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**15 years of measurement model misspecification in trust research? A theory based
approach to solve this problem**

ANONYMOUS

ABSTRACT

The existence of trust in an IT-based service and its providers is an important basis for, among others, the decision to adopt and continuously use such services. It also improves the chances for the successful collaboration in virtual teams and forming strategic alliances. Due to its importance this research area has drawn much attention and has been intensively researched in recent years. We thus deem it is necessary to analyze the current state of the art in quantitative trust research, and are guided by two research questions: a) Which distinct antecedents of the various kinds of trust have been quantitatively examined? b) How did the researchers measure trust, and how reliable are these measurements? Based on the results of the literature review we included a third research questions c) How can current trust measurement models be enhanced, based on the theory, to strengthen the impact of the results?

We conducted a systematic literature review analyzing the top five journals listed in impact factor ranking (ScienceWatch.com, 2009) for the years 1995 to 2009, from which we identified a total of 57 relevant articles. We found that most antecedents were related to system trust and that a huge gap between research theory and research practice exists because all but one contribution reviewed used reflective measurement models, even though the theory suggests using a formative measurement approach. This questions the reliability of the measurements and consequently the reliability of the found antecedents. We therefore developed a formative first-order, formative second-order measurement model for trust using trust theory and a logic that is easily transferable to other areas of interest.

According to our findings, future research should more rigorously discuss the appropriateness of the measurement models used and refrain from adapting previous measurement models without

discussing their suitability. Additionally, the formative measurement of trust should be used to gain insights into the success factors for building and supporting trust.

Keywords: trust, antecedents, measurement.

INTRODUCTION

Trust is a concept widely used in many different research disciplines (Ebert, 2009). The importance of trust is manifold – ranging from a "...key to understanding the relationship development process" (Morgan & Hunt, 1994, p. 32) to being "...a glue that holds the relationship together" (Singh & Sirdeshmukh, 2000, p.156). Many researchers emphasize the importance of trust building (e.g., Gefen, Karahanna, & Straub 2003; Resatsch, Sandner, Leimeister, & Krcmar 2008; Rafaeli, Sagy, & Derfler-Rozin 2008), trust support (e.g., Leimeister, Ebner, & Krcmar 2005) and the identification of factors for the creation of trust (e.g., Bart, Shankar, Sultan, & Urban 2005).

Research has shown the importance of trust in various areas of interest, including e-commerce (Gefen & Straub, 2004), the adoption of new technologies (Gefen et al., 2003), the collaboration in virtual teams (Jarvenpaa, Shaw, & Staples, 2004) and in strategic alliances (Robson, Katsikeas, & Bello, 2008). Different areas of application or objectives lead to varying interpretations and conceptualisations of trust. We therefore conducted a systematic literature review in order to systemize and condense the results from different research areas.

While former literature reviews concerning trust have focused mainly on different dimensions of trust (Bhattacharjee 2002; Gefen & Straub 2004), we focus on the antecedents of trust, depending on the type of trust under investigation. Additionally, we investigate the measurements of trust across the different studies to ascertain the reliability of the measurements and the results. Our literature base is derived from reviewing the top five journals listed in the ScienceWatch.com impact ranking (ScienceWatch.com, 2009) from 1995 onwards. We decided to focus on the

contributions since 1995 because many researchers build upon the theory provided by Mayer, Davis, & Schoorman (1995) or base their measurement models on the work of McAllister (1995).

In the remainder of this article we first provide our definition and conceptualization of trust. We then provide a theoretical background on measurement before we discuss how, according to the underlying theory, trust has to be measured. Additionally, we provide details of our literature review and discuss the results. Based on the gap between research theory and research practice identified in the literature review, we present a logic for the creation of adequate trust measurement models. The paper closes with conclusions and recommendations for future research.

TRUST

The word “trust” is widely used in everyday language, and is therefore addressed by many different disciplines in many different contexts. Additionally, trust is interpreted as being very manifold (Abdul-Rahman & Hailes 2000; Ebert 2009) thus leading to different definitions, depending on the point of view. Nevertheless, Rousseau, Sitkin, Burt, and Camerer (1998) note that the different definitions have a common core, based upon positive expectations and vulnerability. Our contribution builds upon the often cited definition of Mayer, Davis and Schoorman (1995, p. 712): “...trust [...] is the willingness of a party to be vulnerable to the actions of another party based on the expectation that the other will perform a particular action important to the trustor, irrespective of the ability to monitor or control that other party.” Mayer et al. (1995) additionally differentiate between the antecedents and the consequences of trust. They argue that the decision whether to trust or not is based on the general propensity to trust and specific characteristics of the trustee. They identify three very important antecedents of trust:

ability, benevolence and integrity. Resulting from trust, risk taking in relationships is seen by the authors as the consequence of trust, with the argument that the context of interaction (e.g., the stakes involved, the balance of power or the alternatives) is very important here.

Another consequence of the wide-spread use of trust is overlapping categorizations. In order to cluster the different antecedents found in literature in a distinct manner, we follow the interpretation of Abdul-Rahman and Hailes (2000) and Leimeister et al. (2005), using three types of trust: dispositional trust, interpersonal trust and system trust. Dispositional trust refers to the general attitude towards trusting other people. This type of trust, seen as being independent of a specific context or party, can vary across societies (Fukuyama, 1995), and since it is shaped in early childhood, it can therefore hardly be externally influenced afterwards (Erikson, 1968).

Interpersonal trust refers to the trust that one person has directly in another person. This type of trust is party- as well as context-specific. For example, you may trust your mechanic Bob to fix your car, but not to babysit your child. The third type of trust, system trust, refers to trust that is based on perceived properties or structures of an institution, an organization or a system. This can for example refer to trust in the monetary system, a joint venture partner or the Internet.

Researchers have often focused on specific types of trust to show which factors have an influence on them (e.g., Robson et al. 2008; Paul & McDaniel Jr 2004). This is useful to some extent because there might be situations where one type of trust plays a more important role than do other types. For example, considering our trust in a judge, the system type of trust will be more important than the interpersonal one, because the trustee acts in the interest of the judicial system. Nevertheless, we argue that this distinct separation of antecedents affecting only a single types of trust is often very difficult because there are antecedents that influence, for example, interpersonal trust as well as system trust, and in the end our degree of overall trust as a sum of

these three types is the source of our decision to trust or not. Therefore, and due to the fact that very little is known about the interplay of the different types of trust, we have followed Leimeister et al. (2005) and interpreted trust as a black box with the elements of dispositional trust, interpersonal trust and system trust in it, along with a number of antecedents affecting one or more specific types of trust in it. This conceptualization is visualized in Figure 1.

