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This paper investigates how citizens' uncertainty in e-government services can be managed. First, we draw from uncertainty reduction theory, and propose that transparency and trust are two key means of reducing citizens' uncertainty in e-government services. Second, we identify two key sets of relevant drivers of e-government service use: (1) information quality characteristics, i.e., accuracy and completeness; and (2) channel characteristics, i.e., convenience and personalization. We propose that the means of uncertainty reduction, information quality characteristics, and channel characteristics are interrelated factors that jointly influence citizens' intentions to use e-government. We tested our model with 4,430 Hong Kong citizens' reactions to two e-government services: government websites and online appointment booking. Our results show that the information quality and channel characteristics predict citizens' intentions to use e-government. Furthermore, transparency and trust mediate as well as moderate the effects of information quality and channel characteristics on intentions. A follow-up survey found that citizens' intentions predict use and ultimately, citizens' satisfaction.

Keywords: e-services; electronic government; uncertainty reduction; transparency; trust; technology adoption; citizen satisfaction; public management
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1. Introduction

Advances in information technologies have enabled organizations to improve the efficiency and delivery of services. In the public sector, an expanding array of government services is now available online and these offerings are collectively known as *electronic government* or *e-government*. E-government is defined as the use of the Internet by government agencies to provide informational and transactional services to citizens (West 2004). Services delivered online range from providing the latest policy information to downloadable forms for automobile license renewal to filing taxes (Chan et al. 2010, Hu et al. 2009, Venkatesh et al. 2012a). For citizens, the benefits of e-government include greater service access and ease of interaction with the government; and for governments, the benefits are lower service delivery

cost and a new channel to engage citizens. E-government is becoming an important means by which citizens communicate and interact with governments (Reddick 2005, Thomas and Streib 2003).

Despite these promised benefits, significant challenges remain in the provision of e-government services to citizens. One ongoing challenge is to increase the utilization of e-government services and improve citizens' satisfaction with the services. Although e-government has gained popularity in general, some research has suggested that the utilization of certain services, such as electronic tax filing, still falls short of governments' expectations (Carter et al. 2011). The problem of underutilization prevents e-government from realizing its full potential to achieve cost savings and efficiency improvement. Furthermore, compared to e-business

services, e-government services have been found to lag in measures of functionality and satisfaction, threatening the long-term viability of e-government (Morgeson and Mithas 2009). The need to improve citizens' satisfaction with e-government is also evidenced by a growing number of countries collecting citizen feedback through online polls, blogs, surveys, chat rooms, and social networking tools (United Nations 2012). Collectively, these observations indicate a need to investigate the factors that can contribute to citizens' use and satisfaction with e-government (Chan et al. 2010).

Previous studies on e-government have primarily employed theoretical models of technology adoption and diffusion to understand citizens' adoption and use of e-government services (Belanger and Carter 2012). For example, a number of technology adoption models—including the technology acceptance model, the theory of planned behavior, the diffusion of innovation model, and the unified theory of acceptance and use of technology (UTAUT) (see Venkatesh et al. 2003 for a review of these models; see also Venkatesh et al. 2011)—have been used to examine factors affecting citizens' adoption and use of a variety of e-government services, such as government websites (Barnes and Vidgen 2004), electronic tax filing (Carter and Belanger 2005), electronic voting systems (Yao and Murphy 2007), and general electronic public services (Gilbert et al. 2004). Although these models have provided a theoretical basis to examine citizens' adoption and use of e-government services, some research has noted that findings concerning the general factors in these models (e.g., perceived usefulness, perceived ease of use) cannot provide specific guidance to direct design and practice (Hong et al. 2014, Venkatesh 2000, Venkatesh and Bala 2008). Therefore, it is necessary to draw on other theoretical perspectives to identify and examine specific characteristics that are tied more closely to the design of e-government services.

One relevant perspective relates to users' uncertainty in technology. Although prior research has examined the technology adoption decision-making processes and the boundary conditions of different technology adoption models (e.g., Morris and Venkatesh 2000; Venkatesh et al. 2000, 2003), there is little research investigating the influence of users' uncertainty on their technology adoption decisions and how such uncertainty can be managed. In the technology context, uncertainty refers to an individual's perception that she is unable to accurately predict or completely understand the technology environment (Downey and Slocum 1975, Milliken 1987, Song and Montoya-Weiss 2001). Uncertainty arises about what valued functionality a given technology will deliver to users and such uncertainty will form a barrier to users' recognition of the value of innovations and the adoption of new technologies (Rindova and Petkova 2007). In the case of e-government, because it is considered to be a new and innovative technology for the general public, citizens' evaluation of e-government services is subject to much uncertainty, especially during their initial interactions with e-government. The use of e-government services requires citizens to interact with a government website. This increases the spatial and temporal separation between the citizens and the government, creating more uncertainty and concern about the reliability of the underlying Internet and related government infrastructure interfaces (Warkentin et al. 2002). For instance, if a citizen is unable to track the service process and is doubtful about the reliability of the Web platform, she will be less likely to file taxes online even though electronic tax filing is supposed to be more efficient and convenient than paper-based tax filing. Thus, the benefits notwithstanding, uncertainty associated with e-government services needs to be resolved before citizens will view the services as favorable alternatives to traditional offline services.

Against this backdrop, our objective is to investigate how governments can help citizens resolve their uncertainty about e-government services. We draw on prior work in public management, consumer services, and information systems to guide the model development. First, we introduce the concept of uncertainty reduction (Berger 1986, Berger and Calabrese 1975), which originates from the communication literature, to the context of e-government and identify two *means of uncertainty reduction*, i.e., transparency and trust. Second, we identify two sets of factors that are relevant to the means of uncertainty reduction: *information quality characteristics*, i.e., accuracy and completeness; and *channel characteristics*, i.e., convenience and personalization. We posit that transparency and trust can play both mediating and moderating roles in affecting the relationships between the information quality and channel characteristics and citizens' intentions to use e-government. The mediation view suggests that the information quality and channel characteristics will enhance citizens' perceived transparency and trust in e-government and in turn affect their intentions to use e-government. The moderation view suggests that transparency and trust can help citizens resolve their uncertainty about the information quality and channel characteristics, thus having synergistic relationships with these characteristics in affecting citizens' intentions to use e-government.

Our work makes three key contributions. First, we draw from multiple streams of research to identify factors that are relevant to the context of e-government services. This responds to calls for giving a richer treatment to context in theory development and incorporating constructs relevant to the nature of emerging technologies to aid systems design (Hong et al. 2014, Venkatesh and Bala 2008, Venkatesh et al. 2011). Second,

we draw on the uncertainty reduction perspective to identify and theorize about two means of uncertainty reduction, i.e., transparency and trust. This theoretical perspective, which is about uncertainty in individuals' initial interactions, is particularly appropriate for this work because e-government is considered to be a means of facilitating government-citizen interactions (Reddick 2005, Thomas and Streib 2003). Given that prior research has primarily used the technology adoption perspective to examine the direct influence of transparency and trust on e-government adoption and use (e.g., Belanger and Carter 2008, Teo et al. 2008, Welch et al. 2005), our work contributes to the literature by drawing on the uncertainty reduction perspective to examine the potential synergistic effects of transparency and trust with other factors. This theory-grounded examination of synergistic effects helps deepen our understanding of the technology adoption process (see Bagozzi 2007). Third, we specify both the mediating and moderating roles[1] of transparency and trust. Distinguishing between these two roles helps clarify the different ways in which the constructs of interest may account for differences in individuals' behavior. Examining the mediating roles of transparency and trust will yield insights into the mechanisms behind the relationships between the various information quality and channel characteristics and citizens' intentions to use e-government, whereas examining the moderating roles of transparency and trust will yield insights into the conditions under which the various information quality and channel characteristics are especially effective in affecting intention. Overall, this research will provide actionable and prescriptive advice to government agencies regarding the management of citizens' uncertainty with e-government.

2. Theoretical Foundation

2.1. Uncertainty Reduction Theory

Uncertainty reduction theory (URT; Berger 1986, Berger and Calabrese 1975) suggests that the primary concern of individuals during initial interactions is the reduction of uncertainty about their own and their partner's interaction behavior. The core of URT is that individuals employ three general categories of information-seeking strategies to reduce uncertainty and increase the other party's predictability, i.e., passive, active, and interactive. Passive strategies involve unobtrusive observation of target individuals to obtain information about them. Active strategies involve seeking information from third parties or through manipulation of the target

person's environment. Interactive strategies involve obtaining information directly from the target person through such communication methods as interrogation and self-disclosure. For example, as students enroll in a class, they may seek information about their professor in a variety of ways to reduce uncertainty about him or her, e.g., passive observation during class, active information seeking from peers, interactive dyadic conversation with the professor (Westerman et al. 2008). Overall, uncertainty reduction is the gathering of information to reduce uncertainty and increase predictability of the other party's behavior. When uncertainty is reduced, predictability of the other party's behavior will be increased resulting in a decrease in one's perceived risk of the interaction.

The generalizability of URT in explaining communication behaviors has been demonstrated by studies conducted in different contexts of communication, including face-to-face and computer-mediated interactions (e.g., Antheunis et al. 2010, Kramer 1994, Tidwell and Walther 2002). For instance, in a study comparing the communication experiences of newcomers and geographic transferees facing new positions in an organization, Kramer (1994) found that both types of employees increase their requests for information from peers and supervisors and that increased levels of communication lead to a positive adjustment through reduced stress and role ambiguity and more task knowledge. In a computer-mediated communication environment (i.e., a social network site), Antheunis et al. (2010) found that people use passive, active, and interactive information-seeking strategies to reduce uncertainty about their new acquaintance. They found that the interactive strategy is the most effective in reducing uncertainty about the target person, which in turn results in social attraction.

Although the concept of uncertainty reduction originates from the context of interpersonal communication, it is also applicable to other contexts, such as organizational behavior (e.g., Lind and Van den Bos 2002, Sia et al. 2004, Taylor et al. 1998) and consumer behavior (e.g., Choudhury et al. 1998, Murray 1991, Siehl et al. 1992). In the organizational context, employees collect fairness information in their broader work environment to help them cope with uncertainty because the fairness information helps reduce employees' trust-related uncertainty and fears of being exploited in a social exchange (Lind and Van den Bos 2002). As Lind and Van den Bos (2002, p. 216) noted, "people use fairness to manage their reactions to uncertainty, finding comfort in related or even unrelated fair experiences and finding additional distress in unfair experiences." For example, employees care much about the fairness of organizational human resource systems, such as compensation and performance management. The fairness-related information about such systems will

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[1] This specification is consistent with prior research suggesting that a particular construct may assume the roles of both a mediator and a moderator in the same model (James and Brett 1984, Judd et al. 2001).

make employees more satisfied with the outcomes, even when the outcomes are less than desirable (Taylor et al. 1998).

In the consumer context, services are often characterized by incomplete and ambiguous information or evidence that consumers must use in evaluating the services (Siehl et al. 1992). Services are perceived to be riskier than goods and consumers will acquire relevant information to reduce the uncertainty associated with services (Murray 1991). Consumers will use both internal (e.g., past purchase experience) and external (e.g., new information from the environment) sources to gather information and cope with uncertainty. An example of external sources in the electronic markets is the intermediaries that certify businesses on the Web based on their analysis of whether or not the business meets certain standards. Such information will reduce the uncertainty faced by consumers as they encounter new vendors and websites (Choudhury et al. 1998). Similarly, the increasing use of virtual product experience in e-commerce websites has enabled consumers to acquire more information about products by virtually trying out the products (Daugherty et al. 2008). In sum, although prior research has conceptualized uncertainty in different contexts, acquiring relevant information to increase predictability of outcomes is a major means of uncertainty reduction.

2.2. Uncertainty in E-Government
The organizational literature suggests that service organizations face uncertainty from different sources, including the task, the workflow, and the environment. Task uncertainty refers to incomplete information about how to accomplish tasks; workflow uncertainty refers to incomplete information about when inputs will arrive to be processed; and environmental uncertainty refers to the unpredictability of environmental variables that have an impact on service performance outcomes (Downey and Slocum 1975, Milliken 1987, Mills and Moberg 1982, Slocum and Sims 1980). Distinguishing the sources of uncertainty will help organizations better manage the uncertainty associated with service operations.

