Project governance mechanisms and the performance of software development projects: Moderating role of requirements risk

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Abstract

Over the years, practitioners and academicians have been perplexed by low efficiency and poor performance in IT projects. Previous studies have uncovered a variety of critical factors, including effective project governance mechanisms that can trigger project performance and curb opportunism. However, an obvious question that emerges is how effective these governance mechanisms are at improving the performance of an IT organization and software development project in the presence of risk factors. Hence, the overarching objective of the current study is the development of a moderation model to investigate the effectiveness of these governance mechanisms in the presence of requirements risk. This paper follows a positivist research philosophy where a quantitative deductive approach has been used to collect the data of 318 respondents from 175 software development firms based in Pakistan. Statistical Package for the Social Sciences (SPSS) and Structural Equation Modeling (SEM) through SmartPLS 3 have been used to analyze the hypotheses. The results of the study indicate that contractual and relational governances significantly influence project performance and are useful in reducing opportunism. Moreover, there is evidence that the presence of requirements risk tends to negatively moderate the influence of contractual and relational governances on project performance. The findings will help not only Pakistan's software firms, but also those in developing countries that want to improve performance through effective project governance and risk management.

1. Introduction

Over the years, practitioners and researchers have been perplexed by low efficiency and poor performance in project-based organizations (Marnewick et al., 2018; Borgstein et al., 2018; Liu, 2015). Enhancing the performance of software development projects is not only the aim of the industry, but also an important factor in the field of project management.

Over the past few years, researchers and academicians have focused on studying the role of governance mechanisms in the field of project management as well as predictors of better performance. The governance mechanisms that are mainly reported in the recent literature can be divided into two categories: contractual governance and relational governance. Contractual governance is primarily focused on following formal rules and highlighting the importance of agreements and written contracts pertaining to the transactions between two parties (Lusch and Brown, 1996; Reuer and Ariño, 2007; Lumineau et al., 2011; Ke et al., 2015). The second mechanism of governance is relational governance. This is an informal type

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of governance that focuses on building friendly relationships among the parties involved in a respective transaction (Lusch and Brown, 1996; Bstieler and Hemmert, 2015). The importance of the role of contractual and relational governances in the performance of a project cannot be denied (Tangpong et al., 2010). They are significant in terms of triggering collaborative efforts to align project processes, ensure performance, and enhance value for stakeholders (Levitt et al., 2009).

Project governance is frequently aligned to the organizational governance model, which in turn provides comprehensive and consistent methods to control the project. In the organizational framework, project governance is executed through the project governance framework, which provides project managers with the structure, processes, decision-making models, and tools for managing a project (PMI, 2017). Governance in the information science (IS) literature deals with the inter-firm outsourcing of software developments projects (Benaroch et al., 2016; Cao et al., 2013). Cao and colleagues further elaborate that inter-firm IT governance usually consists of contractual and relational governance. The previous literature on governance in the domain of software development projects focused mainly on the interplay between contractual and relational governance, or rather, on the substitutability or complementary nature of contractual and relational governance and their associated effects on project outcomes.

Although governance mechanisms have garnered the most attention as significant predictors of project performance, an obvious question emerges. Specifically, how effective are these governance mechanisms in actually improving the performance of a software development project in the presence of opportunism and risk? Williamson (1975) defined opportunism as the pursuit of self-interests. Usually opportunism involves many subtle and complex forms of tricks, such as breaches of promise, bluffing, misleading stakeholders, misappropriation, and theft (Das and Rahman, 2001). Subsequently, parties' opportunistic behavior may very well lead directly to poor project performance (Phelps and Reddy, 2009). Previous researchers such as Lu et al. (2015) studied the influence of contractual and relational governance on opportunism and project performance. However, the authors focused solely on construction projects. The authors have concluded that contractual and relational governance are useful for improving project performance. Existing literature has elaborated on the role of contractual and relational governance in restraining opportunism and enhancing project performance. Yet the area still remains incomplete, because the previous research has not focused on the influence of project governance mechanisms on project performance in the presence of requirements risk. Requirements risk is the dominating factor in the list of the top five risk factors in cross-cultural software development projects as identified by Wallace et al. (2004). Furthermore, the requirements analysis phase is generally the most important and most critical phase in the life cycle of a software development project: it has a significant effect on the other phases of the project because of the likelihood of facilitating other risks (Nidumolu, 1996a, 1996b; Hussain and Mkpojiogu,

2016). Therefore, the larger objective of the current paper is to investigate the moderating effects of requirements risk on the relationship between project governance mechanisms and project performance. The current study is aimed at answering two main research questions: (1) How do the project governance mechanisms influence project performance and restrain the opportunism present in software development projects? and (2) How does requirements risk moderate the relationship between project governance mechanisms and project performance?

By focusing on contractual and relational governance and their influence on opportunism and project performance, this paper seeks to contribute additional literature with a focus on how software development firms choose their governance structures with the goal of achieving their organizational goals in the presence of requirements risk. By collecting the data from 318 respondents at 175 software firms, this study presents empirical findings to support the proposed hypotheses that contractual and relational governance are useful in restraining opportunism and increasing project performance, and moreover that the requirements risk negatively moderates the relationship between project governance mechanisms and project performance.

The rest of the paper presents the theoretical background and literature review, hypotheses development, and proposed research model. Next, the research design, data analysis techniques, and findings of current research are presented. In the end, we present theoretical and managerial implications, limitations, and future research suggestions.

2. Theoretical background

2.1. Transaction cost economics theory

Because of the complex nature of project governance, it is hard to attribute any single theoretical perspective to an understanding of the underlying mechanisms through which project governance can enhance project performance (Musawir et al., 2017). Therefore, various theoretical lenses have been used to explain the role of project governance in enhancing project performance. Transaction Cost Economies (TCE) is the prominent theoretical perspective used to explain the influence of project governance on project performance. It is a classical interdisciplinary approach linking economic elements to organizational theories with an overlap of contract law (Williamson, 2016). To better understand the TCE, it is important to shed light on the origins and routes of this approach by taking the reader into the economics literature originated by Commons (1931, 1934). According to Commons, the smallest unit of activity used by institutional economists is a transaction where its participants and transactions mediate between two parties for not only the exchange of commodities, but also for the acquisition of resources between the individuals. Continuing the concept of transaction given by Commons (1931, 1934), Oliver Williamson, the founding author of TCE, took the transaction as a unit of analysis and applied the concept of contractual governance to develop a

TCE framework. The application of contractual governance naturally leads to a re-understanding of the organization as opposed to selecting the production function in traditional science. In this case a governance structure is used instead.

In the context of project governance, TCE can be used to describe the contractor and supplier selection process (Winch, 2001; Sumo et al., 2016). Prior researchers suggest that contractual and relational governance can be effective in reducing transaction cost (Bstieler and Hemmert, 2015) and minimizing the opportunistic behavior of partners (Faems et al., 2008). Opportunism is a central theme of TCE that becomes more important in economic activities where transaction-specific investment is involved in human and physical capital (Williamson, 2016). TCE theory emphasizes that proper governance mechanisms can control opportunism (Caniëls and Gelderman, 2010). Recently, a major focus of western research has also been on reducing transaction costs and opportunism in business contracts. In this regard, contractual and relational governance function as complements in software development outsourcing projects where contractual governance takes time in adding details and specifics to the contract. At the same time, partners must have enough time to build trust and form relationships with each other, which ultimately helps them reduce the transaction cost and opportunism (Bstieler and Hemmert, 2015). Similarly, Faems et al. (2008) are of the view that contractual and trust-based governance co-evolve in alliances, which happens frequently in IT projects (Poppo and Zenger, 2002; Duc and Abrahamsson, 2017). The selection of governance structure eventually depends upon the nature of the project, the level of involved risks (Zwikael and Smyrk, 2015), and the nature of available resources (Hoetker and Mellewigt, 2009).

In summary, by focusing on the transaction, TCE theory deals with opportunism directly through the governance mechanism. Based on these theoretical underpinnings, the proposed model of the study will attempt to measure the effects of the two governance models, contractual and relational governance, relative to opportunism and project performance.

2.2. Hypotheses development and research model

2.2.1. Contractual governance and project performance

A project is a complex dynamic system involving participants and their interdependence (Brown and Grundy, 2016; Haq et al., 2018). Other researchers have defined "project" as a one-time activity with constraints involving budgets and time for delivering the unique output (Hussein, 2015). "Contract" refers to an agreement between two partners to meet user expectations and provide desired services (Liu and Sun, 2014). Project governance plays a critical role in enhancing the effectiveness and efficiency of inter-firm collaborations. Contractual governance, which is a key mechanism of project governance, formalizes the legally binding agreements for the inter-organizing trading partnership (Lu et al., 2015) and helps to restrain a partner's opportunistic behavior (Williamson, 2016). Contractual governance also enhances project performance by effectively allocating the project risks and aligning

the enforceable standards with those of project goals (Brahm and Tarziján, 2015).

Based on the prior literature, Lu et al. (2015) conceptualized contractual governance through fundamental elements, specifically change elements and contractual elements. In IT projects, the *fundamental elements* of contractual governance consist of defining the main principles and contracts among the parties, and then defining their roles and responsibilities. Usually the fundamental elements of a contract specify key objects such as deadlines, project costs, and quality standards, as well as the required or expected performance levels of a software project (Goo et al., 2009). The underlying rationale behind the fundamental elements of contractual governance is to publish the mutual beliefs of both the organizations involved in a contract so that their IT outsourcing relationships can be established based on common goals and a general commitment to the outsourcing relationship (Choudhury and Sabherwal, 2003). The *change elements* of contractual governance consist of processes for resolving unforeseeable outcomes of future demands, processes for the implementation of predictable likelihoods and changes, processes for introducing new innovations coordinated with incentive plans, and processes to encourage feedback and efficiency adjustments (Goo et al., 2009). Prior research pertaining to IT outsourcing projects has put additional emphasis on the investigation of possibility and the effect of evolutionary norms of uncertainty or unstructured tasks (Choudhury and Sabherwal, 2003). Change elements may decrease the level of trust, and the organizations involved in the contract may lose their commitments instead of focusing on adherence to contract clauses (Goo et al., 2009). *Governance elements* of contractual governance are aimed at defining the ways through which the relationships are maintained, by specifying the metrics, penalties and incentives, quitting options and responsibilities, process of documenting the communication, and identifying and resolving potential disputes (Goo et al., 2009). Furthermore, certain contractual clauses such as penalties for late delivery, poor performance, and termination are also decided between contractual parties (Wacker et al., 2016). Therefore, the contractual characteristics of governance set administrative procedures that continually assess the value the relationship brings to all stakeholders to ensure that the relationship remains on track (Krishnan et al., 2016). Contractual governance appeared to be an important predictor of effective project performance, because it may reduce the riskiness and uncertainty in projects by providing clear and accurate information regarding contracts (Lu et al., 2015). Therefore, through the above literature the following hypothesis has been proposed:

Hypothesis 1. Contractual governance has a significant and positive effect on project performance as it relates to software development.