Insert Figure 1 about here

DIFFERENT TYPES OF MEASUREMENT MODELS

Conceptual Distinction: reflective vs. formative measurement models

Due to its dimensional character trust is usually measured as a latent variable with multiple indicators (all 57 of the 57 reviewed articles use this measurement). In general, two different types of measurement models for such constructs are prevalent in the literature – the principal factor (reflective) model and the composite latent variable (formative) model (Jarvis, Mackenzie, & Podsakoff, 2003).

If researchers follow the reflective measurement model, the underlying assumption is that the single indicators correlate highly with each other and that this correlation is caused by the underlying latent variable. This means that a change in the latent construct is reflected by a change in all of the respective indicators (Jarvis et al. 2003; Fornell & Bookstein 1982).

When using the formative measurement model instead, researchers follow the assumption that the latent variable is defined and thus caused by its indicators. Thus the causal logic is the opposite of

the reflective measurement model. In the formative model, a change in the underlying indicators causes a change in the latent variable (Jarvis et al. 2003; Fornell & Bookstein 1982; Diamantopoulos & Winklhofer 2001).

The two types of measurement are visualized in Figure 2 (excluding measurement error or correlation between indicators).

Insert Figure 2 about here

Based on these theoretical differences Jarvis et al. (2003) have created four guidelines to decide whether a measurement model should be interpreted as reflective or formative for a certain use.

Decision Criteria for measurement models by Jarvis et al. (2003)

Jarvis et al. (2003) base their decision criteria upon four sets of questions. First, the direction of causality between the latent variable and the indicators needs to be investigated. The measurement model is a reflective model if the causality flows from the latent variable to the indicators, and is a formative model if it flows from the indicators to the latent construct. Second, it has to be determined whether the indicators are interchangeable or if dropping an indicator causes a conceptual problem. For reflective measurement models, the indicator should be interchangeable because a change in the latent variable causes changes in all of the indicators. Due to the fact that formative indicators define and cause the latent variable, they cannot be interchangeable because dropping an indicator would change the definition of the latent variable. The third step for researchers is to investigate whether the indicators should correlate with each other or not. For reflective measurement models, the indicators need to correlate highly with each

other because changes in the latent variable are supposed to cause changes in all respective indicators. For formative measurement models, a correlation is not forbidden, but correlations between two indicators that are too high would suggest that both cover a rather similar aspect and could therefore be redundant. As a fourth and final step, the antecedents and consequences of the single indicators need to be investigated. Reflective indicators should all have the same antecedents and consequences because they should be interchangeable and reflect the whole variable. Formative indicators instead need not have the same antecedents and consequences because they usually capture different aspects of the whole latent variable. Table 1 displays the detailed decision rules from Jarvis et al. (2003).

Insert Table 1 about here

Consequences of a wrong type of measurement

Concerning the consequences of using a wrong kind of measurement, Jarvis et al. (2003) state:

Our simulation results provide strong evidence that measurement model misspecification of even one formatively measured construct within a typical structural equation model can have very serious consequences for the theoretical conclusions drawn from that model. The entire model could appear to adequately fit the data, even though the structural parameter estimates within that model exhibit very substantial biases that would result in erroneous inferences. This is not simply a measurement model or construct validity problem, because its effects clearly extend into the estimates of the structural parameters that drive the development and testing of marketing theory. More specifically, the results indicate that paths emanating from a construct with a misspecified measurement model are likely to be substantially inflated, thus leading to Type I errors.

However, paths leading into a construct with a misspecified measurement model are likely to be deflated, thus leading to Type II errors (Jarvis et al., 2003, p. 212).

A Type I error means that “paths are labeled as statistically significant when there is actually no relationship between the constructs” (Petter, Straub, & Rai, 2007, p. 630) whereas a Type II error means that “paths are labeled as statistically significant when there is actually no relationship between the constructs” (Petter et al., 2007, p. 630). Therefore, measurement model misspecification puts into question the investigated model as a whole and strongly weakens the results of the study. Additionally due to the fact that the results are usually integrated in the theory, this leads to the problem that the whole conceptual understanding of trust is damaged by these measurement errors.

COMBINING TRUST THEORY AND DIFFERENT TYPES OF MEASUREMENT MODELS

Based upon the provided trust theory and the background on measurement models, we now evaluate what the type of measurement for which trust is suited. The causal model underlying the provided trust theory is visualized in Figure 3.

Insert Figure 3 about here

The figure provided by Mayer et al. (1995) shows that the flow of causality comes from the antecedents (ability, benevolence, integrity, propensity to trust) leading to trust, and from there on the flow of causality proceeds to trust’s consequences (grouped as risk taking in relationships). Following the criteria by Jarvis et al. (2003) presented above, it is obvious that a formative

measurement model has to be used to measure trust using indicators such as ability, benevolence, integrity and propensity to trust – whereas a reflective measurement model has to be used to measure trust using risk-taking-related indicators, such as intention to purchase or intention to share information. Figure 4 illustrates the way these two types of measurement are usually visualized in the literature (without including measurement error or correlation between indicators).

Insert Figure 4 about here

We carry out an exemplary check whether the formative measurement model is appropriate for measuring trust. As the direction of causality has already been discussed we now turn to guidelines 2-4, as presented by Jarvis et al. (2003):

2. Interchangeability of the indicators: indicators are not interchangeable because removing, e.g., competence would alter the definition of the latent variable → formative measurement appropriate.
3. Correlation between the indicators: indicators are not supposed to correlate high with each other, e.g., a high competence does not imply a high benevolence → formative measurement appropriate.
4. Indicators share the same antecedents and consequences: indicators do not necessarily share the same antecedents or consequences, e.g., an antecedent of competence is not necessarily an antecedent of benevolence and integrity, too → formative measurement appropriate.

The formative measurement model derived from theory fulfills all four aspects found in the guidelines and hence is correctly specified. Based on understanding of trust measurement theory, we review trust measurement models found in the literature in order to gain insights into the reliability of the presented results.

METHODOLOGY

Systematic literature reviews have gained more and more importance due to the increasing number of books, journals, conferences and workshops. The aim of a systematic literature review is the analysis of relevant work with special focus on specific research questions. The contribution should describe, summarize, assess, appraise, resolve or integrate selected research results with a focus on the methodology, theory, content or other aspects. We used a concept-centric approach for clustering the different antecedents of trust, but as our second objective is the analysis of measurement models used, we followed an author-centric approach for that part (Webster & Watson, 2002).

