

Article

Illuminating Opportunities for Smart Tourism Innovation That Foster Sustainable Tourist Well-Being Using Q Methodology

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Abstract: Technology innovation has become one of the driving forces that advance the tourism industry, but the industry has yet to account for the manner in which personal technologies can foster tourists' sustainable well-being. Generating innovation that promotes the sustainable well-being of individuals is deemed to be challenging because the experience needs to account for users' psychological well-being and their attitudes towards technology. A holistic apprehension of these needs, which requires multidisciplinary perspectives, can help designers to identify design spaces for further design investigations at the fuzzy front-end of innovation. Hence, the goal of this study is to identify design opportunities for smart tourism innovation that foster sustainable tourist well-being by using Q methodology to gather participants' attitudes on the future use of such technology. The study involved 43 participants ranking 46 statements derived from the extant literature. The results show four opinion clusters related to the optimal use of personal technologies for sustainable tourist well-being. These clusters, which highlight both hedonic and eudaimonic user experience considerations, provide directions for designers for developing innovations that promote well-being. Recommendations of using Q as an exploratory design research method are discussed.

Keywords: sustainable tourist well-being; technology-mediated experiences; smart tourism innovation; fuzzy front-end; Q methodology



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1. Introduction

The contribution of technology to the tourism ecosystem has continued to grow from the digitization and strategic management of products and services [1] to the recent emergence of smart tourism characterized by the widespread adoption of personal technologies, big data, and networked devices [2]. These technologies contribute to tourists' experience in a wide range of ways through personalization, context awareness, and real-time monitoring [3]. The interactions with these personal technologies have implications for users that may foster their well-being [4] or cause negative effects such as privacy concerns [5] or addiction leading to social disengagement [6]. Since technology could have both positive and negative impacts on tourist experience [7], designers need to closely examine how technology can foster the well-being of tourists.

However, technology designed for sustainable well-being is still in its infancy because of the difficulty involved in identifying and measuring well-being indicators in digital technological space [8] and addressing the subjective and implicit psychological needs of users [9,10]. Moreover, designing for well-being requires a coordinated effort across multiple disciplines to gain diverse perspectives [11]. The insights gained can inform the conceptualization of services, contents, and features at the fuzzy front-end of innovation (FFI). The FFI is considered a crucial stage in design that aims at identifying desirable design directions prior to the formal design development process [12].

The goal of this research was to identify design opportunities for smart tourism innovation capable of fostering tourists' well-being. By eliciting tourists' opinions and attitudes on how technologies can foster their well-being, this study aimed to provide

guidance for designers about the well-being needs and concerns of potential users. The results provide directions and recommendations for smart tourism designers to develop well-being enabling innovations. Also, this study contributes to filling the knowledge–practice gap on smart tourism innovation that fosters well-being.

2. Literature Review

2.1. Smart Tourism and Tourist Well-Being

The ubiquitous nature of personal technologies has made them a part of the tourism experience. They allow tourists to make better purchase decisions, navigate a destination, share experiences with others, and make their journeys unique through personalization [13]. The technologies that make this possible are considered as being smart because they transform tourists' experiences by fulfilling users' functional needs [14]. However, recent literature on human–computer interaction [15,16] indicates that technology should go beyond utilitarian purposes by enabling the sustainable well-being of users. This can be achieved by developing technology-mediated solutions that address the psychological needs and values of users as highlighted in positive psychology [17].

Positive psychology seeks to uncover the conditions and processes that contribute to the sustainable well-being or optimal functioning of ordinary people, groups, or institutions [18]. Two perspectives about well-being have been recognized: hedonia and eudaimonia [18–20]. Hedonia refers to experiencing positive emotions, avoiding negative emotions, and being satisfied with one's life [21]. Eudaimonia, on the other hand, considers more long-term beneficial, self-developmental, and transformational outcomes [21–23]. While tourists' sustainable well-being as an outcome of tourist experiences has started to gain traction in tourism studies [19,23], the way it can be incorporated into smart tourism innovation remains largely under-researched [24].

Two challenges hinder the development of smart tourism innovation. First, tourism well-being is concerned with both subjective and psychological well-being, which are idiosyncratic and implicit to individuals [25]. Also, the use of technology can enhance the tourism experience in one aspect but decrease it in another [26]. For instance, technologies can provide tourists useful recommendations, but also may cause information overload, privacy concerns, fear of missing out, and distraction [27–29]. The second challenge is tourists' attitudes towards the acceptance of new technology [5]. While the technology acceptance model [30] was based on tourists' cognitive attitude (i.e., the perceived usefulness and ease of use) towards a technology, recent studies [10,31] suggest considering people's subjective and affective attitudes towards technology acceptance to embrace the potentials offered by new technologies. More importantly, these subjective aspects of experience should be captured at the early stage of an innovation process before the development of product/service content and features.

