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Learning cyber trust using a triadic functioning analysis: a qualitative approach

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Abstract The issue of cyber trust has been scattered in several different fields, including computer science, information science and some social sciences. Although social informatics has been a subject of systematic analytical and critical research for more than three decades, previous research has rarely noted the importance of social informatics on cyber trust. Therefore, it is essential to establish a research framework that applies in cyber trust from a perspective of social informatics so that cyber trust may be achieved by different professionals and researchers. This study presents the factors under which cyber trust thrives from a perspective of social informatics. Social informatics research pertains to e-commerce from a perspective of both social and technical changes that shed some light on cyber trust for business professionals and researchers.

Keywords Cyber trust · Social informatics · E-commerce

1 Introduction

Information is widespread via information technology (IT) such as mobile phones and Internet that replaces the traditional ways individuals seek information and advice from their families, relatives and friends, given that the information can be available in the convenience, comfort and privacy of individuals' home or office (Smith and Manna 2004). Instead of completely

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replacing the traditional social activities, IT is an efficient aid for online individuals to the understanding of potential social events (such as shopping and chatting) based on human–computer interaction, and to make right decisions towards the events. For example, it allows individuals to have efficient online access to the information (e.g., check lists for a certain symptom in e-healthcare systems) or service (e.g., e-prescribing or e-consulting in e-healthcare systems) from healthcare service providers via Internet. However, it does not infer that individuals will act on the information or accept the online social activities if their online trust (or cyber trust) is not well established. The consumers may still choose to take similar information or service through a traditional channel because the information or service is perceived more trustworthy than that of e-commerce. Therefore, cyber trust becomes an important issue in business ethics and should be emphasized particularly in e-commerce.

It has been an established fact of "real life" that trust should be viewed as a critical lubricant of social relations in the era of IT (De Laat 2005). A universal parallel to the one of "real life" has been expanding since the 1990s, and still is in an online world. Previous research has pointed out serious problems about trust developed in an online world (De Laat 2005), and some specific obstacles have been indicated by Nissenbaum (2001). For example, the identities of online consumers may be partially or entirely missing, which reduces the number of mutual cues upon which trust may develop (Nissenbaum 2001). This phenomenon may obscure the nature of mutual relationships among online users and imply a diminished sense of responsibility to one another (De Laat 2005; Nissenbaum 2001).

E-commerce has been making concerted efforts to assure their clients that their personal information and privacy are safe and confidential. However, e-commerce administration must also be concerned with something over which they have no control. That is, do people perceptually trust their e-commerce in mind? If not, the administration should have proper strategies to deal with how to strengthen individuals' cyber trust. However, little research regarding cyber trust particularly in e-commerce has been tried previously, leaving an unexplored gap in the issue of cyber trust. In light of the aforementioned gap in the IT usage literature, the two research questions of interest to this study are:

(1) What conceptual dimensions dominate one's cyber trust and how?
(2) What key factors drive one's cyber trust?

Understanding these research questions is important for theoretical and practical reasons. Theoretically, the recent emergence of Internet technology offers us a unique opportunity for building theories of IT-mediated cyber trust, an increasingly relevant yet under-examined area of research. Such theories may help bridge the gap between IT usage and cyber trust literature. From a practical standpoint, an improved understanding of the key determinants of cyber trust may help e-commerce administration design online product features, interfaces, and services that are better suited to the needs of the target client population. Collectively, to obtain the understandings to the above two research questions, this study starts from the theoretical underpinnings of social informatics theory in the following section and formulates a research model of cyber trust.

2 Theory background and research framework

Although social informatics has been a subject of systematic analytical and critical research for more than three decades, social informatics studies are scattered in several different fields, including computer science, information science and some social sciences (Kling 1999). Previous research has rarely noted the importance of social informatics on such IT

ethics as cyber trust. Thus, it is important to establish a research framework that applies in cyber trust from a perspective of social informatics so that cyber trust may be achieved by different professionals and researchers.

