, and collaboration influence psychological determinants such as attitudes, motivation, and intentions, which ultimately drive sustainable consumption behavior. Moreover, analytical planning supports continuous improvement of interventions, and sociocultural factors like norms and consumption culture act as moderators of behavior change. Overall, the model explains behavior change as the result of interactions between structural, community, and individual levels within the SDH framework (Figure 2).

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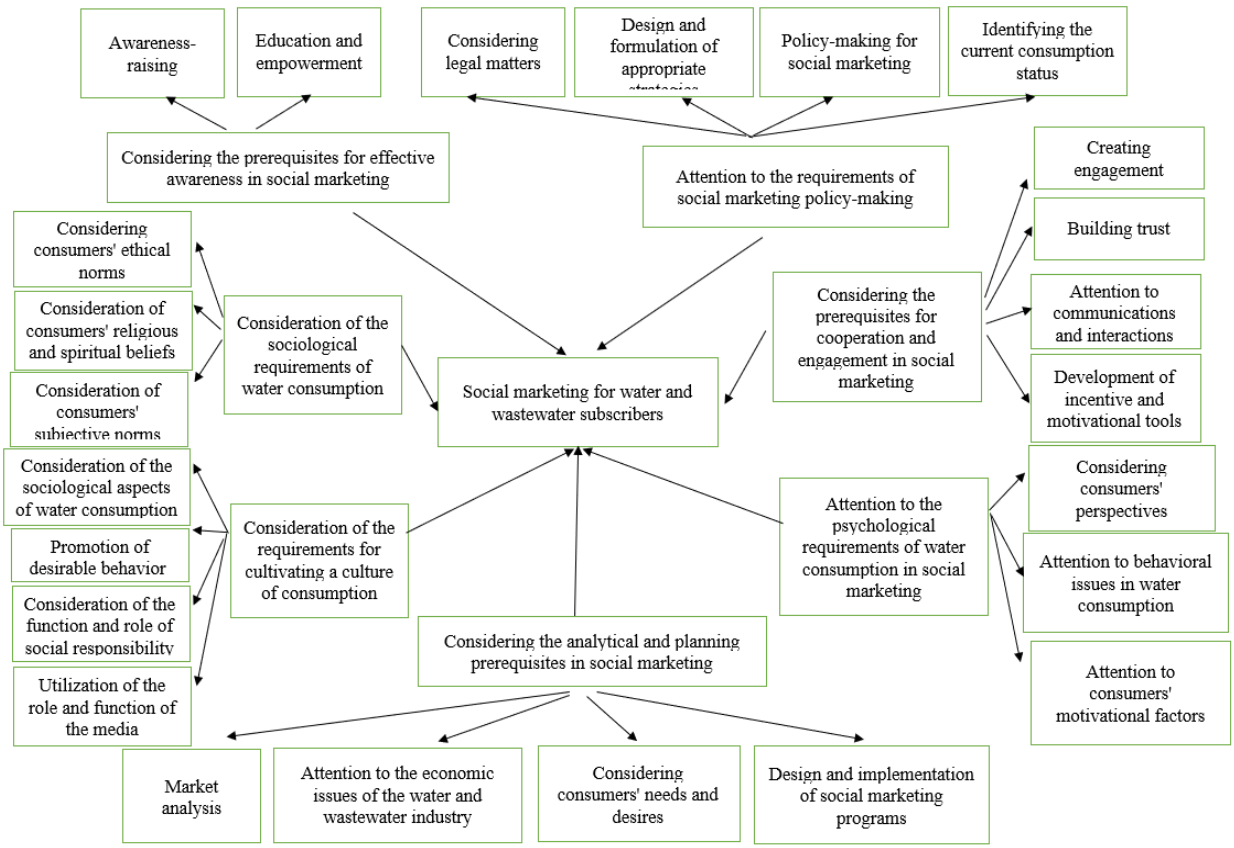


Figure 2. Conceptual model of the study

Discussion

The findings show that water consumption behavior is a multi-dimensional phenomenon shaped by interconnected structural, social, psychological, and cultural determinants within SDH framework. Policy and governance provide structural context, while cooperation and participation build trust and engagement. Psychological factors such as attitudes and motivation are socially shaped and influenced by sociocultural norms, ethics, and consumption culture, which can either reinforce or constrain behavior change. Awareness and education alone are insufficient without structural and participatory support, and analytical planning is essential for evidence-based social marketing. In general, sustainable water consumption emerges from the interaction of these interconnected determinants rather than isolated factors.