2.2. Capturing Subjective and Affective Attitudes at the Fuzzy Front-End of Smart Tourism Innovation

Tourist attitude refers to a predisposition or tendency to respond positively or negatively toward a certain idea, object, person, or situation [32]. Capturing tourists' subjective and affective attitudes on a smart tourism innovation at the early stage of development can increase the speed of product development and the chance of success in the market while reducing the overall development cost [33]. This stage of development is known as the fuzzy front-end of innovation (FFI)—a stage that involves establishing consensus and identifying plausible design directions and opportunities before the development of product/service features and content [34]. Here, conceptualizing innovations that foster tourism well-being requires the synthesis of knowledge across different disciplines [35–37] such as positive psychology [23], tourism well-being [38], and tourism experience design [24]. Probing into tourists' subjective and affective attitudes allows design team members to be in agreement when discussing, exploring, and envisioning design propositions. Thus, the research was poised to answer the following research questions (RQs):

RQ1. What are tourists' attitudes and opinions on the adoption of smart tourism technologies that foster their well-being?

RQ2. Pursuant to RQ1, what would be the considerations for designers to incorporate these attitudes?

This study used Q as an elicitation method to capture the values, attitudes, and opinions of potential users on future technology adoption. Q was an appropriate research method for this study because the concept of well-being is multifaceted, and well-being outcomes are subjectively appraised. Unlike a survey questionnaire, Q uses a ranking order to show how different well-being outcomes are valued among themselves by the research participants. Then, the participants are interviewed to explain the choices made. Therefore, Q offers researchers a gestalt view on participants' well-being desirability and concerns that are crucial to the development of a new product and service. Stergiou and his colleague [39] introduced Q to tourism study to explore the subjective viewpoints of participants. In this study, Q ensured that researchers explored multidisciplinary knowledge about well-being determinants and formulated statements from the users' standpoint. Using these statements can unearth participants' subjective and affective attitudes on using the technologies for their well-being. The results provide recommendations for a design team to identify plausible design directions prior to the development of a product, service concept, and features.

3. Methodology

3.1. Exploring Attitudes about Future Technology Adoption for Sustainable Well-Being through Positive Tourism Experiences

Q-methodology is an exploratory research method often used by researchers to probe into the attitude of people about an interest [40], and findings from Q aim to offer a gestalt view about people's subjective opinion on a particular topic. Conducting Q involves five steps. The first step involves defining the discourse of investigation. To this end, the researchers aimed to know participants' attitudes and opinions on how technology can be used to enrich their tourism experiences for their sustainable well-being. The more layman term "enrich" was used to elicit their desire regarding these well-being attributes in relation to the opinion statements. In the second step, a collection of opinion statements (known as Q set in Figure 1) were generated with reference to current literature. These statements covered different dimensions of technology-mediated positive tourism experiences. Also, statements on potential barriers (i.e., risk and trust) that users may encounter in technology adoption were included. Then, a group of potential users were invited to sort and rank the Q set from their perspectives on a quasinormal distribution grid and subsequently interviewed on the choices made (known as Q sort in Figure 1). Lastly, factor analysis was conducted on the dataset collected and identified factors were interpreted. Insights found in these factors provide practical direction for further design development. Figure 1 shows the research framework for this study.

3.2. Statements on Technology-Mediated Positive Tourism Experiences: The Q Set

The Q set is a collection of 40–80 statements that represent different viewpoints on the topic under investigation [41]. While these statements can come from various places, media, interviews, scholarly articles, and reports are the most trustworthy sources for these statements [41]. The Q set in this study drew reference from two areas of literature: tourism experiences derived from positive psychology, and the negative consequences that may emerge from technology used (refer to Table 1 for the collection of literature used). The former category of literature allows investigators to identify experiences that are valuable, and significant to tourists. These experiences can be associated with distinct stages of their journeys (e.g., pre, on-site, post), the activities (e.g., experience local culture, visit a landmark) tourists participate in during their journeys, and most importantly, psychological benefits as a result of participating in these activities (e.g., learning new knowledge and strengthening relationships). The latter category of literature is on factors that hinder

technology adoption. Diamond and her colleagues [42] proposed using trustworthiness factors (e.g., privacy, security, reliability expectation) and self-compatibility factors (e.g., actual self, ideal self) to probe into attitudes on potential technology adoption. Hence, the researchers incorporated these dimensions to complement the psychological benefits to tourists (e.g., “I hope technology can show me how my journey made me a better person”; “I want to know the privacy risk involved when I am using travel technology”).

