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SUSTAINABILITY OF THE GLOBAL WATER SUPPLY
An Exploratory Study of International Managers' Perspectives

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ABSTRACT

Water risk, both in terms of the risk to human life related to such threats as water scarcity and the risk to business related to such challenges as mismanagement of a critical resource, is a topic of increasing interest and importance to policymakers worldwide. The problems associated with water risk are being tackled by international development organizations such as the United Nations and the Organization for Economic Co-operation and Development; by international business organizations such as the World Business Council for Sustainable Development and the World Resources Institute; and by international aid organizations such as Water.org and countless corporate foundations. There is no shortage of brainpower, passionate

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commitment, or money spent on finding solutions to a growing problem. However, the problems continue.

This research effort's premise is that solutions to problems around the sustainability of the water supply remain elusive because such considerations have not yet become part of the day-to-day problem-solving routine of managers across the hierarchy of business organizations. In this study, managers in Brazil and South Korea were surveyed on their perspectives on the factors in their external environments that held promise for improving the sustainability of the world's water supply. Our analysis identifies stakeholders in the external environment with whom managers might build effective coalitions for addressing this critical issue.

KEYWORDS

water scarcity; UN 2030 Sustainable Development Goals; strategic decision making; external environmental analysis; stakeholders coalitions; international comparative management

INTRODUCTION

Water, water, everywhere, nor any drop to drink.
—S.T. Coleridge, *The Rime of the Ancient Mariner* (1797)

There is no doubt that there is water everywhere. Over 71% of the earth's surface is covered by water. Add in the frozen parts, and that number goes up to 75%. However, the oceans hold about 96.5% of all the water on Earth (US Department of the Interior Water Science School, 2019a). Freshwater accounts for only about 2.5% of the earth's water supply. The rest is found in water vapor and in the living creatures roaming around (US Department of the Interior Water Science School, 2019b). There is about 326 million trillion gallons of water on earth (Earthhow, 2022). Clearly, most of that is undrinkable, and that is where the problem comes in.

Scholarly examination of the importance of the strategic management of sustainability issues has increased dramatically over the last 30 years. In one examination of the literature on the topic, the number of articles has grown from a

handful to well over 1,000. This review also made clear that the interest of scholars in sustainable development grew in correlation with the interest of governments, non-governmental organizations, and businesses (Suriyankietkaew & Petison, 2020). Suriyankietkaew and Petison identify five major themes: Corporate sustainability strategy, Sustainable waste management, Strategic sustainability systems, Strategic sustainability management and entrepreneurship, and Sustainability assessment strategy. Nearly half of the scholars cited in this review work in the area of Corporate sustainability strategy. The most commonly cited scholars in the Corporate sustainability strategy literature include Porter and Kramer (2011), who introduced the "creating shared value" concept; Elkington (1998), who introduced the "triple-bottom-line" framework; and Prahalad and Hart (1999) of the "bottom of the pyramid" concept. The focus of the corporate sustainability strategy research stream is on corporate decision-making. That is also the focus of this research project, as we explore ways to understand how managers build coalitions with their stakeholders to achieve sustainability goals, specifically sustainability of the water supply. Coalition building to address the strategic management of sustainability issues has been used by other researchers to understand organizational decision-making (Calabrese, Costa, Levialdi, & Menichini, 2019; Hoekstra, Chapagain, & Zhang, 2016).

Water Risk: An Unfathomable Problem

By the time the United Nations (UN) adopted their 17 Sustainable Development Goals (UN DESA, 2015), the problems of water risk were already clearly recognized—at least so far as the risk to human populations was concerned. They estimated that the water demand would be 40% greater than the supply by 2030. The problems have not diminished in the ensuing years. As an example, Water.org estimates that 2 billion people, about one-quarter of the earth's population, lack access to safe water (Arney, 2019). According to estimates from the World Health Organization, over 40% of the world's population suffers from water scarcity. Many of these people are located in the world's poorest countries (World Health Organization, 2022). And some of them are wealthy Americans living in a part of the United States that is suffering a 23-year drought (Economist, 2021a).

However, the risk is not just to people. Companies have also had to begin dealing with water-related problems. For example, Coca-Cola recently had to close plants in India due to the drought there. Floods in the Midwestern part of the United States

have caused disruptions for firms all along the rivers. According to CDP, a not-for-profit that provides disclosures on corporations, 783 companies suffered $40bn of losses related to water issues in 2018 (CDP, 2022). Hence, it behooves managers on both a humanitarian basis and a commercial one to try to understand the problems businesses face related to water risk and to incorporate management of these issues into their strategic decision-making.

The Shape of Water

The sustainability of the water supply is an issue that can provide a natural confluence of interest from both humanitarian and commercial organizations. A prime example of an organization that facilitates this interaction is Water.org. The goal of this not-for-profit is to provide access to safe water and sanitation to the millions of people across the globe who do not have such access. They partner with businesses to undertake projects that fulfill a commercial need for the company and a social need for water (Water.org, 2022). An example is a campaign at Christmas 2021 run by Stella Artois. The company regularly has a special Christmas chalice that they sell each year. In 2021, the chalice was a limited-edition Water.org chalice. The campaign told potential customers that purchasing this chalice would generate sufficient resources to provide 5 years of drinking water for one person, as facilitated by Water.org (Fitzgerald, 2021). Water.org has also partnered with companies such as DuPont to provide grants to help people overcome the financial barriers to safe water through their water credit program. A visit to Water.org's web page will show the dozens of corporate partners they work with on programs such as these. Some companies make their direct commitment to water sustainability through their charitable foundations. For example, Swarovski supports a "Waterschool" educational program focusing on sustainable water management and sanitation education projects (Swarovski, 2022).

International business organizations also encourage their members to address issues of water sustainability. As an example, the World Resources Institute (WRI, 2022) works with their members to assess their level of water risk using their "Aqueduct Water Risk" data tool. The World Business Council for Sustainable Development (WBCSD, 2021) asks its members to commit to "Waste Water Zero" to eliminate wastewater pollution by 2030.

International Development agencies are also addressing these issues. The Organization for Economic Co-operation and Development (OECD) since 2015 has had a task force on Water Security and Sustainable Growth that examines the interrelationship between water resources and economic development. Their report, "Securing Water, Sustaining Growth," estimates that water risk decreases global economic growth by $500 billion annually. And most notably, the United Nations Department of Economic and Social Affairs (UN DESA, 2015) listed "Clean Water and Sanitation" as one of the 17 Sustainability Goals on their agenda.

Universities across the United States have also taken up the call to address the impact of water risk. Some, such as the Stanford Woods Institute for the Environment (2023), focus on regional water issues. Others, such as the Center for Water Research (2023) at Northwestern University, focus on water systems, in this case The Great Lakes. And some, such as the Water Center at the University of Pennsylvania (2023), focus on specific water usage issues, in this case urban water systems.

It is crystal clear that there is no lack of attention and concern on issues of sustainability of the water supply by international aid, business, and development organizations. Yet, despite these efforts, the threats to the world water supply are not being ameliorated. As an example, according to a report by the Economist, "The Invisible Wave," the chemical pollution of the oceans is so extensive that it is likely impossible to ever really clean the ocean waters again (Godard & Sasakawa, 2022).