We suggest that the three types of uncertainty—i.e., task, workflow, and environmental uncertainty—can be applied to the context of e-government services and are relevant to the perspective of citizens. First, task uncertainty and workflow uncertainty arise from the service process of e-government. When using an e-government service (e.g., online tax filing), citizens need to be provided with necessary information (e.g., user instructions and status updates) to accomplish service tasks (e.g., filing taxes) and keep track of the service workflow (e.g., checking tax refund status). With incomplete information, citizens may feel uncertain about how they can obtain desired services, and

when and which government agencies will receive and process their service requests. Second, environmental uncertainty arises from the service-delivery channel of e-government, i.e., the website. Because of the vulnerability associated with online transactions (e.g., technical problems and security risks), citizens need to be assured that the website is reliable and safe to use, otherwise they may feel uncertain about the service environment and question the service availability and service performance. In sum, citizens have to resolve their uncertainty about both the service process and the channel before they view e-government as an appropriate way to interact with government agencies.

2.3. Means of Uncertainty Reduction and Technological Characteristics
Based on URT and the conceptualization of uncertainty in e-government, we draw from research in public management, consumer services, and information systems to identify key means of uncertainty reduction and associated technological characteristics—i.e., information quality characteristics and channel characteristics—that contribute to the means of uncertainty reduction as well as e-government use.

First, we identify transparency and trust as two key means of uncertainty reduction. Transparency allows citizens to obtain information about the service process through passive, active, and interactive information-seeking strategies as specified by URT. The information obtained helps citizens to reduce their uncertainty about the service task and workflow. Trust makes citizens willing to accept the potential vulnerability associated with their interactions with the online channel. It alleviates citizens' concerns about the unpredictability of using the channel, thus reducing their uncertainty about the service environment. In sum, transparency and trust represent two key mechanisms for uncertainty reduction.

Second, we identify accuracy and completeness as two key technological characteristics that contribute to transparency and e-government use. Given the emphasis on information seeking in uncertainty reduction, we suggest that technological characteristics related to information quality are particularly important. Information quality refers to better and more information, which can contribute to transparency (Andersen et al. 2010, Welch et al. 2005). Furthermore, as e-government services are information-centric and serve primarily to deliver government information (Cullen and Houghton 2000), information quality is central to citizens' perceptions of service performance and usage intentions. Thus, we identify accuracy and completeness, which are found to be two major determinants of information quality (Wixom and Todd 2005), as key information quality characteristics.

Third, we identify convenience and personalization as two key technological characteristics that contribute

to trust and e-government use. Given the central role of the other party's predictability in reducing uncertainty in an interaction, we suggest that technological characteristics related to the online channel's predictability are particularly important. Convenience captures the notion of ubiquitous and always-on service access; and personalization refers to the capability of an e-government service to deliver information and services tailored to citizens' preferences. Convenience and personalization contribute to increased predictability of using a service in terms of service availability and service relevance, respectively. More generally, both characteristics determine the capability of a service to deliver its promised functionality to users through the online channel that we expect to influence users' trust in the service. Furthermore, convenience and personalization are two unique time- and effort-saving characteristics facilitated by the website (Berry et al. 2002, Curran and Meuter 2005). Both characteristics promote citizens' use of e-government services by making the online channel more preferable than the offline channel for accessing a public service (Meuter et al. 2005, Muthitcharoen et al. 2011). Thus, we identify convenience and personalization as key channel characteristics.

3. Model Development

Based on the uncertainty reduction perspective, we suggest that transparency and trust will play both mediating and moderating roles in explaining the relationships between information quality characteristics, channel characteristics, and citizens' intentions to use e-government (see Figure 1). First, we posit that transparency will partially mediate the effects of information quality characteristics, i.e., accuracy and completeness, on intention; whereas trust will partially mediate the effects of channel characteristics, i.e., convenience and personalization, on intention. Furthermore, we posit that transparency will partially mediate the effects of information quality characteristics on trust, whereas trust will partially mediate the effect of transparency on intention. A general rationale for proposing partial mediation is that while transparency and trust capture the uncertainty reduction aspect of evaluating an e-government service, users meanwhile will consider other aspects in their adoption decision making, such as service performance and effort expectation. As our identified factors correspond to other aspects in addition to uncertainty reduction, we suggest that their effects are not fully mediated by transparency and trust.

Second, we posit that for transparency and trust, each will moderate the effects of both information quality and channel characteristics on intention. Agarwal and Prasad (1998) suggested the existence of moderating influences on the relationship between perceptions and

adoption decisions. They noted that individuals will use their perceptions of the technology differently to arrive at the adoption decision. Of two individuals who perceive a technology as equally desirable, they may develop different levels of usage intention due to factors such as personal or environmental characteristics. In line with this notion, we suggest that transparency and trust, which affect citizens' uncertainty in their evaluation of a service, will moderate the development of usage intentions.

Finally, although not the core of the model, we include citizens' use and satisfaction with e-government as consequences of intention to enhance the comprehensiveness and criterion validity of the model. This is in line with prior research suggesting user satisfaction is a key success indicator of systems implementation in general (e.g., Brown et al. 2008) and e-government implementation in particular (e.g., Chan et al. 2010, Teo et al. 2008).

In the remainder of this section, we first discuss the key information quality and channel characteristics and hypothesize their direct effects on citizens' intentions to use e-government. Next, we discuss the two means of uncertainty reduction and hypothesize their mediating and moderating roles in affecting the relationships between the various information quality and channel characteristics and intention.

3.1. Information Quality Characteristics

3.1.1. Accuracy. Accuracy is an important contributor to information quality (Wixom and Todd 2005). In the context of e-government, accuracy can be defined as the degree to which citizens perceive the information provided by an e-government service to be correct. Accuracy is of particular importance in e-government as e-government reduces the need for face-to-face interactions between citizens and government because of the web-based self-service model (Meuter et al. 2000, Newcomer and Caudle 1991). Government websites are key sources for citizens to obtain information on public policies, regulations, and services. The accuracy of information available on government websites influence citizens' use of the websites (Cullen and Houghton 2000). For example, when a citizen visits a government website to renew a driver's license, that citizen needs to know precisely what documents are required and receive accurate procedural guidance to complete the online application correctly. If an e-government service can ensure accuracy of the information provided, citizens will consider the service to be capable of accomplishing their tasks and are more likely to use it. Thus, we hypothesize the following:

Hypothesis 1 (H1). *Accuracy is positively related to intention to use e-government.*

Figure 1 **Model of Citizens' Adoption and Use of E-Government**
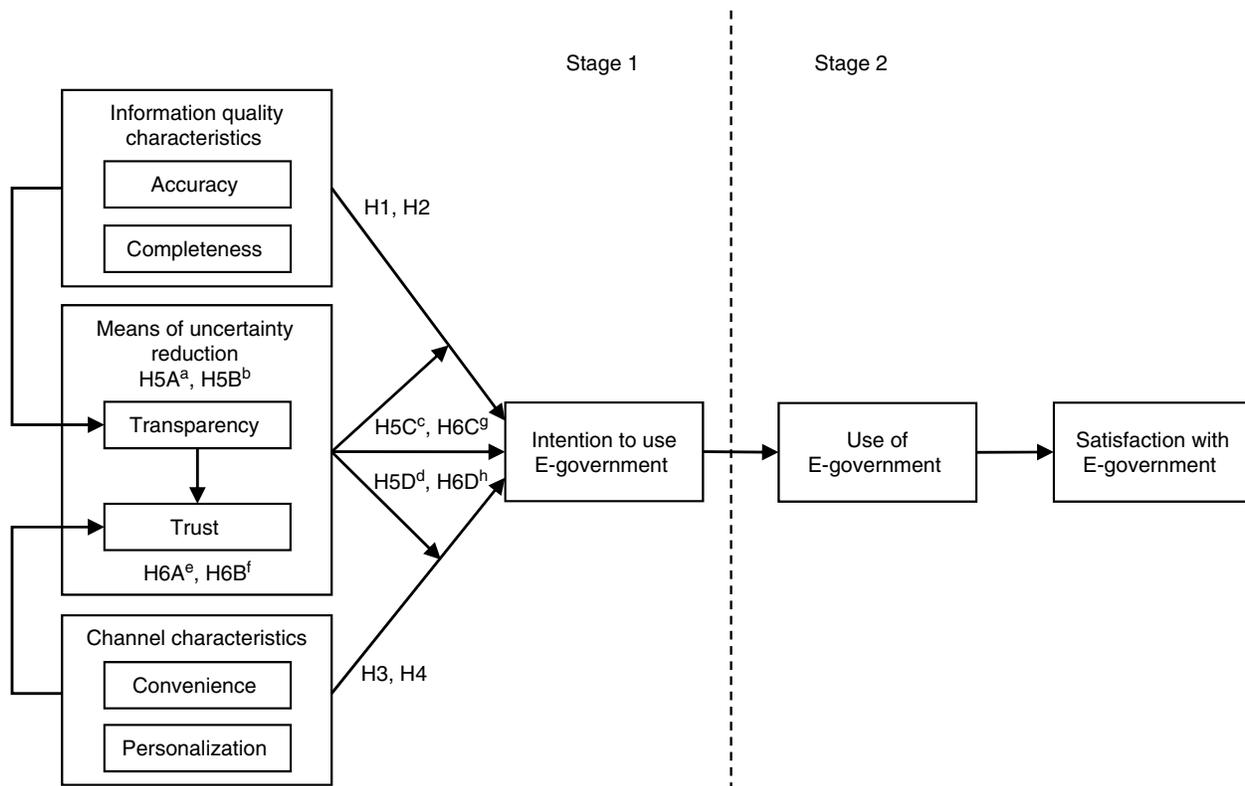
a/b Mediating effect of transparency between information quality characteristics and intention to use e-government/trust.

c/d Moderating effect of transparency between information quality/channel characteristics and intention to use e-government.

e/f Mediating effect of trust between channel characteristics/transparency and intention to use e-government.

g/h Moderating effect of trust between information quality/channel characteristics and intention to use e-government.

3.1.2. Completeness. Consistent with the conceptualization in prior information quality studies (e.g., DeLone and McLean 2003, Wixom and Todd 2005), completeness is defined as the extent to which e-government provides citizens with all of the necessary information or applicable services to fulfill a specific need. Newcomer and Caudle (1991) advocated an emphasis on information completeness when evaluating information systems implemented in the public sector. In the context of e-government, completeness encompasses the notion of comprehensiveness by providing the information necessary for meeting a citizen's particular information or service need. For instance, a citizen could visit a government website to learn about recent changes in income tax policies. In this case, the citizen will expect complete information about the policy changes—e.g., definition, description, eligibility, illustration, advice, and resources for further assistance. When the government website fails to provide complete information, the citizen can become confused or misguided, and may even become frustrated. This is consistent with work that has identified completeness to be an essential aspect of information quality and can affect an individual's use of an innovation or a new

service (Wixom and Todd 2005). Thus, we hypothesize the following:

Hypothesis 2 (H2). *Completeness is positively related to intention to use e-government*.