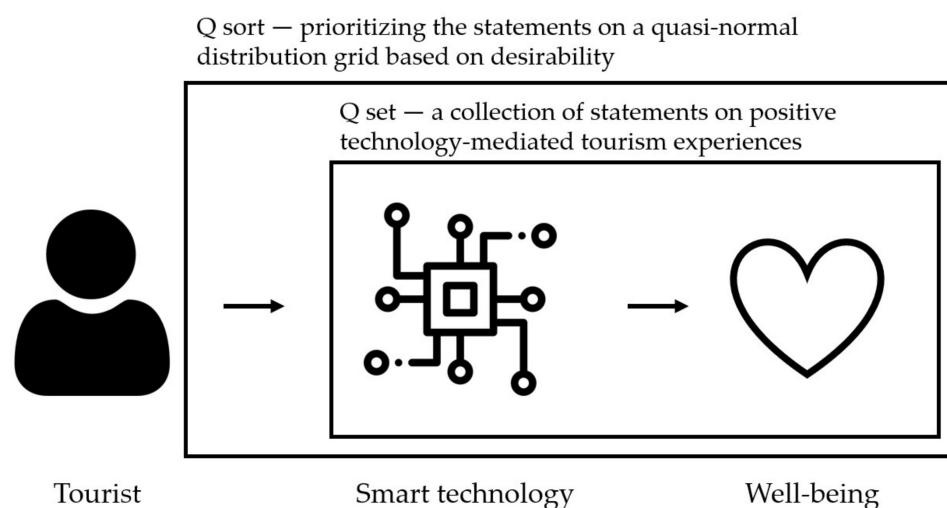


Figure 1. Research framework.

Using 16 core articles that describe the themes of positive psychology, meaningful and memorable travel experiences, and technology usage, the researchers generated 31 associated subthemes through which the statements were developed (Table 1). A total of 139 statements were generated in the first phase, then gradually narrowed down to 46 statements (Appendix A) by eliminating overlapping statements through two rounds of pilot tests. This was done to increase the comprehensiveness of the Q set [41,43]. These statements were framed to succinctly capture the manner, condition, and degree to which the participants wanted technology to enhance their travel experiences in a positive way. Also, further explanation about the statements was printed on the back of the card in the case of need. For example, the meaning of “autonomy” was explained as independence and having the power to make one’s own decisions. This was done to help the participants understand the intended meaning.

Table 1. Deconstructing themes and subthemes into statements.

Knowledge Topic	Theme	Subthemes	*Statement Numbers	References
Psychological well-being in positive psychology	Eudaimonia	Growth, development of potentials, excellence,	1, 3, 13, 21, 22 30, 37, 46	[23,44–47]
		Meaning, contributing to the broader context	11, 28, 29, 45	
		Authenticity, identity, autonomy, character strength	3, 5, 6, 22, 25, 37, 46	
		Positive relationship, social well-being	4, 7, 11, 18, 44	
		Physical health	16	

Table 1. Cont.

Knowledge Topic	Theme	Subthemes	*Statement Numbers	References
Travel Experience	Hedonia	Enjoyment, happiness	10, 12, 23, 27	[23,45,48,49]
		Relaxation, low distress	17, 38, 39,	
	Meaningful and memorable experience	Self-development, learning	2, 3, 13, 20, 21, 22, 30, 37, 46	[23,48,50–54]
		Authentic local experience, local hospitality	8, 19, 20, 26	
		Affective emotions	9, 14, 34,	
		Perceived significance	3, 6, 8, 11, 25, 28, 45	
		Novelty, surprising experience	9, 15, 24, 40	
		Social interaction	2, 4, 7, 10, 13,	
		Service providers (in relation to technology use)	33, 36, 41, 42	
Models of Technology Use	Technology usage and acceptance	Usefulness/functions	31, 33, 41, 44	[5,55,56]
	Perceived Trust	Privacy	35, 36, 43	[56,57]

* Refer to Appendix A for the full list of statements represented by the numbers in the table above.

3.3. Sampling and Data Collection

Purposive sampling was used in this study. Participants needed to be regular users of travel technologies and digital platforms for their journeys (e.g., social media, itinerary planning, wayfinding platforms, etc.). Participant recruitment was performed via posters in a university campus in Hong Kong as well as social media sites. A total of 43 participants, who comprised 53% females and 47% males with an age range of 18–62, were recruited. Nationalities included 47% Hong Kong (SAR), 23% Chinese, 9% Indians, 5% Koreans, and 2% from other countries.

The sorting process, which was conducted individually, involved four steps (Figure 2). First, the participants were briefed on the study. Three items were put on the table: a deck of 46 cards (Q set) on which the statements were printed; a quasinormal distribution grid, ranging from −4 (disagreement) to +4 (agreement), on which the cards would be sorted; and a printed instruction sheet that guided the participants in the card sorting task. In the second step, the participants were introduced to the topic: “How would you like technology to enrich your travel experience?” Then, they were asked to read all the statements and split them into three piles: the items they agreed with, the items they were neutral on, and the items with which they disagreed. The third step was about placing the statements onto the grid, starting with the items they most agreed with, then moving on to items they were neutral on and disagreed with. The last step involved an interview with the participants on their views on the items they most agreed and disagreed with. These were the statements that the participants felt strongly about.

