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RESEARCH PAPER

Who earns trust in online environments? A meta-analysis of trust in technology and trust in provider for technology acceptance

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Abstract

Trust has been identified as inevitable for technology acceptance and might further gain importance as technologies become increasingly complex. However, previous research on trust in online environments lacks a systematic configuration of trust entities in research models; some studies include either trust in technology or trust in provider, others both. In combination with inconsistent results, this leads to a lack of in-depth knowledge about the trust entities' relationship to each other, to their antecedents, and intention to use. Therefore, this study aims at clarifying these relationships and examining how they vary for different configurations. We performed pairwise meta-analyses to generate summary effects for the individual trust entities and examined four different trust configurations by applying meta-analytic structural equation modeling (MASEM). Our findings advance technology acceptance and trust research and highlight the necessity to carefully configure trust. More specifically, the results from pairwise meta-analysis support a strong relationship between the trust entities that is, however, countered by the effects of antecedents in MASEM. Institution-based trust and reputation are found stronger predictors for trust in provider and familiarity a stronger determinant of trust in technology. Furthermore, the trust entities show comparable paths to intention to use when either trust entity is included in the research model, but when both are integrated, trust in technology is more important than trust in provider.

Keywords Trust in technology · Trust in provider · Online trust · Technology acceptance · Trust formation · Meta-analysis

JEL Classification M31 · L81 · D91

Introduction

The concept of trust has been widely studied in online research (Kim & Peterson, 2017). The significant role of trust in online research is based on its ability to reduce associated risks in initial and subsequent interactions (Gefen et al., 2003a). Engaging online is associated with several risks as it involves providing personal information, purchasing goods or services, following advice, or conducting transactions (McKnight et al., 2002a). Therefore, trust has been identified as a critical determinant of technology acceptance decades ago (Gefen et al., 2003b). Technology is and will be increasingly used in many contexts to mediate interactions across space and to retrieve information for faster, more precise decision-making (Li et al., 2012; Maruping et al., 2017). For example, more recently, artificial intelligence-based chatbots, such as large language models like ChatGPT, have proven their potential to solve simple and increasingly complex tasks in diverse fields (Susarla et al., 2023). Deciding to use such technologies and thus paving the way for embracing technological progress relies heavily on the confidence that these technologies have the attributes to fulfill their tasks, for which the provider is responsible.

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Understanding trust, its role in technology acceptance, and how it can be built will thus remain of interest to researchers.

As engaging online is a technology-mediated interaction with a provider, two trust entities have been in the focus of online research investigating trust: technology and provider (Li et al., 2012; McKnight et al., 2011). Technology, in this study, refers to the technological artifact enabling the interaction between customers and providers (B2C), such as websites, apps, or recommendation agents, while providers are the organizations or persons that provide the service of interest. Online research investigating trust has applied different conceptualizations and configurations of trust entities. While early research conceptualized trust as trust in provider (e.g., Gefen et al., 2003b), trust in technology has also increasingly been subject to analysis in technology acceptance and trust-building models (e.g., Lu et al., 2011; Xu et al., 2013). The difference between the concepts of trust in technology and trust in provider has been the subject of interest in information system (IS) research (e.g., Lankton et al., 2015; Li et al., 2012). Research agrees that trust in technology and trust in provider are distinct concepts (Li et al., 2012; McKnight et al., 2011) and made substantial contributions to IS literature highlighting the critical role of trust in technology and trust in provider for technology acceptance and how each can be enhanced.

However, how trust in technology and trust in provider are configured in research models is inconsistent. Some studies include only one trust concept, i.e., a measure of trust in technology (e.g., Shao et al., 2019; Slade et al., 2015), a measure of trust in provider (e.g., Fox & James, 2021; Oliveira et al., 2017), or a construct that measures both simultaneously (e.g., Rose et al., 2012; Shankar et al., 2020). Some studies incorporate both entities as individual constructs (e.g., Kuen et al., 2023; Teo & Liu, 2007; Xiao et al., 2019). When taking a differentiated perspective and including both entities, different assumptions are made concerning their relationship with each other. They have been included as determinants and consequents of each other (e.g., Xiao et al., 2019; Xie et al., 2020) or as unrelated (e.g., Kim & Prabhakar, 2004; Yang et al., 2022). This inconsistency, especially in terms of applying an isolated configuration including only one of the concepts or an integrated configuration including both entities as separate concepts, indicates an uncertainty on how to systemically configure trust.

However, there is a need to understand how trust in technology and trust in provider in the online context relate and integrate within patterns. A lack of solid differentiation and of a systematic, suitable integration of trust in research models can weaken the implications generated as it has been emphasized that both trust in technology and trust in provider are decisive factors for technology acceptance. This understanding is pivotal not only for the online context but also for other areas. Especially in light of the large reliance on technologies and the emergence of new technologies, it is essential that researchers and practitioners are aware of the trust entities. New technologies (e.g., autonomous driving cars and artificial intelligence for disease diagnosis) expose individuals to further uncertainties as those technologies are becoming increasingly complex, intelligent, and autonomous and, consequently, less transparent (Bruckes et al., 2019; Choi & Ji, 2015; Jung et al., 2018; Nilashi et al., 2016; Susarla et al., 2023). As trust represents a mechanism to deal with uncertainties (Pavlou, 2003), it is thus inevitable that a differentiated understanding of the trust entities' relationships is developed to be able to efficiently foster their adoption.

The development of such a profound understanding of the integration of trust concepts in research models is impeded by the variety of variable compositions in research models and inconsistencies in previous results for the trust entities' relationships to their antecedents and technology acceptance. For example, for the relationship between trust in technology and intention to use, Shao et al. (2019) found a positive effect size and Farah et al. (2018) a non-significant effect. Furthermore, Xiao et al. (2019) found propensity to trust as a significant determinant of trust in provider, while Hampton-Sosa and Koufaris (2005) could not find empirical evidence for this relationship. To clarify mixed findings of trust relationships for technology acceptance and to antecedents, meta-analyses have summarized the heterogenous results (e.g., Kim & Peterson, 2017; Mou & Cohen, 2015; Wu et al., 2011). Nevertheless, these meta-analyses take an undifferentiated perspective on trust (e.g., Kim & Peterson, 2017), focus on trust in provider (e.g., Mou & Cohen, 2015), or integrate both entities, yet with different antecedents (Montazemi & Qahri-Saremi, 2015). The missing differentiated, simultaneous analysis of the trust entities prevents systematic comparisons. Taken together, the demonstration of the relationships of both trust in technology and trust in provider to their antecedents and the intention to use as representative of technology acceptance as well as the systematic integration of the entities in research models thus constitutes a notable research gap. Therefore, we investigate the following research questions (RQs).

RQ1: How are trust in technology and trust in provider related to each other, their antecedents, and intention to use?
RQ2: Do the relationships of trust to intention to use and to its antecedents vary for different trust configurations?

We address these research questions by performing a meta-analysis based on 272 independent samples, with a cumulative sample size of 105,199, covering three frequently studied research areas of the following B2C online environments: online shopping, online banking, and electronic (e-)

health (Mou & Cohen, 2015). This focus on three domains is because trust is context-specific (Lewicki & Bunker, 1996; Mou & Cohen, 2015). For meaningful results from the meta-analysis, a certain comparability of the studies should be ensured to control for the dispersion caused (Borenstein et al., 2011). We reflect on trust formation by resorting to a group of antecedents from four main categories of trust antecedents that have been broadly recognized (Gefen et al., 2003b; McKnight et al., 1998) and thus build a reasonable basis for this meta-analysis: (1) propensity to trust, (2) institution-based trust, (3) knowledge-based familiarity, and (4) reputation. For a comprehensive analysis of the trust entities' relationships and configurations, we also consider the conceptualization of trust in technology and trust in provider as an undifferentiated construct. The analysis is organized in two parts according to the research questions. First, RQ1 is addressed by employing pairwise meta-analyses. Second, RQ2 is addressed by conducting two-staged meta-analytic structural equation modeling (MASEM). We compare the relationships for four different configurations of trust in technology and trust in provider as a combined configuration (I), as isolated configurations including either trust in technology (II) or trust in provider (III), and as an integrated configuration incorporating both entities as separate, related concepts (IV).

Meta-analysis is a method to quantitatively synthesize empirical results from previous research in order to extend knowledge about a topic (Eden, 2002). In our study, performing pairwise meta-analysis and MASEM for trust in online environments generated valuable implications for online trust and technology acceptance research. First, synthesizing previous results for the relationship between trust in technology and trust in provider as well as the concepts' relationships to their antecedents and intention to use, using pairwise meta-analyses, allowed us to estimate the overall effects and clarify mixed results for both entities. These results are independent of variable compositions in research models and their interdependencies. Second, MASEM enabled us to revise the concept of trust by differently integrating trust in research models (Blut et al., 2022). The results reveal differences in the relationships between trust configurations and emphasize that the most accurate model is the integration of trust in technology and trust in provider as separate, related constructs. Third, we contribute to the trust transfer theory (Stewart, 2003) by showing that trust in technology and trust in provider are strongly related, which however can be countered by other trust forming relationships (i.e., antecedents). Overall, a more profound understanding of trust in technology and trust in provider relationships across many studies will help researchers to reflect trust concepts and the relationships supporting them in addressing current and future issues (Aguinis et al., 2011; Blut et al., 2022).

The remainder of this paper is structured as follows. The next section provides a literature review and a theoretical background on trust in technology and trust in provider in the online context. Thereafter, hypotheses are derived. Subsequently, the methodological procedure, more precisely, how studies for the meta-analysis were identified, selected, and coded, and how the data was analyzed is described. This is followed by the presentation of the results of the pairwise meta-analysis and MASEM, organized in accordance with the two research questions. Then, we discuss the results, demonstrate how this meta-analysis contributes to technology acceptance and trust research, and derive practical implications. Finally, the paper closes with limiting aspects and avenues for future research on trust in online environments.

The concept of trust in online environments

The following sections give an overview on how trust in technology and trust in provider have been studied in research models and how they can be conceptualized.