A serviceable working conception of "social informatics" is that it identifies a body of research that examines the social aspects of IT (Kling 1999). Social informatics is defined as the interdisciplinary study of the design, users and consequences of information technologies that takes into account their interaction with institutional contexts (Kling 1999). Before understanding social informatics in cyber trust, it is important to note a social phenomenon of "productivity paradox" that has been ignored among professionals and researchers who used to link IT usage and productivity gains together (Kling 1999). The "productivity paradox" suggests that large investments in improving cyber trust do not necessarily boost its productivity. The productivity paradox implies that current strategies in cyber trust may be unable to produce expected social trust without considering social informatics. Note that the most effective IT alone is not sufficient to establish social or economic value (Kling 1999) in case the attention to social practices is not paid. Thus, learning the relationships between IT applications and human life in institutions and a society is a first step before the traditional trust offline is introduced into cyber trust.

Many analysts in IT contexts frame claims about IT in deterministic approaches (Kling 2000). The analysts think that cyber trust suggests more precise and reliable information for users than ever before. This, however, won't be the case if social informatics is not considered.

A triadic functioning analysis of cyber trust in e-commerce based on social informatics is proposed as Fig. 1. In addition to tech-dynamics, the social informatics in cyber trust pays attention to socio-dynamics by considering major premise in a social system. For example, when, who and under what conditions the online information works out for users? Or are users looking for online assistance to help them make a better decision, and thus generating more cyber trust in an online world? This kind of contextual inquiry (Kling 1999) illustrates the ways that social informatics help frame questions in trust and develop an analytical understanding of cyber trust to achieve high level of cyber trust among users. The socio-technical approach in social informatics views cyber trust in e-commerce as mixing both technological elements and social relationships together into an effectively inseparable ensemble (Kling 1999). According to an aspect of technological information processing, new media such as online databases, websites, bulletin boards and instant messenger are used to reduce the communication costs, expand the range of clients and facilitate communications. That is, as business clients communicate with other clients through the new media, differences in value across business organizations would rest upon the differences in technical architectures. For example, clients would be more likely to consider service from the healthcare institution A rather than the healthcare institution B if the institution A provided more informational

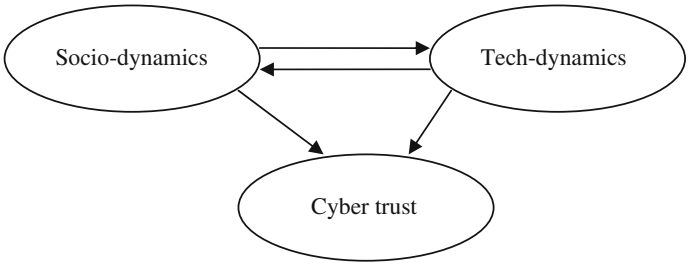

Fig. 1 A triadic functioning analysis of cyber trust in e-commerce based on social informatics

Table 1 The key elements of socio-technical systems in e-commerce

Socio-dynamics	Tech-dynamics
Social image	Perceived ease of use
Social interaction	Perceived usefulness
Social support	Perceived reliability
Social relationship commitment	Perceived personalization

value, such as including more extensive sets of data and graphics about healthcare, or having an elaborate set of cross links between medical symptoms. Of course, it does not mean that technological design alone is sufficient to insure a good quality of healthcare institution. However, there is a strong consensus that the content quality of specific e-commerce is essential in making the institution visible in the market.

Social informatics has produced some useful ideas and findings that are applicable to e-commerce. The concept of "computerized information systems as social technical systems" is one such idea (Kling 1999) that facilitates management to learn the character of e-commerce, as well as other e-service. Even though management in e-commerce often views IT as tools or simple appliances (e.g., Kling 1999), it is more interesting to refer specific IT as "socio-technical systems" that is a complex, interdependent system comprised of the elements in Table 1. The elements in the Table 1 are not just a static list. Instead, they are highly intercorrelated with one another within a socio-technical system. An e-commerce management with a socio-technical orientation does not purely focus on these elements while working alone in a workplace far away from the clients who will encounter the e-commerce system. Establishing cyber trust in e-commerce takes a discovery process such as focus groups, user participation and field survey to help management in e-commerce understand the most critical and appealing features to the clients who frequently take the e-commerce service.

For instance, the public in Taiwan is turning to medical resources on Internet, to get alternative information in discussion groups and make a reservation for e-healthcare service. It is important to note that healthcare clients often seek either alternative medical advice or information about issues that their doctors are not good at explaining. An optometrist who is good at practicing optometry may be incapable of giving his or her clients a thorough understanding of what it takes to go through the improvement process of their eyesight. Clients may find that certain Internet resources may be the complementary supplements to the insufficient and inefficient communication between themselves and their service providers.