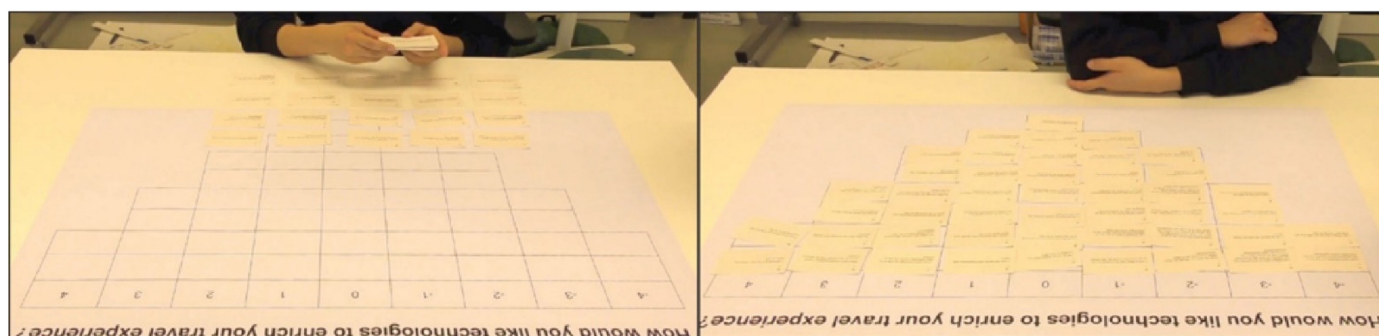


Figure 2. Sorting process.

4. Results

4.1. Analysing Tourists' Attitudes Using Factor Extraction

The KenQ web application for Q analysis was used for data analysis (<https://shawnbanasick.github.io/ken-q-analysis/>, accessed on 25 November 2019). The centroid factor extraction method was adopted based on the recommendation in the literature [40], and six factors were initially extracted. All factors produced an eigenvalue above 1.00 with more than two significant sorts, which met the basic criteria for factor selection. The value for a significant sort loading on a factor was calculated as $2.58 \times (1 \div \sqrt{\text{no. of items in Q set}})$ [40,58]. Hence, the significant sort for this study was calculated as:

$$2.58 \times (1 \div \sqrt{46}) = \pm 0.38.$$

However, further scrutiny of the dataset revealed that four-factor extraction was more representative because it captured more sorts and was more suited to the research goal. Although a bipolar sort was found in factors 1 and 2, they were not considered as separate factors. This was because they did not meet the compulsory two significant loading requirements for any opinion cluster to be considered as a factor [40].

The four factors extracted accounted for 41% of the total study variance. Factor characteristics exhibited good composite reliability at >0.95 (Table 2) and factor correlations were low (Table 3) [40]. The lower correlation suggests that the viewpoints captured were more distinct among these factors [43]. Varimax rotation was applied and flagged at $p < 0.01$ to generate sorts that were statistically relevant to the factors extracted.

Table 2. Factor characteristics.

	Factor 1	Factor 2	Factor 3	Factor 4
No. of Defining Sorts	6	8	9	6
Avg. Rel. Coefficient.	0.8	0.8	0.8	0.8
Composite Reliability	0.96	0.97	0.973	0.96
S.E. of Factor Z-scores	0.2	0.173	0.164	0.2

Table 3. Factor score correlation.

	Factor 1	Factor 2	Factor 3	Factor 4
Factor 1	1	0.2145	−0.1668	0.1158
Factor 2	0.2145	1	−0.0597	−0.1436
Factor 3	−0.1668	−0.0597	1	0.2762
Factor 4	0.1158	−0.1436	0.2762	1

Of the total 43 sorts, 29 were significantly loaded across the four factors at ± 0.38 , 4 had less than the significant value threshold, and 10 were significant but confounded across more than one factor. These confounded sorts were eliminated to maintain factor purity [58].

4.2. Factor Interpretation

Factor interpretation is based on three pieces of evidence: the distinguishing statements of the factor (Appendix A), the crib sheet (Appendix B), and the interview data on the distinguishing statements [40]. The distinguishing statements are statements that define a factor based on the manner in which they are arranged along the $+/-$ axis to give meaning to the factor. The crib sheet, on the other hand, is a list of statements that are unique to a factor when compared to other factors at any ranking position. Using statements from the crib sheet can complement the distinguishing statements of a factor, thereby producing a distinctive interpretation [40]. Interpretation can be further supported by the interview data on the distinguishing statements collected at the end of the sorting process.