Due to the huge number of contributions on trust and the argument that the major contributions will probably be found in leading journals (Webster & Watson, 2002), we limited our review to the top five journals of the ScienceWatch.com impact factor ranking (ScienceWatch.com, 2009). As discussed in the introduction, our review comprised the years of 1995 to 2009. Thus, we reviewed the following journals and issues:

- Management Information Systems Quarterly (MISQ), Volumes 19 (1) – 33 (4)
- Academy of Management Journal (AMJ), Volumes 38 (1) – 52 (6)
- Academy of Management Review (AMR), Volumes 20 (1) – 34 (4)
- Organization Science (OS), Volumes 6 (1) – 20 (6)

- Administrative Science Quarterly (ASQ), Volumes 40 (1) – 54 (4)

In order to identify the possible relevant articles, we decided to use a keyword search in the database, EBSCO, searching for the keyword “trust” in the title, keywords and abstract of each article. The results of this search process were a total of 152 articles that were checked for relevance according to our review. Based upon our research question, we checked whether the articles studied antecedents of trust or at least measured trust quantitatively. To identify these contributions, we checked the research design sections and identified 57 suitable papers. Figure 5 presents the number of articles found per journal. Swanson and Ramiller (1993) reviewed the abstract, introduction, discussion section and conclusion in their literature review, but with our interest in the methodology, we had to expand this method; we thus, additionally checked the research design, method and result sections.

Insert Figure 5 about here

RESULTS

The presentation of our results starts with the different antecedents for each type of trust that we identified in the literature. An overview of the antecedents is provided in Table 1, indicating that researchers focused mainly on system trust. We avoided redundancies and listed the antecedent of a type of trust only once, independent of how many of the reviewed papers used it. One reason for the huge number of antecedents of system trust is our very distinct definition of the two types of trust, dispositional and interpersonal, with system trust being defined very broadly.

Nevertheless, we needed to use these very rigorous definitions because the construct “institution-

based trust”, used, for example, by McKnight et al. (2002b) and McKnight et al. (2002a), refers not only to institutions, but also to technical systems, such as the Internet. We will deal with this point later in the section on future research needed.

Insert Table 2 about here

Table 2 shows that trust research has focused mainly on antecedents of system trust. Generally speaking, we found a huge number of quantitative significant antecedents of trust that extend beyond the provided trust theory. In the next step, we focused on analyzing the reliability of these results by examining the measurement models of the 57 reviewed articles. This was motivated by the results of Jarvis et al. (2003) and Petter et al. (2007), who showed that about 30% of all measurement models in marketing and information systems literature are misspecified. The results of our analysis are summarized in Table 3.

Insert Table 3 about here

Our analysis shows that the degree of misspecification of measurement models in trust literature is much higher than 30%, leading to a huge gap between research theory and research practice. In our analysis of 57 articles, we found only one correctly specified reflective measurement model of trust, namely, Mayer & Gavin (2005). Five measurement models could not be evaluated due to access problems. Thus we found that 51 (~89%) of the measurement models were misspecified. Four measurement models used reflective and formative indicators, and therefore need to be

revised to fit into one concept. Seven measurement models were wrong because some indicators measured trust directly or because they measured, for example, reputation and not trust. Another measurement model resembled a special case not yet addressed in this contribution, and will be discussed later. In the remaining 39 articles (~68%), we found reflective measurement models which should be formative measurement models according to the provided theory on trust and measurement models. This result is disappointing due to the impact of measurement model misspecification. As stated earlier, this misspecification leads to Type I and Type II errors and therefore questions whether the antecedents presented in Table 2 are reliable. As discussed in the section concerning the consequences of wrong measurement, this further questions the conceptual understanding of trust because the biased results are usually integrated into the theory. Another concern is that most measurement models were just adapted from previous research without discussion of their suitability. This appears to be the major reason for the huge amount of misspecification, because once a measurement model is published it seems never to be questioned again. Additionally, we found statements of researchers during our review that showed that the methodological understanding needed to be elevated to ensure reliable and more valuable results. We provide one example and then discuss it:

“For *Trust*, our first dependent variable, we used three items, listed in Table 1, that reflect the three elements that define interorganizational trust” (Gulati & Nickerson, 2008, p. 694).

This statement has wording problems. As described in the theory section, indicators can either reflect (reflective indicators) or define (formative indicators) a latent variable. In general, the statement described is not totally wrong because the author states that they used the three defining elements to measure trust (formative measurement would be appropriate), and each defining element would be resembled by a reflective indicator of this element. This could be

interpreted as a so-called formative first-order, reflective second-order measurement model (Jarvis et al., 2003) which is used by Klein and Rai (2009) and will be discussed later in greater detail. Thus, the problem lies not within the formulation of the statement but in the fact that the measurement is not done in that way. The authors use their three defining elements for a reflective measurement of trust (we used either the graphical illustration or the report of typical indicators, such as Cronbach's Alpha, to identify reflective measurement models). This example shows that the description of the actual measurement is very important and that key terms (such as define and reflect) should be used in an appropriate way.

We have mentioned the special case that used a formative first-order, reflective second-order measurement for trust. This means that the authors assumed the latent variable to be multidimensional and the single dimensions themselves to also be latent variables (Jarvis et al., 2003). Klein and Rai (2009) used this type of measurement, with assumptions in tune with the theory that ability, benevolence and integrity are dimensions of trust but are themselves latent variables that are measured using reflective measurement models. The problem with the measurement model of Klein and Rai (2009) is that the reflective measurement models they use for the latent variables ability, benevolence and integrity seem misspecified – even though they claim that their measurement model fulfills all four guidelines for reflective measurement models from Jarvis (2003). We did not provide a theory on ability, benevolence and integrity, thus we cannot provide a statement as clear as on other trust measurement models, but from a logical point of view, we would argue that one's beliefs about the trustor's ability is created by the beliefs that he is competent, performs his roles well and is knowledgeable; not the other way around (the same for benevolence and integrity). We believe the direction of causality in the

measurement models is from the indicators to the latent variable, too. In our opinion, a first-order formative, second-order formative measurement model would seem to be more appropriate.

After this review and criticism of the huge gap between research theory and practice, we now use a simple example to derive a formative first-order, formative second-order measurement model based on the provided theoretical background and Muir's (1994) logic of a trust network, because we think this follows Mayer & Davis' (1999) call for an examination and consideration of the dimensionality of trust.

