Article

Stakeholder Collaboration on Policymaking for Sustainable Water Management in Singapore’s Hotel Sector: A Network Analysis

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Abstract: Stakeholder collaboration has become a critical issue in sustainable tourism policy due to the increasing complexity and interdisciplinary nature of the domain. Policymaking should reflect tourism values through a dynamic system in which stakeholders come to a consensus on sustainability issues via ongoing interactive engagement. Taking Singapore’s hotel sector as a case, this study explores how stakeholder relationships contribute to participatory policymaking on sustainable water management. Based on a survey of 33 relevant organisations, this research applies network analysis to investigate stakeholder collaboration within this policy domain. While the policymaking process is derived from a complex web of actors and their formal and informal interactions, the national water agency of Singapore and some private businesses were found to be centrally located in the policy network. The aforementioned government body is also perceived to hold the greatest legitimacy, power, and urgency over others in the policy domain. Central stakeholders were found to play an important “bridging” role in terms of the interconnectedness of policy actors across boundaries of the public, private, and third sectors. These prominent political and industry players were also likely to exert control over the policymaking process and access to important resources based on their favourable network positions.

Keywords: policy making; stakeholder collaboration; sustainable tourism and hospitality; sustainable water management; network analysis

1. Introduction

Tourism is widely regarded as an essential social activity because of its economic, social, and environmental significance [1]. Although tourism development is an important destination process, over-exploitation of crucial resources can lead to breakdown of the resource base and threaten ecosystems [2]. Frustratingly, “progress towards sustainable development of tourism is hardly satisfactory while sustainable practices are restricted to a few niche markets, with the rest of the tourism industry keeping its priorities clearly on profit” rather than sustainability [3] (p. 13). To address this shortcoming, recent studies have stressed that sustainable tourism development is dependent on developing “futuristic policies” [1] (p. 148). Importantly, such policymaking will need to acknowledge the interdependencies and interconnectedness within the tourism system [4] as “bring[ing] societal actors into joint projects” [5] (p. 20). A challenge facing stakeholders concerns how the complex and dynamic principles of sustainable tourism development can be translated into a destination’s tourism policy framework [6].
Water is one such crucial tourism development resource, a prominent aspect of various tourist activities fundamental to the scenic beauty of a landscape and necessary to promote accommodation environments [7]. According to the World Tourism Organisation (UNWTO) [8], the rise in the number of international tourists is expected to continue. For the foreseeable future, more tourism-supporting systems (e.g., hotels, restaurants, golf course, spas, and other consumptive water-related recreation activities) will inevitably exert pressure on water availability [9]. The potential for increased water demand from tourism will exacerbate any current water shortage problems and potentially result in conflict over access to existing water resources. Thus, water availability and conservation, wastewater management, and drinking water quality constitute the UNWTO’s top three baseline criteria for sustainability [10]. However, researchers have paid little attention to water management policies in the tourism industry, especially in water constrained destinations [11].

The hotel sector deserves detailed investigation in this regard because hotels are one of the tourism industry’s largest drivers of employment and economic revenue [12] and a critical water consumer in many destinations [13]. As a key component of the tourism industry, the hotel sector is often identified as having the potential to make optimal use of water and other natural resources in the quest for more sustainable forms of development [14]. The confluence of a growing hotel sector concomitant with water shortages could culminate in a crisis in the absence of comprehensive water management strategies [15]. Yet, policymaking for water demand management (WDM) in the hotel sector is a relatively new research area with a limited body of knowledge [16–18].

Using Singapore as a case of best practice, this study seeks to examine the current contact network of inter-relationships of organisational stakeholders (in this study, policy stakeholders are in the public, private, and third sectors. The public sector refers to government authorities; the private sector includes private businesses; and the third sector (or host community) consists of non-governmental institutions, educational establishments and other citizen groups) representing multi-sectors and their perceptions of critical policy stakeholders in a tourist destination. Specifically, this research is guided by three key questions. Firstly, what are the characteristics of the current structure of contact network of WDM policymaking in Singapore’s hotel sector? Secondly, how does the current network structure facilitate water policymaking in the hotel sector? Thirdly, to what extent can the Singapore’s experience be learned by public policymakers?

2. Water Policy Research in the Tourism Industry

Water has been taken for granted as a low-cost renewable resource [19]; as such, tourism and many other economic sectors have arguably neglected to protect the environmental and natural assets on which they rely [20]. Two broad policy categories of polices have been proposed to better manage water resources in the tourism and hospitality industry: supply-side policies, which are aimed at “increasing water provisions” [21] (p. 11); and demand-side policies, which manage “consumptive demand itself to postpone or avoid the need to develop new [potable water] resources” [22] (p. xiii).

Water is critical to the hotel sector, yet provisions of the resource are becoming challenging, particularly in water-stressed regions. Consequently, demand-side water resource management in hotels has become central to ensuring the viability and sustainability of tourist destinations [16]. WDM policies comprise numerous approaches, including pricing strategies, management, and regulatory solutions, engineering and technical interventions, education and community involvement, and alternate water sources for non-potable purposes [23]. However, research on sustainable (demand) management of water within a tourism context remains a relatively low priority compared with residential, industrial, and agricultural water uses [21].

