Review on Perspectives in Supply Chain Trust Evaluation

Manu Mathew, Justin Sunny, and V. Madhusudanan Pillai

Abstract Trust is an obligatory requirement for each supply chain (SC), as it can greatly improve the overall SC performance. Evaluation of trust among SC actors is not an easy task, but it is essentially needed to take crucial SC decisions. To this point in time, many researchers have attempted to evaluate trust through different perspectives. The purpose of this work is primarily to review the various perspectives of researchers in evaluating SC trust. This paper particularly targets the trust in buyer–supplier relationship. Review reveals that researchers mainly adopt two approaches in evaluating trust, which are survey based and mathematical model based. Benevolence, credibility, ability, integrity, goodwill, and openness are the key trust factors considered by most of the researchers.

Keywords Trust · Supply chain management · Trust factors · Trust evaluation

1 Introduction

Trust is a multi-faceted concept that can be interpreted in many ways. Trust is defined in several ways with regard to various fields including sociology, economics, automation, organizational management, computer and networking, psychology, and political science. Supply chain is a network of organizations to produce and distribute specific products to the end customer.

Trust in a SC can be defined in several ways. Fundamentally, trust is the firm's belief that another company will perform actions that will result in positive outcomes for the firm as well as avoid unexpected actions that would result in negative outcomes for the firm [1].

Trust is an efficient solution to improve cooperative efficiency and it reduces the cooperative uncertainty [2]. Trust is a critical factor in fostering commitment among

M. Mathew · J. Sunny · V. M. Pillai (✉)
Department of Mechanical Engineering, National Institute of Technology Calicut, Kozhikode, Kerala, India
e-mail: vmp@nitc.ac.in

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SC partners [3]. Trust can be considered as a necessary antecedent of information sharing in a SC [4]. In short, trust act as a necessary ingredient in improving SC performance.

Measurement of trust in SC is one of the widely researched areas and still lots of researchers are working on this ground. As there is no universal definition of trust, there is no universal way of measuring it. Researchers are adopting different perspectives for evaluating trust in SCs. The purpose of this work is primarily to review the various perspectives of researchers in evaluating SC trust. To the best of our knowledge, this is the first review paper that discusses various perspectives in trust evaluation after McEvily and Tortoriello [5].

This paper is organized as follows. Section 2 describes the methodology. Review on perspectives in SC trust evaluation is presented in Sect. 3. Section 4 highlights the findings from the review. Section 5 concludes the whole work.

2 Methodology

An intensive literature review was done to study the approaches in SC trust evaluation. This work considers literature published from 2000 to 2019. As the next step, an abstract review was done to filter the relevant materials. This review paper fundamentally narrates about 27 recent research works related to the SC trust evaluation. Literatures are thematically analyzed in the chronological order. Even though the search was not exhaustive, it serves as a comprehensive basis for gaining an overall understanding of the attempts for evaluating trust in different kinds of SCs.

3 Perspectives in Supply Chain Trust Evaluation

Researchers have modeled and evaluated trust in a range of perspectives. Perspectives change with respect to the trust factors considered, methodology followed, scenario considered, etc.

Handfield and Bechtel [6] analyzed the effect of four factors, viz. buyer dependence, contract, site-specific asset, and human-specific asset on trust and interpreted the influence of trust on SC responsiveness. They concluded that trust can improve supplier responsiveness. This survey-based study shows that buyer dependence, human-specific asset, and trust are positively related to responsiveness.

The remarkable developments in the technology and wide use of Internet have already redefined the traditional SC concepts. Several authors have attempted to conceptualize trust in electronic-based SC management or e-supply chain management (e-scm). Xiong and Liu [7] has framed a model for evaluating trustworthiness of a peer in a decentralized information system. It was done by combining three trust factors, viz. amount of satisfaction, number of interaction, and balance factors. In this era of electronic-based business, trust in peer-to-peer decentralized information systems

is very important. Wang and Varadharajan [8] considered a decentralized scenario for peer-to-peer interaction and attempted to evaluate the trust of a peer by developing a probability-based model. Trust is evaluated based on the interaction history of a peer with the other peers. Nowadays almost all the SC organizations are net enabled and transactions are done online. In order to evaluate the trust among net-enabled organizations, Lin et al. [9] proposed a trust mechanism for selecting supplier in net-enabled organization. Benevolence, integrity, and ability are considered as trust factors to develop the trust mechanism for selecting the supplier [10].

