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Accomplishing Water Strategy Policies in Hospitals: The Role of Management Information Systems and Managerial Styles

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Abstract: Hospitals are using more sophisticated and comprehensive management information systems to implement multiple strategic policies towards water cost saving and water quality enhancement. However, they do not always achieve the intended strategic goals. This paper analyzes how managerial styles interact with sophisticated management information systems to achieve different water strategic priorities. How proactive vs. reactive managerial styles moderate the effects of management information systems on water cost saving and water quality enhancement is analyzed. Relationships are explored using data collected from 122 general services directors in Spanish public hospitals. The findings show a positive effect of sophisticated management information systems on the achievement of water policies focused on cost saving and quality enhancement. Results also show a different moderated effect of managerial styles; thus, sophisticated management information systems with a proactive managerial style facilitate managers to achieve better water quality policies rather than water cost saving policies.

Keywords: water strategic policies; cost saving and quality enhancement; management information system; managerial styles; hospitals

1. Introduction

Hospitals are organizations that demand high amounts of water for their daily operations. Hospitals are among the facilities with the highest water use intensity, with about 1000 L of water per bed per day on average, which is more than water use at schools and offices, but less than at hotels and senior care facilities. Hospitals use water in different amounts for both core and non-core functions, such as washing and personal hygiene, therapeutic treatments, central sterile operations, water-treatment systems for laboratory or kidney dialysis [1]. Inefficient water usage exists not only in Spanish hospitals but also in many western healthcare facilities [1,2], such as a lack of sub-meters and monitoring in laundries or kitchens, lack of maintenance of tanks overflowing or leakage of cisterns. Furthermore, many hospitals do not have an asset management for water system and for planning replacements, such as pipes and valves [1,2]. These inefficiencies could lead to wastage of valuable resources and money. The healthcare Spanish Ministry reported that water costs in hospitals are about two percent of the water expenditures in Spain, and about ten percent of the total hospital expenditures (see www.mssi.gob.es for more details). Not only are cost saving policies important for hospitals, but water quality assessments and improvements are important. Good water quality in daily hospital operations is crucial to ensure the best patient care, and the well-being of the hospitals' staff and visitors. Thus, Spanish public healthcare authorities are pushing managers in hospitals to focus on water efficiency and effectiveness in order to reduce costs and improve water quality [1,2]. On the one hand, efficiency in water use focuses on achieving high quality water with a minimum

investment. Hospitals' quality water plans are focused mainly on sampling and monitoring water systems to detect microorganisms that can be potentially harmful to health. Quality water plans also encourage uses of the hospital water system that prevent degradation and contamination of water, such as adding oil or medicine to the water system [3,4]. On the other hand, water effectiveness focuses on controlling water consumption, which provides organizations with water supply savings and lower sewer costs, among others [2,3]. Thus, managers in hospitals have to implement strategic policies focused simultaneously on water cost saving and water quality enhancement.

Water management strategy is the process of planning and implementing water policies and objectives in order to achieve the highest quality and the lowest cost of available water. However, hospitals do not always achieve the intended strategic goals [3,4]. Recently, management information literature argued that the achievement of strategic goals can be examined as an outcome of management information systems [5]. Several studies have analyzed how management information systems affect strategic management, examining the attributes of management information systems under different strategic policies [5,6]. In this line, authors have analyzed the adoption of sophisticated management information systems for managing strategic objectives. These systems provide managers with comprehensive information, such as operational and financial information, externally and internally oriented, and information with a focus on both past and future events [7,8]. Empirical results thus far are confused and mixed, since researchers have usually analyzed a specific management information technique [9,10]. Researchers have also extensively examined one single characteristic in the design of management information systems at a time. More seldom, researchers have analyzed the managerial styles rather than the design of management information systems, since managerial styles affect the use of organizational resources in strategic management. In this line, hospitals are more concerned with how managers will accomplish their strategic goals, which include using management information systems to assign tasks, monitor an organization's goal progress, and allocate resources to departments and medical services [11,12].