TOWARDS A FORMATIVE FIRST-ORDER, FORMATIVE SECOND-ORDER MEASUREMENT MODEL OF TRUST

“One should expect trust to be increasingly in demand as a means of enduring the complexity of the future which technology will generate” (Luhmann, 1979, p. 16).

Already in 1979, Luhmann forecasted that the development of new technology would make trust even more important due to the increase in complexity of everyday life. In 1994, Muir discussed human trust in highly automated systems and argued that in such a complex situation the actual trust of a human in the system was only one part of a whole trust network (Muir, 1994).

We argue that this logic is also appropriate today because possibilities such as e-commerce or the growing attention on ubiquitous computing result in many different parties being involved in the smallest transactions. To illustrate this, we now create a trust network for a normal eBay (www.ebay.com) transaction. We identify four different parties that are involved in this transaction and therefore form part of our trust network, as illustrated in Figure 6: the buyer, the seller, the other users (who provide feedback about the seller's past transactions), and eBay as an organization.

Insert Figure 6 about here

We now briefly discuss the trust relations that we have identified. It is worth mentioning that although this trust network was built for exactly one single eBay transaction and therefore relations such as seller's trust in other users is missing, that does not mean that this relation is generally unimportant.

The buyer has to trust eBay because he provides personal information that is valuable to him, such as a credit card number. Additionally, he has to trust the seller that, e.g., the item has the described condition. Furthermore, he needs to trust other users because they provide details about the seller's transaction history. We now focus on a measurement model for buyer's trust in an eBay transaction, and therefore discuss the other parties in lesser detail.

eBay has to trust all parties involved because their whole business model is based on the interplay of the different parties. The seller has to trust eBay because he also provides personal information, the buyer because he would lose money, or at least time, if the buyer just wasn't serious while bidding on the item. The other users are not actively involved and therefore do not need to trust any other party. They could even have decided to stop using eBay in the meantime because the information they provided are still in the system (in this case the term "other users" would not fit anymore, but this is just a detail).

After discussing the different trust relations, we now check which kinds of trust are relevant in our example. When assuming that the buyer and seller are individuals, we need all three of our provided kinds of trust: we need dispositional trust to capture the buyer's general thoughts about

trusting, we need interpersonal trust to capture the buyer's trust in the seller, and we need system trust to capture the buyer's trust in eBay and other users (all other users as a whole).

Following this logic and Mayer et al.'s (1995) trust theory, we now use the three antecedents: ability, benevolence and integrity. Combined with the different parties, a first-order formative, second-order formative measurement model of trust is derived. We do not include disposition to trust in our model because we think the surplus of explanation is outweighed by the additional complexity that an inclusion would cause and because our aim is to show our logic to develop such a measurement model and not to create a perfectly complete one. Our measurement model is illustrated in Figure 7.

Insert Figure 7 about here

Our measurement model is based on the idea that the dimensionality of trust is best represented by the sum of the three dimensions: ability, benevolence and integrity, each dimension being a sum of the beliefs about the other parties. We furthermore purport that in our example we must measure overall trust because the three dimensions influence both interpersonal and system trust making a separate measurement hard to realize. We believe this logic is a good starting point for developing formative measurement models for trust because the logic can be easily transferred to other areas of interest leading to an always optimally suited measurement model for each single situation. Additionally, formative measurement models are suited to better identifying factors that build, support or create trust, as this mode of measurement is named the ideal choice for success factors identification (Albers, 2009).

CONCLUSION AND RECOMMENDATION FOR FUTURE RESEARCH

In this article we have addressed three research questions. Concerning our first research question, we found that researchers focused mainly on system trust and provided a huge number of different antecedents for this kind of trust. Regarding our second research question, we identified a huge gap between research theory and practice, because we found only one correctly specified measurement model, whereas ~89% of the measurement models were misspecified leading to errors, such as, Type I and Type II errors, which questions the reliability of the found antecedents and the researcher's conceptual understanding of trust as a whole. Based on these results, we decided to include a third research question dealing with an theory based improvement of trust measurement models. To this end, we provided our approach for developing an adequate formative measurement model of trust, and used this approach to develop a formative first-order, formative second-order measurement model of trust for our example of an eBay transaction. Furthermore we pointed out that the logic we used to derive such a formative measurement model could easily be transferred to other areas of interest in order to create formative measurement models that are best suited for specific situations.

We recommend future research to address two main points. First, research should try to find a categorization for different kinds of trust that are as distinct as, but more detailed than the one provided by Abdul-Rahman & Hailes (2000). The type of trust considered to be "system trust" cannot adequately represent all the different kinds of trustees used in research. A promising idea could be separating this type of trust into categories such as: "group" (e.g., for virtual teams), "organization" (e.g., for an online vendor), "institution" (e.g., for trustees like the legal system) and "system" (e.g., for technical systems like the Internet). More differentiated categories would

allow researchers to better display relationships between these different types of trustees, leading to more detailed insights about the nature and dynamics of trust.

Second, we believe researchers should place more emphasis on the definition of their measurements and the rigorous use of the selected research method in order to increase the quality of the results, which would lead to a better theoretical understanding of trust. We see no problem in adapting existing measures, but this adaption should be discussed and argued as to why this adaption is reasonable. Additionally, we believe it would be promising to use a formative measurement model for trust because it suits better to the underlying theory, and additionally offers insights about success factors for building and supporting trust.

TABLE 1

Table 1: Decision rules for measurement models from Jarvis et al. (2003, p. 203)

	Formative model	Reflective model
1. Direction of causality from construct to measure implied by the conceptual definition Are the indicators (items) (a) defining characteristics or (b) manifestations of the construct? Would changes in the indicators/items cause changes in the construct or not? Would changes in the construct cause changes in the indicators?	Direction of causality is from items to construct Indicators are defining characteristics of the construct Changes in the indicators should cause changes in the construct Changes in the construct do not cause changes in the indicators	Direction of causality is from construct to items Indicators are manifestations of the construct Changes in the indicator should not cause changes in the construct Changes in the construct do cause changes in the indicators
2. Interchangeability of the indicators/items Should the indicators have the same or similar content? Do the indicators share a common theme? Would dropping one of the indicators alter the conceptual domain of the construct?	Indicators need not be interchangeable Indicators need not have the same or similar content/indicators need not share a common theme Dropping an indicator may alter the conceptual domain of the construct	Indicators should be interchangeable Indicators should have the same or similar content/indicators should share a common theme Dropping an indicator should not alter the conceptual domain of the construct
3. Covariation among the indicators Should a change in one of the indicators be associated with changes in the other indicators?	Not necessary for indicators to covary with each other Not necessarily	Indicators are expected to covary with each other Yes
4. Nomological net of the construct indicators Are the indicators/items expected to have the same antecedents and consequences?	Nomological net for the indicators may differ Indicators are not required to have the same antecedents and consequences	Nomological net for the indicators should not differ Indicators are required to have the same antecedents and consequences