The four factors were named after the key opinions expressed by the participants. Details of the components and interpretation of each factor are given below. In the following interpretations, the numbers in parentheses refer to distinguishing statement numbers. The statements marked “CS” in parentheses are statements from the crib sheets.

4.2.1. Factor 1: I Want Technology to Empower My Social Engagement, but Not in an Intrusive Way

Factor 1 had an eigenvalue of 8.04 and was found to explain 19% of the study variance. Six sorts, which comprised three males and three females, loaded significantly on the factor. The participants stated that they want technology to enrich their social experience with their travel companions or with the people they meet during their journeys (statements 2, 7, 4 (CS 13)). Interview data showed that the participants envisaged that technology could facilitate experience cocreation with their travel mates through exploration of the host destination. They can forgo personal preferences because creating collective memories is more valuable to them (statement 25 (CS 37, 46)). On the other hand, digital souvenirs become the key memorabilia of these collective memories (statement 8). Technology can also help them to reminisce about these collective memories to strengthen their relationships (statement 8) after the trip.

To capture memorable moments with my family and friends is very important because it provides evidence of the time that we spent together and had a nice trip. It allows me to recall these memories later. (Participant 10)

However, they prefer that technology can be used in a nonintrusive manner (statement 27) and are more cautious of providing personal data to travel services in exchange for a more personalized recommendation (statement 33), especially when they are not fully aware of how their data will be used. Their privacy concerns may spill over to other areas such as refraining from using technology to strengthen the newly established relationship (statement 44), although meeting new people is considered to be highly desirable (statement 2). The researchers believe that trust could be an important factor that determines their technology adoption as well as their level of social engagement with others.

4.2.2. Factor 2: I Welcome Technology to Strengthen My Sense of Purpose and am Not Worried about My Personal Data

Factor 2 had an eigenvalue of 4.87 and was found to explain 11% of the study variance. It was defined by eight sorts comprising four males and four females. This factor exemplifies the opinions of people for whom travel technology serves as a means of personal development that is to be achieved by engaging in new and meaningful experiences (statements 22, 45 (CS 3, 28)), even if the experience may take them outside their comfort zones (statement 24). They can be understood as experience seekers and deep learners for whom

exploring local culture (statement 26 (CS 9, 19)) could be the trigger for personal growth (statements 22, 24, 37, 5, 20 (CS 3)). One participant explained why immersing oneself in other cultures can help personal development:

There are a lot of things to discover in other cultures, like language, art, heritage, food, etc. . . . Understanding different cultures has made me more knowledgeable, but more importantly, it expands my perspectives. (Participant 38)

Nevertheless, they are highly motivated by novel experiences. Participant 2 explained why novelty is important:

I think that if you find a recommendation based on your character strengths, you will end up doing the same thing (which he didn't like). (Participant 2)

And the desire for seeking new experiences may explain why they do not want to revisit a destination or engage in experiences that they have had before (statement 11):

. . . Even if I had meaningful and memorable experiences, I would not revisit the place. I prefer to visit some new places. (Participant 39)

In contrast with participants in factor 1, participants in this factor displayed more trust in digital platforms (statements 35, 36, 42, 43). For example, participant 38 responded to statement 42:

Of course, I do not want my data to be misused. But I assume that big companies like Airbnb will be ok. Also, I cannot use their service if I do not agree with the terms. (Participant 38)

Overall, participants in relation to factor 2 seemed to be more adventurous and optimistic about the acceptance of technology. They benefit from using technology to seek novel experiences and develop themselves. Also, they worry less about their personal data being misused.

4.2.3. Factor 3: I Want Technology to Help Me to Escape from My Stress and Remind Me of Memorable Travel Moments

This factor had an eigenvalue of 2.75 and was found to explain 6% of the study variance. Nine significant sorts were loaded on the factor, which consisted of six females and three males. This factor reflects those participants who wish that technology can help them escape from their homes and mental pressure (i.e., related to hedonia) to a destination where they have the freedom of choice (statement 5 (CS 25)). The factor encapsulates experiences that provide relaxation and fun (statements 17, 39) for pleasant memories (statements 23, 8 (CS 31, 45)). In response to statement 17, a participant summed up the factor in this way:

For leisure travel, I prefer going to places I like, away from my work and duties . . . and I hope technology can recommend these places to me. (Participant 5)

Nevertheless, there is no strong sense of attachment to these experiences because seeking meaning or purpose is considered a hassle and a hindrance (statements 20, 21, 22, 26, 28, and 2), which is against their will (statement 25). Seeking meaning and learning new skills may be too physically and mentally demanding for them. However, they are willing to use technology to capture their memorable and meaningful moments for later reminiscing (statements 7, 23) so that they can bring these valuable moments home (statement 8).