Trust in technology and trust in provider in research models

The relevance of trust is rooted in situations characterized by uncertainty as it helps to overcome them (Jarvenpaa et al., 1999; Lewicki et al., 2006; Pavlou, 2003). Online activities require users to engage in different behaviors, such as sharing personal information, purchasing, following advice, or conducting transactions (McKnight et al., 2002b). These behaviors can be associated with various uncertainties. On the one hand, such uncertainties can be based on human-related aspects. For example, there is no guarantee that providers are competent and will not behave opportunistically, such as by misusing personal and financial information or tracking transactions without authorization (Barth et al., 2019; Gefen et al., 2003b). On the other hand, uncertainties can be based on technical aspects. Individuals fear that, for example, a system will not fully support the intended behavior or that it cannot protect personal information from being stolen by cyber criminals (Barth et al., 2019; McKnight et al., 2011). Varying uncertainties and expectations toward the other party in different contexts make trust a diverse concept with perceptions, determinants, and consequences depending on the context (Lewicki & Bunker, 1996; Mou & Cohen, 2015). Although, with increasing experience, trustors gain information about the trustee on which to base their trust decision, they have no control over the trustee's intention or behavior (Gefen, 2000). The uncertainties related to both technology and provider in the online context make

trust in technology and interpersonal trust key concepts in the initial and continuous interactions (Gefen et al., 2003a; Montazemi & Qahri-Saremi, 2015).

Given this theoretical importance, numerous studies in the online context have included trust as part of technology acceptance models (e.g., Lee, 2009) and examined how to build and maintain trust (e.g., Li et al., 2008; Yu, 2015). Early studies focused on interpersonal trust relationships, especially trust in online providers (e.g., Gefen et al., 2003b). Later, technology or technological artifacts, such as e-commerce websites (e.g., Ponte et al., 2015; Tsu Wei et al., 2009), online banking (e.g., Oliveira et al., 2014; Talwar et al., 2020), or recommendation agents (e.g., Benlian et al., 2012; Komiak & Benbasat, 2006) as trust recipients have attracted the researchers' interest. In technology acceptance research, trust in technology and trust in provider have been related to other acceptance factors, such as perceived usefulness, and have been identified as critical predictors of the intention to use (e.g., Guo et al., 2020; Sharma, 2019). The formation of trust in technology and trust in provider has been analyzed from the perspective of various theoretical streams. As a result, similar antecedents were considered for trust in technology and trust in provider. Besides propensity to trust, institution-based trust, familiarity, and reputation, the effects of system quality, information quality, perceived security, and perceived privacy on trust have frequently been studied (for an overview see Kim & Peterson, 2017).

Most primary studies focused on the relationships of either trust in technology (e.g., Shao et al., 2019) or trust in provider (e.g., Guo et al., 2016). Comparatively few studies consider both trust entities in their research models. These studies differ in the assumption about the underlying relationship between trust in technology and trust in provider. Some studies incorporate trust in technology and trust in provider as separate, unrelated constructs (e.g., Kim & Prabhakar, 2004). Other studies assume and find empirical evidence for a relationship between the entities (e.g., Teo & Liu, 2007). Consequently, the direction of causality is argued from trust in provider to trust in technology (e.g., Martínez-López et al., 2015; Xie et al., 2020) and vice versa (e.g., Li et al., 2012; Xiao et al., 2019). A number of studies have compared trust in technology and trust in provider relationships and conceptualizations. Li et al. (2012), for example, argued that trust in technology and trust in provider have distinct roles in research models and examined whether trust in technology substitutes trust in provider. Integrating both entities as related concepts in their research model, Li et al. (2012) found that both trust entities are important in the online context, although there is no direct human interaction, and that the entities are complements. Nevertheless, the question as to how trust in technology and trust in provider relationships differ between when an isolated configuration that includes only one entity or an integrated configuration that incorporates both trust entities is applied remains unanswered in existing literature.

A comparison of trust in technology and trust in provider and their configurations is complicated by heterogeneous effect sizes in primary studies and variations in research models. Trust in technology and trust in provider relationships' significance, effect size, and relative importance to antecedents and intention to use vary across studies. For example, Khalilzadeh et al. (2017) find no effect, while Gu et al. (2009) find a significant medium effect for trust in provider on intention to use. For trust in technology, similarly, the effect size to intention to use reported by Sharma (2019) is relatively stronger compared to the effect size reported by Chen et al. (2018). To clarify ambiguous results, previous meta-analyses synthesized existing results, finding large summary effects for the relationship between trust and intention to use (e.g., Kim & Peterson, 2017; Wu et al., 2011) and summary effects varying in size for different antecedents (e.g., Kim & Peterson, 2017; Mou & Cohen, 2015). These meta-analyses have conceptualized trust as a combined, undifferentiated concept of trust in technology and trust in provider (e.g., Kim & Peterson, 2017) or focused on trust in provider (e.g., Mou & Cohen, 2015). First comparisons were undertaken by Montazemi and Qahri-Saremi's (2015) meta-analysis on adoption factors of online banking. Montazemi and Qahri-Saremi (2015) included trust in the physical bank and trust in online banking in the path analysis and revealed stronger effects for trust in the physical bank than for trust in online banking.

Conceptualizing trust in technology and trust in provider

A variety of approaches have been taken to the conceptualization of trust (Kim & Peterson, 2017). In IS research, researchers most commonly refer to trust as a set of specific beliefs (i.e., trusting beliefs) (e.g., Hallikainen & Laukkanen, 2018; Yoo et al., 2021). Other definitions include trust as a willingness to rely on a trustee (i.e., trusting intention) (e.g., Benamati et al., 2010) or as combinations of these conceptualizations (e.g., Alalwan et al., 2017). The perception of a trustee as trustworthy is based on the belief that the trustee has the attributes to help perform a certain task as expected, i.e., trusting beliefs (Mayer et al., 1995; McKnight et al., 2002a). In the online context, different trusting beliefs or combinations of trusting beliefs have been used to conceptualize trust. For interpersonal trust, three trusting beliefs prevail over many others: ability (possession of skills needed to perform the expected behavior), benevolence (a trustees' good will to act in the trustors' best interest), and integrity (adherence to principles reasonable to the trustor) (McKnight et al., 2002a). Other conceptualizations of trust include predictability, security, or privacy (e.g., Kim & Jones, 2009; Lim et al., 2008). Trust in technology has developed from

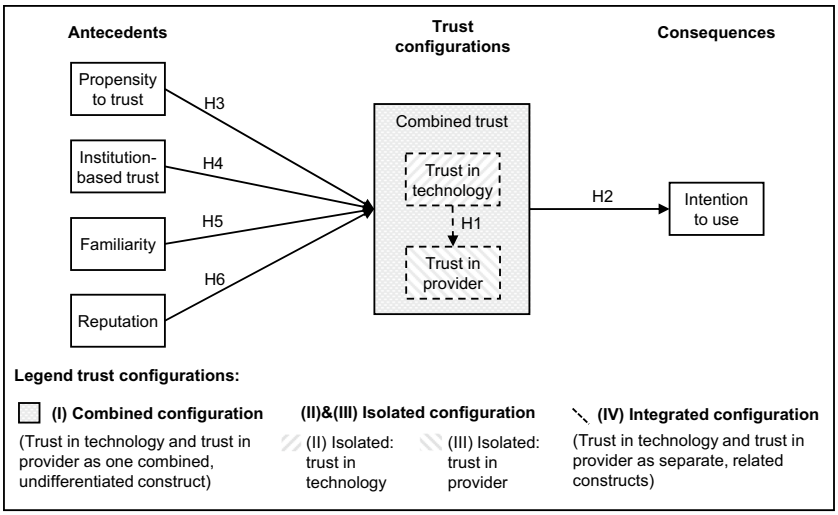

Fig. 1 Research model and trust configurations

interpersonal trust (McKnight et al., 2011). While there has been some disagreement about whether technologies can be trusted (McKnight et al., 2011; Wang & Benbasat, 2005), evidence that technologies can be the object of dependence exists as people respond socially to technologies (Lankton et al., 2015). The dissent is based on the fact that technologies are human-made artifacts that are limited in their capabilities and have no will or moral agency (McKnight et al., 2011; Wang & Benbasat, 2005). In contrast, when trusting people, an individual directs trust towards a "moral and volitional agent" (McKnight et al., 2011, p. 5). To take account of this, McKnight et al. (2011), for example, argue that this difference should be reflected in the attributes an individual believes are necessary for a person or specific technology to perform a particular task as expected (trusting beliefs) (Mayer et al., 1995; McKnight et al., 2011). Accordingly, technologies might alternatively be attributed to system-like beliefs that incorporate the characteristics of technology: functionality, reliability, and helpfulness (McKnight et al., 2011). Researchers have since started applying similar conceptualizations of trust in technology (Afshan & Sharif, 2016; Oliveira et al., 2014) next to human-like trusting beliefs.

Adapting the definitions of McKnight et al. (2011) and Mayer et al. (1995), this meta-analysis refers to trust as trusting beliefs meaning the technology and the provider, respectively, "has the attributes necessary to perform as expected in a given situation in which negative consequences are possible" (McKnight et al., 2011, p. 7). Considering the different conceptualizations in literature, we refer to the beliefs of ability, benevolence, and integrity (Mayer et al., 1995; McKnight et al., 2002a), as well as functionality, helpfulness, and reliability (McKnight et al., 2011). While this understanding of trust was developed decades ago, it represents an established and still very frequently used concept in IS literature (Ingham et al., 2015). Further, it allows a theoretically sound integration of trust formation and technology acceptance literature (Gefen et al., 2003b). Ultimately, this definition enables a reasonable foundation for synthesizing previous findings and testing alternative trust configurations.

Hypotheses development

For building a theoretical understanding for the analysis of trust in technology and trust in provider relationships and configurations, the following sections will derive and depict the relationship between trust in technology and trust in provider as well as the trust entities' relationships to antecedents and intention to use. The research model in Fig. 1 illustrates the relationships and configurations (I–IV) analyzed in this meta-analysis. The combined configuration (I) does not differentiate between trust in technology and trust in provider, instead consolidates the trust entities as one combined trust construct. In the isolated configurations, either trust in technology (II) or trust in provider (III) is included in the research model. The integrated configuration (IV) integrates trust in technology and trust in provider as separate, related constructs.