Managerial styles reflect how the best managers will achieve strategic goals through task assignment and resources allocation, and how they will use management information for controlling and monitoring the achievement of different strategic policies. Managerial styles also reflect the guidance and the use of managerial information to motivate organizational employees to achieve specific strategic policies and objectives [11,12]. Studies in the strategic management literature have often used the description of proactive or interactive vs. reactive or diagnostic managerial styles. Basically, a proactive style focuses on solving problems before they have a chance to appear, where a reactive managerial style focuses on responding to events after they have appeared [11,12]. Generally, researchers argue that a proactive managerial style involves debate and dialogue among managers and subordinates at different organizational levels, which stimulates opportunity-seeking, proactive behaviors, and also encourages the development of new activities and actions [12,13]. In this line, different authors asserted that managers with a proactive style use management information systems to discuss data and interpret information with subordinates and employees at all organizational levels [13,14]. In contrast, a reactive or diagnostic managerial style focuses on controlling efficiency of prescribed tasks, and on monitoring organizational outputs by comparison with preset standards, in order to analyze potential deviations and correct them to achieve the intended strategic goals [12,15,16].

This study attempts to shed some light on the relationship between managerial styles and sophisticated management information systems to implement water strategy policies in hospitals. The general objective examines the appropriate use of sophisticated management information systems that facilitate the achievement of water strategy policies towards cost saving and quality enhancement. The empirical study was undertaken in the Spanish public hospitals industry, where public authorities encourage managers to simultaneously pursue different strategic policies focused on water cost saving and water quality enhancement. This industry provided the setting appropriate for research objectives. A questionnaire was used to collect data from general service directors of 231 public hospitals, from whom an adequate response rate with 122 useful responses was achieved (52.81%).

This research contributes to the management information and water management literature in several ways. First, this paper shows evidence of how different managerial styles are better aligned with management information systems to support different water management strategic policies. It addresses strategic goal adoption as a result of management information systems, rather than as an antecedent of them. Second, while prior literature argues that management information systems can facilitate different water strategy policies simultaneously, the present paper directly examines how this relationship works. The achievement of water strategy policies focused on cost saving and water strategy policies focused on quality enhancement are analyzed, and thus it is acknowledged that both types of strategic goals and policies may not be mutually exclusive, as in fact, hospitals are currently more often pressed towards the implementation of both strategic goals simultaneously [10].

The remainder of this paper is structured as follows. Section 2 develops the research hypotheses of this study. Section 3 describes the design of the empirical study. Section 4 presents the results. Finally, a discussion of the findings and the conclusions are presented.

2. Literature Review and Hypotheses Development

Since effective and efficient uses of water are a major requirement in hospital facilities, water management strategies are becoming more important in the healthcare industry [17,18]. Hospital managers must adopt water-cost saving policies, but maintain high quality water. In hospitals, more than in other types of organizations, there is a higher risk for water to get contaminated and people to get infected [19]. However, there is no single strategic approach for dealing with water managerial issues in hospitals. Managers can adopt different management strategies in relation to every use of water, such as alter the water use habits of hospital consumers, identify water saving alternatives, evaluate and monitor water use to determine performance targets, encourage user education, and minimize water leaks [20,21]. In this line, there are different methods that hospitals can use to detect and to avoid leaks, such as to pay close attention to variations in water meters records, conduct preventive maintenance, or perform a water assessment of the facility regularly [21,22]. User education is an effective way to enhance sustainable use of water, which can also facilitate significant water savings [23,24]. There are several measures that managers in hospital can use to educate users, such as communicate the water management strategy of the hospital not only to employees but also to patients and visitors; create point-of-use information to encourage sustainable behaviors towards water consumption among employees and patients; or instruct relevant subordinates and staffs to ensure proper adoption of any new or revised procedures involving water management [22,25,26]. Furthermore, water management strategies in hospitals also focus on water saving technologies unique to healthcare facilities, since a high percentage of the water consumption of a hospital is used for medical equipment, such as air and compressor equipment, x-ray equipment and sterilizer [19,27,28].