Scholars have pointed out that the design and implementation of WDM measures involve multiple stakeholders, such as water authorities, other government bodies, water consumers, educational establishments, professional associations, and non-governmental organisations (NGOs) [24]. Without stakeholder involvement, sustainability would “just be a marketing slogan or, at best a topic for theoretical debate” [25] (p. 12). Haywood [26] introduced an approach to examining tourism
stakeholders via a one-way, relatively independent economic (or particularly consumptive) relationship between various tourism stakeholders and the business sector. Later, Jamal and Getz [27] applied stakeholder constructs to tourist destination planning. The authors acknowledged the complexity of stakeholder relationships at a tourist destination, noting that the destination domain is characterised by an “open system” of multiple stakeholders. Other researchers have found that as “the tourism system context becomes increasingly fragmented and volatile” [28] (p. 19), stakeholder analysis of sustainability issues in tourism reflects increasing recognition of the extent to which stakeholders can or should influence policymaking [29].

Although stakeholder analysis can identify, characterise, and prioritise stakeholders [29], this approach has been criticised for underestimating the importance of structural characteristics of water policy actors’ relational patterns at a destination level [15,30]. One contribution of the present study is that our integrated network approach provides an analytical tool to systematically and quantitatively examine the relationship structures of given network nodes (i.e., policy stakeholders). Treating a social structure as a network is the cornerstone of network analysis [31]. According to Burt [32], a social network, as an embedded social system, comprises a collection of multiple actors (i.e., nodes). Policy networks are linkages between actors with common interests in public policymaking (including policy formulation and implementation) [33]. Mathematically, a policy network is a graph that provides a lens through which to comprehend structures and collaborative destination policymaking between government bodies, private tourism firms, and civil society. Sustainable tourism policy networks may serve as frameworks to understand the engagement of diverse policy communities and their influences on policymaking in a tourism context [34]. Essentially, a network analysis extends beyond the attributes of individual policy actors to investigate how they are positioned within a policy system [35].

3. Methods

3.1. Study Area: Singapore as Case

Singapore was selected as the study area of this case study. Situated between Malaysia and Indonesia (Figure 1), the Republic of Singapore is located in the rain belt of the equator (130 km north) [36]. Owing to its geographical location, Singapore has a tropical climate with consistently high temperatures and humidity [37] and average annual precipitation of 2497 mm [38], more than twice the global average of 1050 mm per year [39]. However, Singapore is also a finite land mass, with unfavourable topographic constraints that limit the collection and storage of rainfall [40], and no freshwater lakes or underground aquifers [41]. Thus, Singapore faces substantial physical obstacles related to natural freshwater supply. The limited land mass of 720 km$^2$ with a population of 5.6 million [total population consists of Singapore citizens, permanent residents, and non-residents (e.g., work permit holders, dependents of residents, and student pass holders)] [42] together with the recent rapid growth in population and urbanisation only compounds Singapore’s water challenges [43].

In spite of Singapore’s water vulnerability, it remains one of the top tourist destinations in the world [44]. In 2017, inbound travellers to Singapore rose by over 6% to 17.4 million, reflecting a period of continued growth (Figure 2). Total visitor numbers are projected to rise by over 20% in the three years ahead [45]. Nearly 50% of international visitors to Singapore stay at hotels [46–48], and with an average length stay of approximately 3.5 nights [48], 28 million annual hotel guest nights were recorded in 2017.

Studies have shown that water-related conflict has arisen between the hotel sector and other non-household consumers worldwide [7,50,51], and Singapore is not an exception. Water consumption in Singapore’s hotel sector totaled 6.56 million m$^3$ (based on the number of hotel guest nights (i.e., 12.15 million in 2001) (Figure 2) and average water use per guest night (i.e., 0.54 m$^3$) [52]) (1.44% of national potable water use (as of the total potable water use of 455.2 million m$^3$ in 2001 [53],)) in 2001, which increased sharply to approximately 15.13 million m$^3$ (based on the number of hotel guest nights (i.e., 28.01 million in 2017) (Figure 2) and average water use per guest night (i.e., 0.54 m$^3$) [52]) (3.03%
of national potable water use (As of the total potable water use of 499.4 million m³ in 2017 [42]) in 2017. The average water use per guest night in Singapore was recently reported to reach 0.54 m³ [51]; by contrast, the average Singapore household water use per capita per day was as low as 0.14 m³ in a comparable year [54].

Figure 1. Location of Singapore.

In spite of Singapore’s water vulnerability, it remains one of the top tourist destinations in the world [44]. In 2017, inbound travellers to Singapore rose by over 6% to 17.4 million, reflecting a period of continued growth (Figure 2). Total visitor numbers are projected to rise by over 20% in the three years ahead [45]. Nearly 50% of international visitors to Singapore stay at hotels [46–48], and with an average length stay of approximately 3.5 nights [48], 28 million annual hotel guest nights were recorded in 2017.

Figure 2. International arrivals to Singapore (2001–2017). Source: [46,49].

Despite the challenges associated with water resource management, it is essential to the long-term viability and sustainability of the hotel sector and greater tourism industry [21]. Singapore has launched a sustainable water management strategy that contributes to its overall sustainable tourism development goals [55]. The island is considered a success story in water policy and a paragon of water management in megacities, particularly in offering an integrated WDM policy system that includes diverse policy stakeholders [39].
3.2. Data Collection and Analysis

3.2.1. Name Generation

Given the aims of this study, the unit of analysis was set at the organisational level to examine the relationships and network structure among stakeholders in the policy arena. To identify the “seed” stakeholders involved in hotel-sector WDM, approximately 50 public policy documents at the Central Library of the National University of Singapore were reviewed. Sources include sustainable development blueprints, hotel entities’ annual reports, and newspaper reports. An interview process immediately started with the identified “seed” stakeholders, including some government agencies, hotel property developers, hotel entities, water service companies, plumbers, industry associations, and educational establishments. Selected interviews with boundary-spanning personnel (i.e., senior management or delegates responsible for policymaking regarding WDM in Singapore’s hotel sector) also provided “a first impression of [the] policy field” [56] (p. 12) and local background information, contributing to a preliminary understanding of the research issues [57]. During the interview, a “snowballing” technique was adopted to identify other organisational stakeholders who were considered relevant to the purpose of the study. [58]. To minimise misunderstanding and ambiguity of the concept of WDM, the scope of WDM in Singapore’s hotel sector was presented to the respondents. They were asked the following “name generator” question using the “free recall approach” [59] (p. 70).

