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Enabling Knowledge Sharing Through Relational Capital in a Family Business Context

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Abstract

This article provides a more comprehensive view of relational capital (RC) and how it affects knowledge sharing (KS) within family firms. Through the lens of an RC framework with four dimensions (agent, context, object, and relationship) and a relational perspective, we propose that the agent, context and relationship have an effect on the sharing of the object (knowledge). To operationalize the dimensions we used mutual trust and reciprocal commitment to represent the agent, norms and sanctions the context, and strength of ties the relationship. To empirically test the proposal, quantitative relational data at the dyadic level was collected from 27 agents including family members and non-family members in a manufacturing company located in Mexico. Data was analyzed using social network analysis through multiple regression quadratic assignment procedure (MRQAP). Findings suggest that RC is better represented by one individual dimension (mutual trust), one relational dimension (ties strength) and one contextual dimension (norms and sanctions) and they prove to have a significant effect on KS. This study contributes to the social capital and knowledge management literature by expanding, through a relational perspective, the understanding of the RC variables and their effects on KS within the context of family businesses in a Latin American emerging economy.

Keywords Family business · Knowledge sharing · Relational capital · Social network analysis · RC framework

This article is part of the Topical Collection on *Enhancing the Adaptability of Family Businesses to the Knowledge-based Economy*

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Introduction

Family firms, understood as an organization controlled and usually managed by multiple family members (Miller et al., 2007; Shanker & Astrachan, 1996), often from multiple generations (Anderson et al., 2003), are an interesting context in which to examine RC in order to explain specific and valuable outcomes such as KS (Chirico, 2008; Fernandez-Olmos et al., 2020; Pearson et al., 2008). One of the reasons is because family involvement in the business generates a unique bundle of resources and behaviors that possesses the potential to yield a competitive advantage for the firm (Habbershon & Williams, 1999; Habbershon et al., 2003). Two of such resources are internal RC (Pearson et al., 2008) and knowledge (Chirico, 2008). Additionally, family firms play an important economic and social role in developing economies (Wang, 2016), which increases the relevance to provide useful insights that may contribute to surpass their current challenges. For example, in the Mexican context, approximately 80% of businesses are family based, of which between 29 and 33% survive the transition to the second generation (Meza, 2017). Additionally, family businesses generate about 67% of employment and at least 62% of the country's GDP (San Martín & Durán, 2017).

Prior literature has found that when the family is involved in the business an internal social network of rich relationships rooted in family-based ties is created (Pearson et al., 2008). These ties create a form of internal social capital (Sharma, 2008) that is heterogeneous and relates to shared norms, values, vision, purpose, trust, and collective goal orientations within the organization (Leana & Van Buren, 1999; Oh et al., 2006; Sanchez-Famoso et al., 2015) that may yield a competitive advantage for the family firm (Arregle et al., 2007; Dess & Shaw, 2001; Pearson et al., 2008) through sharing knowledge more efficiently and with greater privacy compared to non-family businesses (Cabrera-Suárez et al., 2001; Miller & Le Breton-Miller, 2006; Tagiuri & Davis, 1996). Furthermore, the inherent commitment, family-specific norms, and family-based identity create a unique bond among family members but also permeates into the employees within the firm, increasing the probabilities to share knowledge. Such knowledge sharing and the unique bond may derive into having a psychological safe culture that allows for more innovative strategies and processes (Rivera et al., 2020; Sanchez-Famoso et al., 2015).

Furthermore, the acquisition and transfer of knowledge within firms from a relational perspective has emerged as an underlying theme in strategy and organization research. Despite these contributions, only a few studies focus on internal ties among employees, managers or departments (Thomsen & Hoest, 2001; Zhang et al., 2015) and even fewer in the family business context (Botero et al., 2021). In fact, even though the concept of relational value has generated interest in family business research, due to its association with the family's reputation (e.g., Binz et al., 2013) and the family ties, such studies are limiting because they do not explore RC in a comprehensive manner. For example, they typically consider only specific components of RC such as trust (Cabrera-Suárez et al., 2015),

or focus exclusively on family members, leaving out non-family members. Thus, a more comprehensive explanation is needed. Besides, in spite of the specificity and importance of family firms, to the best of our knowledge, the relationship between RC and KS within family firms has received little attention in previous studies (Cabrera-Suárez et al., 2015; Mani & Lakhal, 2015; Shi et al., 2015).