Trust in technology and trust in provider

Trust transfer theory (Stewart, 2003) states that trust can be transferred between closely related entities. Accordingly, the close link between technology and provider in the online environment implies that trust in technology and trust in provider are related. As providers are responsible for generating and maintaining their technology, some researchers argue that the causal relationship leads from trust in provider toward trust in technology (e.g., Martínez-López et al., 2015); meaning, a trustworthy provider will thus provide a trustworthy technology. On the other hand, it is argued that a technology's role is not only the technical interface but also

a representation of the provider and it thus acts as a signal for the trustworthiness of a provider (e.g., Li et al., 2012). In this case, a technology perceived as trustworthy signals a trustworthy provider.

In online environments, individuals usually lack direct interaction with providers (Li et al., 2012). Instead, the interaction is mediated by technology, making the technology the primary point of contact. Online systems thus act as representatives of providers and serve as a signal for trustworthy provider behavior (Li et al., 2012; Wang & Emurian, 2005). In other words, individuals use an online system's trustworthiness to assess the respective provider's trustworthiness (Corbitt et al., 2003; McKnight et al., 2002a; Pennington et al., 2003). For example, an online system that reliably completes a certain task signals the trustor that the provider is responsible, dedicated, and acts in one's best interest to provide such a system, i.e., is trustworthy (Corbitt et al., 2003; Wang & Emurian, 2005). Following this line of argumentation and the trust transfer theory that suggests that trust can transfer from one source to another (Stewart, 2003), we argue that trust in technology fosters trust in provider, i.e., trust is transferred from technology to provider (Corbitt et al., 2003; Kim, 2014). Thus, we propose that:

Hypothesis 1 (H1): Trust in technology is positively related to trust in provider.

Trust and intention to use

Trust in technology and trust in provider have been found to be critical factors of intention to use in the online environment (e.g., Bansal et al., 2015; Tandon et al., 2021). The intention to use online systems involves possibly engaging in providing personal information, purchasing goods or services, following advice, or conducting transactions (McKnight et al., 2002b). Trust can reduce the uncertainties that are associated with these activities by creating positive attitudes and behavioral control toward the trustee. This, in turn, influences the individual's intention to engage with the trustee (Pavlou, 2003). For example, if an individual believes that the provider is competent and acts in one's best interest when providing the services, the individual creates positive expectations that the provider will perform its task as expected. Or, the perception of a technology as functional and reliable creates a sense of control that the technology can support the task. Hence, both trust in technology and trust in provider help to overcome perceived uncertainties and thus increase intention to use. Therefore, it is proposed that:

Hypothesis 2 (H2): Trust in technology and trust in provider are positively related to intention to use.

Antecedents of trust

A variety of antecedents have been identified as trust antecedents (Kim & Peterson, 2017; Mou & Cohen, 2015). The aim of this meta-analysis is not to comprehensively clarify to what extent specific factors determine trust in technology and trust in provider. Rather, the main objective is to analyze the trust entities' relationships and configurations through involving trust-building factors. Therefore, this study focuses on the representatives of four main categories of antecedents that are established in research based on several disciplines (Gefen et al., 2003b; McKnight et al., 1998). First, personality-based trust is based on an individual's personal attitude or disposition (Mayer et al., 1995; McKnight et al., 1998). Second, institution-based trust relates to the security in a specific situation (Shapiro, 1987; Zucker, 1986); while third, knowledge-based trust is based on an individual's personal experience (Luhmann, 1979). The last category, cognition-based trust, refers to the categorization processes and illusions of control that are based on second-hand information and other cues (Brewer, 1981; Meyerson et al., 1996).

Personality-based trust, which is often referred to as propensity to trust or disposition to trust, is the general tendency of an individual to have confidence in technology and people across situations (Mayer et al., 1995; McKnight et al., 2011; Rotter, 1971). The literature argues that the concept is particularly important in initial trust formation (Mayer et al., 1995; McKnight et al., 1998) as it does not depend on a specific trustee or situation and does not necessitate knowledge about the trustee for building trust. Propensity to trust is personality-based and formed through a person's lifelong experience, personality type, and cultural background. Hence, it varies between individuals (Hallikainen & Laukkanen, 2018; Mayer et al., 1995). Individuals with a high tendency to trust will be more likely to perceive online systems and providers as trustworthy (Hallikainen & Laukkanen, 2018; Kim, 2014; Zhou, 2011). Thus, we propose that:

Hypothesis 3 (H3): Propensity to trust is positively related to trust in technology and trust in provider.

In addition to the influence of personal attributes, researchers have also pointed out the relevance of institution-based aspects. Institution-based trust is defined as the belief that the required supportive situations and structural conditions are in place to increase the likelihood of a successful outcome (McKnight et al., 1998, 2011). More precisely, institution-based trust describes the extent to which situations that are characterized as typical or in proper order (situational normality); for example, the interaction with a provider through the website appears as the user expects (Gu et al., 2009; McKnight et al., 2011) and as secure due

to existing structural conditions (structural assurance) such as third-party certifications, legal regulations, guarantees, privacy statements, feedback mechanisms, or encryption (Gefen et al., 2003b; Luo, 2002; McKnight et al., 2002a; Pavlou & Gefen, 2004). A normal and secured setting signals that technology and provider have favorable attributes for performing the task, fostering trust (McKnight et al., 1998). For example, if the interaction feels comfortable and third-party certifications safeguard technology and provider behavior, the formation of trust in technology and provider is promoted (Li et al., 2008; McKnight et al., 2011). Accordingly, it is proposed that:

Hypothesis 4 (H4): Institution-based trust is positively related to trust in technology and trust in provider.

Besides personal and institutional aspects, research has also found knowledge-related factors to be relevant in online environments (Mou & Cohen, 2014). As such, knowledge-based familiarity refers to understanding the "with what, who, how, and when of what is happening" (Gefen et al., 2003b, p. 63) and is based on actual knowledge of technology and provider through previous interactions. For example, in online shopping, familiarity includes experiences with the process on a provider's website, from searching for a product until all transactions are completed, and the provider behavior, e.g., a provider will not behave opportunistically, will deliver the right product, and will not misuse personal information (Gefen, 2000; Gefen et al., 2003b). This understanding allows the trustor to predict future behavior and attributes of the trustee, which reduces uncertainty (Gefen et al., 2003b; Luhmann, 1979). Therefore, given favorable previous interactions, a higher familiarity increases trust in technology and provider (Afshan & Sharif, 2016; Kim et al., 2009; Lee & Wan, 2010). Following this argumentation, we propose:

Hypothesis 5 (H5): Knowledge-based familiarity is positively related to trust in technology and trust in provider.

Next to personality-based, institution-based, and knowledge-based factors, cognition-based factors exist that also influence trust formation. In online environments, reputation has been found to be a critical cognitive source of trust (e.g., Bansal et al., 2015; Shao et al., 2019). Reputation is the perception or image an individual has about a trustee based on second-hand information (Doney & Cannon, 1997; McKnight et al., 1998). The concept of reputation encompasses the image as capable, reliable, and other trusting beliefs (Doney & Cannon, 1997). Reputation is formed based on past behavior (Zacharia & Maes, 2000) and is a valid point of reference for individuals as it is more difficult to build than to lose (Yaniv & Kleinberger, 2000). As such, it serves as a cue for the formation of trust as individuals infer that the trustee is likely to continue its behavior (Kim et al., 2008; Shapiro, 1987). For example, a website or provider that is known to be dependable is likely to be perceived as reliable. Because of the reliance on second-hand information, reputation is especially important for individuals that lack previous experience with the provider or technology (Kim et al., 2012; McKnight et al., 1998). Therefore, we hypothesize:

Hypothesis 6 (H6): Reputation is positively related to trust in technology and trust in provider.

Methodology

To synthesize the relationships of trust in technology and trust in provider to each other, their antecedents, and intention to use as well as to compare the four different trust configurations, we conducted a quantitative meta-analysis. Meta-analyses have several important benefits as highlighted by Blut et al. (2022). Accordingly, through systematically assessing existing theories and collecting previous results, meta-analyses can extend theories, increase interest in research areas, and foster innovative ideas (Blut et al., 2022; Shaw & Ertug, 2017). The results are less likely to be affected by type II error, and are more robust than those of primary studies. This is because more studies provide a larger sample size and more information. In contrast, the effects found in primary studies could be unique to the sample (McShane & Böckenholt, 2017; Sleesman et al., 2012). Thus, while primary studies can yield ambiguous results, meta-analyses can provide clarity by estimating overall effects (Blut et al., 2022; McShane & Böckenholt, 2017). Pairwise meta-analysis based on correlations provides overall effects independent of research models and the interdependencies between variables. The summary effects of meta-analyses provide an estimate of what is in the literature and are thus important reference points for reflecting and understanding the study results (Borenstein et al., 2011). Meta-analytic structural equation modeling (MASEM) combines meta-analysis and structural equation modeling and enables simultaneous analysis of multiple relationships under the assumption of causality considering interdependencies, based on large sample sizes. Ultimately, this allows the testing and comparison of theoretical and alternative models (Bergh et al., 2016; Blut et al., 2022).

The following sections describe the identification and selection of studies to be included in the meta-analysis and the coding procedure. After, the process of how data was quantitatively synthesized employing pairwise meta-analysis for each relationship to answer the RQ1 is explained. The application of MASEM for testing the relationships for the four different trust configurations (I–IV) and answering RQ2 is delineated in the last subsection of this chapter.

Identification and selection of studies

To identify relevant published and unpublished studies (e.g., conference proceedings, theses), an extensive literature search was conducted. The primary studies had to adhere to a set of eligibility criteria to be included in the meta-analysis. The primary studies' evaluation based on the eligibility criteria was performed by the leading author. In case of ambiguities, a second author was consulted to assess the respective studies, and a consensual evaluation was achieved through discussion. A study had to meet the following eligibility criteria to be included: (1) the study is in the context of some form of B2C e-health, e-banking, or e-commerce. This focus is to reduce the common problem of meta-analysis of comparing "apples and oranges" and to control heterogeneity (Borenstein et al., 2011). (2) The study is a quantitative, empirical study reporting correlation coefficients and sample size. (3) The study reports the questionnaire items used. The reason is that measurement instruments rather than labels were used to evaluate variables because labels assigned to constructs in the primary studies can differ from the labels and definitions used in this meta-analysis. (4) The study measures at least one of the relationships hypothesized in this meta-analysis. Thereby, a construct is classified as "trust" if its measurement includes at least one item that is related to the trusting beliefs or trustworthiness factors defined in this meta-analysis (that is, ability, benevolence, or integrity and functionality, reliability, or helpfulness, respectively) and does not include aspects of other trusting beliefs (e.g., security). The classification as trust in technology or trust in provider is based on the intended recipient in the formulation of the measurement items. (5) The study is written in the English language. (6) Data collection was conducted before 2020. This is because of the exceptional circumstances of the COVID-19 pandemic. For example, because of store closings, customers had limited alternatives to conducting tasks in the online environment during the pandemic (Sheth, 2020). Such circumstances might cause short-term effects in trust relationships, such as increased intention to use online technologies despite a lack of trust or reliance on other factors for trust formation. Yet, consumers are likely to go back to old habits (Sheth, 2020). Against this background, a recent study by Shaw et al. (2022) shows that online shopping behavior in Canada, Germany, and the US shortly after the pandemic is still above pre-pandemic levels but is declining again. Thus, the effects on trust relationships are rather short-term effects that are likely to disappear after the pandemic, and thus, the inclusion of studies performed during the Covid-19 pandemic might bias the results.