2.2.2. Relational governance and project performance

Although contracts play an important role in project performance, the parties to a contract cannot foresee all possible situations that might influence that contract's terms

(Lu et al., 2015). Therefore, a project's contract is usually incomplete. It is not enough to rely solely on contractual governance; Heide and John (1992) argued that contractual governance is flawed by the lack of a critical social factor. To overcome this gap, some firms use relational governance as a mechanism to enhance the performance of inter-firm collaborations. Researchers usually emphasize relational governance, also referred to as relational mechanism (Jayaraman et al., 2013), for its value in mitigating opportunism (Wacker et al., 2016). Relational governance is a type of governance in which the contract between two parties is driven by social dimensions (Dyer and Singh, 1998; Biesenthal and Wilden, 2014). Such partnership involves the behavioral practices governed by self-enforcing informal safeguards in the relationship (Abdi and Aulakh, 2017). These social dimensions play a critical role in addressing the limitations posed by contractual governance (Poppo and Zenger, 2002). The main focus of relational governance is on strengthening social ties instead of on formal and written contracts between two parties. By taking this approach, the firms can overcome limitations of contractual governance such as bounded rationality. Traditionally, relational governance is conceptualized through relational norms such as information sharing, flexibility, and solidarity (Ju and Gao, 2017). In addition to relational norms, Lu et al. (2015) included trust while conceptualizing relational governance. Lu and colleagues are of the view that trust is the essential part of relational governance, because it strengthens the relationship between two parties. By including trust, the authors enriched the conceptualization of relational governance.

Information sharing is the dimension of relational norms that refers to the exchange of unforeseen information by each party to the contract. Sharing useful information can reduce the information asymmetry, enhance the performance of mutual relationship, and reduce conflict (Cao and Lumineau, 2015). *Flexibility* is another important relational norm that refers to adapting to unforeseen changes during a project. It is defined as "the willingness to adapt to one's partner within the context of an exchange relationship" (Aulakh et al., 1996; Heide and John, 1992). *Solidarity,* argued to be a source of encouraging bilateral unity, allows the parties to a contract to know each other, facilitating work on shared mutual interests. In this study, relational norms are considered part of the relational governance of contracts related to software development projects. Usually a service provider and a service recipient form a contract to develop and deliver a software project. The quality of the relationship between the service provider and the service recipient is of great importance for completing the contract successfully (Müller and Martinsuo, 2015).

After Lu et al. (2015) added trust in the conceptualization of relational governance, the researchers paid significant attention to the improved conceptualization as an important factor in reducing the negotiation cost, monitoring, and evaluation cost. It is fruitful to complete a project successfully through the agreements of mutual interest (Chow et al., 2012; Khalfan et al., 2007). In the project management literature, trust has become more notable when the likelihood of treachery, exit, or defection is more real (Walker, 2003). Chow has defined trust

as "the willingness of a trustor to become vulnerable to a trustee whose behavior is beyond his control" (2012, p. 927). Trust shows the confidence among partners, their credibility, integrity, and benevolence in risky transactions (Cao and Lumineau, 2015). In fact, contractual and relational governance are umbrella terms for the overall basis on which governance is built, whereas trust and relational norms are mechanisms through which governance is executed. Some researchers are of the view that developing trust while having contracts helps to reduce opportunism (Spraggon and Bodolica, 2015).

Trust and relational norms complement each other in enhancing project performance; therefore in this scenario, it can be assumed that sometimes the parties to a contract already know each other from their past business dealings (Arino et al., 2005; Macaulay, 2018). Taking this assumption into account, the authors (Liu et al., 2009; Poppo and Zenger, 2002) emphasize that the partners will be able to help each other fulfill the agreement, solve problems, and meet expectations by reusing the existing relationship. At the same time, trust enables partners to be more frank with each other and to gain confidence, making partnerships more reliable, stable, and sustainable by creating an atmosphere of cooperation (Ndubisi et al., 2016; Dimitratos et al., 2010). Based on the above discussion, it can be argued that relational governance as conceptualized through trust and relational norms can enhance project performance by establishing trustworthy and long-term relations between partners of a project. Therefore, the following hypothesis has been proposed:

Hypothesis 2. Relational governance has significant and positive effects on software development project performance.

2.2.3. Contractual governance and opportunism

Contractual governance plays an important role in limiting opportunism (Lu et al., 2015). A clear contract provides details for acceptable behavior and unacceptable behavior (Lui and Ngo, 2004), and can mitigate opportunistic behavior (Poppo and Zenger, 2002). Lui and colleagues further said that the contract can be used to curb opportunism through two mechanisms. First, the contract can change the payment structure by increasing the cost of opportunistic behavior. Second, the contract can reduce monitoring costs by increasing the transparency of relationships (Reuer and Ariño, 2002). Firms form contracts to deal with business transactions, but do not use these contracts to solve the issues they face (Huo et al., 2016).

Since the main objective of opportunistic behavior is for each party to fulfill its self-desires, formal contracts are considered the primary tools for discouraging opportunistic behavior in a transaction (Williamson, 1985). Formal contracts carefully characterize the nature of the transaction, relying solely on formal agreements to resolve conflicts and issues. Mismanaging the relationship between two firms can result in and contribute to poor performance by either party (Cavusgil et al., 2004). According to Caniëls and Gelderman (2010) a formal contract can specify ways to deal with disputes and conflicts (Stinchcombe and Heimer, 1985; Huo et al., 2015).

Through formal contracts, parties can specify the penalties and punishments for opportunistic behavior, where breaching the contract triggers higher prices and penalties to either party (Caniëls and Gelderman, 2010). Another way to reduce opportunism is to have the "dos and don'ts" by each firm clearly defined and stated in the formal contract (Lui and Ngo, 2004).

Previous empirical studies on the relationship between contractual governance and opportunism resulted in mixed findings (Bello and Williamson, 1985; Dahlstrom and Nygaard, 1999; Zhang et al., 2003). According to John (1984), opportunism increases when the service recipient uses a bureaucratic style or tactic to control the service provider. Conversely, Dahlstrom and Nygaard (1999) found that contractual governance minimizes the service provider's opportunism. Bello and Williamson (1985) believe that contractual arrangements encourage export agents to set up promotional efforts and promote cooperation between partners. This indirectly supports the negative relationship between contractual arrangements and foreign distributor opportunism. Similarly, Lu et al. (2015) are also of the view that there is a negative relationship between contractual governance and opportunism, implying that the better the contractual governance, the lower the degree of opportunism. The focus of this research is to find the influence of contractual governance on opportunism in the contracts of IT industry and software development projects. Therefore, the following hypothesis has been proposed:

Hypothesis 3. Enhanced contractual governance reduces opportunism.

2.2.4. Relational governance and opportunism

It can be argued from the above-mentioned literature that contractual governance reduces opportunism. However, there are still some researchers who are of the view that in fact, a contract cannot determine every potential contingency (Zhou et al., 2015) and as such offers only limited protection. Thus, participants to the contract may rely on relational governance to adjust a party's behavior. By sharing norms and values, a party's opportunistic behavior can be limited and curtailed (Handley and Angst, 2015). The validity of relational norms and trust is most prominent in controlling opportunistic behavior (Caniëls and Gelderman, 2010). They can promote the coherence of partner interests (Atkinson et al., 2006). Some studies confirm that trust has a positive effect on broad behavior, such as cooperative communication, conflict resolution, and the flexibility to respond to unexpected situations (Wu et al., 2017). Cultivating trust is considered one of the most effective means of suppressing opportunism (Walker, 2003).

According to Carson et al. (2006) and many other researchers, relational governance is a significant construct that can reduce opportunism while improving a firm's overall performance, increasing the financial bottom line (Handley and Angst, 2015). Relational governance is helpful to ensure that the promised actions are undertaken, which, as a direct result, deters opportunism. The parties that exhibit opportunistic behavior often try to renege, which means violating the mutual commitments explicitly or implicitly. For example, a software provider firm practices some acts that favor the software firm itself but can damage the buyer's interests. The purpose of enterprise participation in opportunism is to hunt for extra benefits while avoiding contractual clauses (Jiang et al., 2018). Therefore, it is important to limit the relevant activities to tolerable limits, using a variety of control mechanisms. In this case, relational governance specifically acts as a supplement to control opportunism and protect the firm's assets (Dong et al., 2017).

In the same line, Huo et al. (2016) conducted a study to measure how different relational norms such as flexibility, solidarity, and information exchange affect different types of contract and third-party opportunistic behavior in exchange relationships. Relational governance made up of relational norms and collaborative actions plays a vital role in reducing opportunism (Zhou et al., 2015). The above discussion indicates that trust and relational norms are very effective in curbing a party's opportunistic behavior, and this study conceptualizes the trust and relational norms into a single variable, i.e., relational governance. Therefore, it can be assumed that relational governance negatively influences opportunism. Hence, the following hypothesis has been proposed:

Hypothesis 4. Relational governance reduces opportunism.