TABLE 2

Results of clustering the different antecedents in the literature

Type of trust	Antecedents (Source)
Dispositional trust	
Interpersonal trust	<ul style="list-style-type: none"> • Ability (Mayer & Gavin, 2005) • Attitudinal predisposition towards peers (Becerra & Gupta, 2003) • Benevolence (Mayer & Gavin, 2005) • Peer affiliative citizenship behavior (McAllister, 1995) • Consideration of team members' input (Korsgaard, Schweiger, & Sapienza, 1995) • Executive communication (Iacovou, Thompson, & Smith, 2009) • Executive knowledge (Iacovou et al., 2009) • Initial trust condition (Ferrin & Dirks, 2003) • Integrity (Mayer & Gavin, 2005) • Interaction Frequency (McAllister, 1995) • Guanxi (Farh, Tsui, Xin, & Cheng, 1998) • Own information sharing (Ferrin & Dirks, 2003) • Perceived motives (Ferrin & Dirks, 2003) • Perceived performance (Ferrin & Dirks, 2003) • Similarities in demographic attributes (Farh et al., 1998)
System trust	<ul style="list-style-type: none"> • Ability (Mayer & Gavin, 2005) • Availability of competent human resources (Child & Möllering, 2003) • Balanced Asset specificity (tangible and intangible) (Young-Ybarra & Wiersema, 1999) • Benevolence (Mayer & Gavin, 2005) • Calculative-based beliefs (Gefen et al., 2003) • Commitment-based HR practices (Collins & Smith, 2006) • Communication (Young-Ybarra & Wiersema, 1999) • Company tenure of a purchasing manager (Perrone, Zaheer, & McEvily, 2003) • Confidence in legal system (Child & Möllering, 2003) • Distribution fairness (Robson et al., 2008) • Expectation of continuity (Poppo, Zhou, & Sungmin, 2008) • Familiarity (Gefen et al., 2003) • Harmonious conflict resolution (Goo, Kishore, Rao, & Nam, 2009) • “Hostages” (Young-Ybarra & Wiersema, 1999) • Image appeal (Cyr, Head, Larios, & Bing, 2009) • Inspirational leadership (Joshi, Lazarova, & Liao, 2009) • Integrity (Mayer & Gavin, 2005) • Interdependence (Robson et al., 2008) • Methods for personal rapport (Child & Möllering, 2003) • Organizational tenure (Becerra & Gupta, 2003)

- | |
|---|
| <ul style="list-style-type: none"> •OSS values (Stewart & Gosain, 2006) •OSS norms (Stewart & Gosain, 2006) •OSS beliefs (Stewart & Gosain, 2006) •Partner similarity (Robson et al., 2008) •Perceived ease of use (Gefen et al., 2003) •Perceived interaction between partner and stranger (Stewart, 2003) •Perceived organization support (Dulac, Coyle-Shapiro, Henderson, & Wayne, 2008) •Perceived personalization (Komiak & Benbasat, 2006) •Perceived social presence (Cyr et al., 2009) •Positive feedback profile (Ba & Pavlou, 2002) •Prior exchange history (Poppo et al., 2008) •Recruitment of own local managers (Child & Möllering, 2003) •Shared values (Young-Ybarra & Wiersema, 1999) •Shared vision (Tsai & Ghoshal, 1998) •Situational normality (Gefen et al., 2003) •Social interaction ties (Tsai & Ghoshal, 1998) •Structural assurance (Gefen et al., 2003) •Task-oriented communication (Kanawattanachai & Yoo, 2007) •Transfer of own business practices (Child & Möllering, 2003) •Visible organizational symbol (Rafaeli et al., 2008) |
|---|

TABLE 3**Quality of measurement model specification in the literature**

Authors	Comment on trust measurement
Ba & Pavlou (2002)	Reflective measurement, adapted from different sources. Scale is based on characteristics like benevolence and integrity → measurement should be formative instead.
Becerra & Gupta (2003)	Reflective measurement, adapted from Mayer & Davis (1999). Scale is based on the dimensions ability, benevolence and integrity → measurement should be formative instead.
Brockner (1997)	Reflective measurement. Scale is based on different dimensions like supervisor and management → measurement should be formative instead.
Carson, Madhok, Varman, & John (2003)	Reflective measurement, adapted from different sources. Scale is based on characteristics like fairness and integrity → measurement should be formative instead.
Chao, Ya-Ru, & Xin (2004)	Reflective measurement. Scale is based on characteristics like ability and integrity → measurement should be formative instead.
Chattopadhyay (1999)	Reflective measurement, adapted from McAllister (1995). Scale is based on characteristics like ability and integrity → measurement should be formative instead.
Child & Möllering (2003)	Reflective measurement. Concrete operationalization requested but not yet received, however the scale seems to be based on characteristics of the Hong Kong managers.
Choudhury & Karahanna (2008)	Reflective measurement, adapted from McKnight et al. (2002a). Scale is based on ability, benevolence and integrity → measurement should be formative instead.
Chua, Ingram, & Morris (2008)	Reflective measurement, adapted from McAllister (1995). Scale is based on characteristics like ability and integrity → measurement should be formative instead.
Collins & Smith (2006)	Reflective measurement, adapted from Mayer & Davis (1999). Scale is based on ability, benevolence and integrity → measurement should be formative instead.
Cyr et al. (2009)	Reflective measurement, adapted from different sources. Scale does not fit to a latent variable because the variable is directly requested in one question.
Dulac et al. (2008)	Reflective measurement, adapted from Robinson (1996). Scale is based on characteristics like integrity → measurement should be formative instead.
Dyer & Chu (2003)	Reflective measurement, adapted from different sources. Scale is based on characteristics like fairness → measurement should be formative instead.
Farh (1998)	Reflective measurement, one scale adapted from Podsakoff (1990). Both scales are based on characteristics like integrity and loyalty → measurement should be formative instead.
Ferrin & Dirks (2003)	Reflective measurement, adapted from a source we could not access.
Gefen et al. (2003)	Reflective measurement. Scale is based on characteristics like ability, benevolence and integrity → measurement should be formative.
George (2003)	Reflective measurement, adapted from a source we could not access.
Goo et al. (2009)	Reflective measurement. Scale is based on characteristics like benevolence and integrity → measurement should be formative.
Gulati & Sytch (2007)	Reflective measurement, adapted from Zaheer, McEvily, & Perrone (1998). Scale is based on characteristics like integrity → measurement should be formative instead.
Gulati & Nickerson (2008)	Reflective measurement. Scale is based on characteristics like fairness → measurement should be formative instead.
Huff & Kelley (2003)	Reflective measurement. Scale is based on characteristics like honesty and integrity → measurement should be formative instead.
Iacovou et al. (2009)	Reflective measurement. Scale is based on characteristics like ability and fairness → measurement should be formative instead.