The strategic management literature emphasizes the importance of managerial styles and management information systems to achieve multiple strategic objectives [9,10]. However, despite significant interest from practitioners and academics in water management literature, relatively little is known about how the combination of different managerial styles and management information systems can influence the achievement of multiple strategic policies [29,30], such as water cost saving and water quality enhancement. Managerial styles can be described as proactive and reactive. A proactive style is a participative style towards re-evaluating organizational objectives, with managers searching for new possibilities for task coordination, and looking for synergy among different departments and services. By contrast, a reactive managerial style is less participative oriented and more autocratic, since it focuses on controlling and monitoring the quantitatively measurable events rather than on searching ways for improving them. An important issue about managerial styles is the extent to which managers are involved in the use of relevant information for their strategic management [15,16,30]. One of the most significant information sources in hospitals is the management information system, which provides information for strategic decision-making. Management information systems can be conceptualized

according to the perceived usefulness of four information characteristics, namely timeliness, scope, aggregation and integration [9,10]. Timeliness refers to the frequency and speed of reporting, that is how often managers request information, and how quickly managers receive requested information. Scope refers to the focus, quantification and time horizon, that is the extent to which management information is oriented with respect to both external and internal events, future and past oriented and operational versus financial oriented. Aggregation refers to how much information is summarized. Finally, integration refers to information about multi-departmental tasks and activities that would then influence activities of another department or organizational sub-unit. The degree of sophistication of management information systems can be classified on the score on these four dimensions. Thus, a sophisticated management information system provides information more focused on internal and external events, quantified in both economical and operational terms, and information related to long-term consequences. More sophisticated management information systems provide information aggregated by functional areas and time periods to a greater extent, and also supply managers with information that is related to different services or programs to facilitate problem-solving and innovative solutions to address strategic policies [9,29].

Strategic policies towards water cost saving focus mainly on water saving measures, such as technical efficiency measures (e.g., install automatic sensors in toilets or faucets to avoid unnecessary water use, or implement energy-efficiency measures to reduce the need for equipment cooling and heating). Strategic policies towards quality enhancement focus mainly on reacting to quality assessment data about the water use, in order to improve the processes by which water services are provided to employees, patients and other consumers [31,32]. For example, develop gap assessment plans to find effectiveness of water policies in place, or implement procedures and protocols about water infection prevention to include risk management approach. Overall, strategic policies towards water quality enhancement are customer oriented, and they emphasize searching for new methods and innovative solutions to problems [10,33]. This requires management information systems that provide comprehensive information to facilitate service customization rather than standardization, which can be supported well by the key characteristics that make up proactive managerial styles [14,33]. Researchers in strategic management information argue that the development of policies focused on quality enhancement, opposite to policies focus on cost control, requires cooperation and coordination within the organization. In addition, they need uses of management information systems that encourage fluent working relationships between managers and employees at different organizational levels [12,14,33]. This scenario requires information systems that provide an extended set of data about the different parts of organizational processes, such as infrastructures, clinical services or indoor air systems [33,34].

Recently, researchers analyzed how organizations use management information systems to support their chosen strategic policies and goals, recognizing the influence of how managers use rather than design management information systems [35,36]. Thus, researchers have found that customization and interdependence increase the importance of timely management information and also the scope of management information, which are characteristics of sophisticated management information systems [36,37]. Although empirical evidence on the relationships between management information systems and strategic policies achievement is not straightforward, it argues that the availability of a more comprehensive set of information facilitates and encourages managers to interact and to debate about how to achieve strategic objectives [37,38]. Furthermore, managers should use the management information systems in a proactive or interactive way when they aim to implement strategic goals focused on flexibility and quality, since an interactive managerial style focuses on the use of management information systems for increasing dialogue, cooperation and finding new solutions to problems [12,38]. In this line, several researchers have argued that an interactive use of management information systems facilitate the adoption of innovative ideas and solutions through the provision of encouragement for triggering of new initiatives, processes and activities [35,39]. It has also been argued that an interactive (diagnostic) style of using management information systems

contributes positively (negatively) to the quality management and organizational learning [14,40]. Therefore, I formulated the following hypotheses:

Hypothesis 1 (H1). *Sophisticated management information systems will facilitate the simultaneous adoption of strategic policies towards water cost saving and water quality enhancement.*

Hypothesis 2 (H2). *Sophisticated management information systems under proactive managerial styles will facilitate the adoption of strategic policies towards water quality enhancement rather than strategic policies towards cost saving.*

3. Materials and Methods

To test the hypotheses, data were collected through a questionnaire sent to 231 general service directors in all Spanish public hospitals in 2012. General service directors are in charge of managing water strategic policies and procedures in public hospitals. A satisfactory response rate was achieved with 122 useful questionnaires returned (52.81%). The questionnaire was written and distributed by following procedures recommended by previous literature [41]. Instruments were selected for the variables based on the water and management literature, and a draft version of the questionnaire was written and tested in six interviews with members of the target population. Small changes were made based on the suggestions and comments received, such as insufficient response spaces, misunderstanding or response locations and wording problems due to the original English wording. Most attention was paid to clarify words rather than to replace items in the questionnaire. The distribution and recollection of the questionnaire involved the five steps recommended by Dillman [41]: (1) pre-notice letter announcing the survey; (2) the questionnaire, which was sent one week later; (3) a follow-up letter, reminding all participants about the importance of responding, which was sent two weeks later; (4) a second copy of the questionnaire, which was distributed to non-respondents three weeks later; and finally; (5) non-respondents were contacted by phone, from which fourteen useful questionnaires were achieved.

Regarding the measurement of the variables, a sophisticated management information system was measured based on the scale developed by previous studies [36,40], where the design of management information systems was conceptualized in terms of four information characteristics, such as (1) scope; (2) timeliness; (3) aggregation and (4) integration. General service directors were asked to indicate in a five point Likert scale from 1 (very low) to 5 (very high) the extent to which their hospital's management information system provides each of those four dimensions identified. The four information dimensions were treated as complementary to construct the variable sophisticated design of management information systems, which was measured by averaging the scores for the four information characteristics. Thus, higher scores for this variable indicated a more sophisticated management information system. The Cronbach alpha for the scale was satisfactory, i.e., 0.82 [42].

The managerial style was measured by considering the descriptions of proactive and reactive managerial styles based on previous studies [12,13,35]. A proactive style was described as a style that encourages interaction, collaborative decision-making, and coordination to enhance organizational learning. This managerial style looks for synergy between hospital services, and it relies on a continual challenge and debate of underlying information, initiatives and action plans. By contrast, a reactive managerial style was described as a style that responds to initiations and requests from others. This managerial style focuses on controlling and close monitoring of goal deviations after they appear. It is also focused on the use of hierarchical reporting practices; discuss information on an exception basis, and debate underlying information infrequently. General service directors had to indicate the extent to which the two descriptions better represented their managerial styles on a five point scale, with anchors of "reactive managerial style" (=1) and "proactive managerial style" (=5). Thus, higher scores of this variable indicated a more proactive managerial style. Several steps were taken to minimise potential social desirability bias in the answers, such as presenting respondents

with managerial style statements that other people had made. Thus, it was showed that both styles were acceptable rather than there was a correct style. Respondents were asked about their managerial style, not just what they thought. Furthermore, they were informed that there were no right or wrong answers to minimise any concerns about being judged for their answers.