This leads one to wonder why this is the case. It may be that solutions to the water sustainability issue need the attention of more than just these international organizations. One way to expand the number of people involved in finding these solutions would be for water sustainability issues to be incorporated into the day-to-day decision-making of managers across the hierarchy of businesses. This is not the case today. One reason managers are not now dealing with this daily may be that they believe that solutions to problems as large as this should be left to international development, business, and aid organizations. However, as we have seen, their combined efforts have not solved the problems. It may also be that managers do not see ways in which issues of water sustainability can be incorporated into their day-to-day decision-making. The premise of this research project is that one of the reasons for this is that there is no strategic decision-making framework to guide this incorporation. This research intends to begin to build such a framework. However,

before we can discuss what such a framework should be, we need to examine two issues:

1. Whose job is it in business organizations to manage water sustainability?
2. What issues related to water sustainability can managers manage?

When the well is dry, we will know the worth of water.
—B. Franklin, *Poor Richard's Almanack, 1746*

Answering the first question is relatively easy. Business strategists have recently come to believe that issues related to sustainability need to be incorporated into strategic decision-making. Many firms have addressed this by establishing a Sustainability department, with the executive in charge holding the title of "Vice President" for sustainability, with sophisticated data-gathering techniques (Economist, 2021b). However, a recent business forum conducted by the Wall Street Journal reports that executives believe "environmental and social goals should be objectives shared across a company, rather than the preserve of its sustainability function" (Ballard, 2022). Some of this concern might be motivated by the need to attract talented employees, many of whom care deeply about these issues. Some may be driven by a concern to avoid litigation as regulation around climate-related reporting becomes more stringent. And some may be motivated by investors, more and more of whom demand transparency regarding climate issues. Whatever the reason, the result is that sustainability is now central to the decision-making at many organizations. As one executive quoted in the report says, "There's been a wholesale transformation in how the business is thinking about this." Another report from the Wall Street Journal emphasizes the need for the board to also understand sustainability issues and to become "much more engaged" with the company's executives (Wall Street Journal, 2022).

So, the answer to the first question seems to be "Everybody's." However, just telling managers that it is their responsibility to make and implement strategies to support water sustainability does not provide direction for their efforts. The next question concerns criteria to focus managers' attention on aspects of water sustainability that they can manage. The UN Sustainable Development Agenda provides some guidance. Number Six on the list of the Sustainable Development

Goals established by the UN DESA (2015) is "Clean Water and Sanitation." Goals set for the achievement of clean water include the following:

> **6.3.** By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing the release of hazardous chemicals and materials, halving the proportion of untreated wastewater, and substantially increasing recycling and safe reuse globally
>
> **6.4.** By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity

These two goals are ones that international business decision-makers can most directly impact, i.e., reducing pollution and increasing efficiency. An examination of two projects that aim to address these two issues provides some insight into how managers can begin to structure their analysis of their decision-making regarding water pollution and water efficiency.

THEORETICAL FRAMEWORK: THE INVISIBLE WAVE

The Economist undertook a global research project to measure world concern about sustainability issues such as climate change (Godard & Sasakawa, 2022). Results indicated that plastic and chemical pollution of the oceans was the greatest concern. To address aspects of this, Economist Impact and The Nippon Foundation developed a project called "Back to Blue," which focused specifically on the chemical pollution of the oceans. One of their reports, "The Invisible Wave," examines the extent of chemical pollution and outlines specific strategies for regulators, industry strategists, financial advisors, and consumers. While their description of the current state of the oceans is sobering, calling chemical pollution a "first-order global threat," their analysis provides specific actions that business decision-makers might take. Moreover, although they do say it might not be possible for the oceans ever to be free of pollution, the report aims to drive some solutions that "prevent, reduce and minimize chemical pollution in the marine environment" (Godard & Sasakawa, 2022). They also produce a roadmap for industry decision-makers that includes:

1. Innovation: develop new, more sustainable products and processes.
2. Commercial Incentive to Change: companies must be allowed to profit from addressing marine pollution.
3. The Coalition of the Willing: a coalition of stakeholders from industry, finance, government, and civil society to mitigate "first-mover disadvantage."
4. Transparency and Collaboration across the Supply Chain: greater openness regarding pollution and hazardous inputs.
5. Improve Processes and Practices for Chemical Users: demonstrating pathways for using and managing chemicals more responsibly.
6. Extend Producer Responsibility: producers need to accept responsibility for what happens with their products after-sale.

This list of recommendations from the report demonstrates a set of decision areas regarding water pollution that goes beyond chemical pollution. This provides a concrete set of actions managers can take to help implement Goal 6.3 and focuses attention on decisions managers can control.

Water for a Healthy Planet and People

Another set of decisions concerning water efficiency, as incorporated in Goal 6.4, can be found by examining Danone Corporation. Recognizing the importance of water to the world's population and to their entire value chain, Danone has taken another approach to water sustainability—in this case, increasing water efficiency. They have developed a "One Planet. One Health" business model that focuses decision-making all across their value chain from their suppliers to their end-users—and back again through their water circularity initiatives (Danone, 2020). They use a Stakeholder decision model that incorporates their value chain partners in projects around the world. They believe their water policy will unite the 100,000 people in their value chain to work together to protect and preserve water. The guiding principles for their water policy are:

1. Valuing Water as Part of Nature: recognizing the benefits of water preservation and conservation.

2. Building Science and Sharing Our Expertise: recognizing that data and data analysis are critical elements of all water preservation and restoration programs.
3. Thinking and Acting Locally and Collaboratively: recognizing that the best outcomes are achieved collectively through a stakeholder-inclusive, integrated landscape approach.

This list of policies, while less action-driven than the list from the Economist (Godard & Sasakawa, 2022), does provide ways to shape the decision-making mindset in organizations. Both examples also provide evidence that it is possible to focus managers' attention on the critical decisions they can make regarding such sustainability issues as reducing pollution and increasing efficiency. Even though they are also examples of what can be accomplished by large organizations with substantial resources, it is not to say that such focus cannot serve the needs of managers in all organizations. These are *strategic* decisions, and strategies are designed and implemented by managers in all organizations—big and small. Therefore, the next step is to examine strategic decision-making and to discuss the aspects of the strategic planning process as they can be enacted regarding water sustainability.

Wading Into the Problem

One conclusion drawn from the discussion so far on water sustainability is that the problem is huge and that solutions are not easy. We contend that solutions may be found if water sustainability concerns are incorporated into the strategic decision-making framework of managers across all sizes and shapes of organizations. However, given the enormity of the problems, it may be difficult for managers in any given organization—no matter the level of their commitment to addressing the problems—to find a way to do that. To provide some direction for organizational decision-makers on how to incorporate considerations of water sustainability into their strategic planning processes, we turn to the roadmap discussed earlier in "The Invisible Wave." One of the recommendations is to build a "coalition of the willing," i.e., to involve the organization's external stakeholders. This is echoed in the policy at Danone to work collaboratively with their stakeholders.

This model based on coalition building to address the strategic management of sustainability issues has been used in other research projects to try to understand

the perspectives of the various members of an organization's stakeholder group (Calabrese et al., 2019; Hoekstra et al., 2016). In these studies, the impact of the differences in perspectives and the need to try to map the decision-making priorities of the various individuals involved are emphasized. It is also made clear from these studies that there is no one single definition of the relative value of each member of a firm's stakeholder group and no one single definition of the "most effective" coalition to bring to bear on solving issues related to sustainable development.

We, therefore, conclude that the first step in incorporating concern for water risk into the strategic planning processes of any organization is to develop an understanding of the potential partners for this coalition. This then requires an examination of the external environment.