3.2. Channel Characteristics

3.2.1. Convenience. In line with the Berry et al. (2002) conceptualization of convenience, we define convenience to be a citizen's perception of the time and effort required to use a government website. In the context of online consumer behavior, convenience has been shown to be a key consideration in consumers' decisions to purchase through online channels rather than conventional store outlets (Torkzadeh and Dhillon 2002). Citizens will expect to spend minimal time and effort when they use a government website to access government-related information and services. E-government promotes self-services through conveniently accessible self-service technologies that connect citizens and government agencies every minute of the day, with almost no geographical constraints (Gilbert et al. 2004). A government website is more likely to be used when citizens can do so at their convenience—from anywhere at any time. The convenience offered

by a government website is an important advantage over the conventional service channels that rely on face-to-face encounters or telephone-based interactions. For instance, citizens can visit a government website to find information specific to their tax questions after normal business hours and when they may be working on their taxes late at night. Similarly, citizens can remotely reserve a government-provided recreation facility in their home country while traveling in another country. Convenience thus relates to the flexibility and ubiquitous access that could be provided by the channel. Convenience is an important driver of e-government use because of its ability to favorably influence time and opportunity costs (Layne and Lee 2001). Thus, we hypothesize the following:

Hʏᴘᴏᴛʜᴇsɪs 3 (H3). *Convenience is positively related to intention to use e-government.*

3.2.2. Personalization. Personalization of online services has been studied in the information systems, human-computer interaction, and e-government literatures (e.g., Hinnant and O'Looney 2003, Ho et al. 2011, Tam and Ho 2006). Drawing on Hinnant and O'Looney (2003), we define personalization in e-government as the extent to which a citizen can customize information and services provided online to fit her specific needs or preferences. Personalization has a substantial value-add for citizens by allowing them to specify the information they want and potentially, the format in which they want the information (e.g., preferred presentation format), rather than be overloaded with information, receive irrelevant information (*spam*), or both. Personalized e-government services can leverage the unique identity of a citizen and provide her with pertinent information—e.g., alerting those citizens who have not paid their property taxes when the deadline is approaching, sending an informational email about a rezoning hearing to those who are likely to be affected, and retaining all tax information for citizens to obtain a copy online without having to visit a government office. Personalization can allow a citizen's entire profile to be constructed and leveraged across all government agencies through seamless information sharing that will break down government agency (functional silo) boundaries. Such personalization in an e-government context helps to improve citizens' efficiency in using a wide array of services, for example, by minimizing the need for reentering the same information (e.g., name and address) for multiple services. Also, personalization can allow citizens to create a customized layout from which the necessary information can be easily identified, reducing citizens' cognitive effort in information processing during their use of the services (Tam and Ho 2006). Personalization thus relates to the increased service effectiveness and users' perceived control facilitated by the channel. Thus, we hypothesize the following:

Hʏᴘᴏᴛʜᴇsɪs 4 (H4). *Personalization is positively related to intention to use e-government.*

3.3. Means of Uncertainty Reduction

3.3.1. Transparency. Drawing from prior work in public management, we define transparency in the context of e-government as the extent to which a citizen can obtain a clear understanding of the working of a particular government process or service (Welch et al. 2005). In particular, transparency is expected to capture the depth of information, the transactional capability that is provided online, and the ability to follow a process (e.g., service request) through its entire life cycle (LaPorte et al. 2002). The use of the Internet to access information and services has made citizens become more "customer-like" and reduce their interactions with public servants (see Welch et al. 2005). Citizens' interactions with e-government reduce the direct interactions of citizens with the government and serves to heighten the importance of transparency. Transparency has been shown to influence citizens' views of government functioning in general (McIvor et al. 2002). One specific example highlights the importance of transparency. Cho and Choi (2004) reported that the Seoul metropolitan government, in an effort to fight corruption, created an online system where citizens could request civil services (e.g., permits) and track the status in real time. They noted that transparency was at the heart of the success of the services that were not only embraced and used by the citizens but also contributed to their perceptions of reduced corruption.

Mediating Role of Transparency between Information Quality Characteristics and Intention. Technology adoption is viewed as a process of information gathering and uncertainty reduction (see Agarwal and Prasad 1998). Users gather and synthesize information about a new system, resulting in the formation of beliefs about using the system that in turn determine the decision to adopt. Availability of accurate and complete information will help users reduce uncertainty and facilitate their adoption decision making. In the context of e-government, provision of information will help to meet citizens' demand for information about the service process and reduce the information gap between the government and its citizens. When citizens are provided with accurate information to verify or assess the service processes taking place, they will be better able to follow through the service processes and perceive the service to be more transparent. By contrast, inaccurate information will be harmful and prevent citizens from obtaining a clear understanding of the working of the service (Hansen et al. 2008). For example, when the procedures for applying for

automobile license renewal listed on the government website do not match with the actual ones, citizens will be unable to comprehend the application process. Similarly, provision of complete information ensures the steps of a service process to be transparent to citizens. With complete information, citizens will be able to develop a better understanding of the working of the service. By contrast, incomplete information, similar to inaccurate information, will prevent citizens from understanding and tracking the service processes. Taken together, both accuracy and completeness enable citizens to better understand the service processes and thus lead to higher transparency.

Transparency determines the extent to which citizens can seek information to reduce uncertainty about a service. According to URT, individuals employ passive, active, and interactive information-seeking strategies to reduce uncertainty. Consistent with these strategies, e-government with high transparency will allow citizens to passively observe service operations of e-government, actively track the service status, and automate government-to-citizen interactions through the Internet. With greater transparency, citizens will be better able to understand and follow through the service processes, resulting in better control and confidence in using the service (Nicolaou and McKnight 2006). We suggest that although accuracy and completeness are essential attributes of e-government services that are expected to directly affect intention by creating favorable user perceptions about service performance (as proposed in H1 and H2), their effects on intention will also be mediated through transparency by facilitating the process of information gathering and uncertainty reduction. Thus, we hypothesize the following:

HYPOTHESIS 5A (H5A). *Transparency partially mediates the positive relationship between information quality characteristics (i.e., accuracy and completeness) and intention to use e-government.*

Mediating Role of Transparency between Information Quality Characteristics and Trust. We suggest that transparency will partially mediate the effects of information quality characteristics on trust. On one hand, accuracy and completeness are expected to directly affect trust, because trust is grounded in users' knowing the technology sufficiently well that they can anticipate how it will respond under different conditions (McKnight et al. 2011). By providing citizens with accurate and complete information, they will be better able to understand and anticipate the consequences of their use of a service. Also, the capability to deliver accurate and complete information represents an attribute of service performance, which positively relates to the competence aspect of trust (McKnight et al. 2002). On the other hand, as discussed in H5A, accuracy and completeness increase transparency. Transparency implies that the

service provider cares enough and is competent to provide helpful information to users, which positively relates to trusting beliefs (Nicolaou and McKnight 2006). In the context of e-government, transparency denotes openness about service operations and responsiveness to user inquiries (Bertot et al. 2010). Transparency also increases accountability of services by making information searches easier for citizens (Tolbert and Mossberger 2006). Together, these notions of transparency contribute favorably to citizens' trust in e-government. Therefore, we suggest that in addition to the direct effects of accuracy and completeness on trust, there will be effects of these characteristics on trust that are mediated by transparency. Thus, we hypothesize the following:

HYPOTHESIS 5B (H5B). *Transparency partially mediates the positive relationship between information quality characteristics (i.e., accuracy and completeness) and trust.*

Moderating Role of Transparency. As Agarwal and Prasad (1998) noted, innovations are inherently risky and there is no guarantee that adoption will produce the anticipated consequences. This uncertainty will moderate the development of usage intentions. For individuals who perceive the same level of benefits (e.g., perceived usefulness), they may differ in their willingness to use the innovation in the face of the uncertainty about the benefits (Agarwal and Prasad 1998). For example, the impact of perceived usefulness on intention to use a system will be higher for individuals who are innovative and have high tolerance for uncertainty (Agarwal and Prasad 1998). By contrast, at the same level of perceived usefulness, individuals who have a low tolerance for uncertainty will have lower intentions to use the system. They demand precise and detailed information to lower uncertainty about the system before they will develop stronger intentions to use the system (Im et al. 2011).

In the context of e-government, the information quality and channel characteristics—i.e., accuracy, completeness, convenience, and personalization—refer to citizens' perceptions about the expected benefits they could receive from using the services. We suggest that the extent to which these characteristics affect intentions is subject to citizens' uncertainty about the services. In general, uncertainty in decision making refers to the extent to which a person has enough information to make decisions, can predict the consequences of those decisions, and has confidence in those decisions (Achrol and Stern 1988, Morgan and Hunt 1994). Individuals who perceive the same levels of information quality and channel characteristics will differ in their intentions to use e-government services, depending on the level of transparency they perceive. With greater transparency, citizens will face less uncertainty in making adoption decisions because they will have more information about the working of the services, which

helps to resolve their uncertainty about the consequences of service use and increase their confidence that service use can produce the expected benefits. As a result, citizens' perceptions about the information quality and channel characteristics will be more likely to develop into usage intentions. By contrast, with lower transparency, citizens will be less certain about the consequences of service use. For example, citizens who have little idea of how government information is provided or how personalization works in a service will be uncertain about the expected benefits of using the service. As a result, although citizens may still perceive the benefits to be high, the information quality and channel characteristics will be less likely to be translated into usage intentions. Thus, we hypothesize the following:

HYPOTHESIS 5C (H5C). *Transparency moderates the positive relationship between information quality characteristics (i.e., accuracy and completeness) and intention to use e-government, such that these characteristics are more strongly, positively related to intention to use e-government when transparency is high rather than low.*

HYPOTHESIS 5D (H5D). *Transparency moderates the positive relationship between channel characteristics (i.e., convenience and personalization) and intention to use e-government, such that these characteristics are more strongly, positively related to intention to use e-government when transparency is high rather than low.*

3.3.2.   Trust. We define trust as a citizen's perception that an e-government website has the essential attributes for preserving her interest, as well as adhering to a set of principles she values (Mayer et al. 1995; McKnight et al. 1998, 2002). We conceptualize trust as a three-dimensional construct that comprises competence, benevolence, and integrity (Mayer et al. 1995). Competence is the belief in the trustee's ability to do what the trustor expects. Benevolence is the belief that the trustee will act in the trustor's interests. Integrity is the belief that the trustee will be honest and keep its promise. In a technology context, trust relates to the extent to which a technology has the capability to complete a required task, provide necessary advice to complete a task, and work consistently and predictably (McKnight et al. 2011). In the context of e-government, trust refers to the extent to which an e-government website will deliver the required services in a consistent manner and act in a citizen's best interest, for example, by using and protecting personal information properly.

Mediating Role of Trust between Channel Characteristics and Intention. Technological characteristics, here channel characteristics, can influence trust perceptions in online environments. We suggest that the channel characteristics can influence trust in two key ways. First, convenience and personalization contribute to increased predictability of using a service online. Convenience relates to the ubiquitous access that is facilitated by the online channel, which allows citizens to access government information and services from anywhere at any time. This always-on service access increases predictability of service use in terms of service availability. Likewise, personalization relates to the capability of a service to deliver information and services according to citizens' preferences. The provision of personalized information and services increases predictability of service use in terms of service relevance. Both channel characteristics determine the capability of a service to meet citizens' expectations, which can influence citizens' trust in the service.

Second, the channel characteristics can signal the government's commitment and caring to its citizens. As the effort placed in configuring a website signals the commitment of a service provider to its relationship with users (Gefen et al. 2003), convenience offered by an e-government website indicates that the government is investing in the relationship with citizens. If more resources are invested by the government in configuring an e-government website so that it provides easy access to public services, citizens will be more likely to conclude that the government cares about its citizens and is capable of delivering services online, thus contributing to trust in the website. Similarly, personalization facilitates the construction of a better representation of user needs that can be used to provide more relevant and better-customized information and services (Tam and Ho 2006). Personalized e-government services enable the government to better understand citizen needs and provide citizens with relevant and customized services (Hinnant and O'Looney 2003). This improves citizens' perceptions that an e-government website understands their personal preferences and acts in their best interests, resulting in higher trust in the website. Taken together, both convenience and personalization contribute to citizens' perceptions that an e-government website is a capable and trustworthy service delivery channel and thus lead to higher trust.

Trust has been found to be a key determinant of citizens' adoption and satisfaction with e-government services (e.g., Belanger and Carter 2008, Teo et al. 2008). If citizens have sufficient trust in an e-government website, they will be confident that it will act in accordance with their expectations. As a result, citizens are more likely to use it to access government information and services. By contrast, when citizens do not have sufficient trust in the e-government website, they are likely to continue using or revert to the familiar but tedious conventional channels (i.e., face-to-face or telephone) to access government information and services. We suggest that although convenience and personalization are important attributes that directly affect intention by creating favorable user perceptions about a service's

effort-saving capability and effectiveness (as proposed in H3 and H4), their effects on intention will also be mediated through trust by increasing the predictability of service use and signaling the government's commitment and caring to its citizens. Thus, we hypothesize the following:

HYPOTHESIS 6A (H6A). *Trust partially mediates the positive relationship between channel characteristics (i.e., convenience and personalization) and intention to use e-government.*

Mediating Role of Trust between Transparency and Intention. We suggest that transparency will influence intention through two different mechanisms. First, transparency will directly affect intention through the uncertainty reduction mechanism. As discussed in H5A, transparency determines the extent to which citizens can seek information to reduce uncertainty about a service. According to URT, citizens can employ various information-seeking strategies to reduce uncertainty, which in turn leads to usage intentions. Second, transparency will also indirectly affect intention through the trust-building mechanism. As discussed in H5B, transparency signals the willingness and competence of the government to provide helpful information to citizens. Transparency also facilitates the provision of open, responsive, and accountable services to citizens (Bertot et al. 2010, Tolbert and Mossberger 2006). These attributes contribute to citizens' trust in e-government that in turn leads to usage intentions. We suggest that these two mechanisms are not mutually exclusive because uncertainty reduction can serve a broader purpose of learning about multiple aspects of a service, not limited to the trust aspect. Thus, we hypothesize the following:

HYPOTHESIS 6B (H6B). *Trust partially mediates the positive relationship between transparency and intention to use e-government.*

Moderating Role of Trust. Trust can be regarded as a means to resolve citizens' uncertainty and may have synergistic relationships with information quality and channel characteristics in affecting citizens' intentions to use e-government. Trust is crucial to situations in which either uncertainty exists or undesirable outcomes are possible (Luhmann 1979). Trust in a technology involves accepting vulnerability that it may or may not work (McKnight et al. 2011). When an individual trusts an application, she will be exposed to and assume the risk of incurring negative consequences if the application fails to act as expected (Bonoma 1976). Thus, trust increases citizens' willingness to accept the vulnerability caused by the uncertainty and increase their risk-taking propensity. As Agarwal and Prasad (1998) suggested, individuals with higher risk-taking propensity will develop stronger intentions to use an

innovation at the same level of perceived benefits of a technology than individuals with lower risk-taking propensity.