We used several search strategies to identify eligible studies. The search was conducted in March 2021. First, a systematic keyword search in databases that likely include internet- and online trust–related articles was performed. The following databases were searched: EBSCOhost (covering the databases Academic Search Premier, Business Source Premier, EconLit, PsycARTICLES, PsycINFO, and PsycBOOKS), Emerald, JSTOR, Science Direct, Springer, and Web of Science (Core Collection). In addition, IEEE Xplore, AIS e-library, and, complementarily, Google Scholar were considered to also search specifically for conference proceedings and dissertations. The rationale for explicitly searching for and including grey literature (such as conference proceedings and dissertations) is to lessen publication bias, which can arise because published journal articles often report higher effect sizes (Borenstein et al., 2011; Pappas & Williams, 2011; Phillips, 2004). The databases were searched using a set of search terms.[1] Each search term consisted of three parts: The first part consisted of "trust". The second part is a group of keywords for each antecedent, while the third part refers to each considered study context. Within each group, the keywords were linked using the Boolean operator OR; the different parts of the search term were then linked using the Boolean operator OR. An exemplary search profile was: "trust" AND "propensity" OR "disposition to trust" AND "electronic commerce" OR "e-commerce" OR "ecommerce" OR "online shopping". The complete list of keywords for each group is listed in Table 1. As a second search strategy, a dozen scientific journals that publish online trust-related articles were searched manually: Decision Support Systems, Electronic Markets, European Journal of Information Systems, ERCA, International Journal of Information Management, Information and Management, Information and Organization, Information System Research, Journal of the Association for Information Systems, Journal of Management Information Systems, Journal of Strategic Information Systems, and Management Information Systems Quarterly.

The main search led to 63,724 (31,026 after the removal of duplicates) search results. After a first practical screen based on the studies' title and abstract, 3746 articles remained and were evaluated based on their full text for inclusion using the above eligibility criteria. Exemplary reasons for exclusion were a measurement of trust that was not in line with this paper's definition (e.g., Alalwan et al., 2017); trust was not targeted towards the provider or technology but, for example, the internet (e.g., George, 2004); the article's context was out of scope, such as social commerce (e.g., Cheng et al., 2019); or technology was not for a B2C purpose, such as online auction (e.g., Gefen & Pavlou, 2012). The main search identified 230 eligible articles. In addition to the keyword search, the citations and reference

[1] A set of search terms rather than one single search term was used as most databases have a length restriction for the keyword search.

Table 1 Search terms

Group 1	Group 2	Group 3
trust	"internet banking" OR "ebanking" OR "e-banking" OR "electronic banking"	"propensity" OR "dispositional trust" OR "disposition to trust" OR "trusting stance"
	"ecommerce" OR "e-commerce" OR "electronic commerce" OR "online shopping"	"institution-based trust" OR "situational normality" OR "structural assurance"
	"ehealth" OR "e-health" OR "electronic health" OR "digital health"	"knowledge-based trust" OR "familiarity"
	"mbanking " OR "m-banking" OR "mobile banking" OR "mobile payment"	"cognition-based trust" OR "cognitive-based trust" OR "reputation"
	"mcommerce" OR "m-commerce" OR "mobile commerce"	"antecedents" OR "acceptance"
	"mhealth" OR "m-health" OR "mobile health"	
	"eservice" OR "e-service" OR "electronic service"	

lists of the eligible articles that were identified through the keyword search were evaluated analogously to the main search. This forward and backward search has contributed 40 eligible articles. When an author or a group of authors used the same sample of participants for multiple studies and measured the same constructs, only one of these articles was included in the meta-analysis (e.g., Kim et al., 2004, 2012). Including several effect sizes for a relationship based on the same data set could distort results through multiple counting (Borenstein et al., 2011; Hunter & Schmidt, 2004). This procedure led to excluding 19 of the 270 eligible articles. Finally, the meta-analytic sample consists of 251 articles with 272 independent samples. A total of 246 samples were from published journal articles, 16 from conference proceedings, seven from dissertations, and three from articles in collected contributions. The sample sizes range from 15 to 2481 (median = 301; mean = 386.76). The total sample size is 105,199, covering respondents from more than 50 countries.

With regard to the configurations of trust in research models, 126 samples measured only trust in technology in their model, 106 only trust in provider, 25 included both, and 15 samples included an undifferentiated construct that contained measures of both. Overall, trust in technology was incorporated in 154 samples and trust in provider in 131 samples. The technological artifacts analyzed in the studies include shopping websites, online recommendation systems, electronic and mobile banking systems, online health consultation systems, online clinic appointment platforms, and health apps. The sample covers interactions with the systems in the context of the domains of shopping, banking, and health. Common device types include laptops and smartphones. The majority of systems researched in the primary studies are based on graphical user interfaces and use a menu-based interaction (Dix et al., 2010).

Coding

To ensure consistency in coding, a coding protocol was developed that specified what information needed to be completed and how. For each included sample, we first recorded report identification (e.g., author(s), year, title, source, type of publication), sample size, variable definitions and questionnaire items, and correlation coefficients between all variables included in this meta-analysis. Next, the variables' definitions as applied in this meta-analysis were used to classify each of the (in sum more than 840) identified variables in the primary studies, based on their measurement. The coding procedure was independently performed by two experienced coders from the author group with profound knowledge of trust in a technology-related context. The inter-rater agreement was 91%. Discrepancies were solved through discussion.

Some studies provided more than one effect size for the same relationship. This is usually because a correlation coefficient was analyzed at different points in time or a construct was measured with more than one sub-dimension (e.g., structural assurance and situational normality are sub-dimensions of institution-based trust McKnight et al., 2002a). The effect sizes were merged into a single effect size to avoid potentially biased results, as suggested by Hunter and Schmidt (2004). Finally, from the 272 samples, 657 effect sizes were extracted for the meta-analysis. This process was also performed for different conceptualizations of trust so that methodologically sound effects for the combined trust concept could be estimated.

Pairwise meta-analysis

In order to answer RQ1 and test hypotheses H1–H6 on how trust in technology and trust in provider are related to

each other, their antecedents, and intention to use, pairwise meta-analyses are performed. This enabled us to synthesize findings, estimate accurate summary effects for each hypothesized relationship, and assess the generalizability of the results. Besides analyzing the relationships for the concepts of trust in technology and trust in provider, we also calculated overall effects for trust as an undifferentiated concept. To this end, we evaluated the relationships for trust measured as a mixed construct, i.e., the measurement instrument includes items that refer to the trust perception of the technology and items that ask about the trust perception of the provider. In addition, we consolidated trust in technology, trust in provider, and mixed trust without differentiation as a combined trust concept.

We applied Hedges and Olkin's (1985) approach to compute summary effects using correlation coefficients as effect size. A random-effects model was employed for the data analysis because the differences in study characteristics (e.g., setting, participants, and measures) of the included samples may cause true differences in the effect sizes that are not due to sampling error (Borenstein et al., 2011; Hedges & Olkin, 1985). The model was fitted using the restricted maximum-likelihood estimator (REML) for estimating the between-study variance (tau^2) as it is nearly unbiased and fairly efficient (Viechtbauer, 2005). Next to summary effects and variances, 95% confidence intervals were computed. As Hedges and Olkin (1985) suggested, all correlations were transformed into Fisher's z scale before the analysis to stabilize the variance by basing the standard error on the sample size and not the correlation (Fisher, 1921). The transformed values were used for all analyses and converted back for presentation (Borenstein et al., 2011; Hedges & Olkin, 1985). The computations were performed with the statistical software RStudio using the metafor package (Viechtbauer, 2010).

In addition, we assessed the robustness of the results. First, the data were inspected regarding outliers and influential cases using leave-one-out analyses (Cooper et al., 2009; Viechtbauer, 2010). Leave-one-out analysis performs pairwise meta-analysis while deleting one sample at a time. The analysis thus demonstrates to what extent the individual samples impact the results. Given that the procedure of identifying and eliminating possibly erroneous data is problematic in meta-analysis, no entries were removed. Second, we assessed publication bias, a common problem in meta-analysis, which arises as significant effect sizes are more likely to be published than smaller, insignificant effect sizes (Borenstein et al., 2011). For evaluating publication bias in our results, the trim and fill method by Duval and Tweedie (2000) was applied. The test analyzes whether summary effects are influenced by publication bias and, if so, computes an estimate of the unbiased mean.

For reflecting the results' generalizability and robustness across studies, heterogeneity was assessed. Heterogeneity, which is also termed true variance, refers to the variance between effect sizes that is not caused by sampling error but by true differences between samples due to differences in study characteristics. Evaluating the heterogeneity can provide implications for the robustness and generalizability of results (Borenstein et al., 2011). The amount of heterogeneity (tau^2), Cochran's Q-test, and I^2 were calculated. Cochran's Q-test tests whether the variance of the mean effect is larger than it would be due to sampling error only. Significant results of Cochran's Q-test imply the presence of heterogeneity (Cochran, 1954). I^2 is the proportion of true variance to overall dispersion (Borenstein et al., 2011). Values of I^2 above 75% indicate high heterogeneity, meaning a high amount of unexplained variance that is not due to sampling error (Higgins et al., 2003). We further estimated 95% prediction intervals. In comparison to confidence intervals, which address the precision of the mean, prediction intervals describe the distribution of the true effect sizes, i.e., the interval within which the underlying population effect sizes would fall (Borenstein et al., 2011).