Which organisation(s) located in Singapore do you think have either an actual or potential effect on policy formulation and implementation of water demand management (WDM) in Singapore’s hotel sector? Please list as many names as you can recall.

Newly nominated policy actors were sent an invitation email to participate in the study. Then, they were also asked the same “name generator” question to identify additional potential stakeholders for the study [29]. This procedure continued until no more new organisational stakeholders were recommended, and the researchers felt that saturation had been achieved [60]. Ultimately, 33 policy stakeholders/stakeholder groups (stakeholder groups refer to stakeholder groups in the private and third sectors (e.g., hotel entities and universities). The following statistical analyses were based on average levels of respondents from these stakeholder groups) (see Table 1) from the public, private, and third sectors were identified (including “seed” actors along with nominees).

It was clear that it would be almost impossible to achieve a complete network by including all the WDM policy stakeholders in Singapore’s hotel sector. Presumably, there were a finite number of public and third sector players. Thereafter, all pertinent public authorities and third-sector entities were included in the survey. On the other hand, there could be a potentially infinite number of private sector members. The private-sector actors were categorized into seven homogeneous stakeholder groups (i.e., consulting and advisory service providers, the corporate headquarter/parent company of hotel groups, hotel building owners/equity investors, hotel entities, hotel property developers/architects/builders, water service companies/water solutions, and water-wise fixture suppliers/plumbers). The sample in each of these stakeholder groups was purposefully selected. For instance, there were 149 member hotel entities registered at the Singapore Hotel Association (SHA) as of 30 April 2017 [61]. Thus, questionnaires were mailed to all the exiting member hotels. In the third sector, the sample included all the identified individual organisational stakeholders [e.g., Singapore Water Association (SWA)] and three stakeholder groups (i.e., media/press, universities, and polytechnics) with infinite members.
Table 1. Profile of Policy Stakeholders.

<table>
<thead>
<tr>
<th>Stakeholder</th>
<th>Acronym</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Public Sector</strong></td>
<td></td>
</tr>
<tr>
<td>Building and Construction Authority</td>
<td>BCA</td>
</tr>
<tr>
<td>Centre for Liveable Cities</td>
<td>CLC</td>
</tr>
<tr>
<td>Economic Development Board</td>
<td>EDB</td>
</tr>
<tr>
<td>Ministry of the Environment and Water Resources</td>
<td>MEWR</td>
</tr>
<tr>
<td>National Environment Agency</td>
<td>NEA</td>
</tr>
<tr>
<td>National Parks Board</td>
<td>NParks</td>
</tr>
<tr>
<td>Public Utilities Board</td>
<td>PUB</td>
</tr>
<tr>
<td>Sentosa Development Corporation</td>
<td>SDC</td>
</tr>
<tr>
<td>Singapore Accreditation Council</td>
<td>SAC</td>
</tr>
<tr>
<td>Singapore Tourism Board</td>
<td>STB</td>
</tr>
<tr>
<td>Standards, Productivity and Innovation Board</td>
<td>SPRING</td>
</tr>
<tr>
<td>Urban Redevelopment Authority</td>
<td>URA</td>
</tr>
<tr>
<td><strong>Private Sector</strong></td>
<td></td>
</tr>
<tr>
<td>Consulting and advisory service providers</td>
<td>Consulting</td>
</tr>
<tr>
<td>Corporate headquarter/Parent company of hotels</td>
<td>HQ oh hotel groups</td>
</tr>
<tr>
<td>Hotel building owners/equity investors</td>
<td>Hotel building owners</td>
</tr>
<tr>
<td>Hotel entities</td>
<td>Hotel entities</td>
</tr>
<tr>
<td>Hotel property developers/Architects/Builders</td>
<td>Hotel property developers</td>
</tr>
<tr>
<td>Water service companies/Water solutions</td>
<td>Water solutions</td>
</tr>
<tr>
<td>Water-wise fixture suppliers/Plumbers</td>
<td>Fixtures/Plumbers</td>
</tr>
<tr>
<td><strong>Third Sector</strong></td>
<td></td>
</tr>
<tr>
<td>Media/Press</td>
<td>Media/Press</td>
</tr>
<tr>
<td>Universities (in Singapore)</td>
<td>Universities</td>
</tr>
<tr>
<td>Institution of Engineers Singapore</td>
<td>IES</td>
</tr>
<tr>
<td>Singapore Institute of Architects</td>
<td>SIA</td>
</tr>
<tr>
<td>Singapore Environment Council</td>
<td>SEC</td>
</tr>
<tr>
<td>Singapore Green Building Council</td>
<td>SGBC</td>
</tr>
<tr>
<td>Singapore Hotel Association</td>
<td>SHA</td>
</tr>
<tr>
<td>Polytechnics (in Singapore)</td>
<td>Polytechnics</td>
</tr>
<tr>
<td>Singapore Water Association</td>
<td>SWA</td>
</tr>
<tr>
<td>Waterways Watch Society</td>
<td>WWS</td>
</tr>
<tr>
<td>Singapore Plumbing Society</td>
<td>SPS</td>
</tr>
<tr>
<td>Real Estate Developers’ Association of Singapore</td>
<td>REDAS</td>
</tr>
<tr>
<td>Singapore Sanitary Ware Importers and Exporters Association</td>
<td>SSWIEA</td>
</tr>
<tr>
<td>Association of Consulting Engineers, Singapore</td>
<td>ACES</td>
</tr>
</tbody>
</table>