We posit that the extent to which the information quality and channel characteristics—i.e., accuracy, completeness, convenience, and personalization—affect intentions is subject to citizens' uncertainty about the service delivery channel. In the context of e-government, trust relates to citizens' willingness to depend on the channel to use the services. It also relates to citizens' willingness to be exposed to uncertainty and risks associated with their interactions with the channel. Citizens with higher trust will be more willing to depend on the channel and assume the associated uncertainty and risks. These citizens, as a result of their risk-taking propensity, will develop stronger intentions to use a service at the same level of information quality and channel characteristics than citizens with lower trust. In other words, with high trust, the information quality and channel characteristics will be more salient when citizens form the intentions to use e-government.

By contrast, citizens with lower trust will be less willing to expose themselves to uncertainty and risks associated with their interactions with the channel. Although they may still view the information quality and channel characteristics favorably, these characteristics will be less salient because of the potential negative consequences in using the channel. This is especially true for the channel characteristics—i.e., convenience and personalization. For example, although citizens may agree that a website provides convenient access to the services, its having multiple points of access that exposes the system to security attacks may keep citizens who do not trust the channel from using the services. Similarly, although personalization will improve citizens' efficiency in using different services, the potential privacy breaches may keep citizens away. In sum, with low trust, the information quality and channel characteristics will be less salient when citizens form the intentions to use e-government. Thus, we hypothesize the following:

HYPOTHESIS 6C (H6C). *Trust moderates the positive relationship between information quality characteristics (i.e., accuracy and completeness) and intention to use e-government, such that these characteristics are more strongly, positively related to intention to use e-government when trust is high rather than low.*

HYPOTHESIS 6D (H6D). *Trust moderates the positive relationship between channel characteristics (i.e., convenience and personalization) and intention to use e-government, such that these characteristics are more strongly, positively related to intention to use e-government when trust is high rather than low.*

4. Method

4.1. Research Context

Our research context is set in Hong Kong where the government is actively pursuing e-government initiatives to improve its efficiency and provide better service quality to its citizens. One major initiative is an e-government portal that allows citizens to access a wide range of government services, including online appointment booking with various government agencies, and linking to various government agencies' websites that provide detailed government information.

4.2. Sample and Procedures

The data used were collected as part of a large-scale online survey on e-government in Hong Kong. Participation in the survey was voluntary, with lucky draw prizes offered as incentives to participants. The survey was advertised through a banner placed on the homepage of the Hong Kong's e-government portal over a period of one month. When a citizen clicked on the survey banner, they were directed to the web-based questionnaires. We report on the data pertaining to two specific e-government services: "government websites" (GWS) and "online appointment booking service" (OABS).[2] These services represent the two major types of e-government services—i.e., informational and transactional services (Layne and Lee 2001). We conducted a two-stage survey to collect data to test our proposed model (see Figure 1 for the measurement of constructs in the two stages). In the initial survey, we obtained a total of 4,430 complete responses: 1,839 for the GWS survey, and 2,591 for the OABS survey. The gender distribution was fairly balanced with 2,137 (48.2%) of the respondents being women. The average age was 29.6 years, with a standard deviation of 4.5. Four months after the initial survey, we conducted a follow-up survey on respondents of the initial survey to collect data on e-government use. We received 752 (40.9%) and 1,433 (55.3%) responses for the follow-up surveys on GWS and OABS, respectively.

We evaluated nonresponse bias[3] by comparing the demographics of our two samples to the government census data on Hong Kong's population. There were no significant differences in terms of gender and income. However, compared to the general population, our samples were relatively younger and more educated. This is understandable as younger citizens are more educated and technology savvy and are thus more likely

to participate in online surveys. A fruitful first step in getting citizens onboard the e-government bandwagon is to target those who are already online. The current samples thus provide meaningful data for our purpose. Finally, we compared the demographics across the two samples and found no significant difference.

4.3. Measures

We used previously validated scales for all constructs (except for convenience) and modified them to fit the context of GWS and OABS (see Appendix A). The items were translated to Chinese and back translated to English by professional translators. Minor wording discrepancies were discussed and resolved. The questionnaire was administered in Chinese, the main lingua franca in Hong Kong. We averaged responses to the relevant items to create the scores for each variable.

4.3.1. Main Constructs. Accuracy and completeness were measured with three items, each adapted from Wixom and Todd (2005). Convenience was measured with three items that we developed based on the definition by Gilbert et al. (2004) and the description in Meuter et al. (2000). Personalization was measured with three items adapted from Hinnant and O'Looney (2003). Transparency was measured with four items adapted from Welch et al. (2005). Trust was measured with three items adapted from McKnight et al. (2002), each measuring one of the three dimensions of trust, i.e., competence, benevolence, and integrity. All of these variables were measured using a seven-point Likert scale ranging from 1 ("strongly disagree") to 7 ("strongly agree").

4.3.2. Control Variables. We included *individual difference* variables, such as gender, education, income, age, and Internet self-efficacy,[4] as control variables given their important roles in media choice (e.g., Internet versus conventional media) and technology/service adoption decisions. Gender is an individual difference that has been shown to affect how prospective users perceive a new technology or service (e.g., Venkatesh et al. 2000). Education, income, age, and Internet self-efficacy have also been found to influence Internet use (Wasserman and Richmond-Abbott 2005). Furthermore, the *need for government service* is an important variable to control because the extent to which a citizen needs a particular government service will influence her intention to use it electronically. Finally, we control whether a respondent is government staff, because government staff will know better about the government's inner workings and are likely to view e-government services more favorably.

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[2] Besides using these e-government services, citizens can obtain government information (e.g., forms and information booklets) from the government agency offices and book appointments by phone.

[3] We also tested for the potential effect of nonresponse bias on our results. We ran analyses using samples of respondents and nonrespondents to the follow-up survey. The results were largely similar to the results based on the full sample.

[4] Some research suggested that task-specific self-efficacy is a better predictor of task performance (e.g., Marakas et al. 2007). Because performance is not our focus, we use general Internet self-efficacy instead of task-specific self-efficacy.

Gender was coded as a dummy variable, with men coded as 0 and women coded as 1. Age was measured in years. The response categories for education were 1 (primary school), 2 (secondary school), 3 (associate degree), 4 (undergraduate degree), and 5 (graduate degree). Monthly income was categorized into 1 (no income), 2 (HK\$1–HK\$5,000), 3 (HK\$5,001–HK\$10,000), 4 (HK\$10,001–HK\$20,000), 5 (HK\$20,001–HK\$30,000), and 6 (>HK\$30,000). Internet self-efficacy was measured using a three-item scale on a 10-point Guttman scale ranging from 1 (not at all confident) to 10 (totally confident), adapted from Compeau and Higgins (1995). Citizens' need for government service was measured using three items on a seven-point Likert scale ranging from 1 ("strongly disagree") to 7 ("strongly agree"), adapted from Wilson and Lankton (2004). Government staff was coded as a dummy variable, with nongovernment staff coded as 0 and government staff coded as 1.

4.3.3. Dependent Variables. Intention to use e-government services was measured with a three-item scale on a seven-point Likert scale ranging from 1 ("strongly disagree") to 7 ("strongly agree"), adapted from Venkatesh et al. (2003). E-government services' use was measured with a two-item scale on a seven-point Likert scale ranging from 1 (very low use) to 7 (very high use), adapted from Wixom and Todd (2005). Satisfaction with e-government services was measured with a three-item scale on a seven-point Likert scale ranging from 1 (very dissatisfied) to 7 (very satisfied), adapted from McKinney et al. (2002).

4.3.4. Pilot Studies. We conducted two pilot studies, one with each service, involving 310 and 330 participants, respectively. The pilot studies helped us assess the time it took to complete the questionnaire and make minor wording changes based on open-ended inputs from the participants. An assessment of the reliability in the pilot studies showed all scales were reliable. Also, the factor analysis demonstrated convergent and discriminant validity. The modified questionnaires were then used in the main data collection.

4.3.5. Reliability and Validity Tests. Table 1 presents the means, standard deviations, and correlation matrix for all of the variables used in our study. For both e-government services, all of the Cronbach's alphas and composite reliabilities were higher than 0.70, thus indicating the constructs had adequate reliability (Nunnally 1978). The average variance extracted (AVE) for each construct was greater than the recommended 0.50 level, indicating that more than one-half of the variance observed in the items was explained by their hypothesized constructs. For both samples, the correlations between variables were all below the square root of AVE of either construct. We conducted an exploratory factor analysis, with direct oblimin rotation to allow for correlated factors, for latent variables

measured in this study. The results showed that all factor loadings were above 0.70 and all cross-loadings were low, thus supporting convergent and discriminant validity of the scales (see Appendix B). In sum, the scales for all variables possessed adequate reliability and construct validity.

We evaluated common-method variance by conducting Harman's one factor test (Podsakoff et al. 2003). In this test, if a substantial amount of common method variance exists, a single factor will emerge from the factor analysis or one general factor will account for the majority of the covariance in the independent and dependent variables (Podsakoff et al. 2003). For the GWS sample, the first factor accounted for 15% of the variance. For the OABS sample, the first factor accounted for 17% of the variance. These results indicated that the first factor does not account for the majority of the covariance in both samples, suggesting that common method bias was not a major concern in this study.[5]

5. Results

We conducted hierarchical regression analyses with SPSS 20 to test our hypotheses. Table 2 presents the results of the analyses predicting intention to use e-government for both services. In block 1, we entered the control variables (i.e., gender, age, education, income, Internet self-efficacy, need for government services, and government staff). In block 2, we added the information quality characteristics (i.e., accuracy and completeness), the channel characteristics (i.e., convenience and personalization), and the means of uncertainty reduction (i.e., transparency and trust). Finally, in block 3, we added the interactions terms (i.e., *Transparency × Accuracy*, *Transparency × Completeness*, *Transparency × Convenience*, *Transparency × Personalization*, *Trust × Accuracy*, *Trust × Completeness*, *Trust × Convenience*, and *Trust × Personalization*). We centered the component variables used for interactions to reduce possible problems of multicollinearity (Aiken and West 1991). All variance inflation factor (VIF) values were below 4, suggesting that multicollinearity was not a major concern.

5.1. Main Effects

The results in block 1 showed that citizens' need for government services positively influenced their intentions to use the e-government services. Gender had no significant effect on citizens' intentions to use e-government. Age and Internet self-efficacy had significant effects in both services, although education was significant in GWS only. The variance explained by the control variables was 10% and 15% in the case of GWS and OABS, respectively.

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[5] The concern for common method bias is further alleviated by the findings of significant interaction effects (Siemsen et al. 2010).