2.2.5. Opportunism and project performance

In simple words, opportunism is a negative variable (Zineldin and Vasicheva, 2016) and can be expressed as taking advantage of opportunities or the environment. It is looking for immediate strategic advantages without regarding the ultimate results. Liu (2015) have described opportunism as a complex and subtle form of guile manifest as a violation of an explicit contract. In business relationships there are performance incentives, so people tend to concern themselves more with their personal benefits. This may result in poor performance of the firm or project. In the context of software development projects, several issues such as extensive competition between software firms to win contracts, high levels of uncertainty, and, particularly, the riskiness associated with a developed project may lead to opportunistic behavior by either party. Subsequently, the project's performance will suffer. Typical opportunistic behaviors include concealing the corporate information, the false declaration of the project information, illegal subcontracting, bluffing, and stealing (Liu, 2015). These actions can hurt the satisfaction and trust in the relationship (Jap and Anderson, 2003). Highly opportunistic firms often lack frankness or honesty in communication (Williamson, 1985; Jin et al., 2016). Inter-firm opportunism may be realized as poor organizational performance, lower satisfaction of the partner, and other functional conflicts (Wang and Yang, 2013). In the short run, opportunism may increase the benefits for the opportunistic party. However, in the long run, the results of opportunism will create barriers and hinder value creation, reducing the firm's revenues (Wathne and Heide, 2000).

According to Luo (2007), opportunism has a degenerative influence on firm performance regardless of whether performance indicators are cost-based, revenue-based, or overall business-based (Holloway and Parmigiani, 2016). Overall, opportunism has a negative effect on factors that improve performance, such as trust, commitment, and satisfaction. Therefore, the following hypothesis has been proposed:

Hypothesis 5. Opportunism decreases project performance.

2.2.6. Project risk and project governance

Project risk refers to a condition that poses a serious threat to successful completion in the context of IT projects (Keil et al., 2013). Numerous studies have focused on identifying, evaluating, and minimizing the risk factors in IT projects, reviewing risk that can affect the project performance negatively (Liu, 2016; Liu et al., 2011). Previous researchers are of the view that project-focused organizations can use effective governance structures to mitigate the risks and avoid those uncertainties (Atkin and Skitmore, 2008). These authors believe that efficient risk management is the most important concern of an effective governance structure (Zwikael and Smyrk, 2015).

Conceptually, risks are the uncertain conditions that may appear unexpectedly during any phase of a project and may hinder the governance strategies to otherwise deal with risks and thereafter influence project performance. Requirements risk is the dominating factor in the list of five risk factors in cross-cultural IT projects as identified by Wallace et al. (2004). Similarly, Nidumolu (1996b) is of the view that the requirements analysis phase is the most important and thus the most critical phase in the life cycle of a software development project. This is because the requirements risk can significantly affect the other phases of the project and may likely facilitate and lead to the development of other additional risks (Singh and Dey, 2017; Wallace et al., 2004).

Therefore, in this study the focus is on requirements risk, which has been specified as a moderator targeting the relationship between project governance mechanisms and project performance. Some customers constantly change their requirements. This indecision may lead to incorrect, inadequate, or inflexible requirements. Frequently changing requirements is a problem not solely associated with software development projects. Incorrect, unclear, inadequate, or inflexible requirements may also spur the risk of project failure by affecting the project performance inversely (Suresh and Dillibabu, 2018; Schmidt et al., 2001).

Project governance mechanisms can be structured and altered according to a project's ongoing situation, whereas risks are unforeseen events that occur during the project. There are some studies in the existing literature investigating the direct effects of project risk on project performance (Nidumolu, 1996b; Wallace et al., 2004). This paper argues that casual mechanisms through which governance and risk affect performance must be studied to know and further understand how project governance mechanisms influence project performance in the presence of risk. Therefore, the authors assert that the requirements risk regulates the influence of project

governance mechanisms, i.e., contractual and relational governance, on project performance.

Hypothesis 6. Requirements risk moderates the relationship between contractual governance and project performance.

Hypothesis 7. Requirements risk moderates the relationship between relational governance and project performance.

Based on the above literature and hypotheses, the following research model has been developed. In this Fig. 1, contractual and relational governance are the independent variables having a proposed effect on project performance and opportunism. Opportunism influences a project. Moreover, requirements risk moderates the relationship between (1) contractual governance and project performance and (2) relational governance and project performance.

3. Methodology

This paper follows a positivist research philosophy. Positivism is famous in social sciences, as it follows a scientific method of inquiry (Neuman, 2013). It takes a quantitative research approach wherein numerical data is collected to examine the hypotheses related to human behaviors (Collis and Hussey, 2013). In general, followers of positivism relate theories, assumptions, variables, and numerical data and thus apply some statistical tools to draw conclusions (Newman and Nollen, 1996). The followers of positivism generally believe that sociologists can detect exact problems related to society and individuals, and find their solutions, by using approved statistical tools.

3.1. Data collection

This study targets the professional staff of software firms based in Pakistan. By the middle of 2017 approximately 320 software firms from all over Pakistan were registered members of the Pakistan Software Houses Association for IT and ITES P@SHA (Haq et al., 2018). To determine the sample size, we used a well-known and widely used sample size formula focusing on a finite population introduced by Krejcie and Morgan (1970). By using this sampling formula, 175 of 318 software firms were selected randomly to be surveyed. In the subsequent step, individuals identified as holding key positions in these firms such as department heads, manager/team leaders, analysts, designer/programmers, and testers were notified and approached through email. They were asked to fill out the online questionnaire and complete our survey. Questionnaires were administered based on each particular software firm's number of employees.

3.2. Measures

Measures for all the variables were adapted from previous studies. In total, five constructs were used in the study. All survey items were measured on a five-point Likert scale and are listed in Appendix 1 along with their factor loadings and descriptive statistics.
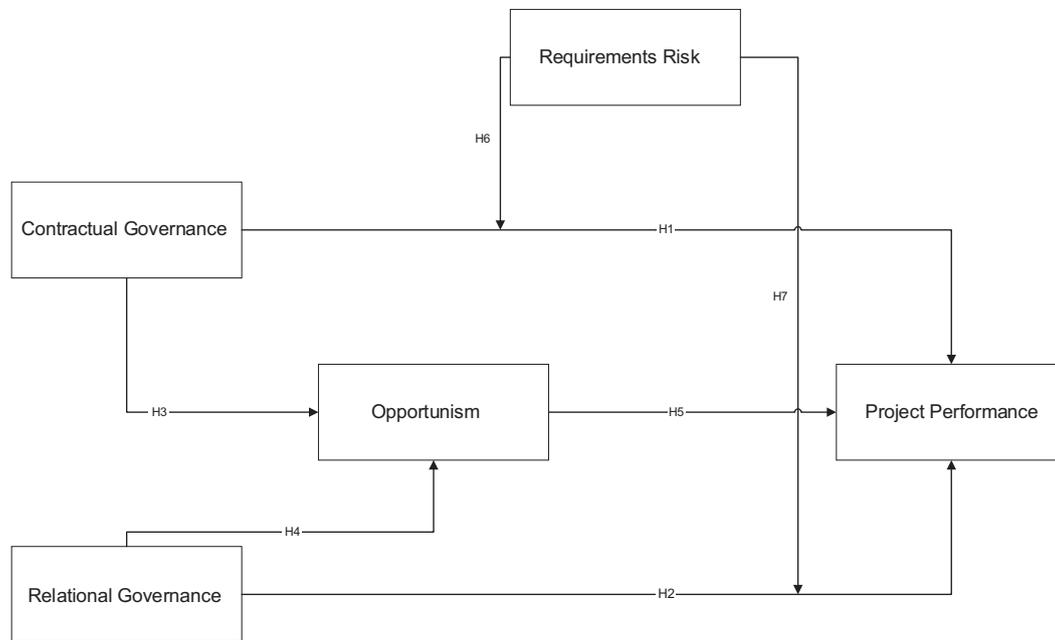
Fig. 1. Hypothesized Model.

3.2.1. Contractual governance

To measure contractual governance in the realm of software development projects, the items were adapted from the previous literature (Goo et al., 2009; Luo, 2002). These authors developed a scale to measure governance of contracts among the different parties involved in a project. This construct further has three facets: fundamental elements, change elements, and governance elements. These facets were used to measure the contractual governance.

3.2.2. Relational governance

Relational governance is measured by using four facets: trust, and relational norms of information exchange, solidarity and flexibility. A six-item scale, developed by Chow et al. (2012), was adapted to measure the trust. Information exchange and solidarity were measured by a scale having three items each and flexibility by a scale having two items developed by Griffith and Myers (2005).

3.2.3. Requirement risk

To measure the project requirements risk, the four-item scale of Wallace et al. (2004) was adapted. This scale includes the items to measure the frequency with which the client asks the development team to change the requirements of required software.

3.2.4. Opportunism

Opportunism was measured by a scale adapted from Heide et al. (2007). This scale describes the extent to which the managers of software development teams try to work in the best interests of their company, as opposed to focusing on the client of that particular software.

3.2.5. Project performance

For the software development industry, the construct project performance, namely the seven-item scale developed by Nidumolu (1996a) and Rai and Al-Hindi (2000), was used. The construct project performance has been measured on two dimensions: product performance and process performance. Five items were designed to measure product performance, and two items were purposed to measure process performance. Note that the same scale was employed by Wallace et al. (2004) to measure the performance of software projects.

3.3. Data analysis

Data is analyzed through structural equation modeling (SEM) by using Smart-PLS 3. In general, PLS-SEM is used to measure the relationship between two or more endogenous and exogenous variables (Hair Jr et al., 2016). This technique is widely used in the social sciences because of its ability to test multiple dependent and independent variables simultaneously, making it suitable to analyze the small and skewed data samples (Hulland, 1999; Lu et al., 2015).

