Knowledge sharing in project-based supply networks

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Abstract

Purpose – Project-based supply networks are an emerging form of organizing used to meet a buying organization's operational and innovation goals. Knowledge sharing among suppliers in the network plays a key role in successful project delivery but is challenging to achieve in practice. We draw on self-determination theory (SDT) to examine the interactive effect of incentive provisions (penalties and bonuses) and network governance (lead or shared) on knowledge sharing motivation by individual boundary-spanners within project-based supply networks.

Design/methodology/approach – A scenario-based behavioral experiment of 217 professionals within the UK using the online platform, Prolific, was conducted. A Hayes Macro PROCESS model was used to analyze the data. We pilot-tested the scenario with project management experts, senior managers, and directors.

Findings – Our findings highlighted that the effectiveness of incentive provisions on knowledge sharing may be dependent on the mode of network governance. Where suppliers have shared responsibility for managing the network (shared governance), bonuses were more effective than penalties in motivating knowledge sharing through support of boundary-spanners' autonomy needs. However, where the buying organization has transferred responsibility for managing the network to an external third-party organization (lead governance), we found no significant difference between the effectiveness of penalty versus bonus provisions in motivating knowledge sharing.

Originality – Prior research in operations and supply chain management (OSCM) has shown the positive effect of incentive provisions on knowledge sharing motivation, but largely overlooked the effectiveness of such incentives when nested within broader governance mechanisms used in projects and their networks. Moreover, while scholars have started to highlight the importance of governance mechanisms in knowledge sharing at the dyadic level, we know very little about the impact of network governance.

Keywords: *Knowledge sharing; governance; projects; network; boundary-spanners; experiments*

1. Introduction

Project-based supply networks are increasingly utilized as a novel form of governance by private and public organizations (Song et al., 2020; Stevens, 2019; Yam and Chan, 2015). Within these networks, a group of suppliers are formed for a limited time to co-create a unique product and/or service for a buying organization (Chen and Lee, 2017; Zacharia et al., 2011). A recent example is "Project Oyster" and "Project Penguin" where networks of 14 suppliers were brought together to manufacture and deliver 30,000 medical ventilators for the British government (Davies, 2020). The high levels of temporal and knowledge interdependence of project-based networks create considerable challenges in controlling and coordinating the actions of suppliers (Mishra et al., 2015; Oliveira and Lumineau, 2017), particularly where many of them have not worked together previously. and may not do so again in the future.

Knowledge sharing has a critical role in the timely and successful delivery of these projects (Eriksson et al., 2017; Roehrich et al., 2019). However, motivating suppliers to share discretionary knowledge beyond the minimum level required to facilitate project goals is often challenging due to, for example, limited prior experience of working together. Moreover, collaboration dilemmas, such as collective action and free-riding problems (Dyer and Nobeoka, 2000; Kalra et al., 2021), as well as the limited role of the buyer in day-to-day management of the project (Dawande et al., 2019), all act to hamper knowledge sharing between suppliers in the network. Utilizing incentive provisions which align suppliers' interests with project objectives and motivate knowledge sharing, often through bonuses or penalties (e.g., Chen et al., 2015; 2017), has been one avenue to address this challenge. While penalty provisions specify monetary deductions from a base pay-out if performance objectives (e.g., delivering by the deadline) are not met, bonuses offer an additional reward if objectives are met or succeeded (Selviaridis and van der Valk, 2019). Extant research has shown that both bonus and penalty provisions could motivate knowledge sharing within project-based supply networks (Siemsen et al., 2007).

While incentive provisions play a valuable role in facilitating knowledge sharing, they are also embedded within a broader set of governance mechanisms. Buying firms, for example, must make a choice *ex ante* about the mode of network governance that will be used to control and coordinate network-level activities of the suppliers during project execution (Provan and Kenis, 2008; Raab et al., 2015). The most common mode is one of lead governance, where a third-party organization (also often called a project management organization - PMO) appointed by the buying firm coordinates issues and encourages requisite knowledge sharing (Braun, 2018; Pathak et al., 2014). Alternatively, the buying firm may delegate responsibility to the network itself (referred to as shared governance), where each supplier member has mutual responsibility to identify coordination issues and share knowledge when needed (Banaszak et al., 2020; Gutierrez et al., 2020). This approach was adopted in "Project Oyster", where the UK government had very limited involvement and oversight over the day-to-day execution of the project.

Evidence from related fields suggests that the effectiveness of incentive provisions in motivating knowledge sharing may depend on their interaction with other forms of governance (e.g., hierarchical control) (Corduneanu et al., 2020; Deci, 1972; Foss et al., 2010). Project-based supply networks represent a particularly salient example, where multiple governance mechanisms operate in parallel to coordinate suppliers' interdependent activities and facilitate timely delivery of projects (Oliveira and Lumineau, 2017). Our research responds to calls in the literature for theoretical and empirical research examining the effectiveness of incentive provisions when combined with other governance mechanisms (Corduneanu et al., 2020; Deci et al., 2017; Foss et al., 2010). Specifically, we apply self-determination theory (SDT) (Ryan and Deci, 2000) to examine the relative effectiveness of bonus versus penalty provisions on an individual boundary-spanners' decision to share discretionary knowledge in project-based supply networks under various forms of network governance. Boundary-spanners are organizations' knowledge holders whose role is central to the transfer of knowledge to other organizations, particularly when making decisions on when and what should be shared (Jarvenpaa and Majchrzak, 2016). We test our hypotheses via a scenario-based behavioral experiment with 217 mid-level and senior professionals in the UK, using the online platform, Prolific.

Our study contributes to the operations and supply chain management (OSCM) literature in two main ways. First, while both bonus and penalty provisions have independently been shown to have positive effects on knowledge sharing motivation (e.g., Crama et al., 2019; Siemsen et al., 2007), the effectiveness of such provisions in the presence of other governance mechanisms has largely been overlooked (Foss et al., 2010). This is a particularly important omission in project-based supply networks, where multiple mechanisms operate in parallel to control suppliers' behavior (Oliveira and Lumineau, 2017). Our findings show that bonus provisions are significantly more effective than penalty provisions in motivating knowledge sharing when used in combination with a shared form of network governance. However, we find no significant differences between the effectiveness of bonus and penalty provisions in lead-governed networks. Further, within project-based supply networks, governance inherently exists at the level of the network in order to coordinate suppliers' interdependent activities and ensure timely project delivery (Braun, 2018; Provan et al., 2007). Prior studies examining governance mechanisms and knowledge sharing have predominantly adopted a dyadic level of analysis (Li et al., 2014; Um and Oh, 2020; Yam and Chan, 2015). Our manipulation of network governance offers an alternate perspective, theoretically and empirically, on how network modes affect knowledge sharing (Pathak et al., 2014). Second, prior OSCM research has provided rich insights into the effect of structural and relational factors on inter-organizational knowledge sharing (Li et al., 2014; Liu et al., 2009). By taking the individual boundary-spanner as the unit of analysis (cf., Chen et al., 2016), we provide insights into the micro-foundations of knowledge sharing, and a richer understanding of the effectiveness of incentive provisions under various forms of network-level governance in project-based supply networks (cf., Foss et al., 2010; Wang et al., 2014).