3.2.2. Survey Questionnaire Development and Administration

In the next stage, a total of 235 structured questionnaires were mailed to all the identified organisations individually in June 2017. The respondents were those who held leading positions, including the top management, heads of departments/units responsible for sustainable water management, sustainable tourism, and/or stakeholder relations of the identified organisations. The survey contained four questions exploring current stakeholder relationships and three widely recognised stakeholder salience attributes: legitimacy, power, and urgency [62]. More than 120 questionnaires were returned by 31 December 2017. After removing incomplete cases, the final sample consisted of 101 participating organisations (12 from the public sector, 59 from the private sector, and 30 from the third sector).

Questions were adapted from the works of Ahmed [63], Timur [64], and Wang [65]. To examine the existing stakeholder interconnectedness, the first question was designed to investigate whether or not policy stakeholders are in contact with one another vis-à-vis policymaking on WDM in Singapore’s hotel sector. A standardised stakeholder list was presented to participants, and they were asked to check off stakeholders with whom their organisation had engaged in formal and/or informal contacts.
(including via postings, newsletters, conferences, on-site visits, surveys, workshops, public forums, joint programmes, co-membership, and casual conversations) within the last 12 months (a recent 12 months is considered valid for surveying participants’ up-to-date opinions on stakeholder salience [64]).

To identify and evaluate salient policy stakeholders who were particularly critical to policymaking, the three main stakeholder attributes, (i.e., legitimacy, power, and urgency) were also examined. These three critical factors, borrowed from Mitchell, Agle [62], may provide valuable insight into which stakeholders are considered particularly important relative to others. Participants were asked to assess the “acceptability” (legitimacy), “problem-solving capacity” (power), and “trustworthiness” (urgency) stakeholders in policymaking. Specifically, three structured questions are included:

- Which stakeholder(s) on this list should be involved in policy formulation and implementation of WDM in Singapore’s hotel sector? Using the scale, please circle the relevant degree of acceptability of for each of the following stakeholders.
- How much power (i.e., problem solving capacity) do the stakeholders below exercise over others with regard to policy formulation and implementation of WDM in Singapore’s hotel sector? Using the scale, please circle the relevant degree of problem solving capacity of for each of the following stakeholders.
- With regard to policy formulation and implementation of WDM in Singapore’s hotel sector, claim from some stakeholders might be considered to be trustworthy. Using the scale, please circle the relevant degree of trustworthiness of for each of the following stakeholders.

Respondents were instructed to use a 5-point Likert-type scale to indicate the level of legitimacy/power/urgency [66], ranging from 1 (extremely low) to 5 (extremely high) for each entry on the standardised stakeholder list.

Quantifiable data were analysed in two main steps. First, once relational data had been gathered from the first question, an adjacency matrix was constructed to depict relationships among policy stakeholders in the policy network. Specifically, basic analysis intended to focus on presence (or absence) rather than the strength of connections among policy actors. Relationships between policy stakeholders were coded, and a squared matrix of 33 × 33 elements was constructed. To visualise stakeholder interconnectedness (i.e., formal and/or informal contacts), the policy stakeholder network was mapped in Netdraw. Several network measures were calculated thereafter with the assistance of UCINET VI, allowing for a structural understanding of how network actors were interconnected [35]. Also, statistical analyses were conducted to determine relative stakeholder importance on the aforementioned three stakeholder attributes [67]; the proportions of respondents with scores of either 4 (high) or 5 (extremely high) were calculated and examined (the scales of 1 (extremely low), 2 (low), and 3 (neutral) are not relevant to the purpose of data analysis) to uncover the legitimate, powerful, and urgent stakeholders.

4. Results

4.1. Policy Stakeholder Network Visualisation

The undirected dichotomous (binary) ties of all 33 identified policy stakeholders in the three sectors and their structural linkages from a whole network perspective are summarised in Figure 3, which illustrates the ego-centric links for each stakeholder. Although the network linkages map does not explicitly display inter-sector relationships, legends differentiate multiple stakeholders among different sectors.

Figure 3 presents the overall composition of policy stakeholders within the network. The map indicates that consulting and advisory service providers, Singapore’s Public Utilities Board (PUB), and hotel entities comprise the network hub, closely surrounded by the following actors: the Building and Construction Authority (BCA); Ministry of the Environment and Water Resources (MEWR); National Environment Agency (NEA); Standards, Productivity, and Innovation Board (SPRING); hotel building owners/equity investors; hotel property developers/architects/builders; water service companies/water
solutions; water-wise fixture suppliers/plumbers; SHA; polytechnics; and Singapore Water Association (SWA). Peripheral actors in this network include the Centre for Liveable Cities (CLC), Economic Development Board (EDB), Sentosa Development Corporation (SDC), Singapore Accreditation Council (SAC), Urban Redevelopment Authority (URA), Singapore Environment Council (SEC), Waterways Watch Society (WWS), and Real Estate Developers’ Association of Singapore (REDAS). Although no organisational stakeholder/stakeholder groups were entirely isolated in the network (i.e., having no ties with other actors in the network), those outlying policy actors were found to exert less influence than others in the realm of WDM policymaking.

Figure 3. Structure of Policy Stakeholder Network. Legends:  Public Sector;  Private Sector;  Third Sector.