4.2.4. Factor 4: Do Not Misuse My Personal Data or I Will Kick You Away. My Privacy Is Most Important To Me

Factor 4 had an eigenvalue of 2.25 and was found to explain 5% of the study variance. This factor consisted of six significant sorts and comprised two females and four males. Collecting personal data is becoming an increasing concern for smart technology because of the security and privacy risks involved, which concerned these participants the most.

The top-ranked statements expressed how much the participants wanted to be informed of the details and the potential uses of their personal data made available to service providers (statements 36, 43, 35, 42, 32). A participant made the following comment:

I will be worried about data breaches when I need to provide my ID, phone number, and other personal information online. I expect the service provider will let me know how my data will be used. (Participant 11)

It is also surprising to see that the statements that ranked the most negatively for this factor were those centered around the potential benefits of traveling related to self-improvement (statements 4, 30, 3, 1, 21 (CS 37)). The participants showed little interest in learning, meeting local people, or self-development during their journeys. It may be that the travel journey is too short for people to develop themselves or reach any personal goal. Unlike the participants in factor 2, travel for them must allow them to stay within their comfort zones and minimize hassle, risk, and uncertainty. These notions are succinctly captured by a response to statement 2 below:

Usually, my trips are only less than one week. Therefore, I don't want to meet or travel with people I don't know. Time is too short to build trust. (Participant 13)

We have presented all four factors that represent different concerns, attitudes, and motivations regarding the use of technology to enrich the tourism experience. In the next section, we discuss the implications of these factors in the FFI.

4.3. Recommendations for Smart Tourism Designers and Developers

In addition to the four factors that highlight plausible design spaces, this study makes two recommendations for designers and developers for smart tourism innovations. First, since smart technology plays a mediating role in fostering tourists' well-being, not only do designers need to conceptualize smart technologies that could foster tourist well-being, but they must also account for how tourists' emotions towards these technologies would influence their adoption of it. For instance, factor 4 shows that fear of not being able to control the technology may push people away from adopting it even if the innovation can foster their well-being. In contrast, helping tourists to alleviate their stress can trigger their willingness to savor their experiences on later days (factor 3). Indeed, privacy is a subject of controversy, so designers should closely examine it when conceptualizing any smart tourism experience. Previous studies found that privacy is a major weakness of smart technologies [59]; however, factor 2 shows that people are willing to forgo privacy concerns for a self-transformative experience [14]. Moreover, establishing a sense of trust can also alleviate people's concerns about their privacy, which extends Gupta and his colleague's findings [60]. Second, this study shows that technology may decrease one's well-being. This can refer to the concept of experience codestruction [7,26], in which technology-mediated experiences can yield negative side effects. This study shows that people have concerns about how technology would challenge their personal agency (factor 1) and put their personal data at risk (factor 4). In sum, designers need to build a more comprehensive understanding, in terms of knowledge and application, of both hedonic and eudaimonic well-being in the context of technology mediation for sustainable smart tourism innovation.

5. Discussions and Conclusions

This study contributes to filling the knowledge–practice gaps of sustainable smart tourism innovation using Q. The goal of this study was to identify design opportunities for smart tourism innovation that fosters sustainable tourist well-being. Current knowledge recognizes hedonia (e.g., seeking positive and avoidance of negative emotions) and eudaimonia (e.g., positive relationship, autonomy, self-development, mastery, sense of purpose) as two aspects of well-being associated with tourism experiences [38,61]. Since eudaimonia is found to be more sustainable than hedonia, smart tourism may consider delivering eudaimonic experiences. However, technology can provoke undesirable ex-

periences, and thus, people's attitudes become important determinants of their adoption of new technologies [9,10,62]. Therefore, capturing these attitudes can provide designers clarity when developing smart tourism content and features. Using Q can contribute to smart tourism innovation by addressing this knowledge–practice gap by probing into people's subjective viewpoints on technology-mediated tourism experiences that foster tourist well-being. This study recognizes four opportunities where technology can improve tourists' well-being: enabling of interactions that foster social engagement, provision of learning opportunities, engendering of a sense of escapism, and application of measures that demonstrate responsible use of tourists' information. This provides a good understanding of factors that foster tourists' well-being as well as the concerns that may dampen it. Also, two recommendations for designers were proposed. First, designers need to consider both technology-mediated well-being and users' attitudes towards the acceptance of technology. Negative attitudes towards new technology may push people away from adopting it even if it can foster their well-being. Second, designers also need a more comprehensive understanding of well-being, because both hedonia and eudaimonia are reflected in all factors.

Like any design process, smart tourism innovation involves various stages of development ranging among exploratory research, generative research, and evaluative research [63]. While the technology acceptance model is more suitable for evaluative research, Q is apt for exploratory studies when concrete content and features are yet to be defined. Q offers a flexible elicitation technique for a design team to identify design spaces for innovation which is the foundation for creativity [64].