In e-commerce access, technological access is considered the physical availability of suitable network equipment, including computers of adequate speed and equipped with proper software for a given online activity, while social access is considered the know-how, a mix of professional knowledge economic resources, and technical skills, to use IT in ways that increase commercial practices and social life (Kling 1999). Particularly, social access is not an "add on" to an IT structure (Kling 1999) because a successful trustworthy e-commerce does not simply tack on an IT interface. In fact, internal structure of business institution and human interfaces are also highly coupled with e-commerce that efficiently satisfies clients' needs.

While IT application facilitates the accessibility and volume of commercial information, the safeguards of the traditional commerce setting are not necessarily applied well to e-commerce. Particularly, successful e-commerce that provides online service requires trustworthy complementary technical-dynamics such as ease of use, usefulness and reliability, while social-dynamics such as social image, interaction and support that deal with clients' social affection are also important. The detail theoretical rationale is discussed in the following section.

3 Socio-dynamics

There is a significant body of evidence outside the domain of e-commerce suggesting that socio-dynamics play important roles in influencing individuals' beliefs in a wide variety of domains (Kling 1999). These socio-dynamics include social image, social interaction, social support and social relationship commitment (e.g., Belen del Río et al. 2001; Venkatesh and Morris 2000), and their substantial influence on tech-dynamics and cyber trust in e-commerce is examined as follows.

Social image is considered the extent to which online clients may derive appreciation from their peers, family members, or referent others for their usage of e-commerce systems. Given that people in general are likely to weigh the opinions of others in a society, social image becomes important in any study related to interactive IT such as *Yahoo Answers* frequently leads to mutual influences among users within social setting (Lee 1994; Venkatesh 1999) and has proven to be a significant social motivation in IT contexts (Hsu and Lu 2004; Venkatesh et al. 2003).

As e-commerce is an interactive application, its clients with high scores in social image are likely to have strong confidence in the e-commerce they prefer. In other words, the clients' social image strengthens their confidence and thereby enhances the cyber trust toward e-commerce. Although few exceptions, such as Brancheau and Wetherbe (1990), exist which have tried to explore the important role of social image on cyber trust of IT systems, the construct of social image has been rarely studied in the e-commerce literature. Such an oversight about this construct might be primarily attributed to the empirical contexts of previous research, many of which focus on single-user productivity software or system such as word processors or Internet browsers rather than interactive or group-level technologies. To date, however, clients interested in functions of interactive e-commerce positively value that e-commerce which enjoys a good reputation among the groups with which they belong to or aspire to be a part of Long and Schiffman (2000), implying the influence of social image on both tech-dynamics and cyber trust in e-commerce.

Social interaction is the second kind of socio-dynamics salient in e-commerce. Social interaction is a behavioral tendency displayed by a client of e-commerce to cultivate and maintain online relationships with online service providers via mutually interactive communications. It has been found that the greater the degree is of interactivity, the more likely it is for the e-commerce to be considered a popular and trustworthy one (e.g., Ghose and Dou 1998), suggesting that the social interaction may substantially affect online clients' confidence toward the e-commerce. Online clients having nice experiences interacting with online commercial providers will generate strong trust toward the online service, because of the better structural bond of relational interaction, and consequently they have much higher faith on the service quality of the site.

Consistent with the view that people in general are motivated by social/affiliation needs (Venkatesh and Morris 2000), clients of e-commerce provided with high interactivity may be disposed toward commercial goals in interpersonal relationships via frequent interaction (e.g., Ghose and Dou 1998; Wright 2004). Social interaction is becoming more prevalent due to the growth and popularity of online interacting channels where online clients who are geographically dispersed can develop relationships with online commercial providers without any face-to-face interaction outside of cyberspace (Wright 2004), implying the influence of social interaction on both tech-dynamics and cyber trust in e-commerce.

Social support is referred as "the exchange of verbal and non-verbal messages conveying emotion, information, or referral, to help reduce one's uncertainty or stress" (Walther and Boyd 2002, p. 154). E-commerce facilitates strengthening clients' cohesion in its online

community. Unfortunately, the role of the e-commerce in generating an individual's online social support is, as of yet, unclear (e.g., Swickert et al. 2002). Little is known about the factors that drive clients to trust e-commerce via their online social support. Despite the social support is transferring in a certain degree from a real world to a virtual one due to the rapid diffusion of Internet (Li et al. 2005; Sarbaugh-Thompson and Feldman 1998), scant attention has been paid to such online social support that is different from face-to-face social support, given the geographic dispersed nature of computer networks (Wellman et al. 2001). Therefore, understanding a potential paradigm shift regarding social support from a real world to e-commerce is important.