Table 1   **Descriptive Statistics and Correlations**[a]

Variables	Government websites[a]					Online appointment booking service[b]					Correlations															
	Mean	SD	CA	CR	AVE	Mean	SD	CA	CR	AVE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. Need for government service	3.93	1.33	0.84	0.80	0.58	3.65	1.42	0.92	0.89	0.74	—	−0.07	0.00	−0.04	0.03	0.15	0.02	0.29	0.11	0.18	0.09	0.32	0.12	0.30	0.06	0.00
2. Gender	0.50	0.50	—	—	—	0.53	0.50	—	—	—	−0.06	—	−0.05	−0.02	−0.07	−0.02	−0.04	0.00	0.02	0.01	0.03	0.01	0.06	−0.01	−0.03	0.07
3. Age	29.76	4.36	—	—	—	29.29	4.49	—	—	—	0.00	0.01	—	0.04	0.40	−0.07	0.15	0.02	0.02	0.01	0.03	0.02	0.03	0.05	0.06	0.00
4. Education	3.16	1.06	—	—	—	3.10	1.06	—	—	—	0.02	−0.05	0.03	—	0.42	0.04	0.05	−0.02	0.04	0.01	−0.01	−0.02	0.03	0.03	0.09	−0.03
5. Income	3.63	1.20	—	—	—	3.57	1.19	—	—	—	0.04	−0.05	0.36	0.40	—	0.00	0.17	0.03	0.05	0.05	0.03	0.03	0.04	0.08	0.06	−0.02
6. Internet self-efficacy	5.33	2.38	0.73	0.82	0.61	5.40	2.49	0.73	0.80	0.58	0.19	−0.04	−0.06	0.04	0.01	—	0.01	0.42	0.40	0.38	0.33	0.36	0.33	0.22	0.16	0.25
7. Government staff	0.06	0.25	—	—	—	0.04	0.19	—	—	—	0.03	−0.01	0.01	0.00	0.01	0.06	—	0.01	0.04	0.03	0.02	0.01	0.03	0.03	0.01	0.00
8. Transparency	4.82	1.11	0.92	0.93	0.76	4.98	1.11	0.92	0.93	0.77	0.39	−0.01	0.01	−0.01	0.02	0.42	0.01	—	0.49	0.47	0.46	0.49	0.37	0.36	0.16	0.33
9. Accuracy	5.25	1.14	0.92	0.93	0.81	5.32	1.12	0.93	0.94	0.85	0.20	0.01	0.01	0.06	0.05	0.41	0.01	0.49	—	0.42	0.54	0.45	0.50	0.34	0.19	0.36
10. Completeness	5.15	1.14	0.94	0.96	0.88	5.22	1.14	0.94	0.94	0.85	0.26	0.01	0.01	0.03	0.04	0.41	0.02	0.44	0.53	—	0.48	0.46	0.45	0.35	0.20	0.33
11. Trust	5.38	1.16	0.91	0.93	0.81	5.55	1.15	0.92	0.93	0.81	0.21	−0.01	0.05	0.00	0.04	0.38	0.02	0.47	0.42	0.50	—	0.44	0.44	0.38	0.20	0.35
12. Personalization	4.76	1.13	0.94	0.96	0.88	5.00	1.13	0.94	0.96	0.88	0.44	−0.02	0.01	−0.01	0.02	0.36	0.02	0.46	0.36	0.40	0.46	—	0.38	0.37	0.17	0.32
13. Convenience	5.42	1.15	0.90	0.93	0.83	5.65	1.16	0.92	0.90	0.74	0.14	0.03	0.05	0.05	0.06	0.37	0.01	0.46	0.47	0.46	0.42	0.44	—	0.32	0.18	0.35
14. Intention to use e-government	5.37	1.28	0.96	0.92	0.79	4.72	1.38	0.95	0.94	0.85	0.22	−0.01	0.06	0.14	0.11	0.29	0.03	0.39	0.50	0.48	0.46	0.40	0.44	—	0.54	0.12
15. Use	4.33	1.43	0.79	0.87	0.77	3.37	1.51	0.74	0.82	0.69	0.19	−0.04	0.04	0.05	0.05	0.21	0.00	0.21	0.19	0.20	0.22	0.17	0.20	0.54	—	0.41
16. Satisfaction	4.74	0.88	0.92	0.93	0.86	5.23	0.95	0.92	0.93	0.83	0.08	0.02	−0.01	−0.05	−0.01	0.34	0.00	0.35	0.34	0.36	0.37	0.34	0.32	0.22	0.38	—

Notes. SD, Standard deviation; CA, Cronbach's alpha; CR, composite reliability; AVE, average variance extracted. The correlations below the diagonal are for the government websites sample and the correlations above the diagonal are for the online appointment booking service sample.

[a]$N = 1,839$ for the sample of respondents to the initial survey who reported on variables 1–14; $N = 752$ for the sample of respondents to the follow-up survey who reported on variables 15–16. For variables 1–14, correlations greater than 0.05 or less than −0.05 are significant at $p < 0.05$, and correlations greater than 0.06 or less than −0.06 are significant at $p < 0.01$. For variables 15–16, correlations greater than 0.08 or less than −0.08 are significant at $p < 0.01$.

[b]$N = 2,591$ for the sample of respondents to the initial survey who reported on variables 1–14; $N = 1,433$ for the sample of respondents to the follow-up survey who reported on variables 15–16. For variables 1–14, correlations greater than 0.02 or less than −0.02 are significant at $p < 0.05$, and correlations greater than 0.03 or less than −0.03 are significant at $p < 0.01$. For variables 15–16, correlations greater than 0.06 or less than −0.06 are significant at $p < 0.05$, and correlations greater than 0.07 or less than −0.07 are significant at $p < 0.01$.

Table 2   Hierarchical Regression Analysis Predicting Intention to Use E-Government

Variables	Government websites[a]			Online appointment booking service[b]		
	Block 1	Block 2	Block 3	Block 1	Block 2	Block 3
Control variables						
Gender	0.01	0.01	0.02	0.00	0.01	0.02
Age	0.07**	0.04	0.03	0.08***	0.04*	0.03
Education	0.10***	0.13***	0.15***	−0.02	0.00	0.02
Income	−0.01	−0.02	−0.03	0.04	0.03	0.03
Internet self-efficacy	0.23***	0.00	0.01	0.20***	0.01	0.01
Need for government service	0.16***	0.04	0.03	0.27***	0.13***	0.11***
Government staff	0.01	0.02	0.02	0.00	0.00	0.00
Information quality characteristics						
Accuracy		0.00	0.01		0.11***	0.09***
Completeness		0.11**	0.09*		0.05	0.03
Channel characteristics						
Convenience		0.22***	0.17***		0.07***	0.04
Personalization		0.07	−0.00		0.05	0.00
Means of uncertainty reduction						
Transparency		0.11**	0.01		0.23***	0.11***
Trust		0.16***	0.12***		0.16***	0.11***
Interaction terms						
Transparency × Accuracy			−0.05			0.12***
Transparency × Completeness			0.17***			0.05
Transparency × Convenience			0.15***			0.00
Transparency × Personalization			−0.01			0.09**
Trust × Accuracy			0.08*			0.00
Trust × Completeness			0.13**			0.08*
Trust × Convenience			−0.06			0.19***
Trust × Personalization			0.19***			0.01
R^2	0.10	0.33	0.40	0.15	0.37	0.43
Adjusted R^2	0.10	0.32	0.39	0.14	0.37	0.42
ΔR^2		0.23***	0.07***		0.22***	0.06***

Note. Standardized regression coefficients are shown.
[a]$N = 1{,}839$.
[b]$N = 2{,}591$.
*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$; two tailed-test.

The results in block 2 showed that information quality characteristics and channel characteristics (except personalization) were significant, positive determinants of citizens' intentions to use either or both services, thus supporting H1–H3. Although not hypothesized, transparency and trust were significant, positive determinants of citizens' intentions to use both services. The information quality characteristics, channel characteristics, transparency, and trust explained 23% and 22% additional variance over the control variables in predicting citizens' intentions in the two services, respectively.

5.2. Mediating Roles of Transparency and Trust
Tables 3 and 4 present the results of our regression analyses predicting transparency, trust, and intention to use e-government for the GWS sample and the OABS sample, respectively. We conducted mediation analyses following the procedures outlined by Baron and Kenny (1986).[6] We first tested for the mediating effects of transparency and trust on the relationships between the information quality and channel characteristics, respectively, on intention. The first step of the analysis was to regress the information quality and channel characteristics on transparency and trust, respectively. The results in blocks A2 and B3 showed that information quality characteristics and channel characteristics were significant, positive determinants of transparency and trust, respectively, for both services. The second step of the analysis was to regress the information quality and channel characteristics on intention. The results in block C2 showed that all information quality and channel characteristics (except accuracy in the GWS sample) had positive effects on

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[6] We used the resampling approach (MacKinnon et al. 2007) to further validate the mediating effects of transparency and trust. We followed Preacher and Hayes' (2008) procedures to test the indirect effects mediated by transparency and trust using 5,000 bootstrap samples. The results confirmed our findings.

Table 3   Regression Analysis for the Mediated Effects of Information Quality and Channel Characteristics (Government Websites Sample)

	Transparency		Trust				Intention to use E-government					
Variables	Block A1	Block A2	Block B1	Block B2	Block B3	Block B4	Block C1	Block C2	Block C3	Block C4	Block C5	Block C6
Control variables												
Gender	0.02	0.01	0.01	−0.00	−0.00	−0.01	0.01	0.01	0.02	0.01	0.01	0.01
Age	0.03	0.02	0.06*	0.04*	0.04*	0.04*	0.07**	0.04	0.05*	0.04	0.04	0.04
Education	−0.03	−0.04	−0.03	−0.03	−0.01	−0.02	0.10***	0.12***	0.14***	0.12***	0.13***	0.13***
Income	0.01	−0.00	0.02	0.01	0.01	0.01	−0.01	−0.02	−0.03	−0.02	−0.02	−0.02
Internet self-efficacy	0.36***	0.20***	0.36***	0.11***	0.14***	0.08***	0.23***	0.02	0.04	0.02	0.01	0.00
Need for government service	0.32***	0.26***	0.14***	0.02	0.04	0.01	0.16***	0.06**	0.02	0.04	0.05*	0.04
Government staff	0.01	−0.02	−0.01	0.00	0.00	0.00	0.00	0.02	0.02	0.02	0.02	0.02
Information quality characteristics												
Accuracy		0.28***		0.11***		0.07**		0.04		0.03	0.01	0.00
Completeness		0.14***		0.26***		0.24***		0.18***		0.12**	0.16***	0.11**
Channel characteristics												
Convenience				0.11***	0.15***	0.07***		0.25***		0.24***	0.23***	0.22***
Personalization				0.24***	0.25***	0.22***		0.14***		0.10***	0.10***	0.07
Means of uncertainty reduction												
Transparency					0.24***	0.18***			0.32***	0.13**		0.11**
Trust									0.25***		0.17***	0.16***
R^2	0.28	0.39	0.17	0.37	0.34	0.39	0.10	0.31	0.28	0.31	0.32	0.33
Adjusted R^2	0.28	0.38	0.17	0.37	0.34	0.39	0.10	0.30	0.28	0.31	0.32	0.32

Notes. $N = 1{,}839$. Standardized regression coefficients are shown.
   $^*p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$; two tailed-test.

intention. The third step of the analysis was to regress transparency and trust on intention. The results in block C3 showed that both transparency and trust had positive effects on intention. To facilitate the testing for the differential mediation effects of transparency and trust, we regressed transparency together with the information quality and channel characteristics on intention in block C4 and regressed trust together

Table 4   Regression Analysis for the Mediated Effects of Information Quality and Channel Characteristics (Online Appointment Booking Service Sample)

	Transparency		Trust				Intention to use E-government					
Variables	Block A1	Block A2	Block B1	Block B2	Block B3	Block B4	Block C1	Block C2	Block C3	Block C4	Block C5	Block C6
Control variables												
Gender	0.03	0.01	0.04*	0.01	0.01	0.01	0.00	0.01	0.01	0.01	0.01	0.01
Age	0.04*	0.03	0.05*	0.02	0.01	0.02	0.08***	0.05**	0.04*	0.04*	0.05**	0.04*
Education	−0.04*	−0.04*	−0.03	−0.03	−0.02	−0.03	−0.02	−0.01	0.01	−0.00	−0.00	0.00
Income	0.03	0.01	0.03	0.00	0.01	0.00	0.04	0.02	0.04	0.03	0.02	0.03
Internet self-efficacy	0.39***	0.22***	0.33***	0.04*	0.08***	0.01	0.20***	0.05**	0.03	0.02	0.03	0.01
Need for government service	0.23***	0.19***	0.04*	0.01	0.02	0.00	0.27***	0.17***	0.11***	0.13***	0.16***	0.13***
Government staff	−0.01	−0.02	0.01	0.01	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00
Information quality characteristics												
Accuracy		0.19***		0.31***		0.29***		0.21***		0.15***	0.16***	0.11***
Completeness		0.28***		0.22***		0.18***		0.14***		0.05	0.13***	0.05
Channel characteristics												
Convenience				0.12***	0.25***	0.11***		0.09***		0.08***	0.08***	0.07***
Personalization				0.16***	0.22***	0.12***		0.12***		0.07**	0.09	0.05
Means of uncertainty reduction												
Transparency					0.25***	0.18***			0.39***	0.24***		0.23***
Trust									0.21***		0.17***	0.16***
R^2	0.23	0.35	0.12	0.40	0.34	0.42	0.15	0.34	0.35	0.35	0.35	0.37
Adjusted R^2	0.23	0.35	0.11	0.40	0.34	0.42	0.14	0.33	0.35	0.35	0.35	0.37

Notes. $N = 2{,}591$. Standardized regression coefficients are shown.
   $^*p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$; two tailed-test.

with the information quality and channel characteristics on intention in block C5. The final step of the analysis was to regress all of the information quality and channel characteristics, transparency, and trust on intention. The results in block C6 showed that some of the significant relationships we found between the information quality/channel characteristics and intention became nonsignificant, including completeness in the case of OABS and personalization in both services (see blocks C5 versus C6 for the mediating effect of transparency; blocks C4 versus C6 for the mediating effect of trust). At the same time, both transparency and trust remained significant. These results indicate that the effects of completeness (in the OABS sample) and personalization (in both samples) were fully mediated through transparency and trust, whereas the effects of accuracy (in the OABS sample), completeness (in the GWS sample) and convenience (in both samples) were partially mediated, thus partially supporting H5A and H6A.