Of course, the external environment of any organization is quite large. Therefore, it is imperative to focus this analysis on the dimensions of the external environment that are directly related to the sustainability of the water supply. A review of the literature on sustainability of the water supply identified six dimensions of the external environment most closely associated with improvements in the sustainability of the water supply, as follows:

1. Changes in the Ecological System
2. Changes in the Human Population
3. Changes in the Economic Dimension
4. Changes in the Political Dimension
5. Changes in the Technological Dimension
6. Changes in the Social/cultural dimension

Authors typically create indices measuring sustainability by grouping environmental/ecological; technology; economy; and social variables, including political and cultural (Choi & Sirakaya, 2006; Corrêa & Teixeira, 2013; Guidolini, Giarolla, Toledo, Valera, & Ometto, 2018; Haak & Pagilla, 2020; Kemper & Partzsch, 2019; Peterson, Nieber, Kanivetsky, & Shmagin, 2013).

Factors that affect water in the environmental/ecological system are chemical pollution (Godard & Sasakawa, 2022) and lack of water treatment (Oliveira, Parkinson, & Von Sperling, 2006). In addition, the level of water flux is a relevant metric manifested in groundwater, rivers, reservoirs, leakage of erosion of water

supply and distribution systems, agriculture runoffs, or accidents at natural sources of water (Gain, Giupponi, & Wada, 2016; Peterson et al., 2013). Particularly for developing countries, factors affecting water are the size of urban or rainforests (Vos & Boelens, 2014), loss of renewable resources, and endangered species (Choi & Sirakaya, 2006).

Indicators often used to assess the impact of changes in the human population are per capita water consumption, wastewater discharge, discharge of solid waste, and population growth (Haak & Pagilla, 2020; Hu, 2020; Vollmer, Regan, & Andelman, 2016; World Health Organization & UNICEF, 2000).

Changes in the economic dimension relate to job growth in tourism (Choi & Sirakaya, 2006; Hu, 2020; Johnson & Rivas, 2013) and job growth in water-intensive agriculture, water-intensive industries, and the energy sector (Connor & Mileto, 2022; Haak & Pagilla, 2020; Kaliba & Norman, 2004; Peterson et al., 2013).

Changes in political systems relate to regulations regarding water pollution, waste management, water conservation, groundwater and surface water quality, cleaning-up of contaminated sites, water in parks and beaches, and designation of water resources as protected areas (World Health Organization & UNICEF, 2000, 2021)Sanitation and Hygiene (JMP.

Changes in the technological dimension correlate with data collection and benchmarking accuracy (Corrêa & Teixeira, 2013; Gain et al., 2016; Pires, Morato, Peixoto, Bradley, & Muller, 2020)stable and productive societies and ecosystems. Hence, United Nations recognized ensuring water security as one (Goal 6 and technological applications to reduce water pollution (Choi & Sirakaya, 2006; Palme & Tillman, 2009)but few studies have examined what information other actors consider important. This paper examines, based on literature and field studies of Swedish water organizations, what sets of SDIs are considered important, in terms of information content by researchers, sector associations and practitioners. Furthermore, the paper investigates how preferred SDI content relates to these actors' conceptions of sustainable development (SD.

Finally, indicators of changes in the social/cultural dimension concern public awareness toward the value of water sustainability, shifts in the social structure (e.g., power shift and its socio-economic implications), public awareness towards litter/

pollution (air, water, etc.), and citizen involvement in water conservation (Vollmer et al., 2016; Vos & Boelens, 2014).

In sum, these would be the sectors of the external environment of an organization where managers might hope to find willing partners to help them build strategies for managing water risk. The next step is for managers to perceive the potential for building these bridges.

METHODOLOGY: SURFING THE DATA

Data and Sample

To examine the potential for building coalitions between companies and their external partners, we surveyed managers in two countries: Brazil and South Korea. These are two countries where water risk can be expected to be in the mindset of managers. The description of water issues in these two countries has been described by the OECD as follows.

> "South Korea's population density and water scarcity are both the highest among OECD countries. Water in river basins is fully, or close to fully, allocated. This poses a problem for an increasing population and demand for water. Diffuse pollution, mostly from livestock and urban storm water runoff, increasingly contaminates already scarce water resources. Korea is also more vulnerable to flooding than other OECD countries. Over the last decade, flood damages totaled USD 4.35 billion and affected almost 200,000 people. Climate change and urbanisation increase water-related risks, and an aging population and recent slow-down in economic growth limit available public funding for responding to them.
>
> These pressures and others raise the stakes on how to best allocate, manage and govern water resources to minimise future investment needs and risks to sustainable economic growth." (OECD, 2022a)
>
> In Brazil, despite great progress, "Nevertheless, water security challenges persist and will be aggravated by megatrends such as climate change, population growth, urbanization, and the economic, social and environmental consequences of the COVID-19 pandemic." Brazil needs a "modern approach to water security, balancing supply and demand management, grey and green infrastructure, and risk management and resilience while embracing a holistic view that connects water to other strategic areas such as environment, land use, and territorial development." (OECD, 2022b)

Measurements

We developed a questionnaire based on the six water sustainability dimensions. We asked two groups of managers whether or not they perceived that changes in aspects of these six dimensions of the external environment would result in improvements in the sustainability of the water supply. The sample consists of 23 Brazilian managers and 18 South Korean managers who completed the survey. The Brazilian sample consists of 61% of upper and middle level managers (13% and 48%, respectively) of NGOs actively involved in sustainability and resilience in Rio de Janeiro; and 39% of entry-level business managers across various industries participating in sustainability training. The South Korean sample consist of 100% of CEOs of small and medium family-run companies across various industries. The participants in Brazil did self-identify as already being concerned in water sustainability, many actively working in solving the restoration of the Green Belt of Rio de Janeiro, working on improving the water table, through the reforestation of the Atlantic Forest. Regarding the participants in South Korea, they took the survey in Seoul. As CEOs of their companies, they are concerned for all strategic issues of their companies, including sustainability. The data in Brazil were gathered as part of the activities of a weeklong program studying sustainable development. The data in South Korea were gathered as part of a seminar in Seoul for CEOs of small and medium Family Business addressing strategic issues.

We administered it in English in Rio de Janeiro and translated the questionnaire to Korean in Seoul. The questionnaire consists of five-point Likert scales ranging from strongly disagree = 1, neutral = 3, to strongly agree = 5. (Appendix A shows the questionnaire).

The results of the data gathering are reported in Tables 1 to 8.

RESULTS

We performed a t-test analysis of the mean differences using SPSS 26, and to improve generalizability, we used stratified bootstrapping with 1,000 samples and two-tailed 95% confidence intervals. Table 1 shows the variable's means for Brazil and South Korea, the t-student statistics of mean differences, and corresponding lower and upper confidence levels.

An initial analysis of the research results seeks to find the aspects of the external environment that these managers believe are related to improvements in the sustainability of the water supply. Analyzing these results would help identify potential partners for coalition building. In our results, mean values higher than "3" indicate managers' perceptions that a variable would improve water sustainability, highlighting the opportunity for coalition building. Conversely, mean values equal to or lower than "3" indicate low interest in the topic. Statistical differences in means suggest that one group is more concerned about such a variable than the other is.