The main objective of this paper is to provide a more comprehensive view of the RC variables and how they affect KS within family firms. We propose that the RC within family firms may consider four dimensions (mutual trust, reciprocal commitment, norms and sanctions, and strength of ties), which are connected based on a RC framework proposed by Rivera and Carrillo (2016). According to this RC framework, there are four theoretical elements during a mutually corresponding ongoing exchange with any possible content between different agents. The agent that is she/he who knows, the object or that which is known, the context that provides significance and it has a referential nature and finally the existent tie between agents (relationship). In this paper we analyse the dynamic of these four theoretical elements arguing that the transfer of knowledge (object) depends on the other variables to be effective (agent, context, and relationship variables).

Moreover, according to Zamudio et al. (2014), the social capital literature and the social network analysis as a tool represent a solid theoretical base on which studies may draw to address both theoretical and empirical challenges in the family firm literature. Therefore, to empirically test our proposal, we collected relational data in a family firm located in Mexico and performed a statistical procedure called multiple regression quadratic assignment procedure. For the analysis, we included both family members involved in the firm, as well as non-family employees, and analyzed their interrelations.

The contribution of this study is threefold. First, this paper extends social capital literature (Pearson et al., 2008; Sirmon & Hitt, 2003; Zahra, 2010) by disentangling the elements that represents the RC and improves our understanding of human interactions related to the transfer of knowledge, which in previous studies has been found is particularly relevant for family firms (Botero et al., 2021). Second, this study empirically tests the RC and its dimension's direct effect on KS by using a relational data survey that includes family members and non-family members involved in the firm. According to Zamudio et al. (2014), empirical (and theoretical) network-based research in the family firm literature is scarce. Finally, the majority of prior research focuses on family firms in North America and Western Europe (Khavul et al., 2009), and only a few have focused on emerging economies (Aguinis et al., 2020; Ramírez-Solís et al., 2017). This paper provides a Latin American perspective.

This article is organised as follows. First we present the theoretical framework regarding KS, RC in the context of family firms, as well as how these variables and arguments are related and hypothesized. Afterwards, we described the research design, including the methods and procedures used for data collection and analysis. Then, the analysis and results are explained. Finally, a discussion and conclusions section provides practical and theoretical implications as well as limitations and future research lines.

Theoretical Framework and Hypotheses

Knowledge Sharing and Family Business

People share knowledge in order to survive. The process of socialization is fundamental in societies because it establishes the exchange of elements of value (for example, knowledge) through relationships. We learn because we interact with others and through these reciprocal interactions we exchange our knowledge and beliefs. Organizations are social constructions in which the people within share what they know and acquire new knowledge to achieve the collective objectives that they have proposed. More than ever, organizations must be able to assimilate knowledge to systematically improve their performance by incorporating this knowledge in their processes and activities (Del Giudice et al., 2017; Oliva et al., 2018).

Several authors have defined the concept of knowledge in the context of organizational studies. Despite some differences, this concept has common elements that are fundamental for its understanding. Knowledge is represented by a set of experiences, abilities and beliefs, it is created through human interactions and it is useful for making decisions (Carrillo, 2002; Davenport & Prusak, 1998; De Long & Fahey, 2000; Kerssens-Van Drongelen, 1996; Krogh et al., 2000; Nonaka & Takeuchi, 1995).

The study of knowledge in organizations has great relevance and is not recent (Grant, 1996; Kogut & Zander, 1992; Nonaka, 1994; Nonaka & Takeuchi, 1995; Polanyi, 1962). Various perspectives, as knowledge management (Del Giudice & Maggioni, 2014; Oliva & Kotabe, 2019), have been used to try to understand the importance of this intangible resource across and within organizational boundaries, as well as the conditions under which it is created, shared, distributed, transferred and applied to generate value in organizations (Ferraris et al., 2017; Grant, 1996; Kogut & Zander, 1996; Nonaka, 1994; Sala et al., 2016). It has been proven that when organizations implement and develop knowledge management principles, processes, and strategies appropriately, they obtain significant benefits from such implementation (Cohen & Olsen, 2015; Jain & Moreno, 2015; Obeidat et al., 2016; Scuotto et al., 2017; Shehzad & Khan, 2013; Taherparvar et al., 2014; Villar et al., 2014; Zhen et al., 2013).