Next, we tested for the mediating effect of transparency on the relationship between information quality characteristics and trust. The results in blocks B2 and B3 showed that the two information quality characteristics and transparency had positive effects on trust, with the effects of convenience and personalization controlled. The results in block B4 showed that the effects of accuracy and completeness were partially mediated through transparency (see blocks B2 versus B4), thus supporting H5B.

Finally, we tested for the mediating effect of trust on the relationship between transparency and intention. The results showed that the effect of transparency was partially mediated through trust (see blocks C4 versus C6), thus supporting H6B.
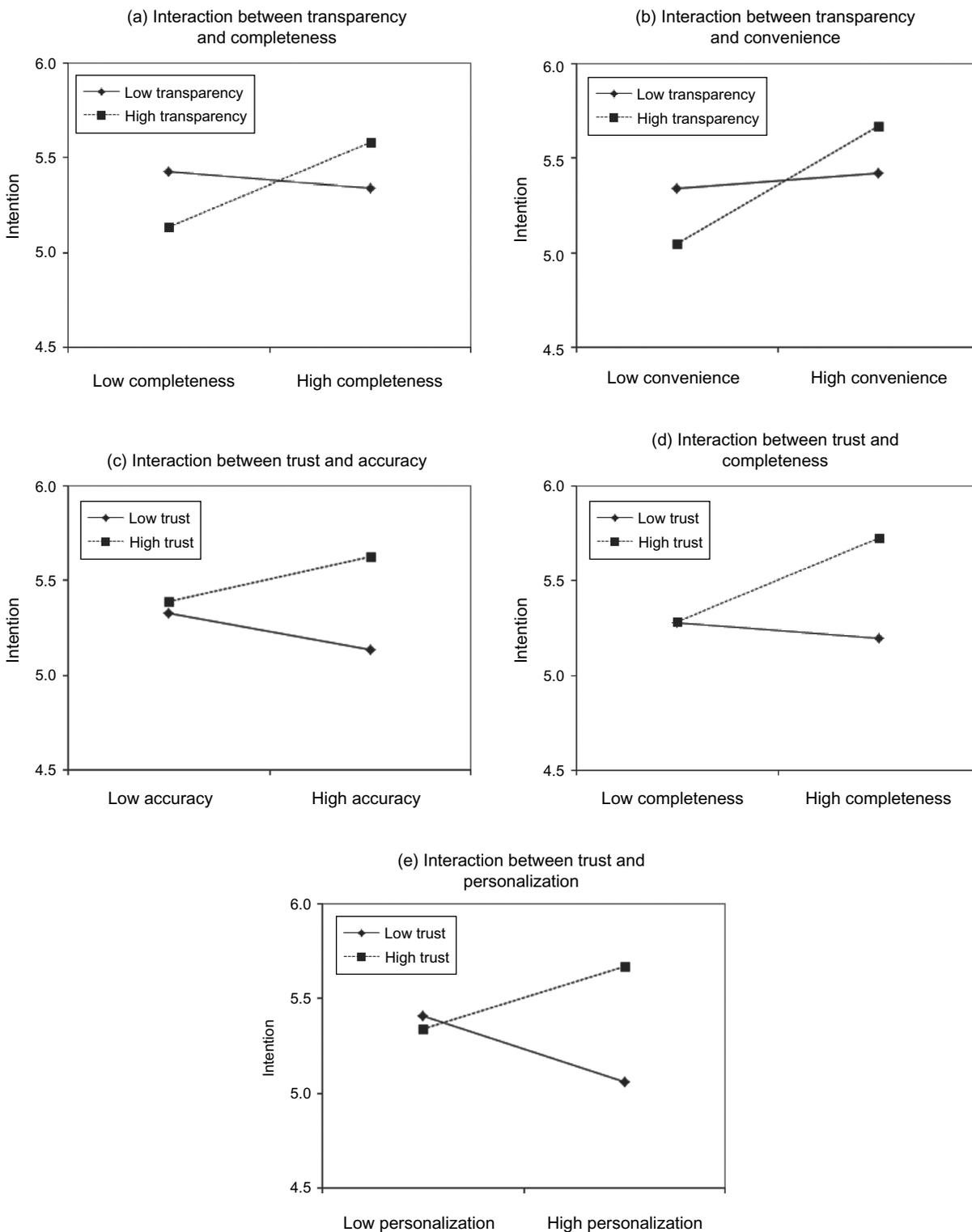
5.3. Moderating Roles of Transparency and Trust

The results in block 3 of Table 2 showed that a number of interaction terms were significant. Figure 2 shows the plots of the significant interactions between means of uncertainty reduction (i.e., transparency and trust) and the relevant characteristics (i.e., accuracy, completeness, convenience, and personalization) that occur when we are predicting citizens' intentions to use GWS. Following Aiken and West (1991), we plotted the interactions by deriving separate equations for high and low (one standard deviation above and below the mean) conditions of the predictors, and test the simple slopes for each of the interactions. First, for individuals who perceived transparency to be high, completeness was positively related to intention ($\beta = 0.20$, $p < 0.001$); and for individuals who perceived transparency to be low, there was no relationship between completeness and intention ($\beta = -0.04$, $p > 0.05$) (see Figure 2(a)). Second, for individuals who perceived transparency to be high, convenience was positively related to intention

($\beta = 0.27$, $p < 0.001$); and for individuals who perceived transparency to be low, there was no relationship between convenience and intention ($\beta = 0.03$, $p > 0.05$) (see Figure 2(b)). Third, for individuals who had high trust in the channel, accuracy was positively related to intention ($\beta = 0.10$, $p < 0.05$); and for individuals who had low trust in the channel, there was no relationship between accuracy and intention ($\beta = -0.08$, $p > 0.05$) (see Figure 2(c)). Fourth, for individuals who had high trust in the channel, completeness was positively related to intention ($\beta = 0.19$, $p < 0.001$); and for individuals who had low trust in the channel, there was no relationship between completeness and intention ($\beta = -0.03$, $p > 0.05$) (see Figure 2(d)). Finally, for individuals who had high trust in the channel, personalization was positively related to intention ($\beta = 0.15$, $p < 0.001$); and for individuals who had low trust in the channel, personalization was negatively related to intention ($\beta = -0.15$, $p < 0.001$) (see Figure 2(e)).

Figure 3 shows the plots of the significant interactions between means of uncertainty reduction (i.e., transparency and trust) and the relevant characteristics (i.e., accuracy, completeness, convenience, and personalization) that occur when we are predicting citizens' intentions to use OABS. First, for individuals who perceived transparency to be high, accuracy was positively related to intention ($\beta = 0.22$, $p < 0.001$); and for individuals who perceived transparency to be low, there was no relationship between accuracy and intention ($\beta = -0.04$, $p > 0.05$) (see Figure 3(a)). Second, for individuals who perceived transparency to be high, personalization was positively related to intention ($\beta = 0.10$, $p < 0.05$); and for individuals who perceived transparency to be low, personalization was negatively related to intention ($\beta = -0.10$, $p < 0.05$) (see Figure 3(b)). Third, for individuals who had high trust in the channel, completeness was positively related to intention ($\beta = 0.12$, $p < 0.05$); and for individuals who had low trust in the channel, there was no relationship between completeness and intention ($\beta = -0.06$, $p > 0.05$) (see Figure 3(c)). Finally, for individuals who had high trust in the channel, convenience was positively related to intention ($\beta = 0.26$, $p < 0.001$); and for individuals who had low trust in the channel, convenience was negatively related to intention ($\beta = -0.18$, $p < 0.001$) (see Figure 3(d)). Taken together, these results demonstrated the synergistic effects of transparency and trust with information quality characteristics and channel characteristics on citizens' intentions, thus supporting H5C, H5D, H6C, and H6D. These interaction effects explained 7% and 6% additional variance in citizens' intentions in the two services, respectively (see Appendix C for a summary of our hypotheses and findings).

Figure 2 **Interaction Effects of Transparency and Trust (Government Websites Sample)**

(a) Interaction between transparency and completeness

(b) Interaction between transparency and convenience

(c) Interaction between trust and accuracy

(d) Interaction between trust and completeness

(e) Interaction between trust and personalization

5.4. Effects of Intention on Use and Satisfaction

Our two-stage study allowed us to examine the relationship between intention, use, and citizens' satisfaction in both services. We examined the relationship between intention and use in that sample of respondents who provided responses in both waves of data collection. We found that intention ($\beta = 0.54$, $p < 0.001$ for GWS; $\beta = 0.55$, $p < 0.001$ for OABS) was positively related to use ($R^2 = 0.29$ for GWS; $R^2 = 0.30$ for OABS), and use ($\beta = 0.38$, $p < 0.001$ for GWS; $\beta = 0.41$, $p < 0.001$

Figure 3   Interaction Effects of Transparency and Trust (Online Appointment Booking Service Sample)

(a) Interaction between transparency and accuracy

(b) Interaction between transparency and personalization

(c) Interaction between trust and completeness

(d) Interaction between trust and convenience
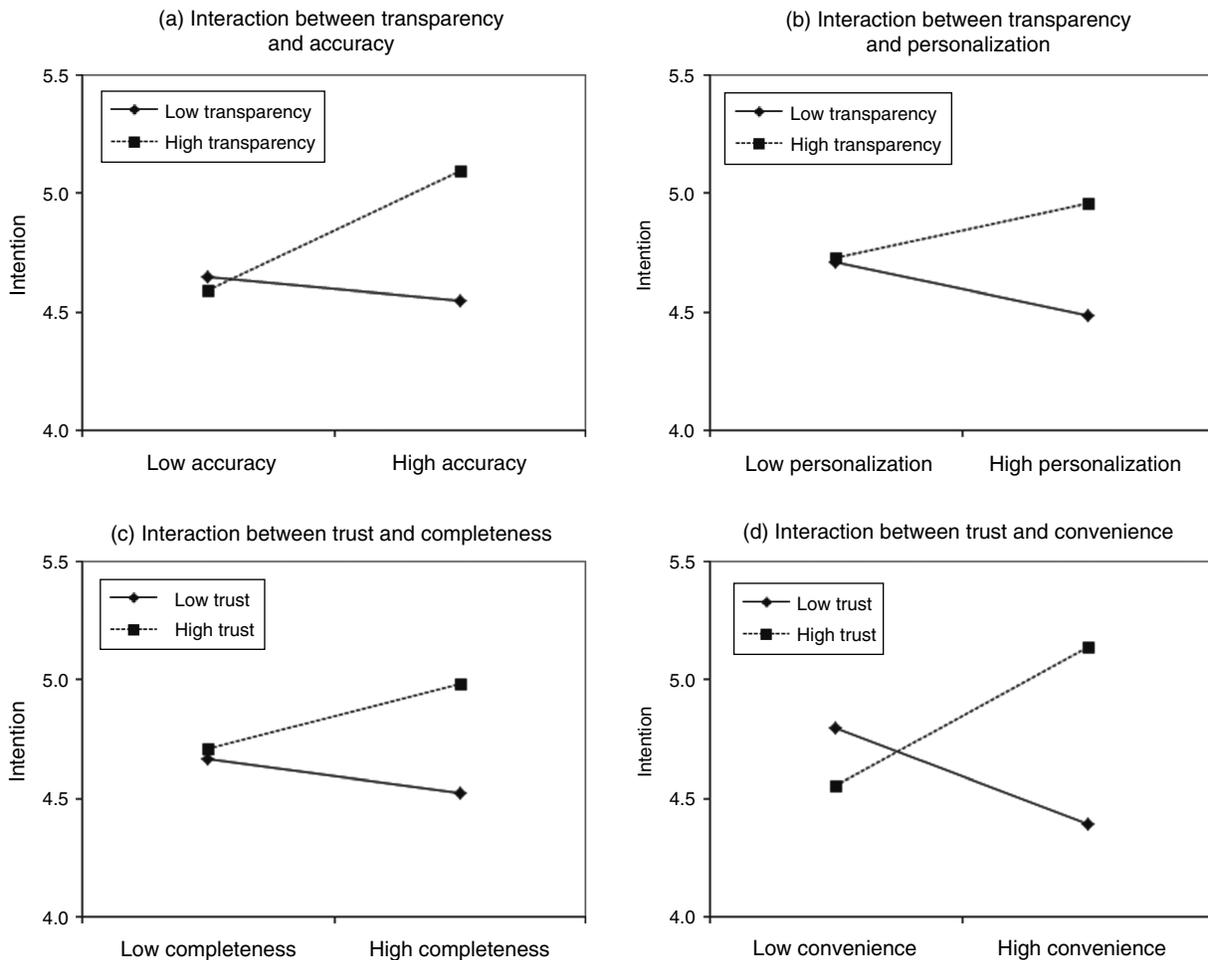
for OABS) was positively related to satisfaction ($R^2 = 0.14$ for GWS; $R^2 = 0.17$ for OABS). We conducted the Sobel (1982) test to further evaluate the mediating effect of use. The significant z-values indicated that use mediated the effect of intention on citizens' satisfaction for both samples ($z = 7.69$, $p < 0.001$ for GWS; $z = 8.43$, $p < 0.001$ for OABS).