2. Theoretical Background

2.1 Knowledge sharing in project-based supply networks: The role of individual boundary-spanners

A project-based supply network is a collection of tier one and tertiary suppliers that are brought together for a limited time to deliver a unique product and/or service for a buying organization (Zacharia et al., 2011). These suppliers pool strategic and tactical resources to form a temporary inter-organizational network (DeFillippi and Sydow, 2016; Pathak et al., 2014). Often these networks are one-off in nature, assembled for the purpose of a single project, and then abandoned (Manning, 2017). While buyers may have a limited role in the day-to-day operations of such projects, their role is critical in setting up incentives and governance mechanisms ex-ante to facilitate effective supplier interactions, as well as timely and successful project delivery (Chen and Lee, 2017).

Project-based supply networks entail high levels of temporal (Oliveira and Lumineau, 2017) and knowledge interdependence (Mishra et al., 2015). Each supplier must perform tasks in a timely manner to avoid disrupting the inter-dependent tasks between suppliers (Atkinson, 1999), but at the same time, project completion relies on a combination of knowledge, capabilities, and skills that are spread across suppliers' boundaries (Anderson and Parker, 2013; Mishra et al., 2015). Sharing knowledge within the network is thus critical to successful project execution and delivery (Chen and Lee, 2017; Siemsen et al., 2007). Knowledge sharing enables suppliers to learn from each other and leverage each other's expertise resulting in superior project outcomes, leading to higher performance for buyers (Ho and Ganesan, 2013; Son et al., 2021). Moreover, knowledge sharing may facilitate problem resolution, such as concerns around quality and technical issues (Anderson and Parker, 2013; Wu et al., 2010), which are inevitable during project execution (Eriksson et al., 2017).

Multiple barriers exist, however, to the sharing of knowledge between suppliers. Suppliers within a network have a natural tendency to protect know-how and specialized knowledge in order to prevent undesirable knowledge spill-overs (Dyer and Nobeoka, 2000). Importantly, a substantial share of such knowledge is tacit, and cannot be easily codified into words or symbols, or included in contracts (Dyer and Nobeoka, 2000). The lack of a shadow of the past or future also increases transactional risks and/or willingness to be vulnerable to other parties (Li et al., 2014; Yam and Chan, 2015). Sharing knowledge is thus heavily reliant on suppliers' motivation to enhance (or avoid negative) performance (Siemsen et al., 2008). Enhancing knowledge sharing motivation for suppliers' key boundary-spanners is vital for buying firms, and requires the use of various control and coordination mechanisms.

In particular, the role of individual boundary spanners, who span the supplier and the supplier network, is critical (Foss et al., 2010). In the context of project-based supply networks, boundary-spanners are organizations' key knowledge holders who regulate when, what, and how much knowledge is to be shared across organizational boundaries (Jarvenpaa and Majchrzak, 2016; Tushman and Katz, 1980). Prior studies have drawn out the importance of these boundary-spanners in inter-organizational relationships (Perrone et al., 2003; Shou et al., 2022; Williams, 2002). These individuals often form personal ties that are beneficial in forming the basis for developing trust between partners, and aid joint decision-making and knowledge sharing (e.g., Adobor, 2006). Boundary-spanners also tend to be trusted by other boundary-spanners (from partnering organizations) if they exhibit high levels of role autonomy, a multidimensional concept that reflects the discretion that agents have in interpreting and enacting their roles (Perrone et al., 2003). To explore further an individual boundary-spanners' motivation to share knowledge, we adopt an SDT approach.

SDT is a theory of human motivation which helps explain how individuals interact with the social environment and exhibit a behavior (Deci et al., 2017). A central tenet of SDT is that individuals possess innate tendencies and mechanisms to optimize their well-being, development, and motivation (Ryan and Deci, 2000). Two broad types of motivation represent opposite ends of self-determination: autonomous and controlled (Deci et al., 1994; Gagné and Deci, 2005). Autonomous (or intrinsic) motivation manifests where engaged behavior is congruent with the individual's own interests and values (i.e., value internalization; Reinholt et al., 2011). The locus of cause for such motivation is internal, since boundary-spanners perceive themselves as having a choice of when, and how to share knowledge. By comparison, controlled (or extrinsic) motivation reflects engagement in behaviors due to an external source of pressure, which acts to reduce autonomy and self-determination (Ryan and Deci, 2000). The locus of cause for such motivation is external, where boundary-spanners may share knowledge to meet an external expectation, comply with regulations, or maintain their reputation in the social environment. Black and Deci (2000) argued that motivated behaviors vary in the degree to which they are autonomous versus controlled, and distinguish extrinsic motivation into four regulatory styles (ranging from external to integrated regulation). Following prior management studies that used SDT to show empirically the effectiveness of both autonomous and controlled motivation in motivating knowledge sharing behavior (Bock et al., 2005; Gagné, 2009; Lin, 2007), we adopted the categorization of autonomous and controlled motivation.

SDT argues that the social context can facilitate internalization of controlled motivation through satisfaction of three innate needs: autonomy, competence, and relatedness (Deci et al., 1994; Weibel, 2007). The need for autonomy focuses on the experience of freedom, based on an individual's own volition and choice. Individuals who experience autonomy have a sense of ownership of behavior (Gagné and Deci, 2005) that is central to the ability to transform extrinsic into intrinsic motivation. The need for competence refers to when individuals feel effective in their ongoing interactions with the environment, and try to maintain their capacity, and skills through actions (Ryan and Deci, 2000). Lastly, the needs for relatedness refers to the feelings of being connected to other people in a social context (Van den Broeck et al., 2016). Studies have used SDT to investigate a range of topics within organizations, such as knowledge sharing (Reinholt et al., 2011), citizenship behavior

(Chiniara and Bentein, 2016), and employees’ performance (Aryee et al., 2015). In the OSCM field, SDT is still under-utilized to understand individuals’ behavior. Roehrich et al. (2017) explored how realizing improved green supply chain management performance in the aerospace industry is contingent upon SDT mechanisms of autonomy, competence, and relatedness. Building on SDT, the study by Ta et al. (2021) explored the ways that variations in messages presented to crowdsourced agents can serve as a mechanism to enhance participation and associated performance outcomes.

Across these studies, the need for autonomy is regarded as the most salient need and is a robust predictor of autonomous motivation for various behaviors, such as knowledge sharing (Kuvaas et al., 2014; Roehrich et al., 2017). Autonomy is related to the experience of oneself as the locus of causality for one’s own behavior. Accordingly, autonomy-supportive mechanisms such as incentive provisions and network governance may be used to encourage self-regulation and support a sense of choice (Deci et al., 1994; Ryan et al., 2000). In turn, such mechanisms help enhance autonomous motivation and/or internalize controlled motivation (Benita et al., 2014). We explore these concepts of incentives and network governance in further detail below.

2.2 Incentive provisions

The main purpose of an incentive provision – whether bonuses and/or penalties - is to motivate firms and/or individuals to collaborate through aligning goals, and sharing risks and benefits for project performance

(Meng and Gallagher, 2012). Extant research has examined the effect of performance incentives on coordination and cooperative behaviors (Chen et al., 2015; Kwon et al., 2010; Song et al., 2020). Such contracts involve fixed and variable payments tied to pre-defined performance objectives. In the context of project-based supply networks, buyers may use performance incentives (e.g., time-based incentives) to ensure not only coordination to meet performance objectives, but also to motivate cooperative behaviors between suppliers (Kwon et al., 2010; Song et al., 2020).