Jarvenpaa (1999)	Reflective measurement, adapted from different sources. Scale is based on risk-taking and characteristics → Scale is mixed and should be revised to be either reflective or formative.
Jehn (2001)	Reflective measurement. Scale does not fit to a latent variable because the variable is directly requested in the question “How much do you trust your fellow group members?”
Joshi et al. (2009)	Reflective measurement, adapted from McAllister (1995). Scale is based on characteristics like ability and integrity → measurement should be formative instead.
Kanawattanachai & Yoo (2007)	Reflective measurement, adapted from different sources. Scale is based on characteristics like ability and integrity → measurement should be formative instead.
Kankanhalli, Tan, & Kwok-Kee (2005)	Reflective measurement, adapted from Mishra (1996). Scale is based on characteristics of colleagues → measurement should be formative.
Klein & Rai (2009)	Reflective first-order, formative second order measurement. Special case, discussed in the text.
Komiak & Benbasat (2006)	Reflective measurement. Scale is based on characteristics like ability and integrity → measurement should be formative instead.
Korsgaard (1995)	Reflective measurement, adapted from a source we could not access.
Krishnan, Martin, & Noorderhaven (2006)	Reflective measurement, adapted from different sources. Scale is based on reliability, fairness and goodwill → measurement should be formative instead.
Lazzarini, Miller, & Zenger (2008)	Reflective measurement, adapted from Yamagishi & Yamagishi (1994). Scale is based on characteristics like honesty → measurement should be formative.
Langfred (2004)	Reflective measurement, adapted from Simons & Peterson (2000). Scale is based on characteristics of other team members → measurement should be formative instead.
Langfred (2007)	Reflective measurement, adapted from Simons & Peterson (2000). Scale is based on characteristics of other team members → measurement should be formative instead.
Malhotra & Murnighan (2002)	Reflective measurement. Scale does not fit to a latent variable because the variable is directly requested in the question “How much did you trust person 2?”
Mayer & Gavin (2005)	Reflective measurement, based on statements concerning risk taking. Correctly specified reflective measurement model of trust.
McAllister (1995)	Reflective measurement. Scale is based on characteristics like ability and integrity → measurement should be formative instead.
Mithas, Jones, & Mitchell (2008)	Reflective measurement. Scale is based on characteristics like ability and benevolence → measurement should be formative instead.
Nelson (1996)	Reflective measurement. Scale measures “reputation”.
Pavlou & Fygenson (2006)	Reflective measurement. Scale is based on characteristics like ability and honesty → measurement should be formative instead.
Pavlou, Huigang, & Yajiong (2007)	Reflective measurement, adapted from Gefen (2002). Scale is based on characteristics like ability, benevolence and integrity → measurement should be formative instead.
Pearce (2000)	Reflective measurement. Scale is based on characteristics like integrity → measurement should be formative instead.
Perrone et al. (2003)	Reflective measurement, adapted from Rempel, Holmes, & Zanna (1985). Scale is based on characteristics like integrity → measurement should be formative instead.
Polzer, Crisp, Jarvenpaa, & Kim (2006)	Reflective measurement, adapted from a source we could not access.
Poppo et al. (2008)	Reflective measurement, adapted from Zaheer et al. (1998). Scale is based on characteristics like integrity → measurement should be formative instead.
Rafaeli et al. (2008)	Reflective measurement. Scale does not fit to a latent variable because the variable is directly requested in 2 questions.
Rai, Maruping, & Venkatesh (2009)	Reflective measurement, adapted from Aulakh, Kotabe, & Sahay (1996). Scale does not fit to a latent variable because the variable is directly requested in several questions.
Robinson (1996)	Reflective measurement. Scale is based on characteristics like integrity →

	measurement should be formative instead.
Robson et al. (2008)	Reflective measurement, adapted from different sources. Scale is based on characteristics like integrity → measurement should be formative instead.
Sia et al. (2009)	Reflective measurement. Scale does not fit to a latent variable because the variable is directly requested in one question.
Saparito, Chen, & Sapienza (2004)	Reflective measurement, adapted from different sources. Scale is based on some risk taking related indicators but also characteristics like integrity → Scale is mixed and should be revised to be either reflective or formative.
Stewart (2003)	Reflective measurement, adapted from Mayer & Davis (1999). Scale is based on ability, benevolence and integrity → measurement should be formative instead.
Stewart & Gosain (2006)	Reflective measurement. Scale is based on characteristics like benevolence and fairness → measurement should be formative instead.
Szulanski, Cappetta, & Jensen (2004)	Reflective measurement. Scale is based on ability, benevolence and integrity → measurement should be formative instead.
Tsai (1998)	Reflective measurement. Scale is based on risk-taking and characteristics → Scale is mixed and should be revised to be either reflective or formative.
Young-Ybarra (1999)	Reflective measurement. Scale is based on risk-taking and characteristics → Scale is mixed and should be revised to be either reflective or formative.
Zaheer et al. (1998)	Reflective measurement. Scale is based on characteristics like integrity → measurement should be formative instead.