Strategic policies towards water cost saving and water quality enhancement were measured with an instrument based on public health care management literature and Spanish policy documents [43,44]. Directors were asked to indicate in a five point Likert scale from 1 (very low) to 5 (very high) the extent to which a set of water strategic policies were adopted in their hospitals. Regarding the strategic policies towards cost saving, managers were asked about the adoption of procedures to reduce water consumption, such as check and correct leaks and drips in bathrooms, toilets or laboratories. I also asked them about the adoption of policies for installing flow reducers on sinks and showers, or automatic water shutoff valves and sensors. Managers were also asked about the adoption of inspection plans or policies on processing equipment. Regarding strategic policies towards water quality enhancement, general service directors were asked about the adoption of policies related to improve current water use to prevent degradation of water systems (e.g., pouring oils, medicines or organic waste into them), and to identify water conservation opportunities, such as implementation of changes to improve practices in cleaning or kitchens. They also were asked about the adoption of policies to increase employee, patient and visitor awareness of quality and sustainable uses of water (e.g., educate staff, assign responsibility, inform about the water conservation policy).

The hospital size and the governmental dependency of hospitals were included as control variables in the research model. Hospital size was measured by the number of beds [45]. Government dependency of hospitals was measured by a dummy variable that distinguished between hospitals in regions with autonomy in health care management before and after 2002, since from this year, a health care reform provided all hospitals with the same formal autonomy (before 2002 just 7 out of 17 regions had autonomy).

4. Results

An exploratory factor analysis was conducted to check that all items loaded on the expected strategic policies. Exploratory factor results showed two factors, with all items loading higher than 0.50 on the expected variables. The factor for strategic policies towards water cost saving explained 37.61% of the variance, with a Cronbach alpha value of 0.83. The factor for strategic policies towards water quality enhancement explained 30.12% of the variance, with a Cronbach alpha value of 0.78.

Potential non-response bias in the survey was tested by comparing questionnaire respondents to the original mailing list. Early respondents and late respondents were also compared [42,46]. A Chi-square test and independent-sample *t*-test on the basis of hospital size and governmental dependency of hospitals were conducted to check if both set of respondents were different. Results from chi-square tests and independent-samples *t*-tests were not significant, that is they showed no sign of non-response bias. For example, the result of the Chi-square test and independent *t*-test on the basis of hospital size for survey respondents and original mailing list was 4.912 ($p = 0.172$) and 1.148 ($p = 0.215$), respectively. The result of the Chi-square test and independent *t*-test for early and late respondents was 1.879 ($p = 0.243$) and 0.955 ($p = 0.284$), respectively. Table 1 shows the descriptive statistics of the sample, and Table 2 shows the correlations between the research variables.

Table 1. Descriptive statistics.

Variable	Mean	Standard Deviation	Theoretical Range	Actual Range
1. Sophisticated management informat. system (MIS)	3.07	0.27	1.00–5.00	1.00–5.00
2. Proactive Managerial Style	3.18	0.32	1.00–5.00	1.00–5.00
3. Achievement water cost policies	2.99	0.41	1.00–5.00	1.00–5.00
4. Achievement water quality policies	3.44	0.47	1.00–5.00	1.00–5.00

Table 2. Correlations among variables.

Variable	1	2	3
1. Sophisticated MIS	1		
2. Proactive Managerial Style	0.162	1	
3. Achievement water cost policies	0.211 [b]	0.147	1
4. Achievement water quality policies	0.237 [a]	0.194 [b]	0.106

Notes: [a] Significant at the 0.01 level (two tailed); [b] Significant at the 0.05 level (two tailed).

The hypotheses were tested using the partial least squares structural equation software. Partial Least square (PLS) is a variance-based approach for the estimation of path models involving latent constructs measured by multiple indicators [47,48]. The PLS technique is comparable with principle components analysis, where path coefficients in the structural model can be interpreted as the statistics from ordinary least squares regression [48]. Furthermore, this technique resembles ordinary least squares regression, with regard to output and assumptions. It can estimate research models with small sample sizes, since it does not make any distributional assumptions about the data for statistical modeling [47,48]. Discriminant validity of the research model was examined by comparing the AVE coefficient (Average Variance Extracted) with the squared correlations of the variables. Results showed AVEs higher than the squared correlations, which were satisfactory.