Batt [11] discussed the distrust developed between growers and market agent in the absence of auction. This work employed a survey-based approach and traced out six trust factors. Study found that factors like relational satisfaction, goal compatibility, and relational investment have positive impact on trust, whereas factors like market agent's power and opportunistic behavior have negative impact. Interestingly, duration of relationship has no impact on trust.

In order to understand the role of trust in the supplier–customer relationship, Sahay [12] has done a survey-based study among the SC managers and consultants from various organizations. From the survey, it was found that factors like ability, calculative, prediction, motive, credibility, integrity, consistency, institutional and behavior have potential influence on trust. Ping and Jing [13] have presented a probabilistic model for evaluating trust among actors in an e-commerce scenario. Numbers of successful trade and total number of interactions were identified as critical factors considered for evaluating partner's trustworthiness. A study has been done to trace the relationship between trust and commitment by a survey-based empirical test [3]. The questionnaire devised in the survey is framed, mainly, by considering two sorts of variables, viz. transaction cost variables and social exchange variables. The model depicts that partner's asset specificity, information sharing, perceived satisfaction, and partner's reputation are positively associated with trust, but the behavioral uncertainty, perceived conflict, and asset specificity of respondent are negatively associated with trust.

Ghosh and Fedorowicz [14] devised the survey-based approach to structure a framework for increasing trust. According to them, trust act as conjunction between the contract and bargaining power. A study found that trust improves SC performance by positively influencing innovativeness [15]. SC performance was measured with parameters such as responsiveness, process improvement, lead time, time to market, and delivery reliability. To measure trust, factors considered were same as the factors considered by [16]. These factors are reputation, willingness, information sharing, likability, similarity, and power.

Laeequddin et al. [17] suggested a multi-perspective and multi-level trust measurement method to measure SC member's trust on a ten-point scale. They have considered characteristic trust, rational trust, and institutional trust in their study. They refer trust as the threshold level of risk bearing capacity of a trustor. Beyond this level, subject of trust will turn into the matter of risk management.

Integrity, reliability, openness, predictability, fairness, benevolence, and honesty were indicated as the key trust factors in the survey-based study [18]. They developed and identified a multi-faceted measure of trust. This trust factors were used as a trust

signal and also as a benchmark to know the extent of trust in relationship. The study describes that trustworthiness would develop relationship commitment in a SC.

Reputation and communication can build mutual trust between SC alliance partners [2]. In the mathematical model, they have considered direct transaction record and recommendation of third-party record for trust evaluation. Updating the trust value after each transaction and incorporation of third-party trust value toward trustor has made the model suitable for faultless decision making for transaction. In light of a survey-based study [19], it was found that social interaction, personality traits, competence and reputation, communication, and rule of law are the paramount important factors constituting trust in SC. Structural equation modeling, a statistical approach was used to find the influence of different factors on trust between SC members. Study indicates that all factors have positive effect on trust.

Honesty, credibility, experience, jurisdiction, sincerity, predictability, transparency, goodwill, commitment, respect confidentiality of information exchange, communication skill, shared value, resemblance, sharing working method, and influence in the network are trust factors recognized by [4] to develop trust in a SC. Esmaili et al. [10] developed a mathematical trust model to calculate the amount of trust that is adaptable in SCs. The probabilistic model considers past interaction to know the trust between retailer and supplier. The issue of organizational relationship based on trust was studied by [20]. Benevolence, credibility, openness, calculative, contract, institutional, availability, reliability, and expertness are some of the generalized trust dimension considered for evaluation of trust in this review paper. To give a complete picture of the proposed structure, a rule-based fuzzy ranking model is considered in the paper for trust evaluation.