	Brazil	Korea	Mean Difference	t	Sig.	LCI (95%)	UCI (95%)
1. Changes to the Ecological system							
a. Use of chemical treatment of the water supply	2.23	2.67	-0.44	-1.05	ns	-1.289	0.411
b. Natural erosion of natural sources of water	2.57	2.63	-0.06	-0.16	ns	-0.832	0.713
c. Frequency of environmental accidents at natural sources of water	2.35	2.56	-0.21	-0.55	ns	-1.01	0.58
d. Levels of water in reservoirs	4.27	3.00	1.27	4.13	***	0.65	1.90
e. Levels of water in the distribution system	4.26	3.07	1.19	3.77	***	0.54	1.84
f. Size of the urban forest	4.68	3.41	1.27	3.65	**	0.54	2.00
g. Size of the non-urban forest	4.48	3.24	1.24	3.41	**	0.50	1.98
h. Loss of endangered species	2.36	2.73	-0.37	-0.90	ns	-1.20	0.46
2. Changes in the Human Population							
a. Per capita water consumption	2.35	3.22	-0.87	-1.86	ns	-1.83	0.08
b. Per capita waste water discharge	2.32	3.17	-0.85	-1.66	ns	-1.88	0.18
c. Per capita discharge of solid waste	2.32	2.53	-0.21	-0.46	ns	-1.14	0.72
d. Rate of water recycling	4.70	3.35	1.34	3.81	***	0.62	2.06
e. Population growth	2.35	2.93	-0.59	-1.39	ns	-1.44	0.27
3. Changes in the Economic Dimension							
a. Employment growth in tourism	3.17	2.88	0.29	0.87	ns	-0.39	0.98
b. Employment growth in water intensive agriculture	2.35	2.94	-0.59	-1.42	ns	-1.44	0.25
c. Employment growth in water intensive industry	2.35	2.72	-0.37	-0.81	ns	-1.30	0.56
d. Employment growth in energy sector	3.61	3.17	0.44	1.08	ns	-0.39	1.27
4. Changes in the Political Dimension							
a. Regulation regarding water pollution	4.87	3.78	1.09	3.91	***	0.51	1.67
b. Regulation regarding waste management	4.74	3.76	0.97	3.84	***	0.45	1.50
c. Regulation regarding water conservation	4.83	3.63	1.20	4.31	***	0.62	1.78
d. Regulation regarding groundwater and surface water quality	4.83	3.47	1.36	4.82	***	0.77	1.94
e. Regulation regarding clean-up of contaminated sites	4.74	3.47	1.27	4.45	***	0.68	1.86
f. Regulation regarding water in parks and beaches	4.57	3.31	1.25	3.89	***	0.59	1.91
g. Regulation regarding designation of water resources as "protected areas"	4.96	3.44	1.51	5.09	***	0.89	2.14
5. Changes in the Technological Dimension							
a. Accuracy of data collection	4.59	3.41	1.18	3.86	***	0.55	1.81
b. Accuracy of benchmarking	4.55	3.38	1.17	3.96	***	0.57	1.77
c. Technological applications to reduce water pollution	4.74	3.78	0.96	3.31	**	0.36	1.57
6. Changes in Social/cultural Dimension							
a. Public awareness toward value of water sustainability	4.91	3.71	1.21	3.59	**	0.50	1.91
b. Shift in social structure (e.g. power shift and its socio-economic implications)	4.04	3.63	0.42	1.31	ns	-0.23	1.07
c. Public awareness towards litter/pollution (air, water, etc.)	4.70	3.69	1.01	3.24	**	0.36	1.65
d. Residents' involvement in water conservation	4.70	3.69	1.01	3.12	**	0.34	1.67

Note: Independence samples t-test. Equal variances not assumed. Results are based on 1000 stratified bootstrap samples. Confidence interval (95%) of mean diffrence, Bias-corrected and accelerated .

ns= not significant, *p<0.05, **p<0.01, ***p<0.01, 2 tailed significance. Brazil sample = 23 obs, South Korea sample = 18 obs.

Table 1: T-test for Brazil and South Korea Samples

Table 2 shows the results of the composite six dimensions. One clear result is that both South Korean and Brazilians believe there is more potential in the Political,

Technological, and Socio/cultural dimensions than in the Ecological, Population, and Economic ones. Therefore, this provides some focus for managers.

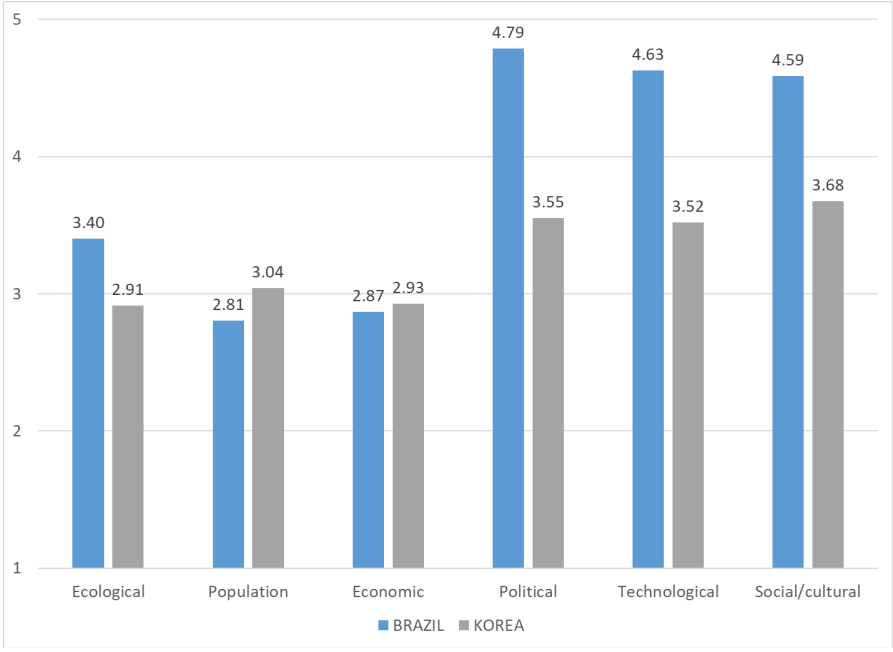
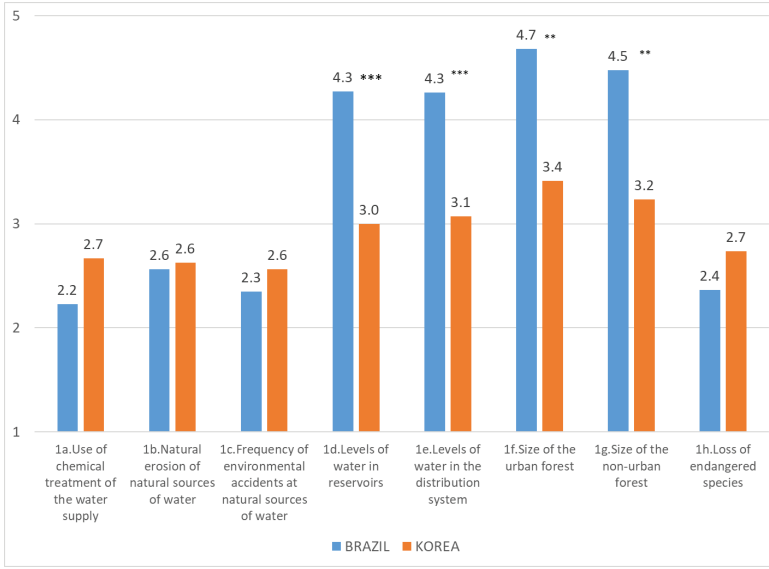


Table 2: Comparing the Average Means for Brazil and South Korea

The following six tables report on the elements of each dimension and compare the two countries. Table 3 reports the items of the Ecological dimension. This dimension shows mixed signals, which various items below a threshold of interest for partnerships. However, Brazilian managers perceive that working on the water infrastructure and the forests would help improve the sustainability of the water supply.



ns = not significant, *p < 0.05, **p < 0.01, ***p < 0.01, 2 tailed significance

Table 3: Comparing Changes in Ecological System Items for Brazil and South Korea

Table 4 reports the impact of the population items. These items show no substantial perception of the potential for improvement. However, Brazilian managers do note the importance of recycling water.