Both bonus and penalty provisions are commonly used in inter-organizational projects to govern suppliers' behavior and motivate desired actions (e.g., Crama et al., 2019; Han et al., 2019; Kwon et al., 2010; Roels et al., 2010; Siemsen et al., 2007). Penalties (e.g., risk-sharing incentives) are framed negatively in terms of losses (Christ et al., 2012), and typically specify monetary deductions from a base pay-out if contract specifications are not met (e.g., late delivery) (Lee et al., 2018). Penalty provisions have been applied to the supply network of projects such as Boeing 787 Dreamliner, Airbus 380, and China's Comac C919 (Song et al., 2019). On the other hand, bonuses provisions (e.g., gain-sharing incentives) are framed positively in terms of gains. These provisions generate positive motivation – i.e., receiving a reward where performance objectives are met and/or over-fulfilled (Christ et al., 2012). Bonuses generally have a fixed base amount at the start of the contract as well as an additional reward to motivate the supplier's performance and discourage inefficiency (Lee et al., 2018).

With respect to knowledge sharing outcomes, prior work supports a positive effect of incentive provisions within a project context (Meng and Gallagher, 2012). By focusing effort on achieving rewards or avoiding penalties, they act to enhance an individual boundary-spanner's motivation to share knowledge (Crama et al., 2019; Siemsen et al., 2007). Crama et al. (2019), for example, investigated the role of bonuses in aligning individuals' goals and outcomes to promote mutual help and knowledge sharing within new product development projects. Similarly, Siemsen et al. (2007) adopted an analytic modelling approach to show that when individual project members' tasks are interrelated, the use of individual-based bonus provisions and/or group-based penalties motivate knowledge sharing. Other work has examined the use of bonuses versus penalties in motivating factory workers (Hossain and List, 2012). The authors show that conditional incentives framed as both losses and gains increase productivity, but that bonuses posed as losses rather than as gains lead to more acute responses.

Despite these positive associations to knowledge sharing, prior studies have predominantly examined the effectiveness of incentive provisions in isolation (e.g., Lee et al., 2018), and overlooked whether such incentives are compatible with broader governance approaches in projects (Foss et al., 2010; Deci et al., 2017). In complex settings, such as project-based supply networks, various governance mechanisms work in combination to control suppliers' behavior and motivate knowledge sharing (Oliveira and Lumineau, 2017). Research in analogous fields of studies has started to show when used in combination with other governance mechanisms, the effect of incentives on individuals' motivation may be reduced, enhanced, or complemented (Deci et al., 2017; He et al., 2020; Lohmann et al., 2016). To address this lacuna, we review network governance in further detail.

2.3 Network governance

Network governance refers to the use of a structure of authority within project-based supply networks to maintain project coherence and quality from initial project vision to delivery (Anderson and Parker, 2013; Pathak et al., 2014). For project-based supply networks with a distinct objective, some form of administrative structure is necessary to ensure that suppliers engage in mutually supportive actions, that conflict is addressed, and that network resources are acquired and utilized efficiently (Provan and Kenis, 2008). Prior work distinguishes mainly two modes of governance: lead and shared. While lead governance relies on a structure where a third-party organization is given authority to coordinate network-level activities on behalf of the buyer (Park, 1996), shared governance refers to a network where the buyer delegates authority to suppliers to mutually control and coordinate network-level activities during project execution (Provan and Kenis, 2008).

Traditionally, many supply networks relied on a lead governance model. For example, Pathak et al. (2014) illustrated both Honda and Daimler Chrysler's center console supply networks where a hub supplier (e.g., Textron in Daimler's case) functions as a lead firm coordinating operations tasks and interaction between more than ten suppliers. Within a project environment, the use of an external consultant, or PMO, to coordinate network-level activities is also critical as such organizations have specialized expertise that allows them to anticipate coordination needs amongst suppliers (Oliveira and Lumineau, 2017).

Shared governance, on the other hand, is increasingly used to enhance suppliers' mutual participation and commitment to projects (Banaszak et al., 2020; Gutierrez et al., 2020). For instance, in health services, shared governance is used in part because it is seen as an important mechanism for building "community capacity" (Provan and Kenis, 2008). Similarly, multi-party alliances leverage such structures to bring firms together in developing new products or services in ways that could not be accomplished through disjointed efforts of independent network members (Provan and Kenis, 2008). The Ventilator Challenge UK is one recent example of a shared-governance model (Davies, 2020).

Managing knowledge flows is intrinsic to both forms of network governance, although through two distinct sources of motivation. The focus in lead-governed networks is on using hierarchical authority to foster extrinsic sources of knowledge sharing motivation (Braun, 2018). For example, one of the main tasks of a PMO is to identify unexpected issues in a project as they arise and encourage knowledge sharing when needed. By comparison, shared governance relies on participative forms of management and internal sources of motivation (Provan et al., 2017). Limited hierarchical oversight is applied during project execution, and coordination is reliant on the mutual participation of all suppliers in problem-solving and exchange of knowledge when needed.

3. Hypotheses Development

The following section develops hypotheses that examine the relative effectiveness of bonus versus penalty provisions in motivating discretionary knowledge sharing in project-based supply networks under lead- and shared-governed networks. Project-based supply networks are characterized by high temporality and inter-dependence of work between supplier partners. Mechanisms which enhance the autonomous motivation of key individual boundary-spanners to exercise their discretion toward collective project goals may be particularly valuable.

We first develop a hypothesis within a shared-governed network. In this network form, boundary-spanners have a voice in decision-making and greater latitude in managing their tasks within the network (Provan and Kenis, 2008). Such participative forms of management induce autonomous motivation for boundary-spanners, and are associated with high performance outcomes (Deci, 1972; Raelin, 2011). Individuals in these settings with high levels of autonomous motivation are more likely to perform well in a comprehensive way, even in activities like knowledge sharing which are not explicitly incentivized/regulated (e.g., Lohmann et al., 2016). In such settings, boundary-spanners can form personal ties that are beneficial in that they can form the basis for developing trust between partners, and aid joint decision-making and knowledge sharing (e.g., Adobor, 2006).

Introducing incentive provisions in such a setting may “crowd-in” or “crowd-out” the effects of autonomous motivation (also referred to as ‘autonomous needs fulfilment’), for the suppliers’ individual boundary-spanners working together on a project (Deci, 1972). Crowding-in reflects situations where another motivation with an internal locus of causality strengthens the effect of autonomous motivation of an individual. Crowding-out, by contrast, refers to a situation in which motivation with an internal locus of causality declines in importance relative to motivation with an external locus of causality (i.e., controlled motivation; Corduneanu et al., 2020). We now in turn propose directionality for relative effectiveness of bonus and penalty provisions, as the two incentives provisions considered in this study.