Figure 1 shows the PLS research model tested. Table 3 reports the output statistics of the path coefficients analysis for the structural model. Table 3 also shows the significance of standardized coefficients that resulted from this analysis, based on a bootstrapping procedure that used 500 samples with replacement. The bootstrapping procedure uses subsamples with randomly drawn observations from the original data set. Since the PLS technique does not assume that the data are normally distributed, it relies on a nonparametric bootstrapping with a replacement procedure to test the significance of estimated path coefficients.

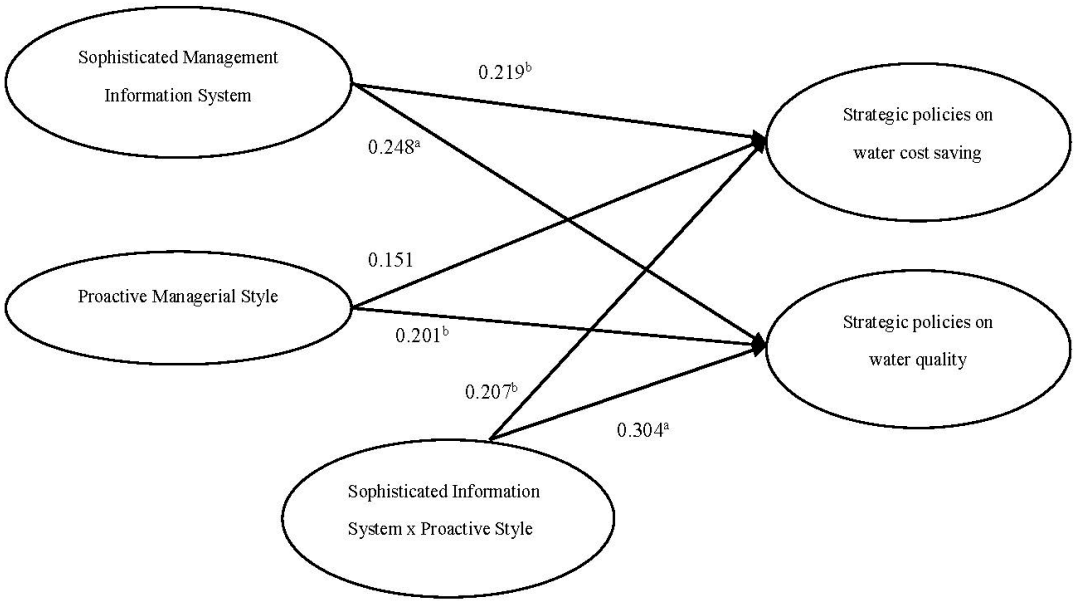

Figure 1. Results from the PLS research model. [a] Significant at the 0.01 level (two tailed); [b] Significant at the 0.05 level (two tailed).

Table 3. Results from PLS analysis (path coefficients).

From:	To:	Quality Enhancement Strategic Goals	Cost Saving Strategic Goals
1. Sophisticated management information system		0.219 [b]	0.248 [a]
2. Proactive managerial style		0.151	0.201 [b]
3. Sophisticated information x Proactive style		0.207 [b]	0.304 [a]

Notes: [a] Significant at the 0.01 level (two tailed); [b] Significant at the 0.05 level (two tailed).

Table 3 shows a positive and significant effect of sophisticated management information systems on strategic policies towards water cost saving (0.219, $p < 0.05$) and also on strategic policies towards water quality enhancement (0.248, $p < 0.01$). These results show support for hypothesis 1, which asserted that sophisticated management information systems would facilitate the simultaneous adoption of strategic policies towards water cost saving and water quality enhancement. Table 3 shows that a proactive managerial style is positively related to strategic goals towards quality enhancement, and also to strategic goals towards cost saving; however, in this case, the relationship was not significant. Results in Table 3 show that the interaction between a sophisticated management information system and a proactive managerial style has a more positive effect on strategic policies towards water quality enhancement (0.304, $p < 0.01$) than on strategic policies towards water cost saving (0.207, $p < 0.05$). Thus, there was support for hypothesis 2. Overall, the results show that hospitals that want to achieve strategic policies focused on both water cost saving and water quality enhancement should encourage general service directors to adopt proactive managerial styles and sophisticated management information systems.