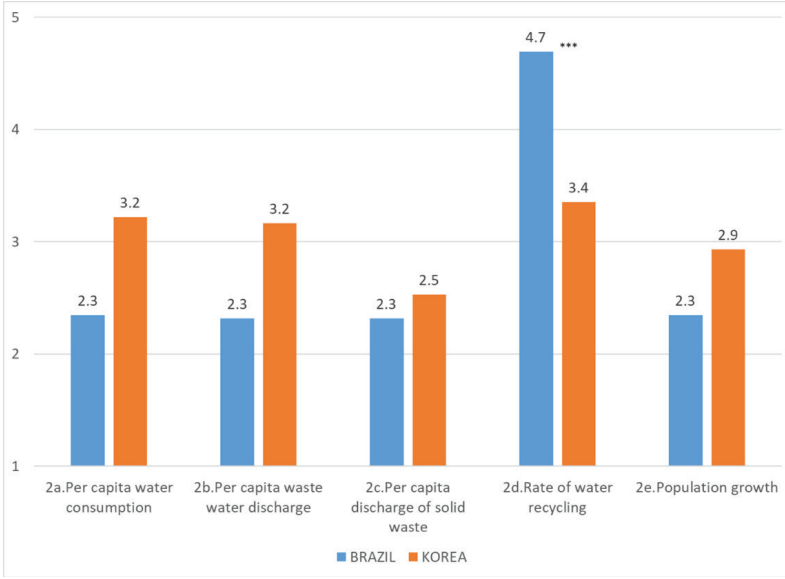


Table 4: Comparing Changes in Human Population Items for Brazil and South Korea

Table 5 reports on aspects of the Economic dimension. Again, the results would indicate that managers do not perceive that making changes in the elements of this dimension would lead to improvements.

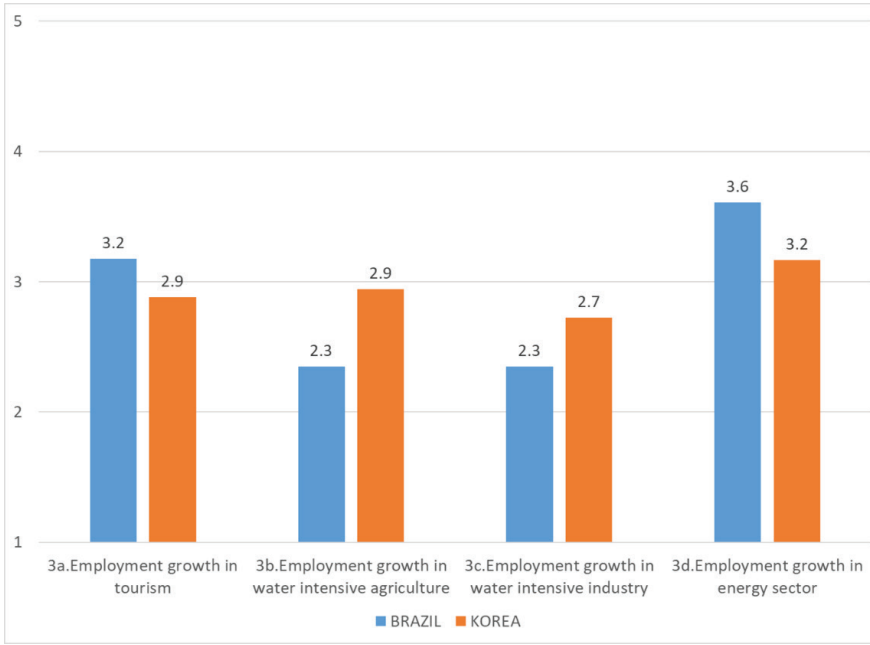


Table 5. Comparing Changes in Economic Dimension Items for Brazil and South Korea

Table 6 shows the results on aspects of the Political environment. This is an area where respondents from both countries see clear potential for making improvements. These results would indicate that managers should be working with regulators to provide improvements.

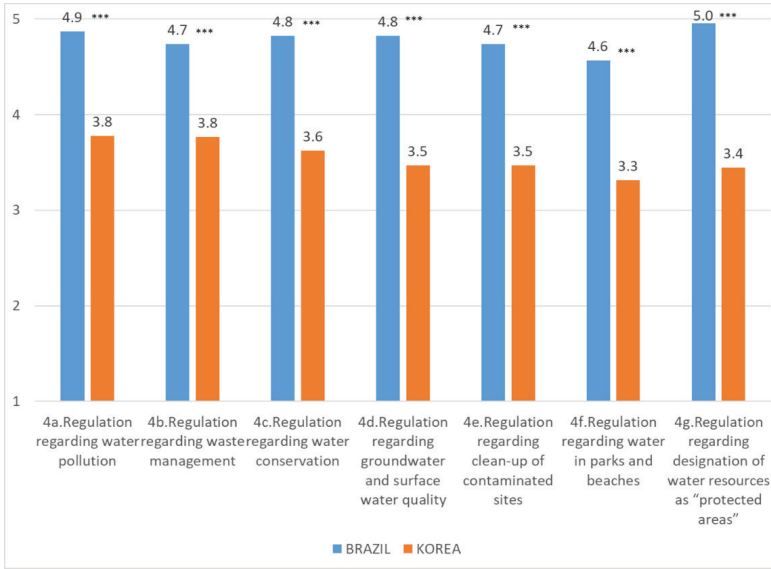


Table 6: Comparing Changes in Political Dimension Items for Brazil and South Korea

Table 7 reports on aspects of the Technological environment—especially the importance of data collection and benchmarking. This is an area where respondents from both countries see the potential for improving the water supply. These results would indicate that working with organizations—perhaps universities—to collect and analyze data would be useful.

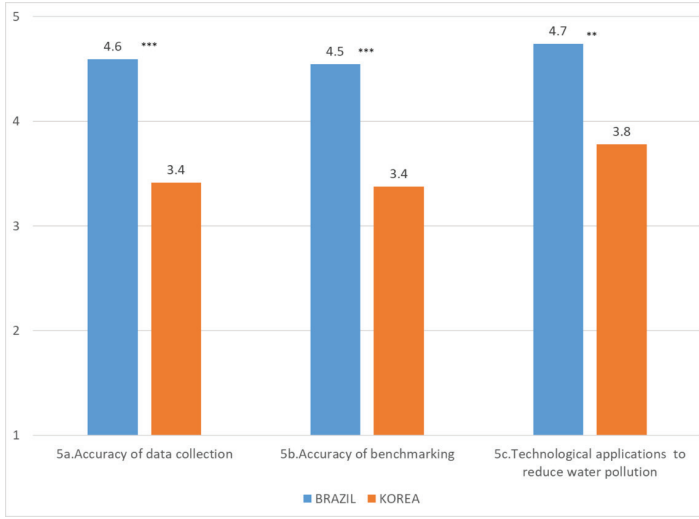


Table 7: Comparing Changes in Technological Dimension Items for Brazil and South Korea

Table 8 reports on the Socio/cultural dimension. The respondents in both samples see the potential in working to develop public awareness of the water risks.