Under a bonus provision, the bonus performance target is framed as the maximum that may be achieved (Weber and Mayer, 2011), with buying firms offered a reward if the supplier project network exceed certain objectives. During project execution, such information may be interpreted as a signal that exceeding performance objectives (e.g., delivering before the deadline) is discretionary, aligning with a boundary-spanner’s autonomy need. Bonus provisions may thus have an additive effect (i.e., crowding-in) autonomous motivation, and thus enhance knowledge sharing motivation of the individual boundary-spanner. By contrast, using a penalty provision, the baseline performance target becomes the minimum performance objective that must be achieved within the project (Selviaridis and van der Valk, 2019). Buyers may specify monetary deductions from a base pay-out if it is determined that suppliers have not met the objectives (e.g., on-time delivery) (Lee et al., 2018). Boundary-spanners, acting on the behalf of their respective organization, will seek to maximize payouts for their organization and avoid deduction of payouts. During project execution, the possibility of monetary deductions from base payments in shared-governed networks may be interpreted as pressuring and 'threatening' (Churchill and Pavey, 2013), acting to crowd-out a boundary-spanner's autonomy motivation required to share discretionary knowledge.

In summary, within a shared-governed network, we argue that the effectiveness of bonus compared to penalty provisions in enhancing knowledge sharing is explained through the mediating role of boundary-spanner's autonomy needs fulfilment. Since bonuses compared to penalties reinforce boundary-spanners' autonomy, they are likely to crowd-in autonomous motivation, and enhance discretionary knowledge sharing motivation. Therefore, we hypothesize that:

> **H1.** *Within a shared-governed network, bonuses are more effective than penalties in enhancing boundary-spanners' knowledge sharing motivation, operating via autonomy needs fulfilment.*

Within lead-governed networks, individual boundary-spanners from partner firms have limited voice in decision-making, and latitude of action in coordinating network-level activities (Braun, 2018). The lead-governance form generates controlled motivation for boundary-spanners who require the third-party organizations' approval or disapproval for engaging in a behavior (Deci et al., 2017). In other words, the lead organization in such project-based supply networks will often closely manage activities and actions within the network, providing less autonomy to individual suppliers (and by extension their boundary-spanners). The locus of causality of behavior is perceived to be external (i.e., extrinsic motivation), where boundary-spanners perceive their behaviors as being directly controlled by others (Ryan and Deci, 2000). Parties under such arrangements are driven by the wish to "attain a desired consequence, or to avoid a threatened punishment" (Deci and Ryan, 2000, p. 236). Hence, in a lead-governed network, where the interactions among supplier firms is externally controlled, boundary-spanners within the individual firms experience high levels of controlled motivation to comply with expectations.

The lead-governed model emphasizes controlled motivation as the underlying mechanism to promote autonomy needs. Bonus and penalty provisions could thus act to either crowd-in or crowd-out controlled motivation (Deci, 1972). We argue that penalty provisions will crowd-in (or reinforce) the effect of controlled motivation, by further separating the locus of control and dampening boundary-spanners' autonomy needs in a project-based supply network (Deci et al., 2017). In such situations, boundary-spanners may share knowledge to oblige hierarchical authority and meet the deadline to avoid penalties. On the other hand, bonuses support autonomy needs through signaling voluntary meeting of objectives to receive rewards and hence, enhancing boundary-spanners' sense of autonomy (Lee et al., 2018; Weber and Mayer, 2011). In this way, bonus provisions may "crowd out" and weaken the effect of controlled knowledge sharing motivation in lead-governed networks.

Therefore, we argue that while penalties may further strengthen controlled motivation for knowledge sharing through the mediating role of boundary-spanners' autonomy need fulfilment, bonuses may weaken such effect by supporting boundary-spanner's needs for autonomy and crowding out controlled motivation.

> **H2.** *Within a lead-governed network, penalties are more effective than bonuses in enhancing boundary-spanners' knowledge sharing motivation through autonomy needs fulfilment.*

4. Method

To test our hypotheses, we used a behavioral scenario-based experiment which allowed us to deploy situational descriptions to assess knowledge sharing motivation of individual boundary-spanners. Experiments provide a controlled environment to test the impact of variables of interest on dependent variables, controlling for spurious effects (i.e., high internal validity) (Rungtusanatham et al., 2011). Extant research has utilized such experiments to study the effect of various (inter-) organizational factors on individual's perception, motivation, actions, and reactions (Ball et al., 2018; Vanpoucke and Ellis, 2019).

We selected this methodology for three main reasons. First, scenarios are commonly used by researchers to assess qualitative aspects of decision-making behavior (e.g., perceptions, motivations) (Chen et al., 2016). Second, such experiments examine participants' responses immediately following exposure to situational characteristics (e.g., organizational, structural, and relational variables), and hence minimize retrospective biases (Esslinger et al., 2019). Third, scenario-based experiments allow for standardizing situational factors and randomization of treatments across subjects, leading to high external validity (Rungtusanatham et al., 2011). In recent years, experiments have gained momentum within management and OSCM research (Eckerd et al., 2021; Vanpoucke and Ellis, 2019; Weber and Bauman, 2019), and have been widely used to study the effect of a range of network-level (Brands and Mehra, 2019), and inter-organizational (Chen et al., 2016) factors on individuals' motivation and behavior.

4.1 Experimental design

We examined the effect of the type of incentive provision (penalty versus bonus) and network governance (lead versus shared) on knowledge sharing motivation, operating indirectly through autonomy needs fulfilment. Each participant received one version of the scenario (Table 1), resulting in a 2 * 2 between-subject full factorial design. The scenario was adapted from an existing study by Esslinger et al. (2019) that uses a vignette about a project-based supply network. We conducted five interviews with project management experts and professionals to pilot test the situation described in the scenario. This helped ensure that the scenario was realistic, clear, and complete (i.e., includes all necessary information for participants to assume their role, and provide their responses) (Rungtusanatham et al., 2011).

All participants received an identical introductory section of the scenario about their role and context of the project. Participants were told to assume the role of a senior project manager at a supplier that manufactures and designs technical components for the electronics industry. In their role, each participant firm was part of a network with three other suppliers to manufacture and develop a new electric motor for a buyer’s new drone product. The drone market was described as highly competitive, and hence time-to-market was critical to the success of the project. Participants were told that the buyer had designed an incentive provision that mutually rewards (penalizes) the project-based supply network for on-time (late delivery) of the electric motor. Depending on the treatment, participants randomly received information about either a bonus or penalty provision. The scenario then randomly assigned treatment-specific information about network governance. We built on the conceptual definition of network governance (Provan and Kenis, 2008), and an existing manipulation of network characteristics (Brands et al., 2015; Brands and Mehra, 2019) to manipulate two modes of governance (lead versus shared).

Participants were finally informed about a technical problem faced by one of the suppliers in the network, which could lead to a delay in delivery of the electric motor. Participants were told that their company has knowledge that is likely to be helpful for addressing the problem and avoiding delays for the project as a whole. The scenario reiterated each participant’s boundary-spanning role in the firm and project, and that the discretion rests with them as to whether (or not) to share the relevant knowledge with the affected supplier partner. Participants were asked to indicate the extent to which they would be willing to do so. After reading the scenario, participants responded to a series of questions about the dependent and control variables, manipulation, and realism checks. Table 1 presents the experimental scenario and treatments.

[PLEASE INSERT TABLE 1 ABOUT HERE]

We recruited 217 participants through the Prolific online platform (prolific.co) (DuHadway et al., 2018). Participants were required to: (i) currently live in the UK; (ii) have at least A-level, or equivalent, education; (iii) be full- and part-time employees; and (iv) be self-employed/partner, and/or hold middle and upper management positions. The gender breakdown was 58% male/42% female, with an average work experience of participants of 15.30 years. We also asked participants to indicate their experience in project environments (*M* = 3.25, *SD* = 1.29), and an inter-organizational context (*M* = 3.26, *SD* = 1.11) on a 5-point Likert scale (1= “not at all”; 5 = “a great deal”). Education level was assessed based on participants’ highest level of education (1 = “high school degree”; 2 = “some college”; 3 = “bachelor's degree”; 4 = “master’s degree”; 5 = “professional degree”; 6 = “doctorate”). Table 2 provides a summary of the sample demographics, categorized by treatment.