The network map also illustrates contacts between sectors. Nearly all the members of the private sector exhibited formal and/or informal relationships with most of the government bodies. In particular, every private-sector member had established contacts with the PUB and BCA. The PUB collaborates with private businesses to optimise the use of Singapore’s strategic water resources. The BCA frequently communicates with industry members to ensure water efficiency in commercial buildings. Likewise, nearly all private businesses demonstrated relationships with most of third-sector members. Consulting and advisory service providers had ties with all third-sector actors. Hotel entities, water service companies/water solutions, and water-wise fixture suppliers/plumbers also exhibited contacts with an overwhelming majority of third-sector actors. SWA and SHA had contacts with every private business. Polytechnics in Singapore had relationships with nearly all private businesses. Conversely, stakeholders in the third sector did not exhibit strong linkages with government authorities; neither SDC nor SAC had ties with any third-sector actors given the absence of prominent collaborative programmes between these sectors. Ties between the public and third sectors manifested through two primary channels—most of the third-sector members had ties with BCA, MEWR, PUB, and SPRING, whereas public-sector actors tended to demonstrate relationships with SWA due to routine events in the water industry.

Overall, the network map can be used to interpret relationships based on recent contacts between policy stakeholders in the three sectors. The interconnectedness of diverse stakeholders representing governmental authorities, businesses, and wider society regarding sustainability issues is promising for sustainable tourism policy development. Given the sampled stakeholders, the map identified
different patterns of stakeholder relationships from a whole-network perspective. These patterns indicate a degree of network-based policymaking around WDM in Singapore’s hotel sector.

The characteristics of whole-network analysis and ego-centric network analysis have been addressed in previous research [33]. Whole-network analysis presents certain pitfalls related to sampling limitations. Thus, the focus of our study was on the ego level—that is, networks connected to a single node (i.e., an individual policy stakeholder) were investigated to describe the total population. A crucial characteristic of contact networks involves relationships among individual nodes scattered throughout the network [68]. Network measures of individual stakeholders (e.g., consulting and advisory service providers, PUB, hotel entities, and SHA) were therefore considered in this work. The following section presents an analysis of the ego-centric network measures and structure of the network to facilitate a clearer understanding of structural patterns behind stakeholder relationships in the policy network.

4.2. Underlying Structure of Policy Stakeholder Network

One way to assess the network structure of organisational stakeholder relationships in the policy domain is to evaluate network centrality and density, which respectively reflect the prominence of actors in the network and the level of connectedness (or cohesion) between them [33].

Degree centrality is generally considered the most intuitive pattern of centrality [69], referring to the total number of others to whom a focal node is directly tied, ignoring the direction and value of ties. The in-degree centrality measure has been deemed a remarkably stable indicator of network position “even at a low sampling level” [70] (p. 291). Furthermore, Freeman [71] developed a method to convert centrality measures into “normalised” centrality measures. In other words, degree centrality scores can be converted into proportions, thus enabling researchers to compare the centrality of actors from one network to another. Those who exhibit numerous ties and high in-degree centrality are significant, as many other nodes will attempt to establish direct connection with them to receive information, resources, and similar benefits. The in-degree centrality measure in this study revealed that consulting and advisory service providers, PUB, and hotel entities had the highest number of contacts in the network; all three groups were policy partners with over 90% of stakeholders/stakeholder groups (see fourth column in Table 2). That is, they shared contacts with more than 90% of respondents through postings, newsletters, official conferences, on-site visits, surveys, workshops, public forums, joint programmes, or co-membership. Active policy actors included water service companies/water solutions, BCA, water-wise fixture suppliers/plumbers, MEWR, SPRING, hotel building owners/equity investors, hotel property developers/architects builders, and SWA. These actors had contacts with at least 70% of policy stakeholders in the network. Although these stakeholders also demonstrated more contact ties than others, CLC and SAC as well as SDC and EDB had far fewer contacts (see third column in Table 2). These four organisations were connected with less than 30% of others (see fourth column in Table 2), suggesting that not all policy stakeholders were actively involved in the network—some were more central, whereas others tended to be peripheral. Nonetheless, results imply that no policy actors were entirely isolated in this network. All respondents had contacts with another actor in the policy context.

Another characteristic of a network is density, defined as the number of ties existing in a network relative to the number of relationships theoretically possible [72]. Analytically, density is the coefficient between the number of actual ties and the number of maximum ties calculated on the basis of network size [73]. To investigate the number of ties linking policy actors in a network, UCINET VI was used to calculate density measures for the 33 stakeholders/stakeholder groups in this study. Density was used to determine the structural characteristics of contacts, denoted by a value ranging from 0 to 1. A network (based on contacts) can be dense (with numerous ties) or sparse (with few ties).

For the present study, a high-network density suggests a high degree of cohesion or connectedness among stakeholders in the policy context. The density of the network is 0.56, considered relatively high. This density may indicate a high overall cohesion in the network along with some potential to
connect to more policy stakeholders via future contacts. Relatedly, the degree centralisation index of 42.29% indicates a relatively flat network structure. Thus, certain policy actors (if not a single one) in the network tend to be much more central than others. As the score approached 50%, certain (more collaborative) policy actors (e.g., consulting and advisory service providers, PUB, and hotel entities) tend to have high core-periphery structure, and thus would exert stronger influences over the outer layer in the network [69]. Optimally, however, a decentralised network structure makes the diffusion of information relatively efficient—once any one of the actor(s) has news of the innovation, the rest of the network can quickly hear [31].

Table 2. Network Measures of Current Contacts.