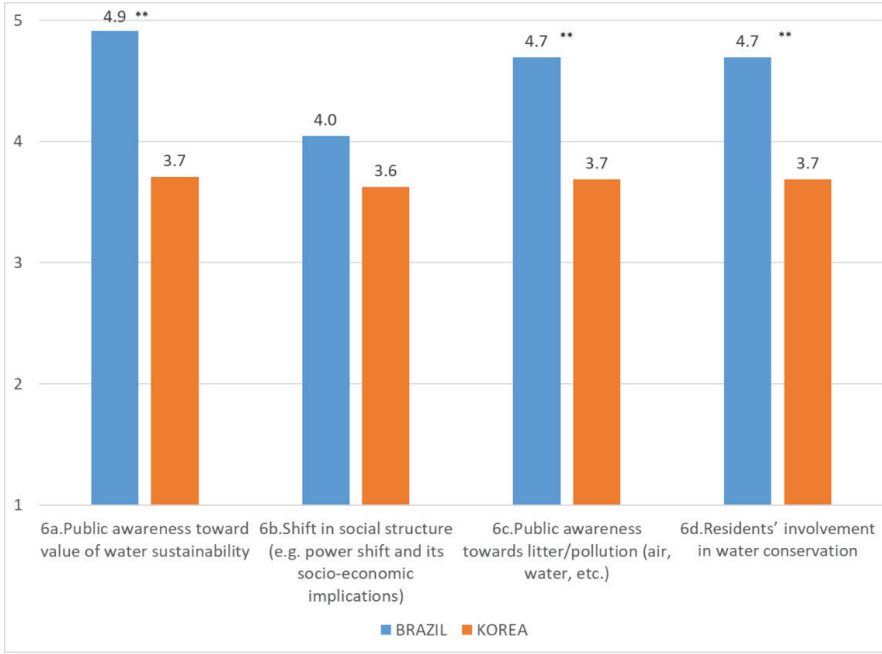


Table 8: Comparing Changes in Socio/Cultural Dimension Items for Brazil and South Korea

DISCUSSION: BUILDING BRIDGES WITH STAKEHOLDERS

While this research is exploratory, the results provide some focus and direction for managers wanting to find ways to incorporate consideration of water risk into their strategic plans. One conclusion of our examination of managers' perceptions of water risk is that it is a problem that no organization alone will easily solve—whether an international development, business, or aid organization. In addition, it will not be solved by one company—even those as committed as Danone and Swarovski. One way to move toward solutions is by building coalitions of committed stakeholders who can focus on aspects of the problem. Moreover, this project does provide some focus.

One interesting result of this research is that the respondents do not see great potential in changes in the ecological, population, and economic dimensions—at

least in so far as these dimensions impact improvements in the sustainability of the water supply. One area that does seem to hold potential is the water supply and the forests in Brazil. There are examples of companies such as Danone working with nonprofit organizations in Brazil, planting trees to protect the water supply. So, other managers in companies in Brazil that rely on groundwater for their production might think of working with local sustainability programs to undertake similar projects.

It is not surprising that respondents in South Korea see potential in working with regulators. Soon after South Korea joined the OECD, they undertook joint actions to improve the water supply in that country. South Korea made such great strides that the OECD now holds them up as a model for sustainable water management actions. This has led to many improvements at the municipal level. It has also led companies such as Samsung to make a commitment to "restore water and air to their natural state" with the goal to achieve this by 2040 (OECD, 2021; Samsung, 2023).

The clear idea arising from these results is that managers—especially in Brazil—see the need for regulation. This is an area where managers need to be involved in the discussion and where managers could help shape the direction of the improvements in the water supply. The managers also see the need for accurate data. Some of that is available from organizations such as the OECD and the WRI. Nevertheless, local data can also be gathered by universities and governmental regulatory agencies. Lastly, the managers see the need for public awareness. This would seem to be an area where businesses can work on campaigns with local media and universities and communities directly impacted by water issues.

While this study does not draw any conclusions on the effectiveness of coalitions built between business organizations and stakeholders in their external environments, this is a model that has been examined in other contexts. In these studies, efforts to address environmental issues as varied as water shortages in the Pyrenees to water management in Beijing indicate the enormity of the problems surrounding water management and the need to build cooperative efforts to stave off potential disasters (López-Moreno, Beniston, & García-Ruiz, 2008; Yu, Yang, & Li, 2020)a comprehensive assessment of changes in the sustainability of the water resource system in Beijing from 2008 to 2018 was conducted on the basis of the driver-pressure-state-impact-response (DPSIR. Other researchers have highlighted the importance of specific stakeholders, generally across the firm's value chain, such as

customers or suppliers (Han, Hwang, Kim, Baek, & Park, 2015; Hurtado-Jaramillo, Chiu, Arimany-Serrat, Ferràs, & Meijide, 2018). Such discussions are reflective of the approach Danone is taking. Other studies have examined the relative value of various stakeholders and their potential for developing strategies for sustainable development (Schmidt, Zanini, Korzenowski, Schmidt Junior, & Xavier do Nascimento, 2018). However, such studies are at the firm level of analysis, while this study examines the individual decision maker. Such studies provide some direction for the next steps in this project as specific stakeholders are examined and priority of stakeholder groups to the strategic management of sustainable development is demonstrated.

LIMITATIONS AND NEXT STEPS

One of the most evident limitations of this study is the sample size and the location of the respondents. Therefore, while some possible approaches to problem-solving in Brazil and South Korea may have surfaced, it would not be possible to generalize beyond those two countries. However, this research demonstrates that managers have clear ideas about the stakeholders in their environments who have the greatest potential for impacting the problems. A next step in Brazil and South Korea is finding examples of successful projects between companies and stakeholders in the Political, Technical, and Socio/Cultural environments. Managers in these two countries would find such examples encouraging and provide valuable models. A second logical next step would be to expand the research to include managers from other countries. It is reasonable to assume they may find potential for coalition-building with different stakeholder groups.

Water Risk is Everywhere, and Managers Can't Shrink --- from their duties

The overall conclusion from this research is that while the problem of water risk is enormous, the solutions can be found drop by drop. Managers can focus on aspects of their external environments where they believe changes can improve the sustainability of the water supply. Managers could identify where to work with external partners to build coalitions of stakeholders, focusing on the specific projects they can undertake as part of their strategic planning processes. As the scenarios

presented by the many international development organizations, businesses, and aid nonprofits make clear, everyone needs to get on board to find solutions.

REFERENCES

Arney, H. 2019. ***How many people are affected by the global water crisis?*** Water.org.

Ballard, E. 2022. The value of collaboration and competition for talent: Takeaways from the WSJ Pro Sustainability Forum. ***The Wall Street Journal,*** April 21.

Calabrese, A., Costa, R., Levialdi, N., & Menichini, T. 2019. Integrating sustainability into strategic decision-making: A fuzzy AHP method for the selection of relevant sustainability issues. ***Technological Forecasting and Social Change,*** 139. Available at https://doi.org/10.1016/j.techfore.2018.11.005.

CDP. 2022. ***High and dry: How water issues are stranding assets.*** Available at https://www.cdp.net/en/research/global-reports/high-and-dry-how-water-issues-are-stranding-assets.

Center for Water Research. 2023. ***Common strategy for smart great lakes.*** Northwestern University. Available at https://water.northwestern.edu/.