In a SC, trust can be specified by the extent a supplier relies on the retailer's ordering information. In this perspective, a trust model for a two-tier SC scenario was proposed [21]. According to the findings of this work, instant behavior of SC actors and predetermined factors like reputation, historical transaction, peer recommendation from trustees, emotions, experience, and cognition from trustors have great impact on trust. In order to determine the factors affecting trust, Cho et al. [22] performed a survey-based study. Survey revealed that risk, faith, fear, feeling, valence, power, delegation, control, credit, cooperation, altruism, reciprocation, adoption, social capital, and relational capital are the factors resulting trust in a supply chain. Ozer and Zheng [23] addressed direct information sharing as the major factor in mitigating risk and increasing coordination in the SC. They identified four building block of trust which are personal values and norms, market environment, business infrastructure, and business process design. Xia and Yongjun considered transactional satisfaction, product ability, risk probability of information concealment, reward, and penalty for evaluating trust among SC enterprises under blockchain environment [24]. Considering these factors, a mathematical model was developed. Rehman et al. [25] proposed a trust model capable of determining the trustworthiness of a trustor on a trustee. Irrespective of scenarios, this model facilitates a framework for graphically representing trust in multiple levels. This study fundamentally considers customer trust toward a particular firm. As per the proposed model, trustworthiness is the sum of

trust gain and trust deficit based on past interactions between trustor and trustee over a period of time.

Ruel et al. [26] highlights trust as a vital part of collaboration. A questionnaire-based survey has been done as the part of this work to identify the key trust factors. Factors considered are shared values, information sharing, communication, information quality, partner reputation, rule of law, and uncertainty behavior. Results indicate that information quality, communication, and uncertainty behavior have a high influence on trust. Recently, [27] scrutinized the relationship between trust and risk. A mathematical model for evaluating risk is formed based on a literature study. The study proposes that risk and trust are inversely related to each other. Mansouribakvand [28] identified benevolence, openness, and credibility as vital trust factors and modeled SC trust under blockchain environment.

From the literature review, it is evident that different researchers view trust in different perspectives with regards to the scenarios under their consideration. At the same time, several similarities are also there; particularly, in the trust factors considered by the researchers. To analyze the homogeneity among the trust factors, we mapped the key trust factors revealed in the literature with the thirty-seven dimensions of trust identified by [5]. Table 1 shows the mapping.

4 Findings from Literature Review and Discussions

The literature review discloses some imperative facts regarding the trends in SC trust evaluation. From the literature, it is observed that attitude toward SC trust varies from person to person and this can be justified with the obscure nature of trust definition. Out of the 27 articles reported in the literature, 20 deals with survey-based methodology. The ideology in judging trust will be probably different for different SC actors. In such a situation, a collective opinion from the survey would be better to make a valid conclusion. This might have prompted majority of researchers to go with survey-oriented trust evaluation. Surveys are devised either to trace out the relevant factors affecting the trust or to assess the level of influence of already identified trust factors. Some researchers have attempted to formulate regression models using the responses they received from surveys. Six articles reported in the literature, exhibit trust evaluation models framed with probabilistic theories. Remarkably, all these works consider past interaction as an antecedent of trust. Only one literature discusses development of fuzzy logic-based model for evaluating trust.

Mapping of trust factors with 37 trust dimensions unveils few interesting points. Benevolence, credibility, ability, integrity, goodwill, and openness were considered as key trust factors in more than ten articles in the literature. This observation undoubtedly declares the importance of these factors in building the SC trust. Benevolence is defined as the extent of desire to exercise liberality. Credibility is the quality, which shows partners capability to keep promise and rise up to other competence standard. Openness takes away all the restrictions and allows transparency in information. Goodwill between SC members is defined as the intention of not harming

Table 1 Mapping of trust factors in the literature with the trust dimension identified by McEvily and Tortoriello [5]