<table>
<thead>
<tr>
<th>Rank</th>
<th>Stakeholders</th>
<th>In-Degree Centrality</th>
<th>Normalised In-Degree Centrality (%)</th>
<th>Stakeholders</th>
<th>Density (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Consulting</td>
<td>31</td>
<td>96.88</td>
<td>CLC</td>
<td>100</td>
</tr>
<tr>
<td>2</td>
<td>PUB</td>
<td>30</td>
<td>93.75</td>
<td>SAC</td>
<td>100</td>
</tr>
<tr>
<td>3</td>
<td>Hotel entities</td>
<td>30</td>
<td>93.75</td>
<td>SEC</td>
<td>97.78</td>
</tr>
<tr>
<td>4</td>
<td>Water solutions</td>
<td>28</td>
<td>87.50</td>
<td>EDB</td>
<td>97.22</td>
</tr>
<tr>
<td>5</td>
<td>BCA</td>
<td>26</td>
<td>81.25</td>
<td>STB</td>
<td>96.97</td>
</tr>
<tr>
<td>6</td>
<td>Fixtures/Plumbers</td>
<td>26</td>
<td>81.25</td>
<td>SSWIEA</td>
<td>91.43</td>
</tr>
<tr>
<td>7</td>
<td>MEWR</td>
<td>25</td>
<td>78.13</td>
<td>SPS</td>
<td>89.54</td>
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Note: See Table 1 for full titles of abbreviated organisation names.

In light of cohesion at the whole-network level, it was difficult to identify how and to what extent a specific policy stakeholder was embedded in the entire network. An actor-centred (or ego network) analysis was therefore required to clarify a policy actor’s condition in establishing connections with others in current contacts. In this study, ego-network analysis of density was performed on all 33 stakeholders/stakeholder groups (see the last two columns of Table 2). Consulting and advisory service providers, PUB, hotel entities, water service companies/water solutions, BCA, and water-wise fixture suppliers/plumbers demonstrated the largest ego networks according to the number of ties received (see third column in Table 2). These actors were directly linked to more than 26 (81%) of the 33 stakeholders/stakeholder groups listed (see fourth column in Table 2). The degree of linkage among the 33 network members for these six stakeholders was lowest (roughly between 55% and 64%) (see fifth and sixth columns of Table 2).
The normalised in-degree centrality measure is also included in Table 2 to clarify the difference between in-degree centrality and density. Taking the stakeholder group of hotel entities as an example, the number of hotel entities’ ties with other stakeholders indicates an in-degree centrality of 30 (see third column of Table 2). Because 33 stakeholders/stakeholder groups were identified, the number of ties in the hotel entity group was divided by the number of other stakeholders in the network (i.e., 32) to obtain the normalised degree centrality measure. The result, 93.75%, indicates that hotel entities had contacts with 93.75% of network members related to WDM in Singapore’s hotel sector; however, hotel entities did not exhibit a dense individual (or ego) network. The level of linkage among the other 32 network members (i.e., density) for hotel entities was 58.85%. Accordingly, nearly 60% of all possible ties were present. A figure of 0.59 cannot be considered an absolutely weak density measure, as the density measure could be any number between zero and one [69]. Nevertheless, this density measure was relatively low compared with that of most others. Stakeholders with the highest density measures (one) for all possible ties were depicted in the ego networks. Both actors exhibited small-sized ego networks (CLC: 3; SAC: 6). SEC, a third-sector member, had the third-highest density measure of 97.78%, demonstrating nearly all possible ties in its individual network. SEC also had a small ego network size (10) based on the number of received links (i.e., formal and/or contacts) with regard to in-degree centrality (see third column of Table 2). Contrastingly, the third-sector member, SWA, with a relatively large ego network size of 23, had a relatively low density measure (66.01%) [59]. Network analysis studies have shown that network density tends to decline when network size increases and vice versa [31]. Our findings strongly support this argument. Highly dense (ego) networks tend to prevent ties with others outside this “small world”, thereby limiting new information exchange and potential collaboration [74].

To sum up, policy stakeholders with high degree centrality measures (e.g., consulting and advisory service providers, PUB, and hotel entities) tended to comprise the core of the network. They were pivotal policy actors with considerable influences in terms of network information flow. No actors from the third sector were found to make prominent policy-related contribution. By contrast, actors with high centrality measures often exhibited a relatively low density score in their individual networks. These factors suggest that policy actors with favoured structural positions (e.g., consulting and advisory service providers, PUB, and hotel entities) should strive to ensure stakeholder interaction and engage actively in cross-sectoral collaboration in policymaking, the absence of which presents a major policy challenge to sustainable tourism development.

4.3. Stakeholder Salience

To locate legitimate, powerful, and urgent policy stakeholders of WDM in Singapore’s hotel sector, questionnaire data were analysed to determine whether central stakeholders were among the salient stakeholders. If an actor is well connected with others, one can be arguably critical, as it is more likely to have access to different non-redundant sources of information [33]. Three measures were combined via a 3-D scatter plot (Figure 4). When scaled to 100%, the x-axis denotes policy stakeholders’ problem-solving capacity (power), the y-axis denotes their acceptability (legitimacy), and the z-axis denotes trustworthiness (urgency). The relative position of each policy stakeholder in this 3-D space provides an overview of their overall salience in the network.