6. Discussion

We sought to examine two means of reducing citizens' uncertainty in e-government services. We found support for our proposed model. We found that the information quality characteristics, i.e., accuracy and completeness, and the channel characteristics, i.e., convenience and personalization, had significant effects on citizens' intentions to use e-government. Furthermore, we found significant mediating and moderating effects of the two means of uncertainty reduction, i.e., transparency and trust, on the relationships between information quality characteristics and channel characteristics on citizens' intentions. The intentions thus formed influenced citizens' use of e-government services and

ultimately, their satisfaction with e-government. We observed these effects after controlling for individuals' service needs and demographic characteristics. Our model explained 40% and 43% of the variance in intention, 29% and 30% of the variance in use, and 14% and 17% of the variance in satisfaction for government websites and online appointment booking service, respectively.

6.1. Theoretical Implications

First, our work proposes an integrated model of citizens' adoption and use of e-government services. We introduce the concept of uncertainty reduction to the context of e-government and identify two means of resolving citizens' uncertainty of e-government, i.e., transparency and trust. As uncertainty is a major barrier to citizens' use of e-government, it will be important for governments to help citizens resolve their uncertainty, e.g., in terms of service outcomes. Next, we identify two sets of factors, i.e., information quality characteristics and channel characteristics, that are relevant to the means of uncertainty reduction. We suggest that transparency and trust can play both

mediating and moderating roles in affecting the relationships between information quality and various channel characteristics and citizens' intentions to use e-government. Furthermore, we include e-government use and citizens' satisfaction in the model to provide greater comprehensiveness and criterion validity. Our results provide empirical support for the proposed model. Overall, the integration of factors from multiple streams to explain e-government use is our core theoretical contribution.

Second, our work introduces a novel theoretical perspective, i.e., uncertainty reduction, to explain the relationships among our identified factors. Although prior research has examined some of our identified factors, e.g., transparency and trust, using the technology adoption perspective and has primarily focused on their direct effects on intention, our proposed uncertainty reduction perspective sheds new light on how the factors will affect intention via both mediation and moderation pathways. Specifically, we examine the roles of transparency and trust in mediating and moderating the effects of information quality and channel characteristics. Our findings provide a nuanced understanding of the different mechanisms through which the identified factors can help reduce citizens' uncertainty and increase the use of e-government services. In particular, our finding of partial mediation and moderation by transparency and trust suggests that the uncertainty reduction perspective may well complement the traditional technology adoption perspective and add to the explanation of service use.

Third, our work provides some evidence of generalizability of our proposed model. We test our model using samples pertaining to two e-government services, i.e., government websites and online appointment booking. Our results show that for both services, all of the information quality and channel characteristics are significant in predicting intention. These characteristics either have a direct effect on intention or interact with transparency or trust or both in predicting intention. Yet, the pattern of results is quite different across the two services. For example, accuracy has a direct effect on intention for the OABS sample but not the GWS sample, whereas the reverse is true for completeness. One possible explanation is that the relative importance of these characteristics may vary across service types (e.g., informational versus transactional). Future research can identify the characteristics that distinguish different services, such as throughput time and degree of variation (Schmenner 2004), and incorporate such characteristics into theorizing.

Fourth, our work offers some insights into consumers' adoption and use of technologies. The technology adoption perspective suggests that consumers' intentions to use a technology are driven primarily by their expectations about the technology in terms of performance, efforts required to use the technology, social norms, facilitating resources, hedonic motivation, price value, and habit (Venkatesh et al. 2012b). However, consumers' formation of these expectations can be subject to uncertainty due to the lack of usage experience and some research has noted the importance of reducing such uncertainty in e-commerce transactions (e.g., Flanagin 2007). Complementing this line of research, our work demonstrates the utility of the uncertainty reduction perspective in identifying specific sets of factors, i.e., means of uncertainty reduction, information quality characteristics, and channel characteristics, rather than adopted extant technology adoption models to study citizens' adoption and use of e-government services. Future research could use this approach to arrive at a set of context-relevant factors that help service providers to reduce users' uncertainty in consumer technologies and develop better deployment strategies (e.g., Xu et al. 2014). Furthermore, with the emergence of social media and citizen responses to government actions based on input they receive from their networks on social media, social network approaches and associated constructs can be helpful in guiding investigations (e.g., Sykes 2015; Sykes et al. 2009, 2014).

6.2. Practical Implications

First, transparency and trust are two effective means of uncertainty reduction that can alter the effects of citizens' beliefs about information quality characteristics and channel characteristics on intentions to use e-government (see Figures 2 and 3). The significant interaction effects of transparency suggest that when transparency is high, citizens are more likely to use e-government services that are accurate and complete as well as value the convenience of the channel and the personalization features that facilitate their use of public services. By contrast, lower transparency will discourage citizens from using e-government services despite their benefits. Thus, governments should foster transparency when deploying their services. As our results suggested, governments could improve transparency by providing accurate and complete information during the service process. For example, governments could provide citizens with a better understanding of the inner working of e-government services by listing the number of steps required to perform the services. Also, governments could allow citizens to track the service status through multiple means (e.g., email and short message service) and provide means for citizens to provide feedback and interact with the government (e.g., blogs and surveys).

Second, similar to transparency, trust encourages citizens to use e-government. When trust is high, citizens are more likely to value the benefits of e-government services, i.e., high-quality information,

convenient access, and personalization capability. When trust is low, citizens will not use the services despite the benefits. Citizens may even regard the characteristics that facilitate the use of the online services (i.e., convenience and personalization) as boosters of security and privacy breaches, resulting in negative perceptions of these services. Therefore, governments should create and sustain trust when deploying their services. As our results suggested, governments could build trust by improving the transparency of services. Also, careful design of the website functionality, not necessarily limited to convenient access and personalization features examined in our study, could contribute to citizens' trust in e-government by signaling that governments care about the citizens, understand their needs, and have the capability to deliver the services. For example, trust could be favorably influenced when an e-government website has implemented adequate security technologies (e.g., digital certificates, encryption) and procedures to protect citizens' information and online activities, including the data and other contents transmitted between citizens' computers and the government's server (Kim et al. 2006).

Third, in terms of design of e-government websites, our investigation suggests that not only are accuracy, completeness, convenience, and personalization important in their own right, but they also help foster transparency and trust. Government agencies should design their informational and transactional services with these attributes in mind. For example, accuracy of online information and services can be ensured by deploying automated checking procedures and policies on the use and maintenance of systems (Berner 2008). Completeness can be ensured by making information content and hyperlinks available as needed for citizens to complete specific tasks (Kim et al. 2005). Convenience can be fostered through 24/7 uptime, an easy-to-use Web interface, and fast response/download time (Meuter et al. 2000). Personalization can be achieved through an analysis of citizens' clickstream data, particularly at early stages in their visits (Ho et al. 2011). When contracting technology solutions providers, managers in government agencies will be well served to discuss these attributes and design solutions that are sensitive to these needs of citizens. It will require a partnership between content providers on the government agency side and the designers on the technology solution provider side to work closely in designing an optimal solution that will be used by citizens.

6.3. Limitations and Future Research
There are some limitations and directions for future research that should be noted. First, our work was conducted in Hong Kong and is thus constrained to a particular cultural and sociopolitical context. Given the importance of socioeconomic factors in influencing technology use, future research can examine potential

contingencies and/or generalizability across different settings, especially by focusing on the deployment of e-government services in developing countries (see Venkatesh and Sykes 2013). Second, an online data collection may be subject to sampling bias. The participants of this study were relatively young and experienced Internet users with fairly high Internet self-efficacy. Thus, this sample may not be representative of the general population, although these participants are very likely to be potential users of e-government services. Future research could target senior citizens and inexperienced users to confirm the findings of this study. Third, we drew on the uncertainty reduction theory (Berger and Calabrese 1975) to identify two means of uncertainty reduction. Future research could adopt other theories relevant to uncertainty mitigation, such as uncertainty management theory (Lind and Van den Bos 2002), to guide the investigation and examine other possible means of uncertainty reduction. Finally, we included a parsimonious set of information quality and channel characteristics in our model to examine the proposed means of uncertainty reduction. Future research could focus on other information quality and channel characteristics to extend our work and findings. Also, as the inclusion of use and satisfaction in the model serves only to provide greater comprehensiveness and criterion validity, we did not include an exhaustive list of factors predicting use and satisfaction. Future work could incorporate additional factors by drawing on theoretical models that are specifically designed for this purpose, such as UTAUT (Venkatesh et al. 2012b) and the expectation-confirmation model (Venkatesh and Goyal 2010).

7. Conclusions
We presented a model with two means of uncertainty reduction for e-government services. Based on a longitudinal field study among 4,430 citizens across two different services, we found support for our proposed model. Transparency and trust showed significant mediating and moderating effects on the relationships between the relevant factors and citizens' intentions to use e-government. The model can serve as a stepping stone for future inquiry into this important and emerging area of public management. We also presented managerial implications, including some of the challenges and potential solutions to making e-government work.

Appendix A. Measurement Items

Accuracy

1. I expect government information on *government websites* to be accurate.
2. I expect *government websites* to provide me with accurate government information.
3. There would be few errors in government information I obtain from *government websites*.

Completeness

1. I expect *government websites* to provide me with comprehensive government information.
2. I expect *government websites* to provide me with all the government information I need.
3. I expect *government websites* to provide me with a complete set of government information.

Convenience

1. *Government websites* would enable me to access government information anytime, day or night.
2. *Government websites* would enable me to obtain government information from home, from the office, on the road, or at other locales.
3. It would be convenient for me to get government information using *government websites*.

Personalization

1. I would be able to fully personalize notifications when using *government websites* to access government information.
2. I would be able to fully personalize the presentation of information when using *government websites* to obtain government services.
3. I expect *government websites* to enable me to fully personalize information that I will see.

Transparency

1. I believe the working processes of *government websites* would be transparent.
2. I believe the government will provide me with deep access to how *government websites* work.
3. I believe the government will provide me with in-depth knowledge about operations of *government websites*.
4. I believe I will have opportunities to provide feedback on *government websites*.

Trust

1. I believe that *government websites* would act in my best interest.

2. I expect *government websites* to be sincere and genuine.
3. I believe that *government websites* perform their roles very well.

Internet self-efficacy

1. I could access government information using *government websites* if I had just the online help information for assistance.
2. I could access government information using *government websites* if I could call someone for help if I got stuck.
3. I could access government information using *government websites* if someone showed me how to do it first.

Need for government service

1. I frequently need government information for various purposes.
2. I often ask government officers for government information.
3. I frequently visit government agencies for government information.

Intention

1. I intend to use *government websites* to access government information in the next four months.
2. I predict I would use *government websites* to access government information in the next four months.
3. I plan to use *government websites* to access government information in the next four months.

E-government services' use

1. How often did you use *government websites* in the past four months?
2. In the past four months, when you have to access government information, how often do you use *government websites* to do so?

Satisfaction

1. I am very dissatisfied/very satisfied with my use of *government websites*.
2. I am very displeased/very pleased with my use of *government websites*.
3. I am very frustrated/very contented with my use of *government websites*.