Most of the contemporary IT models, such as the technology acceptance model (TAM) (Davis et al. 1989), the motivational model (MM) (Davis et al. 1992), and the unified theory of acceptance and use of technology (UTAUT) (Venkatesh et al. 2003), have ignored the role of online social support in IT such as e-healthcare and e-bookstore. Social support is important to everyone in a society because of its relation with psychological and physical well-being (Uchino et al. 1996). The buffering effect of social support was found, for instance, to ameliorate the impact of mental and physical health factors such as anxiety, depression, irritation, and somatic symptoms (LaRocco et al. 1980). For example, the increased e-healthcare usage that may enhance online social support available to and realized by the clients of e-healthcare has been empirically validated in a study of online system usage among elderly users, suggesting the influence of social support on both tech-dynamics and cyber trust in e-commerce.

Social relationship commitment indicates a psychological and emotional attachment to a relationship between individuals and their specific e-commerce. Internet IT provides virtually a social system for online clients to develop their relationships with their online commercial providers and thus social relationship commitment should be effectively taken into practice in e-commerce (e.g., Kraut et al. 1999). The popularity of Internet IT provides evidence that positive experience in communication with a particular e-commerce is driving the clients' social perception of maintaining membership in their e-commerce is driving their subsequent trust and behavior, implying a critical role of social relationship commitment in e-commerce.

Social relationship commitment can be seen as an individual's intrinsic motivation that boosts the expected persist in a supportive relationship with e-commerce (e.g., Agnew et al. 1998). The e-commerce can be helpful particularly for the clients with high commitment to cultivate social relationship with their e-commercial providers. Specifically, as social relationship in e-commerce is the foundation of social identify, the commitment to maintain the social relationship with the online commercial providers can be crucial to the clients' social perception and confidence on the e-commerce, implying the influence of social relationship commitment on both tech-dynamics and cyber trust in e-commerce.

4 Tech-dynamics

There is significant evidence outside the domain of e-commerce suggesting that tech-dynamics play important roles in affecting individuals' trust and social-dynamics in a wide variety of domains (e.g., Rich 2002; Smith and Manna 2004). These tech-dynamics include perceived ease of use, perceived usefulness, perceived reliability and perceived personalization (Ralph and Searby 2003; Taylor and Todd 1995; Zahedi 1987), and their substantial influence on socio-dynamics and cyber trust in e-commerce is examined as follows.

Perceived ease of use has been developed and validated to be a fundamental determinant of user acceptance towards specific IT (Davis 1993). Perceived ease of use for e-commerce

refers to the degree to which the prospective online clients expect the e-commerce usage to be free of effort (e.g., Taylor and Todd 1995). The theoretical foundations for perceived ease of use as a predictor of cyber trust on specific e-commerce are derived from several diverse research streams, including self-efficacy theory (Venkatesh and Davis 1996), a cost-benefit paradigm, and adoption of innovations research (Davis et al. 1989).

Recent research has supported that even with increasing IT experience, the influence of perceived ease of use on individuals' confidence in using a specific IT such as e-commerce might still remain significant (e.g., Venkatesh and Davis 1996; Venkatesh and Morris 2000). Given that perceived ease of use has typically been viewed as a hurdle for clients' faith on the application of e-commerce (e.g., Venkatesh and Davis 1996), when strongly perceiving the ease of use, online clients are likely to perceive satisfactory socio-dynamics and their trust in e-commerce is thus strengthened.

Perceived usefulness stated as a determinant of IT preference and usage behavior is derived from a variety of research streams, such as self-efficacy theory, a cost-benefit paradigm and adoption of innovations research (Chiu et al. 2005). From a perspective of e-commerce, perceived usefulness of online clients may be defined as the prospective clients' subjective probability that using the Internet will efficiently facilitate his or her online service or product. Although perceived usefulness sounds similar to perceived ease of use, the empirical results of factor analyses in previous research suggest that the perceived usefulness and perceived ease of use are statistically distinct dimensions (Chiu et al. 2005). It is affirmed the significance of perceived usefulness and ease of use in ultimately predicting online attitude and confidence (Chiu et al. 2005).