4. Data analysis and results

4.1. Measurement model

4.1.1. Reliability testing

Initially the reliability and validity of all the constructs were checked. Reliability is usually mirrored by internal consistency reliability and measured by the value of Cronbach's alpha. The value of Cronbach's alpha should be greater than 0.70 as recommended by Nunnally et al. (1967). For the current study, the values of Cronbach's alpha are greater than 0.70 for all constructs. Composite Reliability (CR) is another measure of

internal consistency that is commonly used in social sciences. The CR values are considered satisfactory if they are in the range of 0.60 to 0.70. But the CR values are ideally acceptable if they are between 0.70 and 0.90 (Nunnally and Bernstein, 1994). In the current study, the CR values for project performance and requirements risk are 0.916 and 0.913 respectively, which are slightly higher than the ideal threshold but still within the acceptable range: Nunnally and Bernstein (1994) explain that CR values exceeding 0.95 are not acceptable at all, because if the value is higher than 0.95, it is thought that the selected questions or items are measuring the same phenomenon repeatedly.

4.1.2. Validity testing

After reviewing for reliability, the data were checked for validity. The Average Variance Extracted (AVE) has been checked to ensure the convergent validity. Convergent validity refers to how well the indicators of a construct load or converge on their respective constructs (Petter et al., 2007). Statisticians are of the view that the value of AVE should be greater than 0.50 in case of reflective constructs. In this study, the values of AVE for all the constructs are above the threshold showing them to be of good convergent validity. In addition, the data were checked for the discriminant validity. Discriminant validity refers to the degree to which one construct in the model differentiates from other constructs in the same model (Hair Jr et al., 2016). Discriminant validity is usually evaluated through the square root of AVE. The value of the square root of AVE must be greater than the correlations between the construct and that of the other constructs (Fornell and Larcker, 1981). The square root of the AVE is greater than the correlations between the construct, which suggests an excellent discriminant validity. In Table 1, the bold numbers reported diagonally are the square roots of AVE, and off-diagonal numbers are the correlations among the constructs.

4.2. Evaluation of structural model

4.2.1. Results of hypotheses testing

The bootstrapping method using 2000 samples was used to determine the path coefficients of hypotheses. The results of the structural model and hypotheses testing were obtained after

running the PLS-SEM as recommended by Kaplan (2008) and Wong (2013). The results provided the information regarding the direction of the relationship as well as the relative strength of the effect associated with our independent variables on dependent variables. The higher path coefficient demonstrates a stronger effect of the independent variable on the dependent variable. Similarly, the P-value, which is lower than 0.05, and the T-value, which is more than 1.96, shows the significance of the relationship (Hair Jr et al., 2016). After running PLS-SEM, it was found that H5 (Opportunism ➜ Project Performance) was insignificant, whereas the rest of the hypotheses are significant given that their p-values are lower than 0.05 and their T-values are greater than 1.96.

In the next step, the structural model was used to generate the results for the moderating variable. This study conceptualizes requirements risk as a moderating variable and measures its effect on the relationship between (1) contractual governance and project performance and (2) relational governance and project performance. This moderating effect was measured by using the "moderation by interaction terms" method. Here the moderator variables were first multiplied with the independent variable, and then the combined effect was checked against the dependent variable. The results of our hypotheses testing are presented in Table 2 and Figs. 2, 3, and 4.

To completely understand the underpinnings of moderation-by-interaction terms, simple slope analysis has been conducted. The slopes have been presented in Figs. 3 and 4 respectively. In Figs. 3 and 4, green, red, and blue lines specify the moderator's high, mean, and low positions respectively. Results of moderation analysis reveal that requirements risk negatively moderates the relationship between (1) contractual governance and project performance and (2) relational governance and project performance.

5. Discussion

5.1. Contractual governance and project performance

This paper postulates that contractual governance and relational governance have positive, significant effects on project performance (H1 & H2). The results of the structural

Table 1
Mean, standard deviation and discriminant validity.

	CR	Cronbach's alpha	AVE	CE	FE	FX	GE	IE	OPP	PP	RR	SO	TR
CE	0.894	0.822	0.738	**0.859**									
FE	0.893	0.84	0.676	0.651	**0.822**								
FX	0.888	0.753	0.799	0.63	0.757	**0.894**							
GE	0.897	0.828	0.744	0.72	0.647	0.884	**0.863**						
IE	0.876	0.788	0.702	0.762	0.815	0.657	0.686	**0.838**					
OPP	0.848	0.761	0.583	−0.621	−0.574	−0.518	−0.596	−0.57	**0.764**				
PP	0.916	0.893	0.61	0.745	0.763	0.705	0.784	0.802	−0.69	**0.781**			
RR	0.913	0.873	0.725	0.776	0.688	0.688	0.748	0.719	−0.636	0.78	**0.851**		
SO	0.889	0.813	0.728	0.87	0.699	0.749	0.809	0.709	−0.662	0.771	0.777	**0.853**	
TR	0.899	0.865	0.599	0.77	0.779	0.663	0.733	0.758	−0.768	0.92	0.735	0.772	**0.774**

Note: CE = Change Elements; FE = Fundamental Elements; FX = Flexibility; GE = Governance Elements; IE = Information Exchange; OPP = Opportunism; PP = Project Performance; RR = Requirement Risk; SO = Solidarity; TR = Trust;
The square roots of AVE (the bold number on the diagonal in the table) are greater than the correlation coefficients between the factors and other ones, indicating that each factor has a good discriminant validity.

Table 2
Hypotheses decision table.

Sr. No.	Hypothesis	Path coefficient	T Statistics	P values	Effect size f^2	Hypotheses decision
1	Contractual governance ➔ Project performance	0.566	3.858	0.000	0.068	Supported
2	Relational governance ➔ Project performance	1.294	14.008	0.000	0.699	Supported
3	Contractual governance ➔ opportunism	−0.365	4.412	0.000	0.055	Supported
4	Relational governance ➔ Opportunism	−1.288	9.614	0.000	0.285	Supported
5	Opportunism ➔ Project performance	0.025	0.635	0.526	0.002	*Not Supported*
6	Contractual governance * requirements Risk ➔ Project performance	−0.763	1.981	0.048	0.027	Supported
7	Relational governance * requirement risk ➔ Project performance	−0.209	2.705	0.007	0.037	Supported

model support this premise. The findings of prior literature regarding the effects of contractual governance on project performance are contradictory. For example, Benítez-Ávila et al. (2018) concluded that there is no relationship between contractual governance and project performance. However, the results of the current study are aligned with the previous studies conducted by Li et al. (2010) and Lu et al. (2015), who found that contractual governance has positive, significant effects on project performance. Thus it can be used to enhance project performance emphatically and can help a firm achieve its organizational goals (Lu et al., 2015). Given that software firms use formal contracts while having transactions with each other, it is found that these formal contracts help firms tackle unforeseen situations during a project's life cycle, which results in enhancing project performance (Hart and Moore, 2008; Schepker et al., 2014; Wang et al., 2017). According to Lu et al. (2015), the parties to a contract clearly define the do's and don'ts of a project so that the software firms can achieve the project goals. The improved project performance is the result of better contractual management between the different parties involved in the project (Poppo and Zenger, 2002).

The results support the proposed notion of H2 and show a strong relational governance effect on project performance. The results confirm the findings provided by previous studies such as Ferguson et al. (2005), and Lu et al. (2015), who found a positive and significant relationship between relational governance and project performance. In this study, the relational governance has been conceptualized as a sum of trust and relational norms (information exchange, flexibility, and solidarity). The results show a strong and positive influence of relational governance on project performance. Therefore, it is argued that trust and relational norms play a vital role in enhancing the performance of software development projects. It is established that parties in a contract develop trust in each other based on long-term personal relationships. The findings help to infer that parties develop, test, and observe the relationship, and finally confirm the relationship on the basis of trust and relational norms involving information exchange, flexibility, and solidarity. Prior studies (Lu et al., 2015; Müller and Martinsuo, 2015) have confirmed this phenomenon empirically, that firms rely on trust and other relational norms to govern contracts, which, as a result, affects project performance.
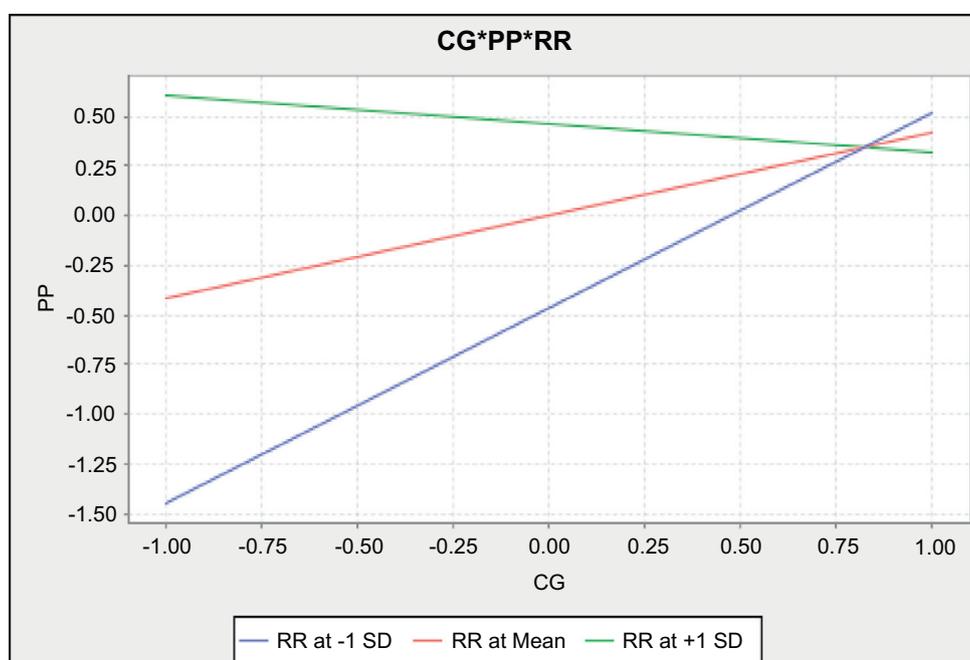