Authors have argued that the transmission of knowledge can be considered from two perspectives. First, as the most important processes within organizations since, through it, agents transfer elements of value in organizations (Al Nahyan et al., 2019; Keszey, 2018; Pentland, 1995; Søndergaard et al., 2007). Second, as an organizational capability (Ali et al., 2019; Szulanski, 1996). In both cases, the transmission of knowledge implies the existence of a relationship between at least two agents, in which one possesses knowledge and another acquires it. In this sense, we argued that the transmission of knowledge has a relational nature. According to Argote et al. (2000) and Wijk et al. (2008) the transmission of knowledge is the process through which organizational actors exchange, receive, and are influenced and affected by the knowledge and experience of others.

The transmission of knowledge is a multilevel concept, which implies that it has been used to explain this phenomenon across and within organizations, teams, and people. Authors have related the transmission of knowledge with performance (Ali et al., 2019), competitive advantage (Gupta & Govindarajan, 2000; Keszey, 2018; Schulz, 2001, 2003; Wijk et al., 2008), the development of ideas, products, and applications (Keszey, 2018; Kogut & Zander, 1992; Powell et al., 1996; Tsai, 2001), and the development of linkages and associations (Jansen et al., 2005). In general terms, authors have suggested that there are some critical aspects in order to transfer knowledge. These aspects include motivation, trustworthiness, lack of absorptive capacity, causal ambiguity, shared language, vocabulary, and collective narratives as well as appropriate knowledge artefacts (Al Nahyan et al., 2019; Cruz et al., 2009; Ferraris et al., 2020; Lam & Lambermont-Ford, 2010; Nahapiet & Ghoshal, 1998; Szulanski, 1996; Tsai & Ghoshal, 1998).

The process of transmission of knowledge in family business has also been studied (Pittino et al., 2018). According to Neubaum et al. (2019), in a family firm context, the processes of communication and knowledge exchange are more efficient since family members have a common language and strong sense of identity. Thus, networks of relationships provide a strong social community that are the basis for the exchange of knowledge and open communication. Adler and Kwon (2002) argued that creating social structures ensures the diffusion of knowledge within the organization. In this regard, the high levels of family involvement that are present in family business may reinforce the social system, which creates the expectation for knowledge to be efficiently shared (Martínez et al., 2016). On the other hand, there are also inhibitors to achieve an adequate transfer of knowledge in the context of family businesses, among them the rivalries and jealousy among family members (Gomez-Mejia et al., 2001; Grote, 2003), the level of entrepreneurial spirit (Morck & Yeung, 2003), the lack of interest of some family members (Grote, 2003; Le Breton-Miller et al., 2004), and the importance of knowledge and learning to family members (Cabrera-Suárez et al., 2001). Regardless, understanding how family firms successfully manage the process of KS between family members and non-family members within company boundaries, remains a crucial process both in research and practice.

Relational Capital and Family Business

RC is rooted in the concept of social capital, which is ideally developed in the family, given the richness of the familial ties that are developed on foundations of trust, stability, interdependence (Arregle et al., 2007), as well as, a shared vision and purpose, and similar norms and values (Pearson et al., 2008). In fact, it is noted that non-family firms are unable to create or imitate this type of family social capital (Herrero, 2018), providing family firms with a competitive advantage over non-family firms (Neubaum et al., 2019). Furthermore, family social capital focuses on the linkages among individuals within the collectivity (Adler & Kwon, 2002), is characterized by cohesiveness (Nahapiet & Ghoshal, 1998), and is composed of three dimensions:

structural, relational, and cognitive (Carr et al., 2011). It is the relational dimension that is the focus of interest in this study.