6. Limitations and Future Research

Q also has its limitations. For instance, only one research question is allowed in each Q study; thus, the design team needs to select a research question for investigation. Also, the quantitative analysis process may challenge designers who are more familiar with qualitative analysis. The Q community provides a list of software capable of analyzing the data (<https://qmethod.org/resources/software/>, accessed 25 November 2019). This study also has some limitations. The sample population was mostly from Asian countries; therefore, the factors identified may only reflect attitudes from an Asian perspective. More research is needed to explore the cultural influence on technology-mediated tourism well-being. Lastly, more studies are needed to evaluate the performance of this method in different smart tourism projects.

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Appendix A. The Q Set

Table A1. List of Statements with Distinguishing Statements for Each Factor.

Statement No	Statements	Factor 1 Sort Value	Factor 2 Sort Value	Factor 3 Sort Value	Factor 4 Sort Value
1	I hope technology can give me recommendations that match with my signature strengths.	<u>+3</u>	<u>−2</u>	<u>0</u>	<u>−2</u>
2	I want technology to help me meet people who are different from me because there is always something to learn from them.	<u>+4</u>	+2	<u>0</u>	<u>0</u>
3	I want technology to recommend trips that will help me to understand myself better.	<u>0</u>	+3	+3	<u>−3</u>
4	Technology can help me participate in activities that help me know my travel mate(s) better.	<u>+2</u>	−1	−1	<u>−4</u>
5	I want technology to help me travel in a way that reflects my authentic self.	−1	<u>+1</u>	<u>+3</u>	−1
6	I want technology to guide me to start my journey with a specific goal that is significant to me.	<u>+2</u>	0	0	<u>−2</u>
7	I want technology to help me capture memorable memories with family or friends during my trips.	<u>+2</u>	<u>−1</u>	<u>+4</u>	<u>+1</u>
8	I want technology to help me keep souvenirs to remind me of my trips.	<u>+4</u>	<u>−2</u>	<u>+2</u>	<u>0</u>
9	I want technology to help me experience something new and surprising during my trip.	+2	+4	+2	+3
10	I enjoy sharing my travel experiences with others and I want technology to support this.	+2	+1	+1	+1
11	I want technology to help me revisit the places where I had meaningful or memorable experiences.	−1	<u>−2</u>	+1	+1
12	I want technology to recommend my itinerary to others if I find it enjoyable and meaningful.	0	−1	+1	+1
13	I want technology to help me meet new people during a trip because it can broaden my horizons.	+3	+2	<u>−1</u>	<u>−1</u>
14	I hope technology can help me find challenging activities during my journey.	−1	+1	+1	−1
15	I want technology to disrupt my routine when I am travelling to a new place.	+1	0	0	0
16	I want travel technology to recommend tourism activities that can promote my health.	−2	<u>+1</u>	−3	−2
17	Travelling allows me to escape from mental pressure, and I would like technology to help me in that regard.	0	+1	<u>+4</u>	0
18	I want technology to enhance my shared memories with others for later reminiscence.	+1	0	+2	+2
19	I want technology to help me travel like a local so as to immerse myself in others' culture.	+1	+3	<u>0</u>	+2
20	I hope that technology can help me visit heritage sites (e.g., museums, historical places) so that I can learn about the history of a destination.	+3	<u>0</u>	<u>−3</u>	+4

Table A1. Cont.