Fig. 2. Moderation-of-requirements risk on the relationship between contractual governance and project performance.
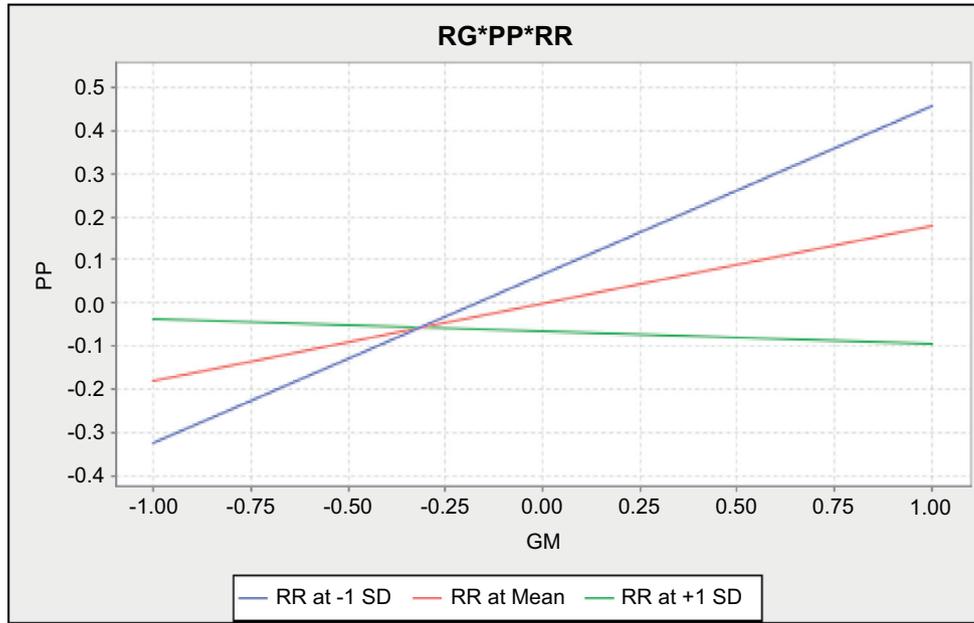
Fig. 3. Moderation-of requirements risk on the relationship between relational governance and project performance.

The study further posited that contractual and relational governance negatively influence opportunism (H3 & H4). The results of this study conform with proposed hypotheses and approve the assumption that contractual and relational governance have negative effects on opportunism in software development projects. The findings of prior literature regarding the role of contractual governance in restraining opportunism are contradictory. For example, Lu et al. (2015) found that contractual governance doesn't play an important role in restraining opportunism. They are of the view that written and formal contracts, which include detailed promises and written obligations for each party, are unable to mitigate opportunism. On the other hand, the findings of the current study are aligned with findings of many previous studies, such as Huo et al. (2016) and Williamson (1985), who established that contractual governance plays an important role in restraining opportunistic behavior. To avoid opportunism and enhance the performance of software development projects, software development firms should adopt an effective governance structure.

The findings of this study support the H4 and confirm the findings of prior literature such as that authored by Lu et al. (2015), who are of the view that relational governance has a
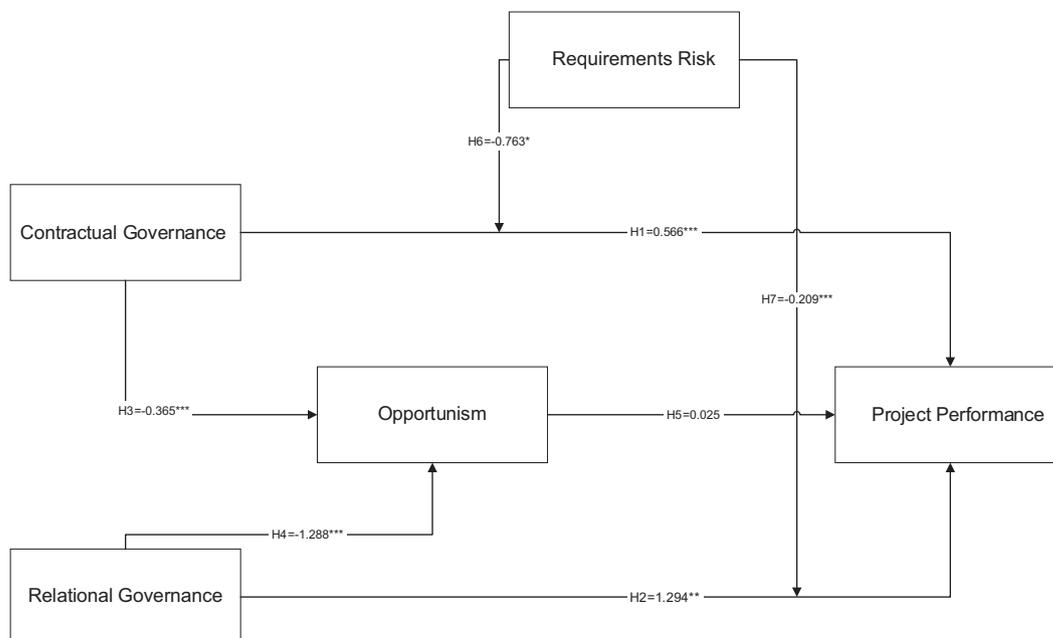

Fig. 4. Results of structural model.

strong and significant negative effect on incidences of opportunism. Lu and colleagues explain that relational governance based on trust and relational norms play a vital role in curbing partners' opportunistic behavior (Tangpong et al., 2010). Although contractual governance and relational governance complement each other in restraining opportunism, the findings of the current study show that relational governance has a stronger effect on curtailing opportunism than contractual governance. This is also in line with the findings of Lu et al. (2015), who found that relational governance is very effective in mitigating opportunism. If a firm aims to reduce opportunism, it should promote inter-firm trust and apply relation norms. Sometimes managers prefer to develop personal relationships with their business partners, which enhances trust among them and thus reduces opportunism.

In H5, the researcher has hypothesized that opportunism has negative effects on project performance. Surprisingly, the results of the structural model do not support the proposed hypothesis. The findings of previous studies regarding the relationship between opportunism and project performance appear to be contradictory. For example, Wang and Yang (2013) found that inter-firm opportunism may result in poor organizational performance. Similarly, Luo (2007) found that opportunism influences firms' performance negatively regardless of whether performance indicators are cost-based, revenue-based, or overall business-based. Various other researchers such as Williamson (1985) are of the view that opportunism directly or indirectly influences performance negatively. Opportunism is related more strongly to the satisfaction in the relationship in the transaction than to the performance of the project or operation. Because opportunistic behavior may not directly reduce performance, it may in fact undermine the satisfaction in the relationship (Lu et al., 2015). According to Wang and Yang (2013), some of the previous studies suggest that opportunism influences performance through various mediating variables such as trust, commitment, conflict, and satisfaction. A potential explanation for an insignificant relationship between opportunism and project performance is the presence of an effective governance structure and control system in the organization that limits the opportunist's ability to negatively influence the performance. Although an opportunist has behavioral tendencies to seek opportunities regardless of their potential effects on project performance, effective governance structures act as a bulwark prohibiting the opportunist from acting in a way that influences performance. In other words, despite his opportunistic intentions, having the governance mechanisms in place does not allow him to realize those intentions. Thus the relationship between opportunism and project performance tends to be insignificant in this context.

Finally, the findings of our current research confirm the assumptions made by TCE theorists. In the TCE literature, it is assumed that if contracts are more formalized, any opportunistic behavior of the parties involved in the contract will be reduced (Liu et al., 2009). It is believed that TCE can restrain opportunistic behavior in several ways. For example, formal contracts assure that formal rules and procedures are in place to lessen opportunism and reduce the uncertainty of behaviors and outcomes (Huo et al., 2016). In addition, formal contracts dictate the penalties and strict monitoring mechanisms available to address any type of fraud and/or misconduct that arises during the established term of the contract. As a result, reduced incidences of opportunism are to be expected (Cavusgil et al., 2004). In addition, the parties can refer to written and formal contracts to resolve any conflict arising out of the formality of fulfilling the transaction, because the formal contract clearly defines the nature of the transaction (Ring and Van de Ven, 1992). Therefore, it can be safely inferred that contractual governance plays a vital role in restraining any opportunistic behavior by the parties involved in software development projects.

5.2. Moderation of requirement risk

In this study, requirements risk has been used as a moderator to find its moderating effects on the relationship between (1) contractual governance and project performance and (2) relational governance and project performance. The findings reveal that requirements risk negatively moderates the relationship between project governance mechanisms and project performance. Therefore, the results of this study provide the evidence to accept H6 and H7. The requirements analysis phase is the most important and most critical phase in the life cycle of a software development project, in part because an accurate requirement analysis has a significant effect on the other phases of a project and thus may become the chief catalyst spawning additional risks (Wallace et al., 2004).

In the context of project governance mechanisms—i.e., contractual and relational governance and their immediate effect on transactions—the requirements risk is the most relevant dimension because of clients' uncertain requirements. However, it is not the only problem associated with software development projects. Incorrect, unclear, inadequate, or inflexible requirements may also increase the risk of project failure by affecting a project's performance inversely (Boehm, 1991; Schmidt et al., 2001). In software development projects, careful requirement analysis plays a vital role in guiding projects toward successful outcomes. This study has found that the empirical evidence of the phenomenon regarding requirements risk can negatively influence the relationship between project governance mechanisms and project performance.

5.3. Theoretical implications

The current study has several important contributions to make to the existing body of knowledge related to project governance mechanisms, opportunism, project performance, and their effectiveness in the presence of requirements risk. Project governance is very complex in nature, and a single theory is not enough to explain its theoretical perspectives adequately. Therefore, our current study provides a brief description of different theories being applied in the context of project governance. The nature of this study and the types of research questions suggest that agency theory and TCE are

more closely related to this study. Because most of the research questions are about the nature of the relationship between buyer and supplier (parties to a software project) and top management and middle-level managers, it is evident that these two theories tend to explain these types of relationships. Agency theory in a project management context emphasizes the relationship between the project owner and the project manager (Turner and Müller, 2005). Monitoring and controlling mechanisms are integral parts of agency theory as well as project governance as defined by Turner (2009). The project owner needs to monitor the performance of the project manager, which will indeed enhance the project's performance. The results of the current study favor this phenomenon, specifically that effective project governance—i.e., the monitoring of the project manager by the project owner, along with efficient management of the requirements risk—will tend to increase project performance. Organizations following TCE should adjust their governance structure to achieve the lowest possible transaction cost.