Choi, H. S. C., & Sirakaya, E. 2006. Sustainability indicators for managing community tourism. ***Tourism Management,*** 27(6): 1274–1289.

Connor, R., & Mileto, M. 2022. ***The United Nations world water development report: Groundwater making the invisible visible.*** Available at https://www.undp.org/publications/united-nations-world-water-development-report-2022-groundwater-making-invisible.

Corrêa, M. d. A., & Teixeira, B. A. d. N. 2013. Developing sustainability indicators for water. ***Journal of Urban and Environmental Engineering,*** 7(1): 8–14.

Danone. 2020. ***Danone water policy: Water for a healthy planet and people***. Available at https://integrated-annual-report-2020.danone.com/wp-content/uploads/Danone-Water-Policy-2020.pdf.

Economist. 2021a. ***Megadry: Americans are moving to a region plagued by a 22-year drought.*** Available at https://www.economist.com/leaders/2021/08/21/americans-are-moving-to-a-region-plagued-by-a-22-year-drought.

Economist. 2021b. ***An expanding pool: Investors start to pay attention to water risk.*** Available at https://www.economist.com/finance-and-economics/2021/01/09/investors-start-to-pay-attention-to-water-risk.

Elkington, J. 1998. Partnerships from cannibals with forks: The triple bottom line of 21st-century business. ***Environmental Quality Management,*** 8(1): 37–51.

Earthhow. 2022. ***How Much Water Is on Earth?*** Available at https://earthhow.com/how-much-water-is-on-earth/

Fitzgerald, A. 2021. Matt Damon x Stella Artois join forces to give back. ***Forbes,*** November 5. Available at https://www.forbes.com/sites/alissafitzgerald/2021/11/05/matt-damon-x-stella-artois-join-forces-to-give-back/?sh=4720898e69.

Gain, A. K., Giupponi, C., & Wada, Y. 2016. Measuring global water security towards sustainable development goals. ***Environmental Research Letters,*** 11(12). Available at https://doi.org/https://doi.org/10.1088/1748-9326/11/12/124015.

Godard, C., & Sasakawa, Y. 2022. ***The invisible wave: Getting to zero chemical pollution in the ocean--back to blue***. Available at https://backtoblueinitiative.com/the-invisible-wave-getting-to-zero-chemical-pollution/.

Guidolini, J. F., Giarolla, A., Toledo, P. M., Valera, C. A., & Ometto, J. P. H. B. 2018. Water sustainability at the River Grande Basin, Brazil: An approach based on the barometer of sustainability. ***International Journal of Environmental Research and Public Health,*** 15(11): 2582.

Haak, L., & Pagilla, K. 2020. The water-economy nexus: A composite index approach to evaluate urban water vulnerability. ***Water Resources Management,*** 34(1): 409–423.

Han, S., Hwang, H., Kim, S., Baek, G. S., & Park, J. 2015. Sustainable water infrastructure asset management: A gap analysis of customer and service provider perspectives. ***Sustainability,*** 7(10). Available at https://doi.org/10.3390/su71013334.

Hoekstra, A. Y., Chapagain, A. K., & Zhang, G. 2016. Water footprints and sustainable water allocation. ***Sustainability,*** 8(1). Available at https://doi.org/10.3390/su8010020.

Hu, X. 2020. Sustainable water demand management: A case study of Singapore's accommodation sector. ***IOP Conference Series. Earth and Environmental Science,*** 576(1). Available at https://doi.org/https://doi.org/10.1088/1755-1315/576/1/012005.

Hurtado-Jaramillo, C. H., Chiu, M. C., Arimany-Serrat, N., Ferràs, X., & Meijide, D. 2018. Identifying sustainability-value creation drivers for a company in the water industry sector: An empirical study. ***Water Resources Management,*** 32(12). Available at https://doi.org/10.1007/s11269-018-2030-5.

Johnson, J. P., & Rivas, R. M. 2013. Maintaining a global competitive advantage: Sustainable tourism in a world heritage site in Peru. In L. Liberman & W. Newburry (Eds.), ***Internationalization, innovation and sustainability of MNCs in Latin America:*** 10–41. London: Palgrave Macmillan.

Kaliba, A. R. M., & Norman, D. W. 2004. Assessing sustainability of community-based water utility projects in Central Tanzania with the help of canonical correlation analysis. ***Journal of Environmental Assessment Policy & Management,*** 6(1): 73–90.

Kemper, L., & Partzsch, L. 2019. Saving water while doing business: Corporate agenda-setting and water sustainability. ***Water,*** 11(2): 297. Available at https://doi.org/10.3390/w11020297.

López-Moreno, J. I., Beniston, M., & García-Ruiz, J. M. 2008. Environmental change and water management in the Pyrenees: Facts and future perspectives for Mediterranean mountains. ***Global and Planetary Change,*** 61(3–4). Available at https://doi.org/10.1016/j.gloplacha.2007.10.004.

OECD [Organisation for Economic Co-operation and Development]. 2021. ***12 ways Korea is changing the world: 25 years of ambitious environmental reform.*** Available at https://www.oecd.org/country/korea/thematic-focus/25-years-of-ambitious-environmental-reform-16cde12d/#section-d1e218.

OECD [Organisation for Economic Co-operation and Development]. 2022a. ***Water management in Korea: From goals to action.*** Available at https://www.oecd.org/about/impact/water-management-in-korea.htm.

OECD [Organisation for Economic Co-operation and Development. 2022b]. ***Fostering water resilience in Brazil.*** Available at https://www.oecd.org/brazil/fostering-water-resilience-in-brazil-85a99a7c-en.htm.

Oliveira, S. M. A. C., Parkinson, J. N., & Von Sperling, M. 2006. Wastewater treatment in Brazil: Institutional framework, recent initiatives and actual plant performance. ***International Journal of Technology Management & Sustainable Development,*** 5(3): 241–256.

Palme, U., & Tillman, A.-M. 2009. Sustainable urban water systems in indicators: researchers' recommendations versus practice in Swedish utilities. ***Water Policy,*** 11(2): 250–268.

Peterson, H. M., Nieber, J. L., Kanivetsky, R., & Shmagin, B. 2013. Water resources sustainability indicator: Application of the watershed characteristics approach. ***Water Resources Management,*** 27(5): 1221–1234.

Pires, A., Morato, J., Peixoto, H., Bradley, S., & Muller, A. 2020. Synthesizing and standardizing criteria for the evaluation of sustainability indicators in the water sector. ***Environment, Development and Sustainability,*** 22(7): 6671–6689.

Porter, M. E., & Kramer, M. R. 2011. The big idea: Creating shared value, rethinking capitalism. ***Harvard Business Review,*** 89: 62–77.

Prahalad, C., & Hart, S. 1999. ***Strategies for the bottom of the pyramid: Creating sustainable development***. Available at http://pdf.wri.org/2001summit_hartarticle.pdf.

Samsung. 2023. ***Sustainability in operations***. Available at https://www.samsung.com/global/sustainability/planet/sustainable-operations/#:~:text=We%20are%20reducing%20the%20amount,double%20between%202022%20and%202030.

Schmidt, F. C., Zanini, R. R., Korzenowski, A. L., Schmidt Junior, R., & Xavier do Nascimento, K. B. 2018. Evaluation of sustainability practices in small and medium-sized manufacturing enterprises in Southern Brazil. ***Sustainability,*** 10(7). Available at https://doi.org/10.3390/su10072460.