Note. Measurement items for the online appointment booking service were modified based on the above items to fit the context.

Appendix B. Factor Analyses with Direct Oblimin Rotation

Table B.1   **Government Websites Sample**

Item	Factor										
	1	2	3	4	5	6	7	8	9	10	11
Accuracy 1	**0.77**	0.00	0.02	−0.01	0.01	0.00	−0.04	−0.04	0.00	−0.09	0.03
Accuracy 2	**0.99**	0.02	0.01	−0.03	0.01	0.03	0.00	−0.01	0.00	0.05	−0.02
Accuracy 3	**0.79**	0.06	0.00	0.00	−0.01	0.06	−0.06	0.00	0.00	−0.22	0.08
Personalization 1	0.02	**0.90**	−0.01	−0.01	−0.02	0.04	−0.02	−0.02	−0.02	0.03	0.00
Personalization 2	0.00	**0.98**	−0.03	0.01	−0.01	−0.02	−0.01	−0.01	−0.01	−0.01	0.00
Personalization 3	0.01	**0.77**	0.02	−0.02	0.03	0.04	0.00	0.01	0.01	−0.03	0.02

Table B.1   (Continued)

	1	2	3	4	5	6	7	8	9	10	11
Intention to use e-government 1	−0.02	0.00	**0.86**	0.01	−0.02	−0.02	−0.02	−0.01	−0.01	−0.07	0.01
Intention to use e-government 2	0.08	−0.01	**0.88**	−0.02	−0.03	0.02	−0.02	0.01	−0.02	0.05	0.00
Intention to use e-government 3	−0.03	0.02	**0.78**	−0.02	0.05	0.06	−0.05	−0.05	0.03	0.01	0.02
Satisfaction 1	0.01	−0.02	0.01	**−0.90**	0.00	−0.02	0.01	−0.02	0.01	0.00	0.01
Satisfaction 2	0.00	0.01	−0.01	**−0.89**	0.00	0.03	0.00	0.01	0.00	0.02	0.00
Satisfaction 3	0.01	0.00	0.01	**−0.89**	−0.02	−0.03	−0.01	0.00	0.00	−0.02	0.00
Need for government service 1	0.04	0.17	0.18	0.00	**0.76**	−0.02	0.04	−0.04	0.13	−0.10	0.02
Need for government service 2	0.00	0.01	−0.03	0.00	**0.95**	−0.04	−0.01	−0.01	−0.01	0.01	0.01
Need for government service 3	0.00	−0.05	−0.04	0.01	**0.89**	0.07	−0.01	0.02	−0.02	0.01	0.00
Transparency 1	0.02	−0.01	0.04	0.01	0.00	**0.77**	0.02	−0.02	0.01	−0.16	−0.03
Transparency 2	0.02	0.02	0.04	−0.01	0.00	**0.90**	0.02	0.02	−0.01	0.01	0.00
Transparency 3	0.06	0.05	0.03	0.01	−0.04	**0.73**	−0.03	−0.06	0.04	0.01	0.07
Transparency 4	−0.02	0.04	−0.05	−0.03	0.06	**0.75**	−0.08	−0.03	0.01	0.01	0.04
Trust 1	−0.01	0.02	0.02	−0.02	0.03	0.04	**−0.82**	0.03	−0.01	0.00	0.02
Trust 2	0.02	0.00	−0.02	0.01	−0.01	−0.01	**−0.94**	−0.01	0.00	−0.01	−0.02
Trust 3	0.03	0.01	0.11	0.00	−0.03	−0.03	**−0.75**	−0.09	0.05	−0.04	0.04
Convenience 1	0.06	0.02	0.04	0.01	−0.03	0.00	0.01	**−0.77**	−0.01	0.00	0.01
Convenience 2	−0.02	−0.03	−0.03	−0.01	0.03	0.00	0.01	**−0.95**	−0.01	0.00	0.01
Convenience 3	0.00	0.06	0.05	−0.03	−0.01	0.06	−0.09	**−0.75**	0.02	−0.03	0.00
Use 1	−0.02	−0.01	−0.07	−0.03	0.07	0.04	−0.03	0.01	**0.79**	0.03	−0.04
Use 2	0.03	0.00	0.06	0.01	−0.08	−0.03	0.01	−0.01	**0.78**	−0.02	0.05
Completeness 1	0.08	0.02	−0.04	−0.03	0.02	0.00	−0.09	0.00	−0.01	**−0.79**	0.00
Completeness 2	0.05	0.03	0.06	−0.03	−0.02	0.01	0.00	−0.05	0.01	**−0.76**	0.05
Completeness 3	0.00	0.01	0.02	−0.02	0.02	0.15	−0.01	−0.04	0.01	**−0.71**	0.01
Internet self-efficacy 1	−0.02	0.03	−0.01	−0.06	0.07	0.05	−0.02	0.05	−0.03	0.00	**0.71**
Internet self-efficacy 2	−0.01	0.04	0.01	−0.02	−0.03	0.02	0.02	−0.05	0.01	−0.04	**0.71**
Internet self-efficacy 3	0.04	−0.04	0.01	0.04	−0.03	−0.02	−0.02	−0.01	0.03	0.02	**0.72**

Table B.2   Online Appointment Booking Service Sample

	Factor										
Item	1	2	3	4	5	6	7	8	9	10	11
Accuracy 1	**0.74**	−0.01	0.00	0.06	0.04	0.05	0.01	−0.02	0.06	−0.04	0.01
Accuracy 2	**0.93**	0.01	0.02	0.00	0.00	0.04	0.00	−0.02	0.02	0.01	0.02
Accuracy 3	**0.71**	0.03	0.02	−0.02	0.10	−0.02	−0.02	−0.09	−0.01	−0.31	0.03
Need for government service 1	0.02	**0.77**	−0.01	0.06	0.10	0.00	0.07	−0.01	−0.03	−0.05	0.05
Need for government service 2	0.02	**0.99**	0.02	0.00	−0.05	−0.01	−0.04	0.03	0.02	0.03	−0.02
Need for government service 3	−0.03	**0.93**	0.00	−0.04	−0.02	0.01	−0.01	−0.01	0.01	0.00	−0.01
Satisfaction 1	0.00	0.01	**0.87**	0.03	0.00	−0.01	0.00	0.00	0.02	0.00	−0.01
Satisfaction 2	−0.02	0.02	**0.91**	−0.03	0.01	0.02	0.00	−0.02	−0.03	0.01	0.01
Satisfaction 3	0.03	−0.01	**0.90**	−0.01	−0.01	0.02	0.00	0.01	0.02	0.00	0.00
Intention to use e-government 1	0.04	−0.01	0.00	**0.85**	0.03	0.02	0.00	0.01	0.01	0.01	0.03
Intention to use e-government 2	0.01	−0.01	−0.01	**0.91**	−0.01	0.04	0.00	0.00	0.03	0.01	0.00
Intention to use e-government 3	−0.02	0.04	0.03	**0.77**	0.02	0.01	0.00	−0.10	0.01	−0.04	−0.02
Personalization 1	−0.01	0.00	0.00	0.03	**0.88**	0.01	−0.01	0.00	0.05	−0.01	0.00
Personalization 2	−0.01	0.00	0.00	−0.01	**0.99**	−0.02	0.01	−0.01	−0.02	0.01	−0.02
Personalization 3	0.05	0.02	0.01	0.00	**0.75**	0.06	0.00	−0.01	0.01	−0.01	0.05
Transparency 1	−0.02	−0.01	0.02	0.04	0.12	**0.77**	−0.01	0.02	0.02	−0.16	0.02
Transparency 2	0.05	−0.02	0.03	0.02	0.03	**0.81**	−0.01	0.02	0.04	−0.05	−0.01
Transparency 3	0.05	−0.01	−0.02	0.05	−0.03	**0.80**	0.02	−0.01	0.01	−0.01	0.03
Transparency 4	0.00	0.05	0.04	−0.01	0.02	**0.71**	0.01	−0.07	−0.01	0.01	0.03
Use 1	−0.01	0.06	−0.08	−0.07	−0.01	0.08	**0.90**	−0.02	0.00	0.05	−0.03
Use 2	0.02	−0.06	0.11	0.08	0.02	−0.07	**0.82**	0.01	0.01	−0.06	0.05
Trust 1	0.04	0.00	0.01	0.01	0.03	0.04	0.03	**−0.78**	0.03	0.06	0.02
Trust 2	−0.02	0.00	0.01	−0.03	0.01	−0.02	−0.02	**−0.93**	−0.02	−0.06	0.02
Trust 3	0.05	−0.01	−0.01	0.18	−0.03	0.01	0.03	**−0.73**	0.08	−0.05	−0.02
Convenience 1	0.07	−0.02	0.00	0.10	0.00	−0.01	0.00	0.01	**0.72**	−0.03	0.00
Convenience 2	−0.05	0.02	0.00	−0.06	0.01	0.02	−0.01	−0.02	**0.91**	−0.02	0.01
Convenience 3	0.07	−0.02	0.03	0.04	0.06	0.01	0.02	−0.03	**0.75**	0.01	0.01
Completeness 1	0.08	0.04	0.02	0.01	0.05	0.10	0.02	−0.02	0.04	**−0.77**	−0.02
Completeness 2	0.03	0.00	0.01	0.03	0.02	0.05	0.00	−0.04	0.05	**−0.77**	0.05
Completeness 3	0.03	0.01	0.00	0.03	0.01	0.09	0.02	−0.04	0.06	**−0.72**	0.03
Internet self-efficacy 1	0.00	0.01	0.03	−0.05	0.03	0.07	−0.02	−0.02	−0.03	0.03	**0.76**
Internet self-efficacy 2	0.02	0.01	0.00	0.00	0.00	0.01	0.02	−0.01	0.07	0.02	**0.71**
Internet self-efficacy 3	−0.01	−0.01	−0.03	0.05	−0.02	−0.05	0.00	0.02	−0.01	−0.05	**0.73**

Appendix C. Summary of Hypotheses and Findings

Table C.1   Hypothesis

Hypothesis		Sample	
		Government websites	Online appointment booking service
H1	Accuracy is positively related to intention to use e-government.	Not supported.	Supported.
H2	Completeness is positively related to intention to use e-government.	Supported.	Not supported.
H3	Convenience is positively related to intention to use e-government.	Supported.	Supported.
H4	Personalization is positively related to intention to use e-government.	Not supported.	Not supported.
H5A	Transparency partially mediates the positive relationship between information quality characteristics (i.e., accuracy and completeness) and intention to use e-government.	Partially supported; Transparency partially mediated the relationship between completeness and intention to use.	Partially supported; Transparency partially mediated the relationship between accuracy and intention to use, and fully mediated the relationship between completeness and intention to use.
H5B	Transparency partially mediates the positive relationship between information quality characteristics (i.e., accuracy and completeness) and trust.	Supported.	Supported.
H5C	Transparency moderates the positive relationship between information quality characteristics (i.e., accuracy and completeness) and intention to use e-government, such that these characteristics are more strongly, positively related to intention to use e-government when transparency is high rather than low.	Partially supported; Transparency moderated the relationship between completeness and intention to use.	Partially supported; Transparency moderated the relationship between accuracy and intention to use.
H5D	Transparency moderates the positive relationship between channel characteristics (i.e., convenience and personalization) and intention to use e-government, such that these characteristics are more strongly, positively related to intention to use e-government when transparency is high rather than low.	Partially supported; Transparency moderated the relationship between convenience and intention to use.	Partially supported; Transparency moderated the relationship between personalization and intention to use.
H6A	Trust partially mediates the positive relationship between channel characteristics (i.e., convenience and personalization) and intention to use e-government.	Partially supported; Trust partially mediated the relationship between convenience and intention to use, and fully mediated the relationship between personalization and intention to use.	Partially supported; Trust partially mediated the relationship between convenience and intention to use, and fully mediated the relationship between personalization and intention to use.
H6B	Trust partially mediates the positive relationship between transparency and intention to use e-government.	Supported.	Supported.
H6C	Trust moderates the positive relationship between information quality characteristics (i.e., accuracy and completeness) and intention to use e-government, such that these characteristics are more strongly, positively related to intention to use e-government when trust is high rather than low.	Supported.	Partially supported; Trust moderated the relationship between completeness and intention to use.
H6D	Trust moderates the positive relationship between channel characteristics (i.e., convenience and personalization) and intention to use e-government, such that these characteristics are more strongly, positively related to intention to use e-government when trust is high rather than low.	Partially supported; Trust moderated the relationship between personalization and intention to use.	Partially supported; Trust moderated the relationship between convenience and intention to use.

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