RC refers to those assets created and leveraged through relationships (Nahapiet & Ghoshal, 1998) and is represented by the quality or value of relationships that agents maintain with other agents in their environment (Rivera & Carrillo, 2016). Furthermore, it is characterized in terms of mutual commitment, mutual trust, and the strength of social ties, norms and sanctions, information exchange, among other variables (Collins & Hitt, 2006; Delerue-Vidot, 2006; Dhanaraj et al., 2004; Kale et al., 2000; Sarkar et al., 2001). From an organizational perspective, RC has to do with the ability of an organization to interact with external stakeholders and business community members in a positive manner in order to stimulate the potential for wealth creation (Johnson, 1999; Kianto et al., 2013). Nevertheless, it is commonly accepted that RC includes the analysis and study of relationships within organizations, their employees, suppliers, dealers, sellers and customers (Sydler et al., 2014) and it includes both B2B and B2C relations (Bontis & Fitz-enz, 2002).

The role of RC associated with strategic processes within organizations includes the study of informal and formal socialization processes (Cousins et al., 2006), the creation of knowledge as a source of organizational advantage (Nahapiet & Ghoshal, 1998), learning across the exchange interface (Kale et al., 2000), the increase of knowledge and expertise within the organization (Hayer & Ibeh, 2006), and the structural power of CEOs (Yan et al., 2019).

In the context of family firms, the crucial role of a family firm's RC has been well documented in the academic literature (Colli, 2012; Cucculelli et al., 2019; Debicki et al., 2020). Regarding ties developed with external individuals and organizations, family firms continuously invest resources in nurturing and reshaping their interpersonal relationships with political contacts and other family firms in order to obtain financial value (Salvato & Melin, 2008), public resources, and avoid expropriations (Amore & Bennedsen, 2013; Faccio & Parsley, 2009). According to Zahra (2010), this is a priority for family firms seeking to achieve profitability and growth (e.g., through exposure to novel, non-redundant knowledge, combating against network closure, and encountering new entrepreneurial opportunities). Regarding ties among family members, RC provides family firms with advantages and resources that derive from moral behavior, cooperation, collaboration, and reciprocity among family members. Moreover, it facilitates knowledge integration (Chirico & Salvato, 2008) and supports family identity (Herrero, 2018).

In operationalization terms, the measurement of RC represents a complex task to perform. Scholars have used different variables at different levels of analysis. For instance, at an organizational level, mutual trust (Dhanaraj et al., 2004; Echambadi et al., 2001; Inkpen & Tsang, 2005; Kale et al., 2000; Moran, 2005; Tsai & Ghoshal, 1998), respect and friendship (Kale et al., 2000) reciprocal information exchange and reciprocal commitment (Dwyer et al., 1987; Echambadi et al., 2001; Tsai & Ghoshal, 1998) strength of social ties, share common processes and values (Dhanarajet al., 2004; Granovetter, 1973; Tsai & Ghoshal, 1998), have been used. At a group level, RC has been measured as higher quality than competitors and better reputation and prestige (Dewhurst & Cegarra, 2004). Finally, closeness has been used as a measure to consider at an individual level, (Moran, 2005). To our knowledge, none of these

studies have focused on measuring RC within the context of family firms, involving family members and non-family members. Furthermore, while the concept of relational value has generated some interest in family firm research, mainly due to its association with the family firm's and the family's reputation (e.g. Binz et al., 2013), studies typically consider only specific components of RC such as trust (Cabrera-Suárez et al., 2015), hence do not offer a more comprehensive explanation of its main and essential components.

Knowledge Sharing and Relational Capital in Family Business

KS has a relational nature that depends on behavioral and contextual factors. Authors have suggested that the KS process between significant agents is affected by the social cohesion around people's relationships (Reagans & McEvily, 2003), and the arduous relationship between the source and the recipient (Szulanski, 1996). As a result, it has been found that RC can be a good predictor of KS. For example, Dhanaraj et al. (2004) and Collins and Hitt (2006), found RC to be effective for the management and leveraging of tacit and explicit KS in international joint ventures and alliances.