Stanford Woods Institute for the Environment. 2023. ***Water in the west.*** Available at https://woods.stanford.edu/research/centers-programs/water-west.

Suriyankietkaew, S., & Petison, P. 2020. A retrospective and foresight: Bibliometric review of international research on strategic management for sustainability, 1991–2019. ***Sustainability,*** 12(1): 91. Available at https://doi.org/10.3390/SU12010091.

Swarovski Waterschool. 2022. ***Home page.*** Available at https://www.swarovskiwaterschool.com/.

UN DESA [United Nations Department of Economic and Social Affairs]. 2015. Goal 6 clean water and sanitation: Ensure availability and sustainable management of water and sanitation for all. ***Sustainable Development Goals.*** Available at https://sdgs.un.org/goals/goal6.

University of Pennsylvania. 2023. ***The Water Center***. Available at https://watercenter.sas.upenn.edu/.

US Department of the Interior Water Science School. 2019a. ***How much water is there on earth?*** Available at https://www.usgs.gov/special-topics/water-science-school/science/how-much-water-there-earth#:~:text=About 71 percent of the,in you and your dog.

US Department of the Interior Water Science School. 2019b. ***The water in you: Water and the human body.*** Available at https://www.usgs.gov/special-topics/water-science-school/science/water-you-water-and-human-body#:~:text=In adult men%2C about 60,their bodies made of water.

Vollmer, D., Regan, H. M., & Andelman, S. J. 2016. Assessing the sustainability of freshwater systems: A critical review of composite indicators. ***Ambio,*** 45(7): 765–780.

Vos, J., & Boelens, R. 2014. Sustainability standards and the water question. ***Development & Change,*** 45(2): 205–230.

Wall Street Journal. 2022. ***The board and sustainability: What role should directors play in ESG efforts?*** April 26.

Water.org. 2022. ***Home page.*** Available at https://water.org.

WBCSD [World Business Council for Sustainable Development]. 2021. ***Wastewater zero commitment.*** Available at https://www.wbcsd.org/Programs/Food-and-Nature/Water/Resources/Wastewater-Zero-Commitment-Guidance-document.

World Health Organization. 2022. ***Home page.*** Available at https://www.who.int/.

World Health Organization, & UNICEF. 2000. ***Global water supply and sanitation assessment 2000 report.*** Geneva, Switzerland. Available at https://www.who.int/publications/i/item/9241562021.

World Health Organization, & UNICEF. 2021. ***Progress on household drinking water, sanitation and hygiene 2000-2020: Five years into the SDGs.*** Available at https://www.who.int/publications/i/item/9789240030848.

WRI [World Resources Institute]. 2022. ***Corporate water stewardship.*** Available at https://www.wri.org/initiatives/corporate-water-stewardship.

Yu, H., Yang, Z., & Li, B. 2020. Sustainability assessment of water resources in Beijing. ***Water,*** 12(7). Available at https://doi.org/10.3390/w12071999.

APPENDIX

This anonymous survey explores perceptions about factors influencing the **SUSTAINABILITY OF WATER SUPPLY**. This survey is estimated to take about 10 minutes of your time. Thank you in advance for your participation in this study!

Increases in the following factors lead to Improvements in the Sustainability of the Water Supply

Please rank every line (including headings) with an **X. You can write comments in the back of this page.**

	Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
1. Changes to the Ecological system					
a. Use of chemical treatment of the water supply					
b. Natural erosion of natural sources of water					
c. Frequency of environmental accidents at natural sources of water					
d. Levels of water in reservoirs					
e. Levels of water in the distribution system					
f. Size of the urban forest					
g. Size of the non-urban forest					
h. Loss of endangered species					
2. Changes in the Human Population					
i. Per capita water consumption					
j. Per capita waste water discharge					
k. Per capita discharge of solid waste					
l. Rate of water recycling					
m. Population growth					
3. Changes in the Economic Dimension					
n. Employment growth in tourism					
o. Employment growth in water intensive agriculture					
p. Employment growth in water intensive industry					
q. Employment growth in energy sector					
3. Changes in the Political Dimension					

r. Regulation regarding water pollution					
s. Regulation regarding waste management					
t. Regulation regarding water conservation					
u. Regulation regarding ground-water and surface water quality					
v. Regulation regarding clean-up of contaminated sites					
w. Regulation regarding water in parks and beaches					
x. Regulation regarding designation of water resources as "protected areas"					
4. Changes in the Technological Dimension					
y. Accuracy of data collection					
z. Accuracy of benchmarking					
aa. Technological applications to reduce water pollution					
5. Changes in Social/cultural dimension					
ab. Public awareness toward value of water sustainability					
ac. Shift in social structure (e.g. power shift and its socio-economic implications)					
ad. Public awareness towards litter/ pollution (air, water, etc.)					
ae. Residents' involvement in water conservation					
Your Organization/Company/ Your Position:					
Your Professional Experience (years):					
You can write comments here.					

Appendix A: Questionnaire

Ronald M. Rivas is a Full professor of Management and Marketing at Canisius University, Buffalo, New York, USA. He is a global management specialist fluent in four languages, with professional work and travel to 15 countries in Asia, the Americas, and Europe. Dr. Rivas has three decades of teaching MBAs and undergraduates in the US, Peru, Chile, and Brazil. He received Fulbright Specialists Grants in 2009 and 2012, visiting Universidad del Pacífico, Peru. He has also visited other prestigious universities in Latin America, including IAG/PUC-Rio de Janeiro, Brazil; EA/UFRGS-Porto Alegre, Brazil; and FEN/Universidad de Chile, Santiago. His research topics include Resilient Strategies to overcome Disruptions, Brand Heritage Management and Marketing, Sustainability, and internationalization of Latin American companies. He earned a Ph.D. at the John E. Anderson School of Management, UCLA, a Magister in Administration at ESAN University, and a BSc in Mechanical and Electrical Engineering at Universidad Nacional de Ingeniería, Peru.

Coral R. Snodgrass is Professor Emerita of Management at Canisius University in Buffalo, NY. Throughout her career, Dr. Snodgrass has focused on researching international business strategies of companies across the globe, in countries including The United States, Canada, Mexico, Japan, and Germany. Her research examines the cultural differences in the mechanisms managers employ to implement their chosen strategies. Dr. Snodgrass has also worked to build international business studies and programs for her students. She was the Project Director for six grants from the US Department of Education which supported the development of study-abroad sites and programs in Peru, Brazil, France, The Netherlands, Sweden, Mexico, and Canada. In addition to her work at the University, Dr. Snodgrass has been active in the community. She works with the Buffalo World Trade Center, designing international programming. She also works with the International Institute of Buffalo, a refugee resettlement agency.

Ji-Hee Kim is a Distinguished Visiting Professor at Hanyang University and the Vice President of the Academy of Entrepreneurship, Seoul, Republic of Korea. She is an accomplished professor who worked and taught as a Director of Entrepreneurship and tenured professor of management and entrepreneurship at Canisius University, Buffalo, New York, U.S.A. She has over 25 years of experience embracing innovative and entrepreneurial core values in teaching, research, and involvement within the entrepreneurial business community. Dr. Kim researched as a German National Government Fellowship Scholar at the Technical University of Munich in Germany, a

Korean National Research Foundation Scholarship Fellow at the Ohio State University, and Ewha Woman's University Excellence Fellow at Cornell University. Her research includes work on family business and entrepreneurship from multicultural, environmental, and international perspectives.