Statement No	Statements	Factor 1 Sort Value	Factor 2 Sort Value	Factor 3 Sort Value	Factor 4 Sort Value
21	I hope technology can help me to learn new skills (e.g., new languages) during my trips.	+1	+1	<u>−2</u>	<u>−1</u>
22	I would like technology to recommend tourism activities that make my life more meaningful.	+1	<u>+3</u>	<u>−2</u>	0
23	I want technology to help me recall my past journeys, as this brings me sustained happiness.	0	−1	<u>+3</u>	<u>+2</u>
24	I hope technology can recommend activities beyond my comfort zone when I travel.	0	<u>+2</u>	−1	−1
25	Being autonomous is crucial to my choice of any tourism activity, and I want technology to support this.	<u>−4</u>	<u>0</u>	+3	+3
26	I want technology to help me in learning and experiencing local culture.	+1	<u>+4</u>	<u>−2</u>	0
27	I prefer staying offline (e.g., not using the Internet) to enjoy the present moment during my trips.	<u>+3</u>	<u>−1</u>	<u>−4</u>	<u>−3</u>
28	I hope technology can help me gain insights into what makes my journey meaningful and memorable.	<u>0</u>	+2	<u>−1</u>	+2
29	I want technology to help me know to what extent my journey would have a positive impact on the destination (e.g., to be more socially or environmentally responsible).	<u>−1</u>	<u>0</u>	−4	−4
30	I hope technology can help me see how my skills and competencies developed over my journey.	−2	<u>0</u>	−2	<u>−3</u>
31	I want travel technology to help me better plan my future journeys based on my past memorable tourism experiences.	−2	−2	+2	+1
32	The trustworthiness of the platform is very important to me.	−2	−3	<u>+2</u>	<u>0</u>
33	I am willing to share my personal data (e.g., my preference for food, age, purchase history) with service providers in the exchange for a more personalized recommendation.	<u>−4</u>	<u>−1</u>	−2	−2
34	I want to capture memorable moments without technology disrupting my experience.	<u>−2</u>	<u>−2</u>	+1	+1
35	I want to know the privacy risks involved when I am using a travel technology (e.g., who will see my location information, who will get hold of my credit card information).	<u>−1</u>	<u>−4</u>	<u>0</u>	<u>+3</u>
36	I want to know what personal data will be accessible to the company when using its services.	<u>−1</u>	<u>−3</u>	<u>0</u>	<u>+4</u>
37	I hope technology can show me how my journey made me a better person.	−3	<u>+1</u>	<u>0</u>	−3
38	I hope technology can help make my trip as relaxing as possible.	0	−1	+1	+2

Table A1. Cont.

Statement No	Statements	Factor 1 Sort Value	Factor 2 Sort Value	Factor 3 Sort Value	Factor 4 Sort Value
39	Travelling provides me with an opportunity to focus on myself rather than work, study, or other duties, and I want tourism technology to support this.	<u>−3</u>	−2	<u>+2</u>	−1
40	I want to be more carefree and spontaneous (without the disruption from technology) rather than travelling with a detailed itinerary.	+2	+2	<u>−2</u>	+2
41	I will delete my account (e.g., my Airbnb account) when I decide to stop using a service.	<u>+1</u>	<u>−4</u>	−3	−2
42	I want to know what the company will do with my personal data to avoid any data misuse.	−2	<u>−3</u>	−1	<u>+1</u>
43	I hope the platforms will warn me when I expose my personal data to others unintentionally.	−1	<u>−3</u>	−1	<u>+3</u>
44	I want technology to help strengthen my relationships with other people I met over my journey.	<u>−3</u>	0	−1	0
45	I hope technology can help me to look back on my past journey even if the experience is negative.	<u>0</u>	<u>+3</u>	−3	−1
46	I hope that technology can show me how my journey made me mature.	−3	+2	+1	−2

Note: Sort values underlined in each factors' column are such factor's distinguishing statements.

Appendix B. The Crib Sheet

Table A2. Supporting Statements from Each Factor's Crib Sheet.

Statement No	Statements	Factor 1	Factor 2	Factor 3	Factor 4
Relative Ranking of Statements in Factor 1					
13	I want technology to help me meet new people during a trip because it can broaden my horizons.	3	2	−1	−1
21	I hope technology can help me to learn new skills (e.g., new languages) during my trips.	1	1	−2	−1
5	I want technology to help me travel in a way that reflects my authentic self.	−1	1	3	−1
31	I want travel technology to help me better plan my future journeys based on my past memorable tourism experiences.	−2	−2	2	1
37	I hope technology can show me how my journey made me a better person.	−3	1	0	−3
46	I hope that technology can show me how my journey made me mature.	−3	2	1	−2
Relative Ranking of Statements in Factor 2					
9	I want technology to help me experience something new and surprising during my trip.	2	4	2	3
19	I want technology to help me travel like a local so as to immerse myself into others' culture.	1	3	0	2
3	I want technology to recommend trips that will help me to understand myself better.	0	3	3	−3
28	I hope technology can help me gain insights into what makes my journey meaningful and memorable.	0	2	−1	2

Table A2. Cont.

Statement No	Statements	Factor 1	Factor 2	Factor 3	Factor 4
46	I hope that technology can show me how my journey made me mature.	−3	2	1	−2
21	I hope technology can help me to learn new skills (e.g., new languages) during my trips.	1	1	−2	−1
14	I hope technology can help me find challenging activities during my journey.	−1	1	1	−1
Relative Ranking of Statements in Factor 3					
25	Being autonomous is crucial to my choice of any tourism activity, and I want technology to support this.	−4	0	3	3
31	I want travel technology to help me better plan my future journey based on my past memorable tourism experiences.	−2	−2	2	1
45	I hope technology can help me to look back on my past journey even if the experience is negative.	0	3	−3	−1
Relative Ranking of Statements in Factor 4					
2	I want technology to help me meet people who are different from me because there is always something to learn from them.	4	2	0	0
37	I hope technology can show me how my journey made me a better person.	−3	1	0	−3

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