Figure 4 reveals PUB and BCA as salient policy stakeholders. Both were highly involved in policy composition, enabling them to assert government control over policymaking. SHA exemplified a highly balanced policy actor according to the stakeholder attribute criteria. Therefore, the hotel industry association was the only representative of the third sector to achieve a relatively high overall ranking in the scatter plot. After SHA, hotel property developers/architects/builders, hotel entities, and consulting and advisory service providers were relatively balanced policy stakeholders per the chosen criteria.
By contrast, many third sector members, as well as some public authorities, could be considered less salient stakeholders. As can be observed in Figure 4, the Singapore Sanitary Ware Importers and Exporters Association (SSWIEA), WWS, REDAS, Association of Consulting Engineers, Singapore (ACES), media/press, universities, and polytechnics were relatively close to zero on all three axes. None of them were centrally located in the network either.

Overall, all policy stakeholders/stakeholder groups with high salience except for NEA and SHA were among the top 10 policy stakeholders with relatively high levels of in-degree centrality (Table 2). Respondents’ overall scores revealed PUB to be the most prioritised stakeholder with the highest centrality. PUB also played a bridging role in inter-sector networking, enabling contacts between clusters to be established and maintained. Developing contacts with less connected or peripherised policy actors could alleviate inter-sector isolation while improving the legitimacy and acceptability of sustainable tourism policies. Moreover, respondents did not appear to consider any private- or third-sector policy actors to be the most salient ones, although some private-sector members (e.g., consulting and advisory service providers and hotel entities) occupied the central positions accordingly to the survey results. Comparatively, four policy actors with relatively high levels of centrality (i.e., water service companies/water solutions, water-wise fixture suppliers/plumbers, SPRING, and hotel building owners/equity investors) were not found to be highly salient stakeholders. This pattern concurs to some extent with the assertions from Prell [59] that “degree centrality is . . . seen as a measure for an actor’s level of involvement or activity in the network. It does not consider whether or not an actor is seen as influential or popular” [59] (p. 17). Again, it is observed that only the stakeholders with high levels of centrality and with access to or possession of critical resources are perceived to be salient in the policy network.

5. Discussion

Stakeholder collaboration in pursuit of common goals in sustainable tourism is determined by the stakeholder relationships established in a policy network [75]. To create an environment
where collaboration on sustainable tourism policy formulation and implementation could be realised, a policymaking framework for WDM in Singapore’s hotel sector was introduced (Figure 5). Our findings suggest that different stakeholders can play crucial roles in developing sustainable tourism policies, some public sector bureaucracies (e.g., PUB) are expected to assume prominent roles in the policy field. Naturally, this government player scored high on stakeholder attributes given its oversight of Singapore’s water sustainability. Sustainable tourism policymaking may therefore appear subordinated to administrative or political priorities. Also, the government bodies had been well-connected with other policy actors within the past 12 months. Considering the fragmented nature of tourism, participation and involvement of broker stakeholders is crucial for the achievement of sustainable tourism development goals [35].

**Figure 5.** Policymaking framework for water demand management (WDM) in Singapore’s hotel sector. Note: See Table 1 for full titles of abbreviated organisation names.

Notably, no dominant public authorities were typical players in the tourism and hospitality industry. For instance, the role of PUB pertained to sustainable water management in Singapore. The following commentary from Mr. Lee Kuan Yew, Singapore’s founding father, could explain why diverse stakeholder respondents expected the PUB to assume a prominent role in the policy domain: “… [water] dominate[s] every other policy. Every other policy [must] bend at the knees of water survival” [55] (p. 189) as Singapore’s demand for water far exceeds its naturally occurring supply [76]. In addition, our findings empirically confirm the multidisciplinary and complex nature of sustainable tourism and the significance of environmental government agencies’ roles in sustainable tourism policymaking [1,75].

As Singapore’s “government cannot be expected to solve our public problem in isolation” [77] (p. xviii), some private sector members, including consulting and advisory service providers and hotel entities, are also important in policymaking. Although the island’s hotel sector has achieved robust growth in the last decade or two [44], sustainability challenges in water-intensive sectors are becoming increasingly evident [78]. Therefore, other policy stakeholders may have numerous ties to consulting and advisory service providers and hotel entities during the design, construction, operation, and occupation stages related to WDM matters.

Unlike in the public and private sectors, no third-sector member necessarily played a consistently important role in sustainable tourism policymaking. From a policy network perspective, it is essential to cooperate with various sectors; achieving sustainable tourism would be rather difficult otherwise [75]. As greater integration in the tourism policy domain is considered a prerequisite to more sustainable outcomes [79], it is crucial for central policy actors to link other actors in the network. The ability to act as a “broker” relies heavily on central players’ abilities to forge connections among other network
entities [68]. For example, SHA, the umbrella body for hotels in Singapore, could be considered an emerging third-sector member in the policy context.

These findings highlight that policy stakeholders from all three sectors perceive sustainable tourism policymaking to be more than a tourism-sector responsibility. Instead, many other (non-tourism) organisations concerned about sustainability issues may be incorporated into relevant discussion. Some scholars have supported decentralised policymaking, especially through combining the government, industry, and community [15,80]. However, governmental authorities can appear irresponsible if they work alone to devise solutions to integrated economic, environmental, and social problems. For instance, other policy stakeholders’ greater dependence on PUB increases the likelihood that they would regard PUB as powerful. This attitude could then allow the national water agency to hold a more central position and become even more influential in the policy context. Ideally, policy networks for sustainable tourism development would be non-hierarchical [75]. Yet, this case study of WDM in Singapore’s hotel sector suggests that an ideal policy network “occurs very rarely, if at all” in reality [81] (p. 5).

6. Conclusions

This study applies classical stakeholder analysis and a network analysis approach to investigate relationships among stakeholders in a sustainable tourism policy context. Focus is given to a specific policy arena, namely WDM in Singapore’s hotel sector, as this is considered an exemplar domain for the development of sustainable tourism.