In testing the PLS model, the control variables were included, which result in no significant path with sophisticated management information systems, proactive managerial styles and strategic policies towards water cost saving and water quality enhancement. The results presented are those of the model tested with control variables. For reasons of clarity, control variables were not included in Figure 1.

To extend the results from the PLS analysis, an additional analysis was conducted using two-way ANOVA for examining the effect on cost and quality strategic goals of the alignment between sophisticated management information systems and management styles. Strategic management literature under a contingency framework argues that an appropriate fit between information systems and managerial styles has to exist in organizations to better implement their strategic objectives [49,50]. Thus, I analysed whether a sophisticated vs. simple design of management information systems under proactive vs. reactive managerial styles will have a greater influence on the adoption of strategic policies towards water cost saving or strategic policies towards water quality enhancement. The managerial style variable was split at the median to create two classifications: Proactive style (above the median) and reactive style (below the median). The sophisticated management information system variable was also split on the basis of the median score to create two groups: Sophisticated management information systems (above the median) and simple management information systems (below the median). Since ANOVA assumes equality of variance between groups, I checked this by conducting Levene's test, which showed homogeneity of variance with a significance value of the Levene statistic higher than 0.05. The mean scores for strategic policies towards water quality enhancement shown in Table 4 indicate the highest score when a sophisticated management information system is matched with a proactive management style. Table 4 also shows the lowest score (mismatch) with the use of sophisticated management information systems under reactive management styles. Thus, results show that sophisticated management information systems will facilitate more the adoption of strategic policies towards water quality enhancement under proactive managerial styles than under reactive managerial styles. Table 5 shows the effect on strategic goals towards water cost saving, and the results show that the highest score is with the alignment between simple sophisticated management information systems and reactive managerial styles. Results in

Table 5 also show that the lowest score is obtained when simple management information systems are used under proactive managerial styles.

Table 4. ANOVA results: Mean scores for strategic goals towards quality enhancement (n = 122).

	Sophisticated Information System	Simple Information System
Proactive managerial style	3.42	3.14
Reactive managerial style	2.91	2.98

Table 5. ANOVA results: Mean scores for strategic goals towards cost saving (n = 122).

	Sophisticated Information System	Simple Information System
Proactive managerial style	3.02	2.86
Reactive managerial style	3.18	3.26

5. Discussion and Conclusions

This paper analyzed the relationship between management information systems and managerial styles to implement water strategic policies. It was argued that the interaction between sophisticated management information systems and proactive managerial styles has a different effect on the achievement of water strategic policies, focused on cost saving and quality enhancement. This paper tried to improve our understanding of managerial styles as a key variable that moderates the relationship between management information systems and multiple water strategic policies. The research findings can be summarized as follows. Sophisticated management information systems are positively related to water strategic policies towards both cost saving and quality enhancement. Thus, the adoption of sophisticated management information systems by hospitals can facilitate the achievement of multiple water strategic policies. Results also show that a proactive managerial style only has a positive significant effect on policies towards water quality enhancement. The findings show that proactive managerial styles moderate the relationship between sophisticated management information systems and water strategic policies focused on cost saving and quality enhancement. Results show that sophisticated management information systems under proactive managerial styles will facilitate more the adoption of strategic policies towards water quality enhancement rather than strategic policies towards cost saving. This is consistent with previous studies that argued that quality strategic policies are complex since they require cross-functional responsiveness to different demands and specific requirements, and thus they need flexible managerial styles to process and manage a comprehensive set of information from different services directed at improving workflows, prioritizing activities, and optimizing resource allocation [36,37].