We further analyzed the identified heterogeneity against the background that trust is context-specific (Lewicki & Bunker, 1996) by testing whether results differ with levels of experience and according to the domain the technology was used in. Various researchers have stated that trust relationships can change with the individuals' level of experience with a trust recipient (Gefen et al., 2003a; Kim et al., 2004; Liao et al., 2011; Mou et al., 2017) and contexts (Gefen, 2000). This meta-analysis differentiates between two categories of experience: low and high. Samples were coded as low when there was no or only little (first contact) prior interaction with a specific trustee and as high when there were more previous interactions. Of the 272 samples, 52 were coded as low experience, 166 as high experience, and 54 were not assignable. For the analysis of differences between the domains the technology was used in, samples were sorted into three domains based on their setting: e-commerce, e-banking, and e-health. Most of the samples were in the context of e-commerce (171), followed by e-banking (65), and e-health (35).

The moderating effects of level of experience and study context were tested by performing subgroup-analysis using mixed-effects models (Borenstein et al., 2011). For this purpose, an omnibus test based on Wald-type tests was conducted. Significant values of Q-statistic imply that the moderator influences the relationship and effects differ between subgroups (Viechtbauer, 2010).

Meta-analytic structural equation modeling (MASEM)

After synthesizing previous findings using pairwise meta-analysis, MASEM was conducted to test the relationships for the alternative models of four different trust configurations (RQ2). The advantage of MASEM over pairwise meta-analysis is the integration of the bivariate relationships and the consideration of other variables when calculating effect sizes. These results are of higher statistical power than those in single empirical studies as the sample size in MASEM is much larger (Bergh et al., 2016; Cheung & Chan, 2005). We tested the four configurations of trust presented in Fig. 1: (I) combined (trust in technology and trust in provider as one combined, undifferentiated construct), (II) isolate d: trust in technology, (III) isolated: trust in provider, and (IV) integrated (trust in technology and trust in provider as separate, related constructs). The combined configuration (I) does not differentiate between trust in technology and trust in provider and thus consolidates studies that measured trust in technology, trust in provider, or mixed trust. The differentiated configurations (II–IV) exclude studies that measured mixed trust. While the isolated configurations (II and III) include the studies that include trust in technology, respectively, trust in provider, the integrated configuration (IV) involves all studies that integrate trust in technology, trust in provider, or both as differentiated constructs.

We applied the two-stage structural equation modeling approach (TSSEM) by Cheung and Chan (2005) to conduct MASEM. Accordingly, in stage 1, matrices of the correlations, variances, and covariances were estimated using a random-effects model. This procedure is similar to the pairwise meta-analysis with the difference that the overall correlations are not calculated separately. Among other advantages, this allows a more precise estimation, as the precision depends on the sample size and also on the number of studies that report the specific correlation coefficient (Jak, 2015). The estimated matrices from stage 1 were used in stage 2 to compute the path diagram with a weighted least squares estimation (Cheung & Chan, 2005). The computations were conducted in *R* with the metaSEM package proposed by Cheung (2015). Next to χ^2, χ^2/df, root mean squared error of approximation (RMSEA), root mean squared residual (SRMR), and comparative fit index (CFI) are also reported to evaluate the model fit.

Results

The results of this study are organized in two parts. First, the results of the pairwise meta-analyses for each trust conceptualization (trust in technology, trust in provider, trust as a mixed construct, and combined trust) are described and H1 to H6 are evaluated (RQ1). Thereafter, the results of testing and comparing the relationships of four different trust configurations—(I) combined, (II) isolated: trust in technology, (III) isolated: trust in provider, and (IV) integrated—using MASEM are reported (RQ2).

Pairwise meta-analyses

We conducted pairwise meta-analysis for the relationships of each trust conceptualization to address RQ1 and test hypotheses H1 to H6. The hypotheses are assessed for each trust conceptualization: trust in technology, trust in provider, trust as mixed construct (measurement instrument includes items that refer to the trust perception of the technology and items that ask about the trust perception of the provider), and combined trust (consolidation of trust in technology, trust in provider, and mixed trust without differentiation as one combined, undifferentiated trust construct). Table 2 reports the summary effect (r), the number of samples (k) and cumulative sample size (N), and the 95% confidence interval (95% CI) for each relationship. All summary effects are positive, as assumed, and significant. Thus, all hypotheses are supported. According to Cohen (1988), the size of correlation coefficients can be interpreted as small (> 0.10), moderate (> 0.30), and large (> 0.50). In detail, the summary effect of trust in technology and trust in provider (H1) is large and positive. All trust concepts show similar moderate to large effects to intention to use (H2). For trust with an undifferentiated conceptualization, the summary effect is also moderate (H2). The summary effects for the relationships between propensity to trust and the different trust conceptualizations are the smallest but still medium-sized effects (H3). Institution-based trust shows a medium effect to all trust concepts (H4). The overall effect for the relationship between familiarity is large for trust in technology and medium-sized for trust in provider, with combined trust in between (H5). The largest effect size is reported for reputation (H6) for all trust concepts. For trust as a mixed construct, only one sample reported a correlation with institution-based trust and reputation. Table 2 summarizes the results of the pairwise meta-analyses.

Sensitivity analysis was performed to examine whether the results are robust. For this purpose, leave-one-out analysis was conducted. The procedure showed that the results are fairly robust to the influences of single studies. Further, publication bias was analyzed using the trim and fill method (Duval & Tweedie, 2000). The results show that for some relationships, extreme outcomes are suppressed. However, as the adjusted means are positive and statistically significant, and in a similar range to the original mean effects, the overall conclusions do not change. The results are depicted in Table 3.

Table 2 Results of pairwise meta-analyses

		k	*N*	*r*	95% CI	tau^2	I^2 (%)	*Q*-statistic	95% PI
H1	Trust in technology and trust in provider	25	10,120	0.588***	[0.515, 0.652]	0.065	96.42	751.762***	[0.150, 0.833]
Trust in technology									
H2	Intention to use	128	50,667	0.503***	[0.470, 0.535]	0.058	95.92	3366.178***	[0.071, 0.776]
H3	Propensity to trust	19	10,048	0.363***	[0.271, 0.449]	0.026	96.15	661.047***	[−0.066, 0.679]
H4	Institution-based trust	35	11,337	0.493***	[0.434, 0.548]	0.046	93.74	670.4507***	[0.106, 0.750]
H5	Familiarity	12	5066	0.521***	[0.420, 0.609]	0.048	95.14	278.177***	[0.122, 0.775]
H6	Reputation	29	14,721	0.600***	[0.553, 0.643]	0.033	94.50	404.204***	[0.311, 0.787]
Trust in provider									
H2	Intention to use	105	40,639	0.498***	[0.464, 0.530]	0.048	94.94	2256.792***	[0.109, 0.755]
H3	Propensity to trust	23	11,955	0.309***	[0.232, 0.383]	0.020	94.95	966.387***	[−0.072, 0.611]
H4	Institution-based trust	25	10,818	0.492***	[0.402, 0.572]	0.092	96.95	1126.751***	[−0.020, 0.799]
H5	Familiarity	23	10,643	0.356***	[0.265, 0.441]	0.055	96.19	1036.487***	[−0.109, 0.693]
H6	Reputation	28	10,696	0.604***	[0.548, 0.654]	0.049	94.55	419.600***	[0.261, 0.811]
Trust as mixed construct									
H2	Intention to use	10	4778	0.444***	[0.354, 0.526]	0.026	92.38	146.694***	[0.138, 0.673]
H3	Propensity to trust	5	2179	0.193***	[0.132, 0.253]	0.002	48.98	8.029***	[0.080, 0.301]
H4	Institution-based trust	1	468	-	-	-	-	-	-
H5	Familiarity	3	977	0.415***	[0.259, 0.550]	0.021	86.51	16.148***	[0.107 0.651]
H6	Reputation	1	468	-	-	-	-	-	-
Combined trust									
H2	Intention to use	221	86,602	0.500***	[0.476, 0.523]	0.052	95.27	5237.674***	[0.101, 0.760]
H3	Propensity to trust	39	19,628	0.324***	[0.260, 0.385]	0.021	95.76	1686.100***	[−0.090, 0.643]
H4	Institution-based trust	54	21,094	0.492***	[0.439, 0.542]	0.070	95.91	1812.869***	[0.048, 0.774]
H5	Familiarity	36	15,969	0.412***	[0.341, 0.479]	0.055	96.36	1395.532***	[−0.056, 0.732]
H6	Reputation	52	21,934	0.595***	[0.556, 0.632]	0.039	94.66	802.347***	[0.270, 0.799]

k number of samples, *N* combined sample size, *r* weighted mean effect size, tau^2 estimated amount of total heterogeneity, I^2 true variance/total dispersion

*$p < 0.05$; ** $p < 0.01$; ***$p < 0.001$

95% CI, 95%-confidence interval

95% PI, 95%-prediction interval

Q-test, Cochran's *Q*-test for heterogeneity with *k*-1 degrees of freedom

Trust as mixed construct: Trust was measured with an instrument including items targeted at the technology and at the provider

Combined trust: Consolidates trust in technology, trust in provider, and trust as mixed construct as one combined, undifferentiated trust construct

Furthermore, we evaluated the heterogeneity in the summary effects (see Table 2 for results). Cochran's *Q*-test reports statistically significant results for all mean effects, implying true variance between studies. Furthermore, the I^2 statistic reports high values of total heterogeneity relative to total variability for all summary effects ($I^2 > 75\%$ for all mean effects, except 49.98% for trust as mixed construct and familiarity). The prediction intervals, that indicate within which 95% of new true effect sizes would fall, also indicate differences between studies. These results conclude the presence of factors that affect the relationships.