Perceived usefulness is found to be a highly significant predictor of attitude and behavioral intentions to use the new technology at two different time periods in the context of word-processing software (Davis et al. 1989). It is also understandable that socio-dynamics in e-commerce such as social image, interaction, support and relationship commitment counts heavily on perceived usefulness that facilitates applications of the e-commerce system. Similar studies were then replicated by Venkatesh and Davis (1996), Adams et al. (1992), Szajna (1996), Agarwal and Karahanna (2000) and Chiu et al. (2005) find support for the modification of a technology acceptance model. Despite some differences in these models from the original conceptualization of TAM, the salience of perceived usefulness in data collected for IT usage and confidence is again supported, suggesting the critical influence of perceived usefulness on socio-dynamics and cyber trust in e-commerce.

Perceived reliability is a quantifiable measure useful in the management of IT (Zahedi 1987). Zhu et al. (2002) indicated that perceived reliability has a direct positive effect on perceived service quality and customer confidence by electronic banking systems. Online consumers are disillusioned and dissatisfied with unreliable response, late deliveries, and inaccurate billing (Sliwa and Collett 2000), suggesting that perceived reliability plays an influential role on lifting user satisfaction with the IT. Similarly, it has been reported that online service providers must offer mistake-free service and secure online transactions and functions (Lee and Lin 2005) to enhance users' confidence in online social interaction and trust on such interactive IT as e-healthcare and e-mall.

Previous research considers the traditional IT reliability as the probability that the IT system remains successful (does not fail) in achieving its intended objectives under a given set of situations and within a given period of time (Zahedi 1987). However, the reliability of e-commerce nowadays turns to not only the success of the e-commerce system itself, but also that of managerial solutions to disburden the clients. Particularly, perceived reliability can be conceptualized as the extent to which online clients believe that the e-commerce is reliable for transmitting important information online and keeping personal and private information

secure (Lee and Lin 2005). Perceived reliability is critical to confidence in socio-dynamics and trust in commerce, because it reflects the capability of a commercial organization to perform the promised service dependably, safely, and accurately (Parasuraman et al. 1988).

Perceived personalization, founded in the world of targeted marketing and on-line sales, has proved to be a key success factor in interactive online systems (e.g., e-healthcare, mobile telephones, online shopping) (Ralph and Searby 2003). Its use on the online business activities is primarily in systems that support socio-dynamics and cyber trust in e-commerce. Perceived personalization in this study can be defined as the extent that online clients are provided with adequate information or functions based on their individuals' habits, preferences, historical records and usage patterns (Mulvenna et al. 2000). Albeit personalization is a technology that has been applied to e-businesses such as online shopping, targeted advertising, and customization (Ralph and Searby 2003), it should have a much wider application than its current format, including establishing customer relationship (satisfaction), service integration, and knowledge management in e-commerce (Ralph and Searby 2003). As personalization is emerging in an IT world, commercial organizations are working to maximize the amount of online services that match clients' interests and needs based on a minimum amount of confidential information (Anonymous 2004).

To sum up, perceived personalization guides e-commerce service providers to implement strategies to lock in existing clients (Mulvenna et al. 2000) and to consequently win new online clients by stimulating their trust. Previous research has examined the influence of the personalized service provided by Internet service providers on customer satisfaction and trust (e.g., Lee and Lin 2005).

5 Conclusions

As the application of the Internet technology has increased tremendously, many issues of cyber trust have arisen. Especially, online consumers have filed plenty of complaints with the Federal Trade Commission alleging online frauds (Wolverton 2000). Previous market survey has indicated that one out of ten consumers have paid online for items that never were delivered (Williams 2001), suggesting the importance of cyber trust. There is no doubt that online consumers are tremendously worried bout whom to trust in online interactions (Koehn 2003). This study presents the factors under which cyber trust thrives from a perspective of social informatics. Social informatics research pertains to e-commerce from a perspective of both social and technical changes that shed some light on cyber trust for business professionals and researchers. Social informatics introduces intriguing new social phenomena that emerge when clients use e-commerce and develop cyber trust on it. E-service providers should learn in depth the triadic functioning model proposed by this study so as to improve their consumers' trust.

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