Findings from the additional analysis that examined the appropriate alignment among the research variables showed that hospitals can achieve their water strategic policies better with an appropriate fit between management information systems and management styles. The findings showed that sophisticated management information systems have to be matched with proactive managerial styles to achieve water quality policies rather than cost saving policies. By contrast, the results showed that simple or less sophisticated management information systems have to be matched with reactive managerial styles to better achieve water cost saving policies. These results are consistent with previous studies in the contingency management literature, which found that the interaction between participative managerial styles and management information systems had a positive effect on strategic goals and organizational performance [10,36]. Overall, these results support the central contention of contingency theory, which is that different organizational dimensions must align well with each other or friction may prevent organizations from performing optimally [49,50].

The results from this study extend the previous findings in the literature by showing evidence of the role of two internal organizational variables, such as the design of management information

system and the management style in an interaction affecting different water strategic policies. Results confirmed evidence in the literature about the public hospital management as well. The issues of water management effectiveness and efficiency are critical problems confronting managers in public hospitals, not only in Spain, but also in most western countries. It can be concluded that governmental authorities must encourage the design of management information systems that provide suitable and comprehensive information to healthcare directors. In doing so, managers can achieve better water strategic policies, and they can also face the challenge of creating a more sustainable and healthier system that addresses the needs and demands of patients, employees, the community and governmental authorities.

It can be also concluded that managers need to receive more sophisticated information to manage multiple and more complex strategic objectives properly, such as quality enhancement policies. This paper showed that managerial styles can be more or less supportive in function of the water strategic policies that hospitals want to implement. Thus, the use of reactive managerial styles with less sophisticated management information systems seems to be more appropriate to achieve water cost saving policies than quality enhancement policies. This conclusion is in line with previous studies that argued that more simple management information systems avoid managerial information overload, which may be dysfunctional for managing strategic policies focused on very specific objectives, such as cost control and reduction [40,49,50]. Furthermore, it can be concluded that hospital managers should be aware of the type of information that has to be provided by management information systems in order to optimize strategic policies achievement. To be effective, the information should reflect external and internal events, be short-term and long-term oriented, with data quantified in both economical and operational terms. However, not only the appropriate management information system matters, but the alignment with the management style is also required for hospitals to be able to implement well multiple strategic policies.

These results let us conclude that encouraging proactive managerial styles that focus on participation, coordination and communication does not automatically guarantee the achievement of multiple strategic objectives. Hospitals have to encourage a managerial style that is related to an appropriate design of management information systems in order to better achieve water strategic policies. Overall, this paper has shown that the design of management information systems is a critical feature for hospitals that want to achieve multiple water strategic policies. Authorities in hospital who are in charge of training and hiring of general service directors to manage water strategic policies should focus more on the management information system design when examining the management style of directors. The findings of this research also have policy implications for reducing water consumption and improving water quality in hospitals. With a broader range of information, hospitals can adopt a total water cycle management approach that facilitates all water entering or leaving the site be considered [1,2]. Thus, managers can better monitor water usage and undertake water audits and leakage detection programs. They can also develop a benchmarking approach to determine a water efficient percentage, for example, hospitals could cut water consumption by about 10% (e.g., laundry done off site). Hospital managers should develop water awareness programs among staff and patient, and also train employees to gather information and analysis of trends on water supply system and usage at the hospital.

This study has also several limitations, such as those inherent in the use of a questionnaire, which is a method that does not permit an assessment of causality among the variables. Additional research could help to clarify these cause and effect relationships. Furthermore, the results from this research have a limited generalization since this study relied on a single industry. Clearly, empirical testing of the research objectives in a different industry or in hospitals from different countries may provide more insight into the external validity of results. Another limitation of this study is the operationalization of the variables; water strategy policies are complex and multidimensional constructs, involving different objectives and goals, which can create limitations of comparability among results from previous studies. This paper considered that water quality enhancement can be achieved only by changing

the behavior of hospital employees and patients. However, there are other ways to improve water quality, for example, by implementing technical solutions. Future research could examine the effect of other characteristics of strategic policies, and also different characteristics of managerial styles, such as psychological or cognitive traits of hospital managers.

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