Author (year)	Benevolence	Credibility	Ability	Integrity	Cognitive	Affective	Openness	Reliability	Fairness
Handfielda and Bechtelb (2001)	✓	✓					✓		
Xiong and Liu (2002)	✓	✓		✓					✓
Batt and Peter (2003)	✓		✓	✓			✓		✓
Sahay (2003)		✓	✓	✓					
Wang and Varadharajan (2004)	✓	✓		✓					✓
Lin et al. (2005)	✓		✓	✓					
Ping and Jing(2007)	✓	✓	✓	✓			✓		
Kwon and Suh (2008)		✓	✓				✓		
Ghosh and Fedorowicz (2008)									
Panayides and Lun (2009)		✓	✓				✓		
Laeequddin et al. (2010)	✓	✓			✓			✓	✓
Jones et al. (2010)	✓			✓			✓	✓	✓
Zhuo and Dai (2010)	✓	✓					✓		
Evilya and Tortoriellob (2011)	✓		✓	✓	✓	✓	✓	✓	✓
Xhuvani and Elbasan (2012)	✓	✓	✓						
Hossain and Ouzrout (2012)	✓	✓		✓			✓		
Esmaili et al. (2014)		✓							
Husseini et al. (2015)	✓	✓					✓	✓	
Han and Dong (2015)	✓	✓			✓				
Cho et al. (2015)		✓	✓	✓			✓	✓	
Esmaeili et al. (2015)		✓			✓				
Ozer and Zheng (2017)		✓							

(continued)

Table 1 (continued)

Author (year)	Benevolence	Credibility	Ability	Integrity	Cognitive	Affective	Openness	Reliability	Fairness
Xia and Yongjun (2017)	✓	✓	✓	✓			✓		✓
Rehman et al. (2017)		✓	✓				✓		
Ruel et al. (2018)	✓	✓							
Piotrcofta (2019)									
Bakvand and Norrman (2019)	✓	✓					✓		

Author (year)	Faith in intention	Predictability	Commitment	Willingness to risk	Availability	Consistency	Discreteness	Opportunity	Receptivity
Handfielda and Bechtelb (2001)				✓					
Xiong and Liu (2002)									
Batt and Peter (2003)						✓		✓	
Sahay (2003)		✓				✓			
Wang and Varadharajan (2004)									
Lin et al. (2005)									
Ping and Jing(2007)									
Kwon and Suh (2008)		✓					✓	✓	
Ghosh and Fedorowicz (2008)				✓					

(continued)

Table 1 (continued)

Author (year)	Faith in intention	Predictability	Commitment	Willingness to risk	Availability	Consistency	Discreteness	Opportunity	Receptivity
Panayides and Lun (2009)		✓							✓
Laeequddin et al. (2010)			✓						
Jones et al. (2010)		✓							
Zhuo and Dai (2010)									
Evilya and Tortoriellob (2011)									
Xhuvani and Elbasan (2012)			✓						
Hossain and Ouzrout (2012)		✓	✓						
Esmaili et al. (2014)									
Husseini et al. (2015)		✓			✓				
Han and Dong (2015)									
Cho et al. (2015)		✓			✓	✓			✓
Esmaeili et al. (2015)		✓							
Ozer and Zheng (2017)									
Xia and Yongjun (2017)									

(continued)

Table 1 (continued)

Author (year)	Faith in intention	Predictability	Commitment	Willingness to risk	Availability	Consistency	Discreteness	Opportunity	Receptivity
Rehman et al. (2017)									
Ruel et al. (2018)		✓							
Piotrcofta (2019)				✓					
Bakvand and Norrman (2019)									

Author (year)	Surveillance	Motives	Institutional	Informal agreement	Influence acceptance	Honesty	Goodwill	Forbearance	Judgment
Handfielda and Bechtelb (2001)			✓		✓				
Xiong and Liu (2002)							✓		
Batt and Peter (2003)					✓		✓		
Sahay (2003)		✓	✓						
Wang and Varadharajan (2004)									
Lin et al. (2005)									
Ping and Jing(2007)									
Kwon and Suh (2008)	✓						✓		
Ghosh and Fedorowicz (2008)			✓		✓				