Furthermore, we used subgroup analysis to test if the level of experience and different study domains the technology was used in can explain heterogeneity. Table 4 reports the results of the moderator analyses. The moderator analysis results should be viewed carefully because most of the individual subgroups' mean effects are based on a relatively small number of samples. The level of experience significantly moderates the relationship between trust in technology and trust in provider. Differences in mean effects between low and high levels of experience are also found for the relationships between familiarity and trust in technology, reputation and trust in technology, and reputation and trust in provider. The subgroup analysis of study domain yields statistically significant results for the relationships between institution-based trust and trust in technology as well as for the relationships between trust in provider and propensity to trust, institution-based trust,

Table 3 Results of robustness analysis

	Trust in technology	Trust in provider	Trust as mixed construct	Combined trust
Intention to use	[0.499, 0.506]	[0.493, 0.502]	[0.419, 0.472]	[0.498, 0.502]
	(0)	0.450 (16 left)	(0)	(0)
Propensity to trust	[0.333, 0.375]	[0.284, 0.324]	[0.169, 0.214]	[0.307, 0.331]
	0.414 (4 left)	0.377 (6 right)	(0)	0.384 (10 right)
Institution-based trust	[0.480, 0.504]	[0.468, 0.504]	-[a]	[0.475, 0.492]
	(0)	(0)		(0)
Familiarity	[0.495, 0.546]	[0.332, 0.374]	[0.335, 0.473]	[0.397, 0.421]
	0.545 (1 right)	0.431 (6 right)	(0)	0.460 (6 right)
Reputation	[0.592, 0.608]	[0.591, 0.614]	-[a]	[0.587, 0.598]
	(0)	0.649 (6 right)		0.635 (10 right)

All effects are significant at $p < 0.001$

-[a] No calculation possible because $k = 1$

Upper line: [minimum, maximum] of leave-one-out analysis

Lower line: corrected estimate according to trim and till analysis (number and direction of missing studies)

familiarity, and reputation. For the undifferentiated conceptualizations of trust, significant moderator results for study domain are reported for the relationships between trust as mixed construct and familiarity, as well as combined trust and institution-based trust.

MASEM

In the final step of the analysis, path analysis using MASEM was performed to test the relationships of four different trust configurations (RQ2). For this purpose, four models were tested: (I) combined (trust in technology and trust in provider as one combined, undifferentiated construct), (II) isolated: trust in technology, (III) isolated: trust in provider, and (IV) integrated (trust in technology and trust in provider as separate, related constructs). The results are depicted in Fig. 2 (I–IV). While all models overall report good model fit, the model's fit integrating trust in technology and trust in provider as separate but related constructs is slightly better (see Table 5).

Regarding H1, the analysis of relationships in model (IV) reveals that the path coefficient between trust in technology and trust in provider is not significant ($\beta = 0.088$, $p = 0.626$). Trust is significantly related to the intention to use (H2) for all trust configurations (I–IV). Regarding antecedents, the relationship between propensity to trust and trust (H3) is insignificant for all trust configurations. All other relationships (H4–H6) are found to have positive significant effect sizes between antecedents and trust for models (I), (II), and (III). When integrating trust in technology and trust in provider as separate but related constructs (IV), institution-based trust (H4) and reputation (H6) show positive significant effect sizes to both trust entities; familiarity is positively related to trust in technology only (H5).

Discussion

Discussion of main results

To extend the knowledge concerning the concepts trust in technology and trust in provider in online environments, this meta-analysis synthesized previous quantitative findings of 272 independent samples in the domains of commerce, banking, and health. The underlying online systems are characterized by employing graphical user interfaces and menu-based interaction through, for example, smartphones and laptops. First, the relationship of trust in technology and trust in provider to each other and their individual relationships to antecedents and intention to use, using pairwise meta-analyses were analyzed (RQ1). Moreover, the impact of four different configurations (I–IV) of trust in technology and trust in provider on the relationships was tested by applying MASEM (RQ2). The following discussion of the main results is organized by the RQs.

RQ1 addressed the synthesis of trust in technology and trust in provider relationships. First, we provide empirical support with a high explanatory power that trust in technology and trust in provider are separate, but related concepts (RQ1). The summary effect for the relationship estimated in pairwise meta-analysis is large ($r = 0.588$, $p < 0.001$; Cohen, 1988); however, it is not high enough to assume that the same overarching construct was measured. The positive relationship supports the theoretically derived hypothesis and implies that an increase in trust in technology is linked to an increase in trust in provider. This finding is in line with the theoretical assumptions of the trust transfer theory, which suggest that trust is transferred between related entities (Stewart, 2003). This implies that the strong relationship between trust in technology and trust in provider is based on technology and provider being closely linked entities. Both

Table 4 Results of moderator analysis

		Level of experience			Study domain			
		Q-statistic	*r (k)*		*Q*-statistic	*r (k)*		
			Low	High		E-banking	E-commerce	E-health
H1	Trust in technology & trust in provider	10.325***	0.435*** (5)	0.643*** (13)	0.928	0.618** (1)	0.602*** (18)	0.523*** (6)
Trust in technology								
H2	Intention to use	2.323	0.457*** (28)	0.519*** (74)	2.356	0.539*** (39)	0.487*** (70)	0.476*** (18)
H3	Propensity to trust	2.180	0.299** (5)	0.504*** (5)	0.703	0.398*** (6)	0.335*** (12)	0.470* (1)
H4	Institution-based trust	0.203	0.483*** (14)	0.512*** (14)	9.435**	0.570*** (16)	0.398*** (15)	0.506*** (4)
H5	Familiarity	4.600*	0.353** (3)	0.579*** (7)	2.772	0.639*** (3)	0.476*** (9)	- (0)
H6	Reputation	4.214*	0.682*** (6)	0.568*** (19)	1.155	0.821*** (6)	0.587*** (21)	0.672*** (2)
Trust in provider								
H2	Intention to use	0.128	0.491*** (22)	0.507*** (60)	0.215	0.504*** (11)	0.493*** (76)	0.513*** (18)
H3	Propensity to trust	0.533	0.252** (6)	0.329*** (11)	6.963*	0.564*** (2)	0.281*** (20)	0.272*** (1)
H4	Institution-based trust	2.235	0.352** (6)	0.515*** (14)	9.701**	0.689*** (5)	0.239** (18)	0.357* (2)
H5	Familiarity	3.068	0.110 (2)	0.397*** (19)	21.822***	0.721*** (2)	0.310*** (21)	- (0)
H6	Reputation	5.866*	0.439** (5)	0.625*** (19)	9.992**	0.512*** (2)	0.641*** (22)	0.414*** (4)
Trust as mixed construct								
H2	Intention to use	7.181**	0.180 (1)	0.495*** (7)	3.158	0.333*** (3)	0.491*** (6)	0.500*** (1)
H3	Propensity to trust	-[a]	-[a]	-[a]	-[a]	-[a]	-[a]	-[a]
H4	Institution-based trust	-[a]	-[a]	-[a]	-[a]	-[a]	-[a]	-[a]
H5	Familiarity	-[a]	-[a]	-[a]	8.819**	0.545*** (1)	0.335*** (2)	- (0)
H6	Reputation	-[a]	-[a]	-[a]	-[a]	-[a]	-[a]	-[a]
Combined trust								
H2	Intention to use	1.134	0.477*** (45)	0.509*** (132)	1.742	0.526*** (52)	0.491*** (136)	0.486*** (32)
H3	Propensity to trust	0.610	0.298*** (17)	0.370*** (9)	4.687	0.443*** (8)	0.285*** (29)	0.377** (2)
H4	Institution-based trust	0.546	0.456*** (16)	0.504*** (27)	16.007***	0.601*** (21)	0.410*** (28)	0.434*** (5)
H5	Familiarity	3.165	0.260* (5)	0.445*** (27)	21.445***	0.656*** (6)	0.369*** (30)	- (0)
H6	Reputation	0.031	0.584*** (36)	0.593*** (11)	3.717	0.595*** (52)	0.608*** (8)	0.455*** (40)

r weighted mean effect size for subgroup, *k* number of samples

*$p<0.05$; **$p<0.01$; ***$p<0.001$

-[a] Studies do not differ in the manifestation of the moderator

Trust as mixed construct: Trust was measured with an instrument including items targeted at the technology and at the provider

Q-statistic: Test of moderator

Combined trust: Consolidates trust in technology, trust in provider, and trust as mixed construct as one combined, undifferentiated trust construct

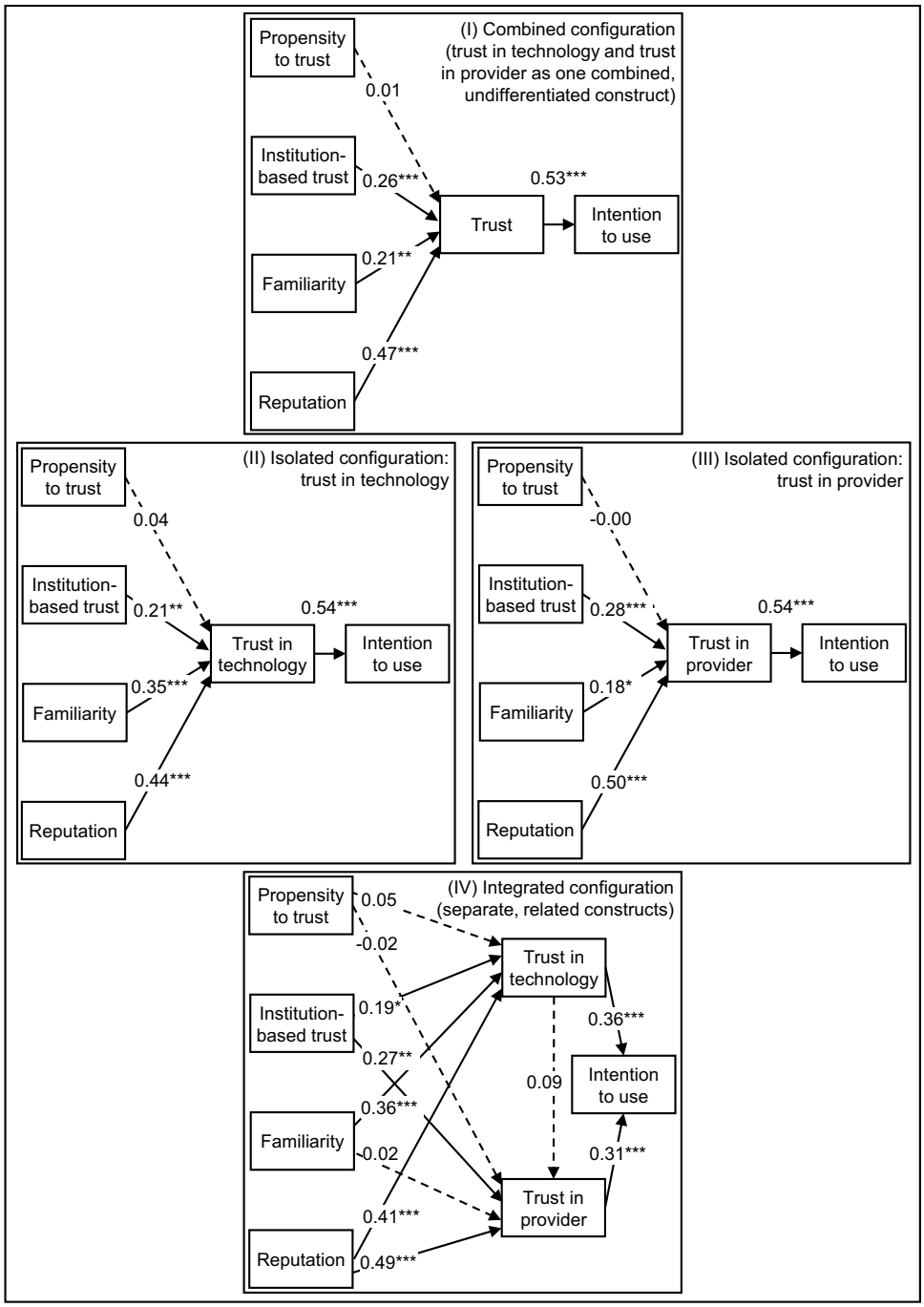

Fig. 2 Results of MASEM analysis for trust configurations (I–IV). Dashed lines represent non-significant paths; numbers are standardized β coefficients; $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$