In spite of its importance, relatively little is known about how family firms successfully manage the crucial process of KS. To the best of our knowledge, the relationship between RC and KS has been analyzed in a variety of contexts but not explicitly in family business, which has been demonstrated to have specificities that should be considered. For instance, a family firm's strong sense of identity, unique social system (Denison et al., 2004), emotional involvement, lifelong common history, and the use of a private language (Tagiuri & Davis, 1996), allows family members to share knowledge more efficiently and with greater privacy compared to non-family businesses (Cabrera-Suárez et al., 2001; Miller & Le Breton-Miller, 2006; Tagiuri & Davis, 1996). Furthermore, the inherent commitment, family-specific norms, and family-based identity create a unique bond among kin that is shared among individuals within the family group, which we believe can be permeated into the employees within the firm, increasing probability of KS.

In this study we aim to provide a more comprehensive explanation as to the main components of RC and its relationship with KS within family firms. Considering the Carrillo's characterization of K-events (2002, p. 379), Rivera and Carrillo (2016) proposed an RC framework which states that the quality of the relationship between two agents relies on the development and measurement of certain combinations of variables that are embedded in different categories: (1) agent, (2) object, (3) context, and (4) relationship. According to these authors, the quality or value of relationships that agents maintain with other agents in their environment is given by the context conditions, the object characteristics, and the agent's perception. Previous research has demonstrated that RC can be represented by mutual trust (Carey et al., 2011; Granovetter, 1985; Kale et al., 2000; Nahapiet & Ghoshal, 1998), as well as mutual reciprocity and commitment (Mathwick et al., 2008; Wasko & Faraj, 2005), which we consider as agent variables. Based on this multivariate RC approach, we also consider norms and sanctions (Coleman, 1988; Wang et al., 2014) as a context variable, and the strength

of ties (Granovetter, 1985) as the relationship one. This is because in family firms, strong family norms lead to family obligations and expectations which in turn create strong family ties (Hoffman et al., 2006). This also applies to non-family organizations which adhere to norms or rules to affect KS (DiMaggio & Powell, 1983; Gilsing & Nooteboom, 2006) by encouraging employees to increase their interactions and share knowledge, experience, and information (Wang, et al., 2014).

Thus, the following hypothesis is presented:

H1. RC (mutual trust, reciprocal commitment, norms and sanctions and strength of ties) has a positive effect on KS in family businesses.

Some authors have treated these variables of internal RC independently (Carr et al., 2011; Nahapiet & Ghoshal, 1998). Therefore, in the following discussion we explain the relationship between each of the four variables of RC and KS. Afterwards, we develop hypotheses for respective relationships and present our research model.

Mutual Trust

For the purpose of this paper, trust refers to a belief that a colleague's word is reliable and will fulfill its obligations in the relationship (Inkpen & Tsang, 2005). In an organizational context, it can be understood as the favourable belief that a person adequately performs his/her assigned work and activities according to his/her actions and previous history. It has been observed that the trust-based relationship and interactions tend to be more strongly related to greater KS (Gubbins & MacCurtain, 2008; Levin & Cross, 2004; Nahapiet & Ghoshal, 1998; Srirama et al., 2020). In particular, family firms are often depicted as being high in trust (LaChapelle & Barnes, 1998; Steier, 2001) and it represents a significant source of competitive advantage for them (Sundaramurthy, 2008). In other words, the strong sense of identity and meaning built inside family firms, opens the channels of communication that extrapolate the family-member status and allows for the exchange of ideas and experiences between all members of the organization, in the understanding that such a process will be favorable for the firm and all its members. In this way, trust becomes a reciprocated behavior.

Thus, the following hypothesis is presented:

H1a. The extent to which actor i shares knowledge with actor j in family businesses, is a positive function of the extent to which actor i trusts actor j, and vice versa.

Reciprocal Commitment

For the purpose of this paper, reciprocal commitment is defined as the mutually corresponding ongoing exchange with any possible content between different entities (Dwyer et al., 1987). In other words, a person 's disposition to make commitments and fulfill them, to comply with an agreement, to not blame others for the scarcity of results and to respect timelines. For instance, commitment may contribute to

fostering employees' participation in knowledge-sharing activities because it facilitates positive responses among coworkers (Jo & Joo, 2011; Lin, 2007; Srirama et al., 2020). In this sense, the social exchange theory (Emerson, 1976) explains that participants expect mutual reciprocity that justifies their expense in terms of the time and effort spent sharing their knowledge. In family firms, commitment to the family and the business promotes stability in the relationships among employees (Pearson et al., 2008), through the identification with the organization's values and goals (O'Reilly & Chatman, 1986), which provoques prosocial behaviors such as KS (Jo & Joo, 2011; Lin, 2007; Lombardi et al., 2019).