(continued)

Table 1 (continued)

Author (year)	Surveillance	Motives	Institutional	Informal agreement	Influence acceptance	Honesty	Goodwill	Forbearance	Judgment
Panayides and Lun (2009)		✓					✓		
Laeequddin et al. (2010)			✓		✓	✓	✓		
Jones et al. (2010)						✓			
Zhuo and Dai (2010)							✓		
Evilya and Tortoriellob (2011)									
Xhuvani and Elbasan (2012)		✓	✓				✓		
Hossain and Ouzrout (2012)					✓	✓	✓		✓
Esmaili et al. (2014)							✓		
Husseini et al. (2015)			✓						
Han and Dong (2015)				✓			✓		
Cho et al. (2015)	✓				✓	✓	✓	✓	
Esmaeili et al. (2015)									
Ozer and Zheng (2017)									
Xia and Yongjun (2017)									

(continued)

Table 1 (continued)

Author (year)	Surveillance	Motives	Institutional	Informal agreement	Influence acceptance	Honesty	Goodwill	Forbearance	Judgment
Rehman et al. (2017)									
Ruel et al. (2018)	✓		✓				✓		
Piotrcofta (2019)									
Bakvand and Norrman (2019)									

Author (year)	Dynamism	Coordination	Concern	Communication	Character	Loyalty	Habitualization	Expertness	Avoid taking excessive advantages	Calculative
Handfielda and Bechtelb (2001)										
Xiong and Liu (2002)		✓								
Batt and Peter (2003)		✓	✓	✓						
Sahay (2003)							✓			
Wang and Varadharajan (2004)		✓								
Lin et al. (2005)										
Ping and Jing(2007)										
Kwon and Suh (2008)		✓	✓	✓					✓	✓
Ghosh and Fedorowicz (2008)										
Panayides and Lun (2009)							✓			
Laeequddin et al. (2010)	✓				✓			✓		✓
Jones et al. (2010)										
Zhuo and Dai (2010)				✓						

(continued)

Table 1 (continued)

Author (year)	Dynamism	Coordination	Concern	Communication	Character	Loyalty	Habitualization	Expertness	Avoid taking excessive advantages	Calculative
Evilya and Tortoriellob (2011)						✓				
Xhuvani and Elbasan (2012)		✓		✓						
Hossain and Ouzrout (2012)				✓						
Esmaili et al. (2014)										
Husseini et al. (2015)								✓		✓
Han and Dong (2015)		✓	✓		✓		✓			
Cho et al. (2015)					✓					
Esmaeili et al. (2015)					✓		✓			
Ozer and Zheng (2017)										
Xia and Yongjun (2017)										
Rehman et al. (2017)										
Ruel et al. (2018)				✓						
Piotrcofta (2019)										
Bakvand and Norrman (2019)										

each other's interest. Goodwill pile up when there is a repeated transaction with the same chain member. The expertness and capability of trustee are represented as ability. Integrity implies the probability of a trustee keeping a promise to its partner.

5 Conclusion and Recommendations

In this work, an extensive literature review was done to get a bird's eye view on the different perspectives on SC trust evaluation. Findings from the review point out that trust has different meanings in different SC contexts and hence quantifying trust and identifying the appropriate factors for evaluating trust in SC are very tedious jobs. Researchers view trust in diverse angles. SC trust factors traced by researchers are not exactly same but have some level of homogeneity.

Identification of suitable trust factors is highly important in modeling and evaluating SC trust. While most of the researchers have adopted a survey-based approach in finding these factors, others built trust models, either based on probability theory or with fuzzy logic. Benevolence, credibility, ability, integrity, goodwill, and openness are the trust factors considered in most of the literature.

Latest trends such as incorporation of blockchain or machine learning in decentralized SC network are changing the outlook of trust. Novel trust evaluation models that perfectly suit these kinds of modern SC circumstances are currently limited and thus provide scope for further research.

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