[PLEASE INSERT TABLE 2 ABOUT HERE]

4.2 Measurements

We used existing multi-item measurements to assess participants’ responses to dependent and control variables. All questions were measured on a 7-point Likert scale. Descriptive statistics are provided in Table 3.

[PLEASE INSERT TABLE 3 ABOUT HERE]

Knowledge sharing motivation. To assess knowledge sharing motivation, we adopted established measures from prior studies (Chen et al., 2016; Siemsen et al., 2008). After reading the scenario, participants responded on a 7-point scale (1 = "strongly disagree"; 7 = "strongly agree") to the following statements: "I have no intention to share this knowledge" (reverse-coded), "I am motivated to share what I know", "I really want to share this knowledge", "I mean to share this knowledge", and "I have no intention to share this knowledge."

Autonomy needs fulfillment. Autonomy needs fulfilment was assessed using an existing multi-item measurement (Chiniara and Bentein, 2016). Participants indicated on a 7-point scale how satisfied they were (1= "extremely dissatisfied"; 7 "extremely satisfied") about "the opportunities to take personal initiatives in the project", "the level of autonomy I have in the project", "the opportunities to exercise my own judgment and my own actions", and "the degree of freedom I have to do my job the way I think it can be done best."

The treatment variables were the type of incentive provision and network governance. We created dummy variables for each of the treatments. Penalty provision (= 0) and lead governance (= 0) were used as the reference groups for the type of incentive provision and network governance, respectively.

Control variables. To account for the effect of extraneous variables, we included a set of demographic-related control variables, including participant's work experience in inter-organizational settings and education-level (Esslinger et al., 2019; Siemsen et al., 2008), as well as age (in years) and gender (female = 1). We also added control variables to capture individual differences in behavior. Loss aversion and perceptions of contract fairness were introduced as previous work has shown they influence the effectiveness of incentive provisions (e.g. Lee et al. 2018; Li and Cropanzano, 2009). Similarly, we measure risk aversion since the scenario requires participants to make a decision involving a potential gain or loss. Participants attitude toward risk, either risk-seeking or risk-aversion, may therefore influence their intentions to share knowledge with a supplier partner. These behavioral controls were intended to ensure that the observed effects were due to differences in governance and incentive mechanisms, rather than individual differences.

Confirmatory factor analysis (CFA) was used to assess the reliability and validity of our multi-item measurement model (i.e., knowledge sharing motivation, autonomy needs fulfilment, risk aversion). We applied maximum likelihood estimation with robust standard errors using the MLR estimator implemented in *Lavaan* (Version 0.6-4). Overall, the measurement model showed satisfactory psychometric properties (Kline, 2005). Table 4 illustrates all scale items and reliability indicators. All factor loadings exceed a .50 threshold and we observed no cross-loadings of items (Hair et al., 1998). Average Variance Extracted (AVE) values of our main variables were greater than .50[1], and Cronbach's alpha values exceeded the .70 threshold, indicating good validity and

[1] AVE for "risk aversion" – one of our control variables - is 0.46.

reliability of our measures. In addition, we checked for discriminant validity of the measures by comparing the AVE for each construct and the squared correlation between each pair of constructs (Fornell and Larcker, 1981). There were no concerns about discriminant validity of the measures.

[PLEASE INSERT TABLE 4 ABOUT HERE]

4.3 Manipulation and realism checks

To check our manipulation, we asked participants to indicate how concerned they were with bonuses or penalties when reading the scenario (1= "entirely concerned with penalties"; 7 = "entirely concerned with bonuses"). The results of an ANOVA showed significant difference between responses across the two treatments ($F(1.215) = 11.27$, $p < 0.001$). In addition, we checked manipulation of network governance by asking participants to indicate on a 7-point scale (1= "strongly disagree"; 7= "strongly agree") the extent to which they agree or disagree that suppliers' activities within the project is managed "jointly by all the suppliers in the network" or "through an external organization" (i.e., reverse coded). We averaged responses to these two items and ran ANOVA to check differences between the two experimental conditions (i.e., lead and shared). The results of an ANOVA proved the effectiveness of our manipulation ($F(1.215) = 132$, $p < 0.001$). Furthermore, to check realism of the scenario, we asked participants to indicate the extent to which they agree with the following statements: "the situation described in the scenario was realistic"; "I can imagine myself in the described situation"; and "I took my assumed role seriously while reading the scenario". With an average score of 5.90 on a 7-point Likert scale, the study may be deemed realistic.

5. Findings

We employed Hayes's (2013) PROCESS2 Model 7 with 95% bias-corrected confidence intervals and 5,000 bootstrap subsamples to test our hypotheses (see Figure 1). The PROCESS macro is widely used in several disciplines, including marketing and organizational behavior (Feenstra et al., 2020; Kanze et al., 2018), and OSCM (Mir et al., 2017; Cantor et al., 2019). PROCESS uses bootstrapping on a series of regression models to calculate the path coefficients and SEs, and determine the strength and statistical significance of the indirect effect (Hayes, 2013). Using the PROCESS model, the indirect effects (i.e., mediation and moderated mediation) are confirmed if zero is not included in the confidence interval (CI) of the indirect effect. Participants' age, gender, work experience, education background, loss aversion, risk aversion, and fairness perception were added to the model as covariates. Table 4 shows regression results for the two parts of the model, with autonomy needs fulfilment and knowledge sharing motivation as dependent variables, respectively.

[PLEASE INSERT FIGURE 1 & TABLE 5 ABOUT HERE]

Consistent with our argument, we found that the effectiveness of incentive provisions in knowledge sharing motivation depends on the form of network governance, mediated by autonomy need fulfilment. The index of moderated mediation of network governance (Index = -0.138, 95% CI = [-0.320, -0.004]) was significant. No significant direct effect was identified between incentive provisions and knowledge sharing motivation (*b* = -0.157; *95%CI* = [-0.445; 0.184]). As predicted by Hypothesis 1, within shared-governed networks, bonuses are significantly more effective than penalties in motivating knowledge sharing, operating via autonomy need fulfilment (*b* = 0.099; *95%CI* = [0.003; 0.234]) (Table 5). We find no support for Hypothesis 2, with findings indicating that the effectiveness of bonus and penalty provisions in knowledge sharing motivation is not significantly different within lead-governed networks (*b* = -0.039; *95%CI* = [-0.147; 0.617]) (Table 5).

[PLEASE INSERT TABLE 6 ABOUT HERE]

Using a spotlight analysis (Spiller et al., 2013), we compared the effectiveness of bonus compared to penalty provisions on autonomy need fulfilment across lead and shared governed networks. As shown in Figure 2, bonuses are significantly more effective than penalties in supporting an individual boundary-spanner's autonomy need fulfilment in shared-governed networks (*Slope = 0.357, p < 0.05*). The impact of the type of incentive provision on autonomy need fulfilment was non-significant in lead-governed networks (*Slope = -0.139, p = n.s*).