The first contribution of this study is that contractual governance and relational governance are useful in curbing opportunism in the software development industry and enhancing project performance. This study provides empirical evidence from the developing software development industry that effective project governance—i.e., contractual and relational governance—have significant negative effects on opportunism. On the other hand, contractual governance and relational governance are useful tools for triggering the performance of software development projects. Relationships such as the effect of contractual governance and relational governance on opportunism and project performance have been studied before (for example, Benítez-Ávila et al., 2018; Chi et al., 2017), but the scope of the current study is a bit different. Moreover, most of those studies have been conducted relative to developed economies or other business sectors such as construction (see, for example, Lu et al., 2015).

The larger contribution of this study is the development of a moderation model. The model lays theoretical foundations for explaining how requirements risk regulates the relationship between project governance mechanisms and project performance. The findings provide support for the moderation of requirements risk on the relationship between project governance mechanisms and project performance.

5.4. Managerial implications

This study provides significant insights into Pakistan's software firms' ability to track and enhance project performance as well as their ability to formulate strategies to measure the performance of ongoing projects, all while addressing project governance mechanisms, specifically opportunism and requirements risk. The concepts of agency theory will help practitioners develop a governance structure based on strict monitoring, which can ultimately enhance project performance. Hence, this study suggests the following practical implications for software firms' project managers in Pakistan and should be applicable in other developing countries as well.

Having appropriate knowledge of governance mechanisms, project managers should pay considerable attention to the understanding gleaned regarding the effectiveness of contractual governance and relational governance in dealing with opportunism and the increased performance gains of software development projects. Furthermore, contractual governance elements such as fundamental elements, change elements, and governance elements must be appropriately considered to create long-term and successful contracts. By creating such contracts, firms can avoid opportunistic behavior and increase the performance of software development projects. Similarly, trust and relational norms should be considered key aspects of relational governance when creating contracts based on mutual relationships. For instance, establishing relational norms can capture the potential partnerships defined in the contract, including the risk-sharing regimen and transparent renegotiation. This is especially important in the face of complexity, where parties need to work collaboratively to manage technology.

The parties to a contract should make an accurate and careful requirements analysis at the time of contract formation to avoid incorrect, inadequate, or unsubtle requirements. An accurate requirements analysis plays a vital role in governing and guiding projects toward successful outcomes. IT project managers and team leaders should have the authority, ability, and resources to make appropriate decisions and empower their team members to achieve their goals.

To minimize the threats posed by requirements risk in software development projects, project managers should consider technical and social approaches. On the technical side, software development firms can develop flexible system architecture that may make it easier for the firms to quickly manage any changes in requirements. On the social side, software firms can build friendly relations (based on trust and relational norms) with their clients and communicate the costs associated with any change in requirements and/or change requests. Furthermore, to trigger the performance of software development projects, the practitioners should find a good fit between risk factors and governance mechanisms.

5.5. Conclusion

Previous studies have investigated the influence of contractual and relational governance on opportunism and project performance. But the focus of those studies was primarily to study the complementary and substitutability nature of these governance mechanisms. The larger comprehensive contribution of our current study is in the important development of a moderation model to investigate the effectiveness of these governance mechanisms in the presence of requirements risk. Based on survey data collected from the software development industry, the results of the current study reveal that contractual and relational governance play an important role in increasing project performance and restraining opportunism. Moreover, this study provides empirical evidence that the presence of requirements risk negatively moderates the influence of contractual and relational governance on project performance. The findings of our study provide significant insights into software firms' ability to track and

enhance project performance, and further, their ability to formulate strategies to measure the performance of ongoing projects while addressing project governance mechanisms, opportunism, and requirements risk.

It should be noted that this study has certain limitations. First, this research does not measure the direct effects of trust, relational norms, fundamental elements, change elements, and governance elements on opportunism and project performance. We encourage future research to investigate the effects of these factors on opportunism and project performance individually. This will help identify the predictors of contractual governance and relational governance, providing more in-depth findings. Secondly, this study didn't consider the antecedent factors such as duration of contract, complexity, and project size. Future research may want to consider these factors in order to add more detailed insights into this important research area. Thirdly, the pay structure, social system of Pakistan, popularity, and growth of the software industry are other factors that may affect the governance structures and their effect on project performance. But since they are outside the scope of this study, future research should consider incorporating these factors as well. Fourthly, the current study did not collect data on agile methods of software development. Agile methods of software development are designed to deliver high-quality projects within a prescribed scope under rapidly changing customer requirements. Therefore, any future study may wish to consider the current moderation model to test moderating role requirements risk as it pertains to agile software development projects.

Acknowledgments

Appendix 1. Survey instrument and factor loadings

Note: All the items were measured on a five-point Likert scale (1 = strongly disagree; 5 = strongly agree).

Construct/Item	Factor loading	Mean	SD
PP: Project Performance (Nidumolu, 1996; Rai and Al-Hindi, 2000)			
PP1 The application developed is reliable.	0.804	3.799	0.755
PP2 The application is easy to maintain.	0.817	3.786	0.835
PP3 The users perceive that the system meets intended functional requirements.	0.814	3.667	0.87
PP4 The system meets user expectations with respect to response time.	0.755	3.66	0.864
PP5 The overall quality of the developed application is high.	0.742	3.403	0.898
PP6 The project was completed within budget.	0.784	3.613	0.796
PP7 The project was completed within schedule.	0.746	3.67	0.732
RR: Requirements Risk (Wallace et al., 2004)			
RR1 Continually changing system requirements	0.813	3.692	0.839
RR2 System requirements are not adequately identified.	0.838	3.541	1.032
RR3 Unclear system requirements	0.903	3.642	0.864
RR4 Incorrect system requirements	0.820	3.645	0.895
OPP: Opportunism (Heide et al., 2007)			
OPP1 On occasion, we lie about certain things in order to protect our interests.	0.708	2.336	0.505
OPP2 We sometimes promise to do things without actually doing them later.	0.748	2.39	0.613
OPP3 We sometimes take advantage of "holes" in our contracts or agreements to further our own interests.	0.784	2.346	0.514
OPP4 We do not always act in accordance with our contracts or agreements.	0.816	2.365	0.513
Contractual Governance			
FE: Fundamental Elements (Goo et al., 2009; Luo, 2002)			
FE1 Our relationship with the other parties is governed primarily by written contracts.	0.792	3.626	0.786
FE2 The contract has detailed the obligations and rights of every party.	0.782	3.648	0.758
FE3 The contract has a clear statement of the time, place, and the way of project fulfillment.	0.850	3.739	0.792
FE4 The contract has described the safety management requirements, quality standards, contract price, and its payment to manage the agreements among parties.	0.863	3.799	0.652
CE: Change Elements (Goo et al., 2009; Luo, 2002)			
CE1 The contract has specified major principles or guidelines for handling unanticipated contingencies as they arise.	0.879	3.651	0.828
CE2 The contract has provided alternative solutions for responding to various contingencies that are likely to arise.	0.874	3.61	0.886
CE3 The contract has allowed us to respond quickly to match evolving client requirements.	0.823	3.623	0.758
GE: Governance Elements (Goo et al., 2009)			
GE1 We have a clear expression of the default definitions and formula.	0.878	3.541	0.986
GE2 The contract has a detailed description of conditions under which termination may occur.	0.818	3.55	0.833
GE3 The contract has specified the procedures and methods for disputes.	0.891	3.664	0.807

Appendix 1.(*continued*)

Construct/Item	Factor loading	Mean	SD
Relational Governance			
TR: Trust (Chow et al., 2012; Pinto et al., 2009)			
TR1 We believe the other party can keep their word throughout the life of the project.	0.806	3.802	0.745
TR2 We feel confident that the other parties have high levels of integrity and honest.	0.845	3.77	0.782
TR3 We believe the project engineers and other technical people are competent at what they are doing.	0.792	3.701	0.774
TR4 We trust that the project participants are able to fulfill contractual agreements.	0.789	3.656	0.905
TR5 We are certain that the other parties have the ability to perform their tasks.	0.647	3.55	0.825
TR6 We believe that the other parties could meet the requirements of the project in technology and management.	0.753	3.736	0.654
IE: Information Exchange (Griffith and Myers, 2005)			
IE1 Exchange of information among the parties takes place frequently.	0.841	3.711	0.772
IE2 We keep each other informed about events or changes that may affect the other parties.	0.875	3.843	0.701
IE3 The parties established a good contact with each other, avoiding possible misunderstandings.	0.796	3.654	0.921
SO: Solidarity (Griffith and Myers, 2005)			
SO1 The parties are consistent with the expectations of this project.	0.885	3.645	0.895
SO2 The project's overall plan and the implementation scheme are shared by every party.	0.845	3.701	0.806
SO3 Parties involved in this project regard each other as major partners.	0.829	3.535	0.983
FX: Flexibility (Griffith and Myers, 2005)			
FX1 We believed that the parties were willing to cooperate to work out solutions if some unexpected situations arose	0.860	3.478	0.875
FX2 The parties expected to be able to make adjustments in the ongoing relationship to cope with changing circumstances.	0.926	3.642	0.799

References

Abdi, M., Aulakh, P.S., 2017. Locus of uncertainty and the relationship between contractual and relational governance in cross-border interfirm relationships. J. Manag. 43 (3), 771–803.

Arino, A., Torre, J., Ring, P.S., 2005. Relational quality and inter-personal trust in strategic alliances. Eur. Manag. Rev. 2 (1), 15–27.

Atkin, B., Skitmore, M., 2008. Editorial: stakeholder management in construction. Constr. Manag. Econ. 26 (6), 549–552. https://doi.org/10.1080/01446190802142405.

Atkinson, R., Crawford, L., Ward, S., 2006. Fundamental uncertainties in projects and the scope of project management. Int. J. Proj. Manag. 24 (8), 687–698.

Aulakh, P.S., Kotabe, M., Sahay, A., 1996. Trust and performance in cross-border marketing partnerships: a behavioral approach. J. Int. Bus. Stud. 27 (5), 1005–1032.