The findings of the present study are broadly consistent with prior research in the field of social marketing and water consumption behavior, particularly studies grounded in behavioral and socio-psychological theories. For instance, Kalami et al. (2022)(kalami et al., 2022) identified psychological constructs such as attitudes, subjective norms, perceived behavioral control, and moral norms as key determinants of water consumption behavior, largely based on the Theory of Planned Behavior framework(Ajzen, 1991). Similarly, Arabpour (2021) emphasized the role of integrated governance mechanisms, including education, incentive systems, and stakeholder participation, as essential tools for improving water consumption management(Arabpour, 2021).

These findings were also consistent with earlier behavioral studies, which suggested that intention-based models are useful but insufficient predictors regarding actual behavior, particularly in environmental contexts where structural

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constraints are strong. For example, Ajzen (1991) himself acknowledged that perceived behavioral control does not fully capture external constraints that may prevent behavioral execution(Ajzen, 1991). However, a critical gap in this body of literature is its predominantly individual-centric orientation, where behavior is explained mainly through cognitive and motivational variables. This limitation has also been highlighted in environmental behavior research, where scholars argue that psychological models often neglect structural and contextual determinants of behavior(Kollmuss & Agyeman, 2002).

Although many studies have identified psychological factors, such as attitudes, intentions, and perceived behavioral control, as the primary determinants of water conservation behavior, one research suggests that these factors alone do not consistently translate into actual behavioral change. Structural barriers limited institutional support, socioeconomic inequalities, and cultural contexts and may weaken the relationship between behavioral intention and observed behavior. Thus, the present study reconciles these perspectives by adopting SDH framework, which conceptualizes water consumption behavior as the product of interactions between individual, social, and structural determinants rather than any single category of factors.

In contrast, this study extends prior literature by using a multi-level SDH-based framework that integrates structural, social, cultural, and psychological dimensions into a unified model, consistent with ecological behavior theories (Bronfenbrenner, 1979). A key contribution is the inclusion of consumption culture and sociological determinants, which have been underexplored in water-related behavioral research. Unlike earlier studies that assume awareness and education alone drive behavior change, evidence from environmental psychology shows that knowledge has limited impact unless reinforced by social norms, institutional support, and cultural acceptance(Kollmuss & Agyeman, 2002; Stern, 2000).

Moreover, prior research tends to treat policy, education, and behavior as separate analytical domains, whereas the present study integrates these dimensions into a cohesive systemic framework(Organization, 2008; Solar & Irwin, 2010). From a water governance perspective, similar arguments have been made in integrated resource management literature, which emphasizes that sustainable water use requires not only behavioral change but also institutional reform and participatory governance structures (Akhmouch et al., 2020; Water, 2020). These perspectives support the argument of the present study that behavioral interventions alone are insufficient without parallel structural and cultural interventions.

Therefore, while previous studies such as Kalami et al. (2022)(kalami et al., 2022) and Arabpour (2021)(Arabpour, 2021) provide valuable insights into psychological and governance-related determinants, they remain fragmented in scope. The present study addresses this limitation by proposing a comprehensive SDH-based meta-synthesis model, which conceptualizes water consumption behavior as the outcome of interacting structural, social, cultural, and individual systems.

This research contributes to literature in three main ways. First, it extends social marketing theory by integrating it with SDH framework, offering a multi-level conceptual model of consumer behavior in the water sector. Second, it moves beyond traditional psychological models by incorporating structural and cultural determinants, thereby addressing a significant gap in existing literature. Third, it provides a synthesized framework that bridges behavioral analysis, social marketing, and sustainability science, offering a comprehensive perspective for future research and policy design.

Conclusion

By integrating social marketing, behavioral analysis, and SDH framework, this study provides a comprehensive understanding of the social factors influencing the behavior of water and

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wastewater consumers. The proposed conceptual model extends the existing literature on social marketing and water governance by incorporating structural, social, cultural, and psychological factors into an integrated multilevel framework. Findings suggest that sustainable water use requires coordinated interventions that combine supportive policies, stakeholder engagement, effective communication, culturally sensitive strategies, and institutional capacity.

Future Research

Future research is recommended to address these limitations by empirically validating the proposed conceptual model using quantitative approaches such as structural equation modeling or system dynamics analysis. In addition, testing the model across different cultural, institutional, and geographic contexts would enhance its generalizability and robustness.

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Conflicts of Interest

The authors declsred no conflict of interest.

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Ethical considerations

Not Applicable.

Code of Ethics

This study was conducted within the framework of the Ministry of Science research system, where formal ethical approval was not required for studies of this type under its applicable guidelines.

Authors' Contributions

M.H. and S.N contributed to conceptualization, review, project management, writing the original draft, reviewing, and editing. SH.H. contributed to writing the original draft, reviewing, and editing.

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