[PLEASE INSERT FIGURE 2 ABOUT HERE]

6. Discussion

Project-based supply networks - particularly where buying firm has limited day-to-day involvement - are becoming commonplace for private and public organizations (Manning, 2017). The buying firm's *ex ante* decisions regarding the governance structures and incentive provisions are key to encouraging appropriate coordination and control, and knowledge sharing, within the network. Our study draws on SDT (Ryan and Deci, 2000) to investigate the interactive effect of the type of incentive provisions and network governance on boundary-spanners' motivation to share knowledge within project-based supply networks. The sections below explore the theoretical contributions, boundary conditions, and practical implications of our study.

6.1 Theoretical contributions

While prior OSCM research indicates a positive impact of penalty and bonus provisions on knowledge sharing motivation in projects (Crama et al., 2019; Siemsen et al., 2007), the effectiveness of such provisions, and the use of both, in the presence of other governance mechanisms has been largely ignored in prior studies. This is an important omission in project-based supply networks, where multiple incentive and control mechanisms are used to address the interdependency of suppliers' activities and time-sensitive nature of the work (Oliveira and Lumineau, 2017). To address this gap, we adopt the concept of "network governance" from public administration and strategic management research (e.g., Provan et al., 2007; Raab et al., 2015).

We now review our findings relating to the relative effectiveness of incentive provisions under differently governed network conditions. Previous SDT studies argue incentive provisions per se may not dampen autonomous knowledge sharing motivation (e.g., Corduneanu et al., 2020; Deci et al., 2017); rather, different incentives could “crowd in” or “crowd out” autonomous motivation depending on the extent to which they support boundary-spanners’ autonomy needs. We show that incentive provisions work most effectively when they reinforce underlying motivation, manifesting in boundary-spanners’ autonomy needs fulfilment. More specifically, our findings show that in shared-governed networks, bonuses are more effective than penalties in enhancing knowledge sharing motivation. In line with SDT, bonuses appear to encourage the underlying autonomy motivating mechanisms of boundary-spanners, which manifests as autonomy needs fulfilment and motivation to share knowledge. We find evidence that bonus provisions have an additive effect (i.e., crowd-in) autonomous motivation within the context of project-based supply networks.

Contrary to expectations, we find no systematic difference between the effectiveness of bonus and penalty provisions in lead-governed networks (b = -0.0395; *95%CI* = [-0.1476; 0.617]). One explanation may be the relative size and amount of incentive provisions (Deci, 1972). Lead-governed networks are reliant on high controlled motivation as the underlying driver to enhance autonomy needs fulfilment of individual boundary-spanners. It is possible that relatively larger penalties are required to generate the coercive effects of hierarchical control which incentive knowledge sharing motivation in order to meet the project deadline. The findings may also be explained through the lens of incentive design. Performance-based incentives tend to motivate attention on the explicit dimensions of performance (e.g., such as the time-based mechanisms used in our experiment). Since knowledge sharing in project-based supply networks is difficult to explicitly contract for and/or monitor (Dyer and Nobeoka, 2000), performance-based incentives may only motivate indirectly knowledge sharing across organizational boundaries. Put simply, boundary-spanners focus their knowledge sharing efforts where collaboration and problem-solving will influence the project-based supply network's ability to achieve the incentivized project objectives (Suprapto et al., 2016). In the presence of hierarchical control (i.e., lead governance), boundary-spanners may narrowly focus on behaviors that are explicitly rewarded or punished (Lohmann et al., 2016), limiting the relative effectiveness of incentive provisions in stimulating knowledge sharing.

Our results provide further insights on the role of network governance within supply networks. Previous OSCM research has focused on a dyadic buyer-supplier context, and the relationship between governance mechanisms and knowledge sharing (Li et al., 2014; Liu et al., 2009; Yam and Chan, 2015). We offer one of the first theoretical discussions and empirical insights on the impact of network-level governance decisions on the behavior of individual firms and their boundary-spanners in a project-based supply consortium. Our findings show that the buying firms' decisions on the structure of the governed network ex ante have significant interaction with other governance mechanisms, such as incentive provisions including bonuses and penalties. Projects which require high levels of knowledge sharing among partner firms benefit most from use of bonuses and a shared-governance mode. Second, we also offer a perspective on the role of individual boundary-spanners within project-based supply networks, highlighting their role in facilitating knowledge sharing among partner firms (cf., Jarvenpaa and Majchrzak, 2016; Ta et al., 2021). In particular, we sought to untangle how the *ex ante* design choices around management interventions and incentive structures influences individuals' perceptions and motivations to share knowledge. To the best of our knowledge, our study is an early attempt in OSCM (cf., Chen et al., 2016) that focuses on the micro-foundations of knowledge sharing driven by inter-organizational factors. Individuals are key knowledge holders within and across organizational boundaries, and SDT provides a lens to show that knowledge sharing within project-based supply networks, at least partly, can be explained through fulfilling individuals' innate needs for autonomy.

6.2 Boundary conditions and future research opportunities

Our research focused on the interactive effect of the type of incentive provisions and network governance modes on knowledge sharing motivation, operating via autonomy needs fulfilment. While the findings contribute to our understanding of the underlying mechanisms by which the buyer can influence knowledge sharing in a project-based supply network, it does not reflect on the regulatory mechanisms of an individual's home organization. Management scholars have argued that knowledge sharing behavior may be also influenced simultaneously by the context of a home organization (e.g., Jarvenpaa and Majchrzak, 2016). The characteristics of home organizations (e.g., managerial discretion, bureaucratic control systems) may play a role in supporting/hampering autonomy needs, and decisions by boundary-spanners within an inter-organizational network setting. Future research could explore the interaction between regulatory mechanisms at the home organization and the inter-organizational context. Moreover, future studies may adopt the distinction by Black and Deci (2000) in order to explore the four regulatory styles of extrinsic motivation (ranging from external to integrated regulation), and how the various regulatory styles may be affected by different incentive and governance structures.

In addition, we used a behavioral experiment to control for a range of supplier-supplier relational factors on individuals' autonomy needs, and their decision to share knowledge (Wu et al., 2010). This was plausible as it allowed us to ensure variations in individuals' autonomy needs fulfilment, and knowledge sharing motivation were indeed caused by our experimental treatments. Knowledge-sharing within such networks may, however, also be affected by potential shadows of the past and/or future between suppliers in networks (Phelps et al., 2012). Future efforts may extend findings from our study and examine the relative effect of project- and network-level versus dyadic factors in enhancing boundary-spanners' motivation to share knowledge. Following Craighead et al. (2020), we would urge future studies to explore prospect theory and its focus on decision-making under uncertainty. This is particularly pertinent when seeking to explain decisions (such as to share (or not to share) knowledge) during and after pandemics (describing a highly uncertain environment). Future research may build on prospect theory to examine more deeply how the way a problem is framed influences actors' decisions (i.e., describing a situation in negative terms will lead to riskier choices than if the same scenario is described in positive terms), and its impact on knowledge sharing in project-based supply networks. Future work might also explore how the probability distributions faced by decision makers around bonuses and penalties affects their discretionary actions in an inter-organizational context.