Bello, D.C., Williamson, N.C., 1985. Contractual arrangement and marketing practices in the indirect export channel. J. Int. Bus. Stud. 16 (2), 65–82.

Benaroch, M., Lichtenstein, Y., Fink, L., 2016. Contract design choices and the balance of ex-ante and ex-post transaction costs in software development outsourcing. MIS Q. 40 (1).

Benítez-Ávila, C., Hartmann, A., Dewulf, G., Henseler, J., 2018. Interplay of relational and contractual governance in public-private partnerships: the mediating role of relational norms, trust and partners' contribution. Int. J. Proj. Manag. 36 (3), 429–443.

Biesenthal, C., Wilden, R., 2014. Multi-level project governance: trends and opportunities. Int. J. Proj. Manag. 32 (8), 1291–1308.

Boehm, B.W., 1991. Software risk management: principles and practices. IEEE Softw. 8 (1), 32–41.

Borgstein, E.H., Lamberts, R., Hensen, J.L.M., 2018. Mapping failures in energy and environmental performance of buildings. Energy Build. 158, 476–485.

Brahm, F., Tarziján, J., 2015. Does complexity and prior interactions affect project procurement? Evidence from mining mega-projects. Int. J. Proj. Manag. 33 (8), 1851–1862.

Brown, L., Grundy, T., 2016. Project Management for the Pharmaceutical Industry. Routledge, London, UK.

Bstieler, L., Hemmert, M., 2015. The effectiveness of relational and contractual governance in new product development collaborations: evidence from Korea. Technovation 45, 29–39.

Caniëls, M.C., Gelderman, C.J., 2010. The safeguarding effect of governance mechanisms in inter-firm exchange: the decisive role of mutual opportunism. Br. J. Manag. 21 (1), 239–254.

Cao, Z., Lumineau, F., 2015. Revisiting the interplay between contractual and relational governance: a qualitative and meta-analytic investigation. J. Oper. Manag. 33, 15–42.

Cao, L., Mohan, K., Ramesh, B., Sarkar, S., 2013. Evolution of governance: achieving ambidexterity in IT outsourcing. J. Manag. Inf. Syst. 30 (3), 115–140.

Carson, S.J., Madhok, A., Wu, T., 2006. Uncertainty, opportunism, and governance: the effects of volatility and ambiguity on formal and relational contracting. Acad. Manag. J. 49 (5), 1058–1077.

Cavusgil, S.T., Deligonul, S., Zhang, C., 2004. Curbing foreign distributor opportunism: an examination of trust, contracts, and the legal environment in international channel relationships. J. Int. Mark. 12 (2), 7–27.

Chi, M., Zhao, J., George, J.F., Li, Y., Zhai, S., 2017. The influence of inter-firm IT governance strategies on relational performance: the moderation effect of information technology ambidexterity. Int. J. Inf. Manag. 37 (2), 43–53.

Choudhury, V., Sabherwal, R., 2003. Portfolios of control in outsourced software development projects. Inf. Syst. Res. 14 (3), 291–314.

Chow, P.T., Cheung, S.O., Chan, K.Y., 2012. Trust-building in construction contracting: mechanism and expectation. Int. J. Proj. Manag. 30 (8), 927–937.

Collis, J., Hussey, R., 2013. Business Research: A Practical Guide for Undergraduate and Postgraduate Students. Palgrave Macmillan, England.

Commons, J.R., 1931. Institutional economics. Am. Econ. Rev. 648–657.

Commons, J.R., 1934. Institutional Economics: Its Place in Political Economy. MacMillan, New York.

Dahlstrom, R., Nygaard, A., 1999. Ownership decisions in plural contractual systems: twelve networks from the quick service restaurant industry. Eur. J. Mark. 33 (1/2), 59–87.

Das, T., Rahman, N., 2001. Partner misbehaviour in strategic alliances: guidelines for effective deterrence. J. Gen. Manag. 27 (1), 43–70.

Dimitratos, P., Lioukas, S., Ibeh, K.I., Wheeler, C., 2010. Governance mechanisms of small and medium enterprise international partner management. Br. J. Manag. 21 (3), 754–771.

Dong, W., Ma, Z., Zhou, X., 2017. Relational governance in supplier-buyer relationships: the mediating effects of boundary spanners' interpersonal guanxi in China's B2B market. J. Bus. Res. 78, 332–340.

Duc, A.N., Abrahamsson, P., 2017, June. Exploring the outsourcing relationship in software startups: a multiple case study. Proceedings of the 21st International Conference on Evaluation and Assessment in Software Engineering, pp. 134–143 (ACM).

Dyer, J.H., Singh, H., 1998. The relational view: cooperative strategy and sources of interorganizational competitive advantage. Acad. Manag. Rev. 23 (4), 660–679.

Faems, D., Janssens, M., Madhok, A., Van Looy, B., 2008. Toward an integrative perspective on alliance governance: connecting contract design, trust dynamics, and contract application. Acad. Manag. J. 51 (6), 1053–1078.

Ferguson, R.J., Paulin, M., Bergeron, J., 2005. Contractual governance, relational governance, and the performance of interfirm service exchanges: the influence of boundary-spanner closeness. J. Acad. Mark. Sci. 33 (2), 217–234.

Fornell, C., Larcker, D.F., 1981. Evaluating structural equation models with unobservable variables and measurement error. J. Mark. Res. 39–50.

Goo, J., Kishore, R., Rao, H.R., Nam, K., 2009. The role of service level agreements in relational management of information technology outsourcing: an empirical study. MIS Q. 119–145.

Griffith, D.A., Myers, M.B., 2005. The performance implications of strategic fit of relational norm governance strategies in global supply chain relationships. J. Int. Bus. Stud. 36 (3), 254–269.

Hair Jr., J.F., Hult, G.T.M., Ringle, C., Sarstedt, M., 2016. A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM). Sage Publications, Thousand Oaks, CA, USA.

Handley, S.M., Angst, C.M., 2015. The impact of culture on the relationship between governance and opportunism in outsourcing relationships. Strateg. Manag. J. 36 (9), 1412–1434.

Haq, S.U., Liang, C., Gu, D., et al., 2018. Project governance, project performance, and the mediating role of project quality and Project Management risk: an agency theory perspective. Eng. Manag. J. 30, 274–292.

Hart, O., Moore, J., 2008. Contracts as reference points. Q. J. Econ. 123 (1), 1–48.

Heide, J.B., John, G., 1992. Do norms matter in marketing relationships? J. Mark. 32–44.

Heide, J.B., Wathne, K.H., Rokkan, A.I., 2007. Inter-firm monitoring, social contracts, and relationship outcomes. J. Mark. Res. 44 (3), 425–433.

Hoetker, G., Mellewigt, T., 2009. Choice and performance of governance mechanisms: matching alliance governance to asset type. Strateg. Manag. J. 30 (10), 1025–1044.

Holloway, S.S., Parmigiani, A., 2016. Friends and profits don't mix: the performance implications of repeated partnerships. Acad. Manag. J. 59 (2), 460–478.

Hulland, J., 1999. Use of partial least squares (PLS) in strategic management research: a review of four recent studies. Strateg. Manag. J. 195–204.

Huo, B., Ye, Y., Zhao, X., 2015. The impacts of trust and contracts on opportunism in the 3PL industry: the moderating role of demand uncertainty. Int. J. Prod. Econ. 170, 160–170.

Huo, B., Fu, D., Zhao, X., Zhu, J., 2016. Curbing opportunism in logistics outsourcing relationships: the role of relational norms and contract. Int. J. Prod. Econ. 182, 293–303.

Hussain, A., & Mkpojiogu, E. O. (2016, August). Requirements: towards an understanding on why software projects fail. In AIP Conference Proceedings (Vol. vol. 1761, no. 1, p. 020046). AIP Publishing.

Hussein, B.A., Ahmad, S.B.S., Zidane, Y.J.T., 2015. Problems associated with defining project success[J]. Procedia Comput. Sci. 64, 940–947.

Jap, S.D., Anderson, E., 2003. Safeguarding interorganizational performance and continuity under ex post opportunism. Manag. Sci. 49 (12), 1684–1701.

Jayaraman, V., Narayanan, S., Luo, Y., Swaminathan, J.M., 2013. Offshoring business process services and governance control mechanisms: an examination of service providers from India. Prod. Oper. Manag. 22 (2), 314–334.

Jiang, H., Cannella, A.A., Jiao, J., 2018. Does desperation breed deceiver? A behavioral model of new venture opportunism. Entrep. Theory Pract. 42 (5), 769–796.

Jin, Y., Meng, Y., Xu, Y., Xie, F., 2016. A study on what cause the lack of integrity in China's food companies. Food Hygiene, Agriculture and Animal Science: Proceedings of the 2015 International Conference on Food Hygiene. Agriculture and Animal Science, pp. 136–144.

John, G., 1984. An empirical investigation of some antecedents of opportunism in a marketing channel. J. Mark. Res. 278–289.

Ju, M., Gao, G.Y., 2017. Relational governance and control mechanisms of export ventures: an examination across relationship length. J. Int. Mark. 25 (2), 72–87.

Kaplan, D., 2008. Structural equation modeling: Foundations and extensions. vol. 10. Sage Publications.

Ke, H., Cui, Z., Govindan, K., Zavadskas, E.K., 2015. The impact of contractual governance and trust on EPC projects in construction supply chain performance. Inzinerine Ekon. Eng. Econ. 26 (4), 349–363.

Keil, M., Rai, A., Liu, S., 2013. How user risk and requirements risk moderate the effects of formal and informal control on the process performance of IT projects. Eur. J. Inf. Syst. 22 (6), 650–672.

Khalfan, M.M., McDermott, P., Swan, W., 2007. Building trust in construction projects. Supply Chain Manag. 12 (6), 385–391.

Krejcie, R.V., Morgan, D.W., 1970. Determining sample size for research activities. Educ. Psychol. Meas. 30 (3), 607–610. https://doi.org/10.1177/001316447003000308.