FIGURE 1

Trust conceptualization (based on Leimeister et al. (2005))

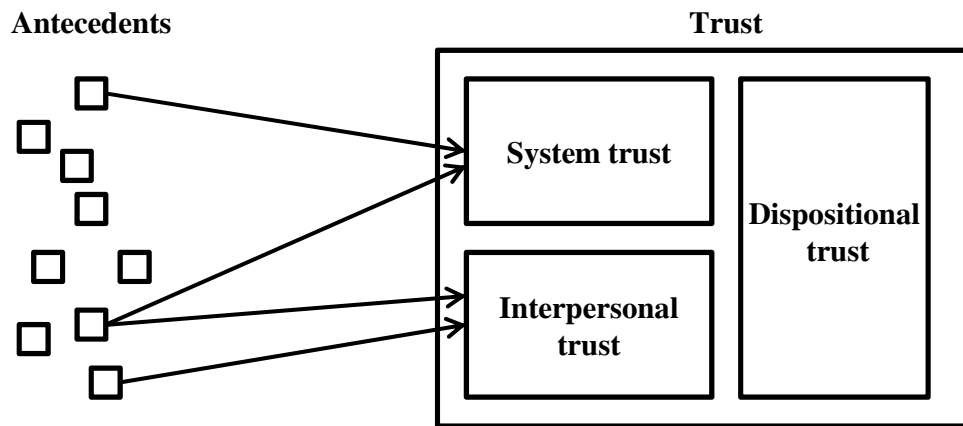
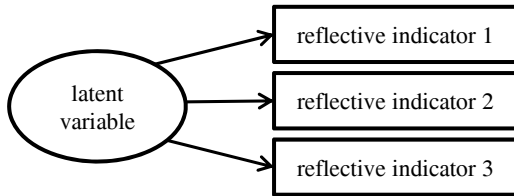


FIGURE 2

Formative and reflective measurement model

Reflective measurement model



Formative measurement model

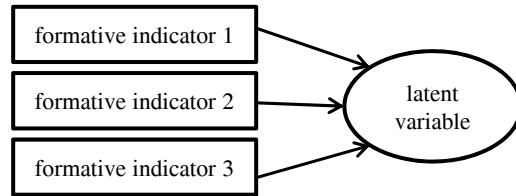


FIGURE 3

Proposed model of trust by Mayer et al. (1995, p. 715)

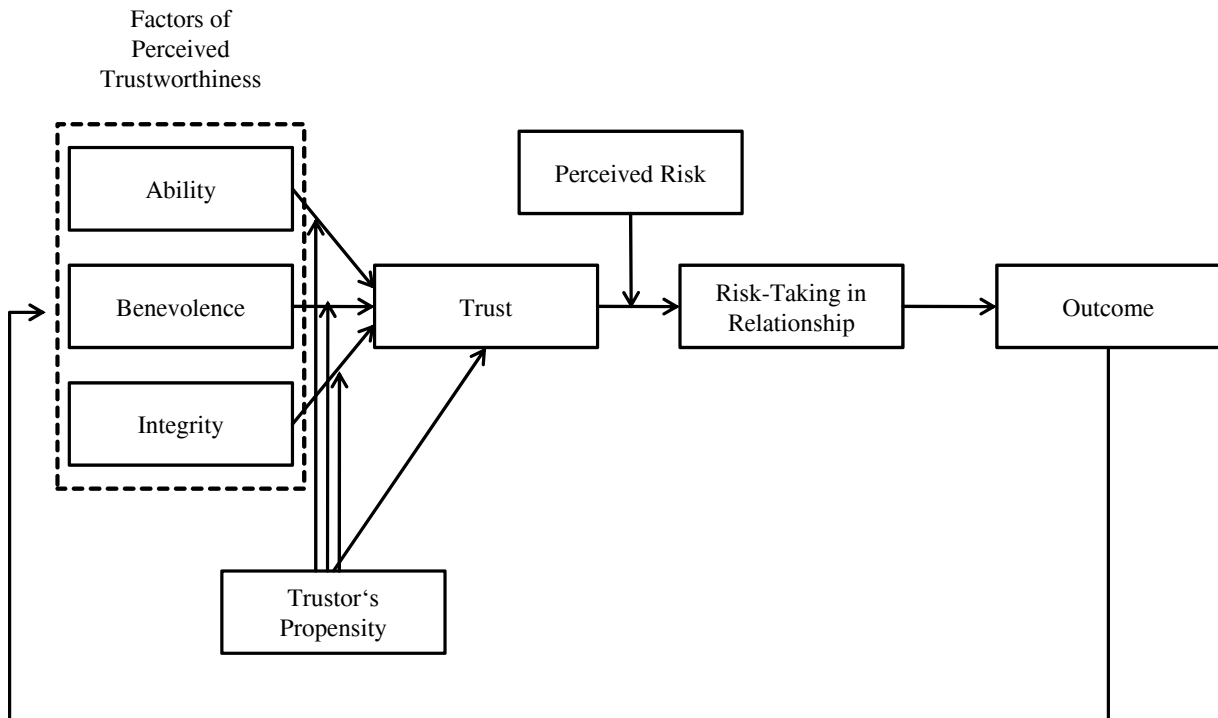
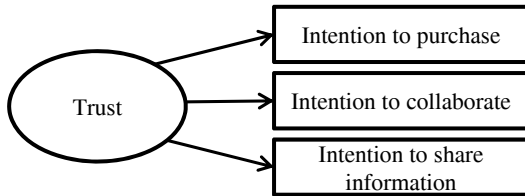