Lastly, our experiment closely examined how individuals' autonomy needs fulfilment enhances knowledge sharing within a project-based supply network. While many of our findings are relevant to public and private organizations managing project-based supply networks, future research could compare our findings with other types of relationships and organizations (such as public-private, or involving NGOs), and across other sectors with different characteristics (e.g., different clock speed, different type of product/service).

6.3 Implications for practice

Our findings have important implications for buyers when establishing and managing project-based supply networks. Buyers often have limited oversight over day-to-day operations of these networks. At the same time, successful project delivery relies on knowledge sharing between participating suppliers. This is particularly important in project where suppliers with limited/no prior joint work experience must coordinate to deliver complex, innovative, and/or time-sensitive products and/or services. We show that the choice of governance structure and incentive provisions ex-ante can play a significant role in motivating knowledge sharing during project execution, and the buyer can play a crucial role in supporting (or hindering) knowledge sharing for the benefits of the project. In particular, the choice of bonus versus penalty provisions is particularly important when setting up a shared-governed network. Within these networks, using bonus provisions provide a significantly stronger motivational mechanism than penalties to discretionary knowledge sharing. In other words, for projects which require high levels of knowledge sharing (e.g., in situations where suppliers have to develop an innovative product (high uncertainty), and in which suppliers have no prior joint working experience) among partner firms benefit most from use of bonuses and a shared-governance mode.

By comparison, the emphasis on incentive provisions has little implication for knowledge sharing within lead-governed networks. In this context, buyers may need to install explicit hierarchical mechanisms to actively encourage the sharing of knowledge, such as direct intervention or operational tracking mechanisms. Here, the buyer may also decide to play a more active role in managing the network, and thus stimulate more knowledge sharing between partnering suppliers. Overall, at the outset of setting up project-based supply networks, the buying firm should consider carefully, and balance potential trade-offs, the benefits of each type of network governance (shared vs. lead) in combination with incentive provisions to drive broader operational performance measures vis-à-vis the need (degree of) knowledge sharing between suppliers.

7. Conclusions

We apply self-determination theory (SDT), an under-utilized theory in OSCM studies, to examine the interactive effect of incentive provisions (penalties and bonuses), and network governance (lead or shared) on knowledge sharing motivation by individual boundary-spanners within project-based supply networks. Project-based supply networks are an emerging form of organizing used to meet buyers' operational and innovation goals. Knowledge sharing in these networks plays a key role in successful project delivery, but numerous examples highlight the difficulty in achieving this in practice.

Our findings, from a scenario-based behavioral experiment of 217 professionals in the UK, highlight that when suppliers have shared responsibility for managing the network (shared governance), bonuses are more effective than penalties in motivating knowledge sharing through support of boundary-spanners' autonomy needs. However, where the buying organization has transferred responsibility for managing the network to an external third-party organization (lead governance), there is no significant difference between the effectiveness of penalty versus bonus provisions in motivating knowledge sharing. Our findings encourage future research to augment our understanding of the effective use of incentive provisions for motivating individual boundary-spanners to share knowledge in project-based supply networks.

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FIGURES AND TABLES

Figure 1 Incentive provisions' conditional indirect effects on knowledge sharing motivation through autonomy need fulfilment (Hayes' model 7)

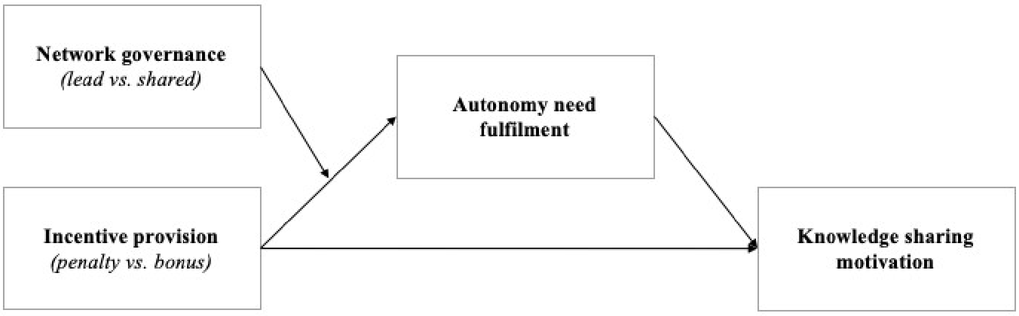


Figure 2 Interactive effect of the type of incentive provision and network governance on autonomy need fulfilment

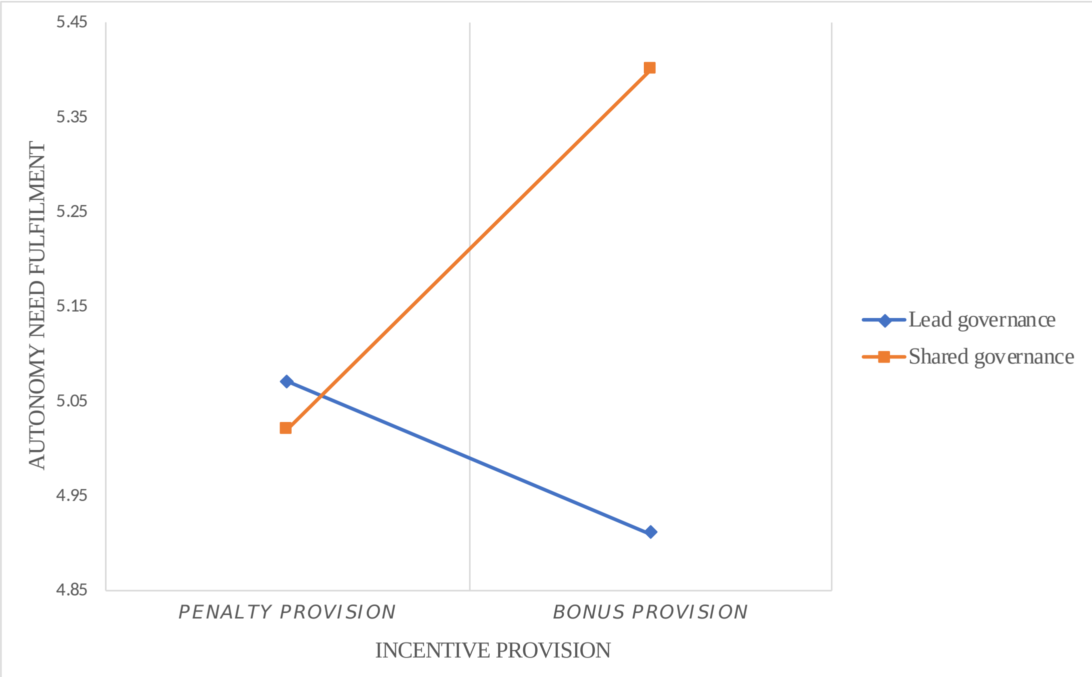


Table 1 Scenario for Experiment

<table>
<tr><td colspan="2">Your role and company
You are a senior project manager at SPLR, a mid-sized company that supplies technical components for the electronics industry. One of your customers — a drone manufacturer called JDI — has recently initiated a project to involve suppliers in the development and manufacture of a high-performance electric motor. This motor is intended to power JDI’s next generation of drones.

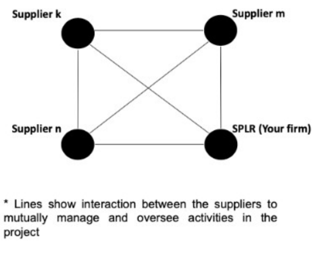
Overall, your business relationship with JDI is solid and professional; both companies value the balanced nature of your buyer–supplier relationship. In terms of your overall sales volume and profit, you would consider JDI to be one of your company’s larger business customers.