Stakeholder analysis provides valuable insights into policymaking, as stakeholder involvement is integral to sustainable tourism development [1]. In tourism policymaking, various stakeholder perspectives must be taken into account, including those of responsible government authorities, industry players, and NGOs [75]. A depiction of a policy framework through which sustainable tourism policymaking may be realised was generated by identifying key stakeholders through questionnaires, after which three core characteristics (legitimacy, power, and urgency) were employed to distinguish important and less important policy stakeholders in sustainable tourism policymaking.

Through the use of social network analysis in this study, central stakeholders in policy development were identified. The existing structural positions of stakeholders displayed that consulting and advisory service providers, PUB, and hotel entities possess extremely high centrality. The network size and cohesion further revealed the apparent openness and vibrancy of WDM in Singapore’s hotel sector as a policy system. Although the policy system was found to include collaborations centred around some stakeholders, the interrelatedness of multiple stakeholders denotes a trend in cross-sector collaboration in sustainable tourism.

This study also investigated whether an actor’s central position is well-established because that actor is considered a salient stakeholder, or is an actor considered a salient stakeholder because it has connections to numerous policy actors? In the case of Singapore, both statements appear to apply. The leadership role of national water agencies in the sustainability-related policy domain—in this case, PUB—is of relevance to practitioners in this case study destination but also other water constrained destinations and other natural resource management issues.

Is the current structure of policy stakeholder network good? This research does not provide the answer, and causes and consequences of policy network attached to environmental and organizational antecedents are to be discussed elsewhere. However, the network analysis does strongly suggest that sustainable tourism in particular does not represent a traditional public policy domain. The complexity of tourism’s interactions with the “natural” environment (e.g., water resource) and the inclusion of other concerns (e.g., social, cultural, and economic) have become critical issues to address [14]. Governments, businesses, and non-government organisations are looking for ways to minimise the environmental impacts of tourism while simultaneously continuing to enjoy the socio-economic benefits that tourism can generate [82]. Therefore, embeddedness of policy stakeholders echoes the nature of sustainability-driven policymaking. In other words, policymaking has to stretch beyond
sectoral boundaries to devise solutions that are acceptable and responsive to challenges in sustainable tourism [75]. The interaction of multi-stakeholders reflects different patterns of network structures, which influence the relative salience balance between central policy stakeholders and others. The central stakeholder should be the one with highest centrality measure and the most important one perceived by others. In the long-term, increased participation of cross-sectoral stakeholders with mitigated “structural holes” are likely to become fully interconnected. This study argues that sustainable tourism is a process of interaction and an outcome of collaboration. Achieving sustainable tourism would rely on the extent to which a destination creates a participative model in which policy stakeholders are involved, and their interests and concerns should be included in a sustainable tourism policy system. Thus, there is a need for establishing and maintaining sustainability policy networks at destinations to improve the process of sustainable tourism development at destinations. Despite the valuable and interesting findings of this research, the causes and consequences of network structures and stakeholder salience have yet to be examined. We recommend that further studies incorporate qualitative methods to supplement the quantitative results; qualitative findings may reveal and justify additional stakeholder attributes and the interactional nature of relevant relationships. For example, open-ended questions may facilitate more in-depth interpretation of the quality and content of interaction between and among public-, private-, and third-sector members. Although social network analysis serves a useful analytical tool for the scrutiny of structure of current contacts networks in this study, little has been done to compare it with that of other natural resources management. Also, the diverse WDM policy themes (e.g., pricing and non-pricing mechanisms), their linkages, policy preferences of divergent stakeholders, and longitudinal analyses of structural changes in stakeholder collaboration deserve stronger attention in another research.

Further, this study concentrates on the outcome, rather than the communication channel, per se. Formal and informal contacts are considered to be equally important in providing an in-depth insight into how a divergent group of policy stakeholders interact at a destination. Future research could focus on the possibly different functions that formal and informal contacts may respectively serve, as comparative studies of different types of relationships would further increase the validity of the test results [75].

Another limitation was related to plenty of responses that came from certain stakeholder groups (e.g., hotel entities). The stakeholder analysis was examined at an average level, thus no specific individual variables were taken into consideration. Further, larger-sized stakeholder groups are highly likely to have contacts with other policy actors, which would favour “normalised” centrality of these stakeholder groups. The results could reflect biases from these stakeholder groups.

Finally, attempting to ameliorate criticism of the generalised case study to theory, this study is conceptually framed within a blended network approach, which allows a logical investigation of a “real-life phenomenon in depth” [75] regarding stakeholder network structure, the pattern of stakeholder relationships, and how the structure of relations among stakeholders can influence water policymaking system in Singapore’s hotel sector.

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References

17. Hadjikakou, M.; Miller, G.; Chenoweth, J.; Druckman, A.; Zoumides, C. A comprehensive framework for comparing water use intensity across different tourist types. J. Sustain. Tour. 2015, 23, 1445–1467. [CrossRef]
30. Lienert, J.; Schnetzer, F.; Ingold, K. Stakeholder analysis combined with social network analysis provides fine-grained insights into water infrastructure planning processes. J. Environ. Manag. 2013, 125, 134–148. [CrossRef] [PubMed]
51. Becken, S. Water equity—Contrasting tourism water use with that of the local community. Water Resour. Ind. 2014, 7–8, 9–22. [CrossRef]


64. Timur, S. A network perspective of stakeholder relationships in the context of sustainable urban tourism. In Haskayne School of Business; University of Calgary: Calgary, AB, Canada, 2005.