FIGURE 4

Formative and reflective measurement models derived from trust theory

Reflective measurement model



Formative measurement model

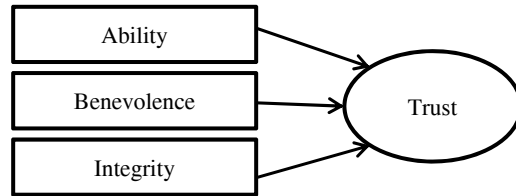


FIGURE 5

Number of articles included in the literature review grouped by journal

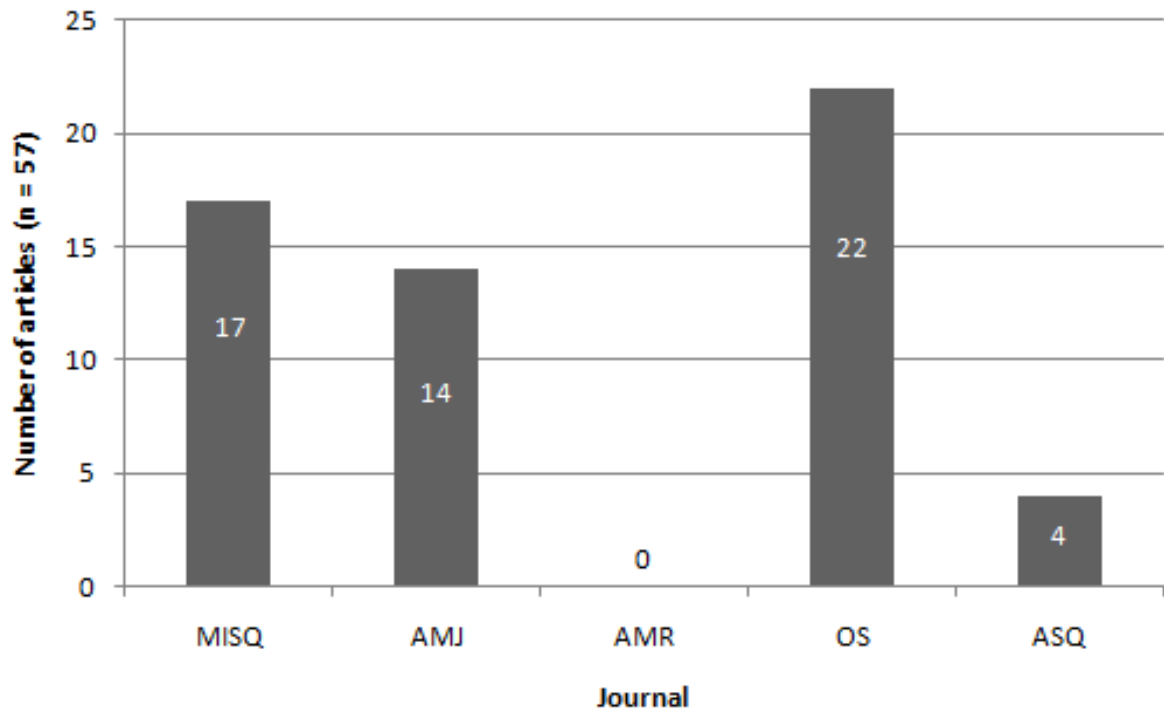


FIGURE 6

Trust network of the eBay example

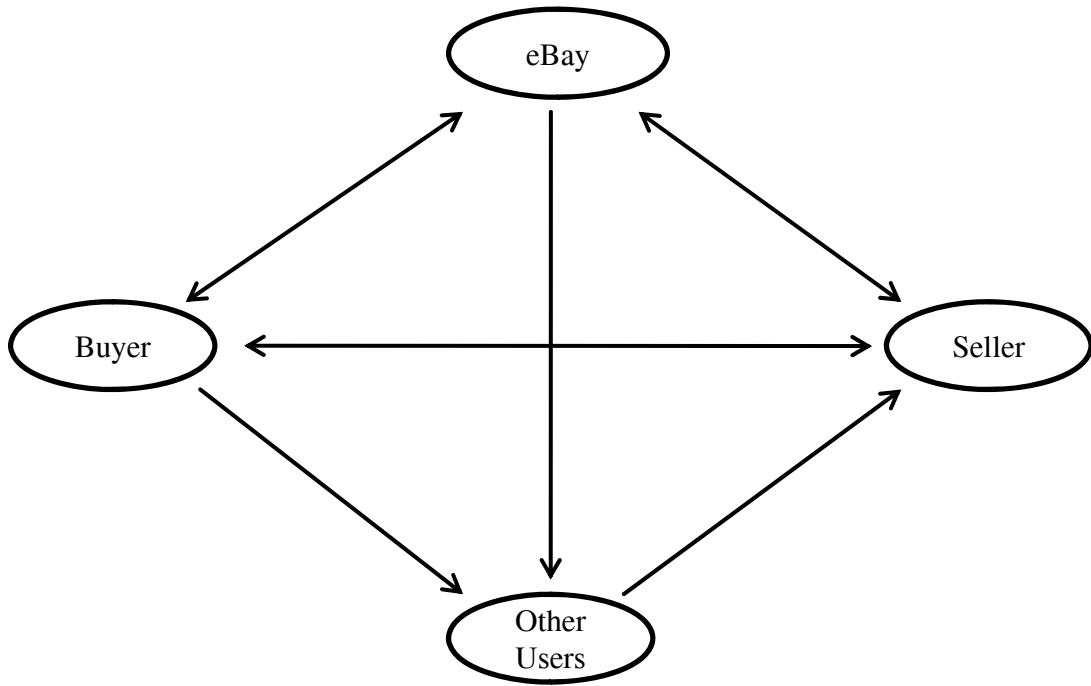
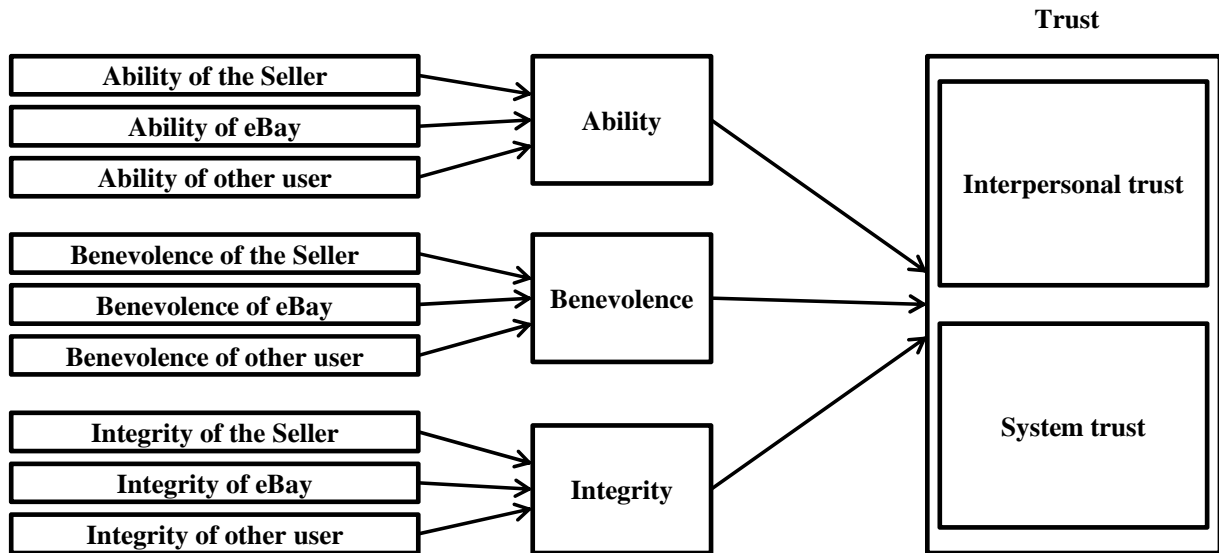


FIGURE 7

First-order formative, second-order formative measurement model of trust for the eBay example



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