Your company is part of JDI’s network of direct suppliers for this project. This network comprises of four suppliers that will develop and deliver the electric motor.

The drone market is highly competitive and speed to market is critical to the success of a new drone product. Therefore, timely delivery of the electric motor is critical. As a senior project manager, you are in charge of your company’s performance in this project.

Supplier network
The suppliers will receive fixed payments for designing and delivering the electric motor’s components, subject to meeting JDI’s quality and cost requirements.</td></tr>
<tr><td>[PENALTY PROVISION]
In addition, JDI has estimated an optimal completion date for the project and assigns a joint performance-contingent penalty for the supplier network of the electric motor. If the suppliers fail to deliver the electric motor on-time, there will be a joint financial penalty. The penalty will be paid equally by all the four suppliers. The goal of the penalty is to ensure that you and the other suppliers will deliver the electric motor on-time.</td><td>[BONUS PROVISION]
In addition, JDI has estimated an optimal completion date for the project and offers a joint performance-contingent financial bonus for the supplier network of the electric motor. If all the suppliers complete their individual tasks and deliver the electric motor on-time, JDI will offer a joint financial bonus. The bonus will be shared equally among the four suppliers. The goal of the bonus is to encourage you and the other suppliers to deliver the electric motor on-time.</td></tr>
<tr><td>[LEAD GOVERNANCE]
JDI has appointed an external Project Management Organization (PMO) to monitor the performance of you and the other suppliers in the electric motor network. The PMO is responsible for centrally monitoring the performance and ensuring project goals are met. As the representative of your company, you interact with the PMO that centrally manages and monitors performance in the electric motor project. Figure 1 (below) illustrates interactions between suppliers and the PMO.

Figure 1</td><td>[SHARED GOVERNANCE]
You and the other suppliers in the electric motor network are mutually responsible for monitoring performance and ensuring project goals are met. As your company’s representative, you interact with senior members of the other suppliers to mutually manage and monitor the performance in the electric motor project. Figure 1 (below) illustrates interactions among suppliers.

Figure 1

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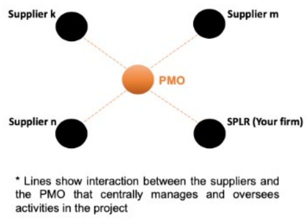

The challenge

You have become aware that one of the suppliers in the network is experiencing a technical problem in their work. The issue could result in delays in completing their project task and therefore, on-time delivery of the electric motor. Should a delay eventuate, it will not influence your reward.

Your company has some knowledge pertinent to this specific technical problem. This is an opportunity to share your company's knowledge with the affected supplier in order to resolve the issue. However, if you offer to share the knowledge, there is also a risk that this knowledge may be leaked to other suppliers in the wider electronic industry, that are also your competitors.

Given the situation described above, how would you be most likely to react?

Table 2 Demographic data of experiment participants, by treatment

	Lead Governance, Penalties	Shared governance, Penalties	Lead Governance, Bonuses	Shared Governance, Bonuses
N	55	55	54	53
Gender (female / male)	52% / 48%	46% / 54%	52% / 48%	49% / 51%
Age	42.69 (11.75)	34.12 (9.14)	39.16 (9.45)	38.94 (10.28)
Work experience	3.18 (1.26)	3.30 (1.12)	3.18 (1.23)	3.38 (1.28)
Education	3.20 (1.20)	2.96 (1.23)	2.93 (1.22)	3.05 (1.24)

N = 217; std. dev. in parenthesis

Table 3 Descriptive statistics

	Variable	Mean	Standard deviation	1	2	3	4	5	6	7	8
1	Knowledge sharing motivation	4.53	1.27	1.00							
2	Autonomy need fulfilment	5.11	1.00	.17	1.00						
3	Education	3.04	0.39	.10	-.05	1.00					
4	Age	38.73	10.59	-.02	.04	-.03	1.00				
5	Work experience	3.26	1.21	.03	.14	.08	-.01	1.00			
6	Fairness	2.05	1.13	.09	.46	-.06	-.02	.02	1.00		
7	Risk aversion	4.55	1.36	.08	.13	.05	.12	.15	.07	1.00	
8	Loss aversion	6.01	0.96	-.13	.14	.09	-.02	.12	.05	.32	1.00

n=217; * p ≤ .05, ** p ≤ .01

Table 4 Confirmatory factor analysis

Measures and associated indicators	α	AVE	λ^a	*SE*	*z*-value	R^2
Knowledge sharing motivation	0.86	0.63				
After reading the scenario, please indicate to what extent you would like to engage in knowledge-sharing?						
I have no intention to share this knowledge			0.62	–[b]	–[b]	0.39
I am motivated to share what I know			0.91	0.17	8.10	0.83
I really want to share this knowledge			0.74	0.17	7.23	0.55
I mean to share this knowledge			0.89	0.18	8.08	0.79
Autonomy need satisfaction	0.81	0.55				
After reading the scenario, how satisfied are you with the following aspect of the project?						
the opportunities to take personal initiatives in the project			0.59	–[b]	–[b]	0.34
the level of autonomy I have in the project			0.70	0.14	7.08	0.49
the opportunities to exercise my own judgment and my own actions			0.75	0.25	5.91	0.56
			0.88	0.25	6.20	0.77
Risk aversion	0.76	0.46				
For each of the following statements, please indicate the likelihood of engaging in each activity or behavior.						
Investing 10% of your annual income in a moderate growth mutual fund			0.50	–[b]	–[b]	0.25
Investing 5% of your annual income in a very speculative stock			0.56	0.26	5.16	0.31
Investing 5% of your annual income in a conservative stock			0.88	0.41	4.61	0.78
Investing 10% of your annual income in government bonds (treasury bills)			0.71	0.30	5.46	0.50

Table 5 Results of regression analyses in predicting autonomy need fulfilment and knowledge sharing motivation

	DV = Autonomy need fulfilment		**DV = knowledge sharing motivation**	
	B	*SE*	*B*	*SE*
Gender	0.048	0.120	0.041	0.174
Education	-0.046	0.052	0.136^{*}	0.075
Age	0.006	0.006	-0.005	0.008
Work experience	0.132^{**}	0.051	0.006	0.074
Fairness	0.392^{***}	0.057	-0.030	0.091
Loss aversion	0.101	0.068	-0.0246^{**}	0.098
Risk aversion	0.028	0.047	0.114^{**}	0.068
Type of incentive (bonus = 1)	-0.15	0.167	-0.157	0.173
Network governance (shared = 1)	-0.012	0.176		
Type of incentive * Network governance	0.513^{**}	0.242		
Autonomy need fulfilment			0.270^{***}	0.099
R^2	0.297		0.083	
F	8.533		2.036	
P	0.000		0.037	

Note.
$^{*}p < 0.1$; $^{**}p < 0.05$; $^{***}p < 0.01$

Table 6 Conditional indirect effects through autonomy need fulfilment

	Effect	***SE***	***LLCI***	***ULCI***
Lead governance	-0.0395	0.0508	-0.1476	0.0603
Shared governance	0.0990	0.0620	0.0030	0.2337