technology and provider are critical for a successful interaction. The technology is the technical interface for interaction and a representation of the provider. On the other hand, the provider is responsible—besides other related tasks—for the technology. This means that the technology's characteristics depend on providers and their characteristics. This concludes that trust in technology and trust in provider, reflecting an individual's belief in these attributes, are separate concepts that depend on each other in a way that is deeply rooted and thus should be considered complementary.

Second, with further regard to RQ1, the pairwise meta-analysis reports medium to large summary effects that support our hypotheses that trust in technology and trust in provider are positively related to the antecedents in focus and intention to use. Trust in technology and trust in provider show large significant overall effects for the relationship with the intention to use. This is in line with previous meta-analyses (e.g., Kim & Peterson, 2017). Regarding antecedents, propensity to trust, institution-based trust, knowledge-based familiarity, and reputation are found to be positively

Table 5 Model fits for trust configurations (I–IV)

	(I) combined (one combined, undifferentiated construct)	(II) isolated: trust in technology	(III) isolated: trust in provider	(IV) integrated (separate, related constructs)
k (*N*)	267 (103,602)	191 (73,676)	171 (66,330)	263 (100,301)
χ^2	43.320	20.501	41.231	11.367
p-value	0.000	0.000	0.000	0.023
χ^2/df	10.830	5.123	10.308	2.841
RMSEA	0.010	0.008	0.012	0.004
SRMR	0.056	0.043	0.062	0.031
CFI	0.987	0.992	0.980	0.998

k number of samples, *N* combined sample size, *df* degrees of freedom, *RMSEA* root mean squared error of approximation, *SRMR* root mean squared residual, *CFI* comparative fit index

related to each trust entity in varying degrees. On the one hand, the summary effects of propensity to trust, institution-based trust, and reputation for trust in technology and trust in provider can be classified in the same range. Propensity to trust shows with a medium-sized effect the weakest overall effect to trust in technology and trust in provider, while reputation with a large effect-size is most strongly related to trust in technology and trust in provider. Institution-based trust shows a similar medium-sized effect in relation to trust in technology and trust in provider. On the other hand, the results indicate differences in the magnitude and the relative importance for the relationship between familiarity and trust in technology compared to trust in provider. Generally, these results are in line with previous meta-analyses analyzing trust in online providers (He, 2011; Mou & Cohen, 2015).

The effects for the relationships are to be reflected against the dispersion between the studies. The summary effects are weighted mean values of what is in the literature, i.e., weighted mean values of the distribution of measured effect sizes (Borenstein et al., 2011). The analysis of heterogeneity (I^2, Q-statistic, and 95% prediction intervals) shows differences between the effect sizes of primary studies that cause true variance. This means that the true effect of a given study can deviate from the summary effects due to contextual differences. A possible reason for the dispersion is the fact that trust and its relationships are context-specific (Lewicki & Bunker, 1996). Against this background, the contextual influences of the study domain in which the technology is used (e-commerce, e-banking, and e-health) and experience level (low and high) on the trust relationships were analyzed using subgroup analysis. Our results show no significant differences in the role of the two trust entities for intention to use between experience levels and domains. Further results indicate varying mean values between the subgroups but should be interpreted cautiously as only a few samples contribute to the summary effects of the individual subgroups. For example, the results indicate that institution-based trust is more strongly related to both trust in technology and trust in provider for the e-banking domain than the other domains. A possible reason for this preliminary finding is that due to the importance and severe potential negative consequences of financial transactions, trust in the domain specifically depends on the security provided through structural safeguards. The meta-analysis by Mou and Cohen (2015) also found contextual differences in trust formation in their moderator analysis of culture and the type of online environment (commercial-based vs. non-commercial-based).

While RQ1 focused on estimating summary effects using pairwise meta-analyses to elucidate how the two trust entities are related to each other, their antecedents, and intention to use independent of research models, RQ2 addressed these relationships under four different trust configurations (I–IV). In contrast to pairwise meta-analyses (RQ1), MASEM (RQ2) simultaneously examines all relationships and considers causalities and interdependencies between variables. Thus, MASEM enables a systematic comparison of the trust configurations—(I) combined (trust in technology and trust in provider as one combined, undifferentiated construct), (II) isolated: trust in technology, (III) isolated: trust in provider, and (IV) integrated (trust in technology and trust in provider as separate, related constructs). The consideration of causalities and interdependencies of the variables in the research model can lead to differences in the effect sizes between the different models of configurations. In light of the different configurations of trust in technology and trust in provider in research models, testing alternative models of configuring the trust entities facilitates gaining additional insights into the differentiation of trust in technology and trust in provider. The main results of RQ2 that pertain to similarities and, more essentially, differences between the configurations are demonstrated by first comparing configurations with only one trust concept (I–III), followed by configurations with differentiated trust concepts (II–IV).

First, the configurations are consistent in the missing significance for the path coefficients from propensity to trust to trust. A possible explanation is that propensity to trust influences other antecedents of trust and thus has an indirect

effect or moderates the trust development process (Li et al., 2008; McKnight et al., 2011).

Second, the comparison of the configurations that include only one trust construct, i.e., combined (I) and isolated configurations (II) and (III), reveals differences in the antecedents' relationships to trust and comparable path coefficients to intention to use. The model of the combined configuration (I) shows that familiarity has the smallest and reputation the largest effect on combined trust. The differentiation of combined trust (I) as two separate, isolated configurations (II) and (III) reveals differences in the path coefficients of the trust entities to antecedents. The isolated configurations (II) and (III) in MASEM show that institution-based trust and reputation contribute more to increasing trust in provider than to trust in technology; while familiarity is a stronger predictor of trust in technology compared to trust in provider. A possible explanation for the differences in the path coefficients between trust in technology and trust in provider with familiarity, institution-based trust, and reputation in MASEM is that human behavior, even if individuals are well acquainted with a provider, is more difficult to anticipate than the behavior of a technology. Since trust is built on signals (McKnight et al., 1998), trust in provider cannot be enhanced by ones' familiarity to the same extent as trust in technology and is more dependent on external cues that supply additional information, such as structural conditions and cues provided by reputation.

Third, MASEM demonstrates differences between the configurations with differentiated trust concepts, i.e., the isolated (II) and (III) and integrated configurations (IV). Integrating trust in technology and trust in provider as separate, related constructs (IV) reveals a larger path coefficient from trust in technology to intention to use than from trust in provider to intention to use. This can be argued by the fact that the technology, i.e., the online system, represents the provider and direct interaction with the provider is missing. As the primary point of contact in the interaction, an online system that is believed to be trustworthy and thus more influential for predicting intention to use than a trustworthy provider is. Regarding antecedents, the effects of institution-based trust and reputation to trust in technology and trust in provider in the integrated configuration (IV) are similar compared to the isolated configurations (II) and (III). The effect of familiarity on trust in provider, however, is not significant. This indicates that the effect is countered by other relationships that impact trust in provider.

Fourth, interestingly, the effect size for the path between trust in technology and trust in provider is not significant when analyzing relationships for the integrated trust configuration (IV), although they were found to be strongly related in pairwise meta-analysis. The absence of significance for the trust-transfer effect is not consistent with the primary studies (e.g., Kim, 2014; Xiao et al., 2019). A possible reason is the multitude of antecedents analyzed. In their study on the acceptance of robo-advisory systems in the financial industry, Bruckes et al. (2019) compared stepwise the results of research models that differ in the inclusion of institution-based structural assurance. With the inclusion of structural assurance, the significant trust-transfer effect between trust in bank and trust in technology became non-significant. For the present meta-analysis, this implies that the effects of other antecedents absorb the variance of trust in provider, meaning that other factors are more important for trust formation in provider than trust in technology. Montazemi and Qahri-Saremi (2015) were not able to come to a generalizable conclusion for the trust-transfer effect in their meta-analysis on online banking and come to a similar conclusion.

More recently, online systems that involve conversational or immersive interfaces and artificial intelligence have attracted researchers' and practitioners' interest. Compared to most of the underlying technologies in this meta-analysis, the inner workings of such technologies are becoming increasingly complex and more difficult to understand (Susarla et al., 2023). This might imply differences in trust in technology and trust in provider relationships compared to the sample in this meta-analysis. For example, based on the majority of previous researches in this field (e.g., Li et al., 2012; Mou et al., 2017; Pennington et al., 2003; Thatcher et al., 2013), this meta-analysis argues that the causality leads from trust in technology to trust in provider. Nevertheless, in the context of, for example, artificial intelligence-based chatbots or large language models (such as ChatGPT), trust may rather be transferred from the provider to the technology. This is because as the assessment of the technology's attributes and thus, trustworthiness becomes increasingly complex for users, the attributes of the organization responsible for the system might act as cues for the trustworthiness of the technology. In addition, this might imply that the role of trust in provider relative to trust in technology gains relevance. Moreover, differences in the characteristics of online systems might also mean differences in path coefficients. For example, with increased automation and less transparent systems, institution-based structural assurances that safeguard the interaction with the technology might gain relevance for building trust in technology.