Krishnan, R., Geyskens, I., Steenkamp, J.B.E., 2016. The effectiveness of contractual and trust-based governance in strategic alliances under behavioral and environmental uncertainty. Strateg. Manag. J. 37 (12), 2521–2542.

Levitt, R.E., Henisz, W.J., Settel, D., 2009. Defining and mitigating the governance challenges of infrastructure project development and delivery. Paper presented at the 2009 Conference on Leadership and Management of Construction.

Li, J.J., Poppo, L., Zhou, K.Z., 2010. Relational mechanisms, formal contracts, and local knowledge acquisition by international subsidiaries. Strateg. Manag. J. 31 (4), 349–370.

Liu, S., 2015. Effects of control on the performance of information systems projects: the moderating role of complexity risk. J. Oper. Manag. 36, 46–62.

Liu, S., 2016. How the user liaison's understanding of development processes moderates the effects of user-related and project management risks on IT project performance. Inf. Manag. 53 (1), 122–134.

Liu, H., Sun, T., 2014. U.S. Patent No. 8,654,386. U.S. Patent and Trademark Office, Washington, DC.

Liu, Y., Luo, Y., Liu, T., 2009. Governing buyer–supplier relationships through transactional and relational mechanisms: evidence from China. J. Oper. Manag. 27 (4), 294–309.

Liu, J.Y.-C., Chen, H.-G., Chen, C.C., Sheu, T.S., 2011. Relationships among interpersonal conflict, requirements uncertainty, and software project performance. Int. J. Proj. Manag. 29 (5), 547–556.

Lu, P., Guo, S., Qian, L., He, P., Xu, X., 2015. The effectiveness of contractual and relational governances in construction projects in China. Int. J. Proj. Manag. 33 (1), 212–222.

Lui, S.S., Ngo, H.-Y., 2004. The role of trust and contractual safeguards on cooperation in non-equity alliances. J. Manag. 30 (4), 471–485.

Lumineau, F., Fréchet, M., Puthod, D., 2011. An organizational learning perspective on the contracting process. Strateg. Organ. 9 (1), 8–32.

Luo, Y., 2002. Contract, cooperation, and performance in international joint ventures. Strateg. Manag. J. 23 (10), 903–919.

Luo, Y., 2007. An integrated anti-opportunism system in international exchange. J. Int. Bus. Stud. 38 (6), 855–877.

Lusch, R.F., Brown, J.R., 1996. Interdependency, contracting, and relational behavior in marketing channels. J. Mark. 19–38.

Macaulay, S., 2018. Non-contractual relations in business: a preliminary study. The Law and Society Canon. Routledge, pp. 155–167.

Marnewick, C., Erasmus, W., Nazeer, J., 2018. The Symbiosis Between Information System Project Complexity and Information System Project Success. AOSIS, p. 184.

Müller, R., Martinsuo, M., 2015. The impact of relational norms on information technology project success and its moderation through project governance. Int. J. Manag. Proj. Bus. 8 (1), 154–176.

Musawir, A.u., Serra, C.E.M., Zwikael, O., Ali, I., 2017. Project governance, benefit management, and project success: towards a framework for supporting organizational strategy implementation. Int. J. Proj. Manag. https://doi.org/10.1016/j.ijproman.2017.07.007.

Ndubisi, N.O., Ehret, M., Wirtz, J., 2016. Relational governance mechanisms and uncertainties in nonownership services. Psychol. Mark. 33 (4), 250–266.

Neuman, W.L., 2013. Social research methods: Qualitative and quantitative approaches: Pearson Education.

Newman, K.L., Nollen, S.D., 1996. Culture and congruence: the fit between management practices and national culture. J. Int. Bus. Stud. 27 (4), 753–779.

Nidumolu, S.R., 1996a. A comparison of the structural contingency and risk-based perspectives on coordination in software-development projects. J. Manag. Inf. Syst. 13 (2), 77–113.

Nidumolu, S.R., 1996b. Standardization, requirements uncertainty and software project performance. Inf. Manag. 31 (3), 135–150.

Nunnally, J., Bernstein, I., 1994. Psychometric Theory. 3rd ed. McGraw-Hill, New York.

Nunnally, J.C., Bernstein, I.H., Berge, J.M.T., 1967. Psychometric Theory. vol. 226. McGraw-Hill, New York.

Petter, S., Straub, D., Rai, A., 2007. Specifying formative constructs in information systems research. MIS Q. 623–656.

Phelps, A.F., Reddy, M., 2009. The influence of boundary objects on group collaboration in construction project teams. Paper Presented at the PROCEEDINGS of the ACM 2009 International Conference on Supporting Group Work.

Pinto, J.K., Slevin, D.P., English, B., 2009. Trust in projects: An empirical assessment of owner/contractor relationships[J]. Int. J. Proj. Manag. 27 (6), 638–648.

PMI, 2017. A Guide to the Project Management Body of Knowledge. Project Management Institute, PA, USA.

Poppo, L., Zenger, T., 2002. Do formal contracts and relational governance function as substitutes or complements? Strateg. Manag. J. 23 (8), 707–725.

Rai, A., Al-Hindi, H., 2000. The effects of development process modeling and task uncertainty on development quality performance. Inf. Manag. 37 (6), 335–346.

Reuer, J.J., Ariño, A., 2002. Contractual renegotiations in strategic alliances. J. Manag. 28 (1), 47–68.

Reuer, J.J., Ariño, A., 2007. Strategic alliance contracts: dimensions and determinants of contractual complexity. Strateg. Manag. J. 28 (3), 313–330.

Ring, P.S., Van de Ven, A.H., 1992. Structuring cooperative relationships between organizations. Strateg. Manag. J. 13 (7), 483–498.

Schepker, D.J., Oh, W.-Y., Martynov, A., Poppo, L., 2014. The many futures of contracts: moving beyond structure and safeguarding to coordination and adaptation. J. Manag. 40 (1), 193–225.

Schmidt, R., Lyytinen, K., Mark Keil, P.C., 2001. Identifying software project risks: an international Delphi study. J. Manag. Inf. Syst. 17 (4), 5–36.

Singh, N., Dey, A.K., 2017. Dimensions of Risk and Performance of Software Projects.

Spraggon, M., Bodolica, V., 2015. Trust, authentic pride, and moral reasoning: a unified framework of relational governance and emotional self-regulation. Bus. Eth. 24 (3), 297–314.

Stinchcombe, A.L., Heimer, C.A., 1985. Organization theory and project management: Administering uncertainty in Norwegian offshore oil: Oxford. Oxford University Press, UK.

Sumo, R., van der Valk, W., van Weele, A., Duysters, G., 2016. How incomplete contracts Foster innovation in inter organizational relationships. Eur. Manag. Rev. 13 (3), 179–192.

Suresh, K., Dillibabu, R., 2018. Designing a Machine Learning Based Software Risk Assessment Model Using Naïve Bayes Algorithm.

Tangpong, C., Hung, K.-T., Ro, Y.K., 2010. The interaction effect of relational norms and agent cooperativeness on opportunism in buyer–supplier relationships. J. Oper. Manag. 28 (5), 398–414.

Turner, J.R., 2009. The handbook of project-based management. vol. 92. McGraw-Hill.

Turner, J.R., Müller, R., 2005. The Project manager's Leadership Style as a Success Factor on Projects: A Literature Review.

Wacker, J.G., Yang, C., Sheu, C., 2016. A transaction cost economics model for estimating performance effectiveness of relational and contractual governance: theory and statistical results. Int. J. Oper. Prod. Manag. 36 (11), 1551–1575.

Walker, D., 2003. Implications of human capital issues. Procurement strategies: A relationship based approach. Black Well Science, Oxford, UK, pp. 258–295.

Wallace, L., Keil, M., Rai, A., 2004. How software project risk affects project performance: an investigation of the dimensions of risk and an exploratory model*. Decis. Sci. 35 (2), 289–321.

Wang, X., Yang, Z., 2013. Inter-firm opportunism: a meta-analytic review and assessment of its antecedents and effect on performance. J. Bus. Ind. Mark. 28 (2), 137–146.

Wang, Y., Chen, Y., Fu, Y., Zhang, W., 2017. Do prior interactions breed cooperation in construction projects? The mediating role of contracts. Int. J. Proj. Manag. 35 (4), 633–646.

Wathne, K.H., Heide, J.B., 2000. Opportunism in interfirm relationships: forms, outcomes, and solutions. J. Mark. 64 (4), 36–51.

Williamson, O.E., 1975. Markets and Hierarchies: Antitrust Analysis and Implications. Free Press, New York.

Williamson, O.E., 1985. The Economic Institutions of Capitalism. Free Press, New York.

Williamson, O.E., 2016. The transaction cost economics project: origins, evolution, utilization. The Elgar Companion to Ronald H. Coase. pp. 34–42.

Winch, G.M., 2001. Governing the project process: a conceptual framework. Constr. Manag. Econ. 19 (8), 799–808.

Wong, K.K.-K., 2013. Partial least squares structural equation modeling (PLS-SEM) techniques using SmartPLS. Mark. Bull. 24 (1), 1–32.

Wu, A., Wang, Z., Chen, S., 2017. Impact of specific investments, governance mechanisms and behaviors on the performance of cooperative innovation projects. Int. J. Proj. Manag. 35 (3), 504–515.

Zhang, C., Cavusgil, S.T., Roath, A.S., 2003. Manufacturer governance of foreign distributor relationships: do relational norms enhance competitiveness in the export market? J. Int. Bus. Stud. 34 (6), 550–566.

Zhou, Y., Zhang, X., Zhuang, G., Zhou, N., 2015. Relational norms and collaborative activities: roles in reducing opportunism in marketing channels. Ind. Mark. Manag. 46, 147–159.

Zineldin, M., Vasicheva, V., 2016. Marriage versus strategic alliance: soft and hard dissatisfaction and failure factors. Int. J. Strateg. Bus. Alliances 5 (1), 22–33.

Zwikael, O., Smyrk, J., 2015. Project governance: balancing control and trust in dealing with risk. Int. J. Proj. Manag. 33 (4), 852–862.