Implications for research

Synthesizing primary studies and analyzing the results for different configurations of trust, this study has several implications for trust research in online environments that pertain to interactions with online systems in the domains of commerce, banking, and health using graphical user interfaces and menu-based interaction.

First, we contribute to the trust transfer theory (Stewart, 2003) by demonstrating the strong relationship between trust in technology and trust in provider in online environments that, however, can be countered by the effects of other antecedents when configured as separate, related concepts in research models. The extant literature found that trust can be transferred between entities (Gong et al., 2020; Teo & Liu, 2007). The strong relationship between the entities identified in pairwise meta-analysis supports trust transfer theory in the online context on a large basis. Nevertheless, the non-significant path in MASEM reveals that there are other, more substantial signals than the trustworthiness of the technology that predict trust in provider in online environments. For research, this implies awareness that the perceptions of the technology and provider having the necessary attributes to perform the expected behavior are dependent on each other. Thus, first, in an integrated configuration, trust in technology and trust in provider should thus be related to each other to account for their strong relationship. Furthermore, a non-significant path should not be interpreted as an absent relationship between the two entities. Rather, it should be reflected against the other variables in the research model.

Second, we contribute to online trust research by demonstrating how trust in technology and trust in provider are related to and predicted by antecedents under different configurations. The inconsistent results in previous studies and the varying considerations of antecedents have made it difficult to derive conclusions on the relative importance of antecedents for trust in technology and trust in provider and how trust configurations impact these relationships. Our results from pairwise meta-analysis shed light on the overall effects of the four major categories of trust determinants and indicate differences between trust in technology compared to trust in provider for their relationships to propensity to trust and familiarity. Moreover, our analysis suggests that the context is relevant in trust formation. For example, the relationship of institution-based trust to trust in technology indicates to differ in magnitude across the domains of e-commerce, e-banking, and e-health. Especially for e-banking which represents a domain characterized by critical negative consequences, a large summary effect is estimated for the relationship. Furthermore, MASEM creates additional value by pointing out the relevance of the antecedents' effects on trust in technology and in trust in provider between configurations of trust given a consistent choice of antecedents. For online trust research, these findings highlight the existence of different patterns in trust formation that depend on the trust entity and integration in research models. More specifically, the results imply that especially reputation is inevitable for predicting trust in technology and trust in provider across configurations, while the effect of propensity to trust is neglectable. Furthermore, our results imply a careful consideration in configuring trust in technology and trust in provider as institution-based trust and familiarity are of different relative importance in the trust formation for the entities. Researchers should also be aware that familiarity is a predictor for trust in provider, but in an integrated configuration, the effect might be countered. Generally, the results imply that a differentiated configuration of trust in technology and trust in provider allows deriving more specific conclusions as the antecedents differently predict trust in technology and trust in provider.

Third, the meta-analysis adds to technology acceptance research by bringing light to the inconsistent findings of the effects' magnitude and showing similarities and differences in how trust in technology and trust in provider predict the intention to use for four different configurations of trust, (I–IV), in the online context. Existing literature has found trust in technology and trust in provider to be critical determinants of the intention to use (e.g., Akter et al., 2010; Zhou, 2011). This meta-analysis confirms their importance by demonstrating the relationships for each trust entity to intention to use as differentiated conceptualizations based on a large sample and across configurations. The results indicate that the domain and the experience level have no impact on the relationships of both trust entities to intention to use. Moreover, our results demonstrate that for the analyzed sample of systems, when configured as isolated, trust in technology and trust in provider show comparable paths to intention to use. However, in an integrated configuration as separate, related entities, trust in technology is a stronger predictor of intention to use than trust in provider. This emphasizes that researchers should consider the impact caused by the existing relationship between the trust entities. It is, therefore, inevitable that trust is systematically configured for generating meaningful results in the context of technology acceptance.

Overall, the meta-analysis contributes to technology acceptance and online trust research by synthesizing previous results and testing alternative models. In contrast to previous meta-analyses, our results clarify the mixed findings in primary studies for both trust entities, reflect what is in the literature, and provide reference points for future studies to compare their results. Furthermore, our results revealed differences between the configurations, demonstrating that they cannot be applied interchangeably. Therefore, besides taking a retrospective view to clarify the impact of the configurations on relationships in research models, our findings, in combination with theory, guide researchers to adopt a reasoned configuration of trust. For research, our findings imply that the most accurate results can be reached by integrating both trust in technology and trust in provider as separate, related constructs in research models. Thus, this meta-analysis extends the previous research by uncovering the nomological relationships of trust in technology and trust in provider in different configurations.

Implications for practice

This study also has implications for practice. Organizations conducting business that involves interaction with online systems using graphical user interfaces as interaction modality should be aware that both the trustworthiness of their online system and their trustworthiness as an organization are essential for their services to be accepted and used. For example, individuals are more willing to use a recommendation agent in Amazon.com, the more they believe that the algorithm will perform the task well and the more confidence they have in the attributes of Amazon.com as an organization. This implies that the role of neither trust entity should be neglected, and both should be fostered. This role of trust in technology and trust in provider holds across domains and the (potential) users' experience levels. In the advancement of automated and intelligent systems (such as chatbots or large language models) that make it difficult for potential users to comprehend the technology's attributes, this knowledge might become even more critical for organizations. Furthermore, organizations need to keep in mind that the trustworthiness of their online system reflects their own trustworthiness, and that individuals transfer trust perceptions from the technology to the people behind the technology. For example, if the online banking system works reliably, this can lead to a more positive evaluation of the trustworthiness of the respective bank. Moreover, organizations should take care to provide a trustworthy system, because if the system does not function properly, that can negatively affect individuals' perception of them as an organization.

Besides, practitioners must be aware that factors that build trust are not equally important for forming trust in technology and their organization. Thus, they need to ensure that they implement suitable measures to promote trust effectively. This especially includes establishing and maintaining a good reputation of themselves as an organization, but also of their technology. This implies that organizations should motivate customers to evaluate the interaction with the system and the organization's behavior by means of reviews. In addition, with regard to the online system, organizations should specifically take into account the role of familiarity in building trust in technology. For example, they should ensure that the graphical user interface does not significantly change regularly. When proposing a new system to the market, the interaction should be similar to other established online systems. Moreover, organizations should signal to the potential customer that the online system and the organization align with expectations in that domain. In addition, organizations need to implement structural conditions (e.g., compliance with legal regulations or guarantees) that counteract the uncertainties related to the specific interaction and emphasize especially the trustworthiness of the organization but also of the technology. This implies that the structural conditions should be carefully aligned with the basic conditions of the interaction. For example, institution-based trust is especially important in e-banking for building trust in technology. E-banking is a context that is, due to the potential negative consequences, in need of regulation. This might also apply to contexts in which users need the feeling of security through safety nets. For example, applications based on artificial intelligence are still relatively new to many people and may generate uncertainties that require guarantees or legal regulations to build trust.

Limitations and future research

In addition to the general methodological limitations (e.g., "garbage-in-garbage-out", "apples and oranges") of meta-analyses discussed in the method section, the findings of this analysis should be reflected against some limitations. The first limitation concerns the selection of trust relationships to antecedents and consequences. As this study aimed to comprehend trust configurations, a reasonable selection of antecedents was chosen. Previous analyses have shown that factors like information quality and privacy are also relevant to trust formation in this context (Kim & Peterson, 2017). Moreover, trust conceptualizations might link differently to perceived risk dimensions. Future studies could provide a different perspective on the issue by including these factors.

Moreover, the focus of this analysis has been restricted to the context of B2C online environments. Even though trust in technology in electronic business is relevant, providing a broad understanding of this issue in other technologies is equally important. This is particularly interesting for technologies that interact with users in some ways, such as automated or autonomous systems that provide recommendations or support decision-making. For future analyses, it would therefore be promising to investigate trust relationships in these contexts and whether effects vary with these types of technology.

A further limitation concerns the data sample. Only studies that collected primary data before 2020 were eligible to be included in this meta-analysis. As the systematic literature search to identify studies was conducted in March 2021, this eligibility criterion was reasonable as the short-term effects resulting from the exceptional circumstances during the Covid-19 pandemic could lead to biases in results. As consumers are likely to return to old habits after the Covid-19 pandemic (Shaw et al., 2022; Sheth, 2020) and the relationships in focus are grounded on established theoretical argumentations, the results are likely to apply also after the Covid-19 pandemic. However, the specific effects of the Covid-19 pandemic on trust relationships constitute an avenue for future research.

Furthermore, we find discrepancies in results between pairwise meta-analysis and MASEM. As the focus of this study was to synthesize research on trust and test trust configurations, the meta-analysis does not additionally empirically analyze the theoretical explanations of the identified discrepancies. Future studies would contribute to IS and trust literature by conducting a stepwise approach to structural equation modeling and finding an empirical justification for the absence of significance of certain paths, specifically between trust in technology and trust in provider.

Further promising avenues for future research relate to the analysis of trust in technology and trust in provider specifically for online systems increasingly involving immersive interfaces or artificial intelligence. Trust relationships may change as the inner workings of such technologies become increasingly complex. Future research should thus evaluate and compare existing trust models and the trust formation processes for trust in technology and trust in provider.

Conclusion

The meta-analysis analyzed how trust in technology and trust in provider are related to each other, their antecedents, and the intention to use in B2C online environments. Furthermore, we aimed to clarify how different configurations of trust in technology and trust in provider impact these relationships. Our results highlight the strong relationship between trust in technology and trust in provider. Nevertheless, this relationship is countered by the trust-building mechanisms of the antecedents. The synthesized effects based on previous research show that trust in technology and trust in provider are differently related to antecedents and strongly related to the intention to use. Testing alternative models in terms of different trust configurations, we demonstrate differences in the relationships caused by interdependencies of the variables. This finding highlights the necessity of carefully considering and configuring trust in research models. Therefore, we encourage researchers to move away from an isolated configuration of trust. Being more explicit about the dimensions investigated will enhance our understanding of this research area and provide additional insights into how trust is formed and maintained as technology develops.

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Declarations

Conflict of interests The authors declare no competing interests.

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