Therefore, we present the following hypothesis.

H1b. The extent to which actor i shares knowledge with actor j in family businesses, is a positive function of the extent to which actor i perceive reciprocal commitment for actor j.

Norms and Sanctions

The theoretical construction of norms and sanctions appears to be the most abstract amongst the dimensions postulated by Coleman (1988) (Leung et al., 2011). For the purpose of this paper, the variable norms and sanctions is defined as control policies and clear guidelines for the development of activities in the organization as well as precise plans that allow the requirements of administrative and operative procedures to be accomplished. This is based on the fact that social interactions form and alter a person's behavior. Therefore, successful KS requires a tangible management system and intangible rules derived from social obligation, social expectation, common recognition, customs, imitation, and informal practices (Wang et al., 2014). If an excellent management system and institutional-based rules are in place, employees will have greater cooperation opportunities and further increase knowledge sharing willingness and behaviors (Kondra & Hurst, 2009; Newell & Swan, 2000). In family firms, family norms improve effectiveness of action and attenuate external unknowns (Hoffman et al., 2006). Moreover, strong family norms lead to family obligations and expectations, which create future benefit in family businesses characterized by strong family ties (Hoffman et al., 2006). Finally, Danes et al. (2009) suggested that RC can be relied upon to uphold the norms and reciprocal nature of structures in family firms, thus directly enhancing the notion of KS. Thus, we present the following hypothesis.

H1c. The extent to which actor i shares knowledge with actor j in family businesses, is a positive function of the extent to which actor i and actor j (on average) perceive the applications of norms and sanctions.

Ties Strength

For the purpose of this paper, ties strength is defined as the combination of the amount of time, the emotional intensity, the intimacy, and the reciprocal services that formulate the tie (Granovetter, 1973). It has been found that strong ties convey a more detailed KS and a stronger cooperative willingness (Granovetter, 1973; Jiang

et al., 2020; Rost, 2011). In family firms, the abundant history of interaction and interdependence existing in family ties (Pearson et al., 2008) enhance a feeling of membership stability, interaction and interdependence (Arregle et al., 2007) within the firm, which creates the conditions for KS.

Therefore, we formulated the following hypothesis:

H1d. The extent to which actor i shares knowledge with actor j in family businesses, is a positive function of the strength of ties between actor i and actor j.

Altogether, for this study we proposed the following research model.

Methodology

The research design is a case study, which is traditionally used in FB research (Handler, 1989), and aims to contribute to KS, RC, and FB theory by testing the proposed model in terms of the established hypotheses. The approach is quantitative because it relies on the collection and analysis of quantitative relational data to test how four dimensions of RC affect the KS in a FB context (Distelberg & Blow, 2011). The guidelines for case study methodology were employed (Eisenhardt & Graebner, 2007; Yin, 1981, 2003). We selected a Mexican family firm located in Monterrey, the capital and largest city of the northeastern state of Nuevo León. The company was selected for three main reasons. First, three family members are involved in the day to day operations (the founder, the successor and a founder's brother). Moreover, there are five non-family members in key leading roles that are really close to the family interests. Besides, employees describe themselves as a big family in the company. The fact that members were expected to develop relationships and at the same time to transfer knowledge proved to be a good research setting to understand the perceptions and practices dealing with RC and KS. Second, our single case design (Eisenhardt & Graebner, 2007; Yin, 1981, 2003) is typical of other manufacturing companies in the region, in terms of size, type, family control, and operations. Third, we had full access to data and information.

Our unit of analysis is the relationship between pairs of agents, meaning that all of the variables are dyadic (Borgatti & Cross, 2003). For the relational data survey (Wasserman & Faust, 1994), a sociometric technique called roster was used, in which we presented to the respondents a list of all the employees in the company (Marouf, 2007) and asked, by using a 0–10 response scale, if the perception of people's behaviors or contextual conditions was null or existent (0 means nonexistent and 10 indicated the opposite) (Marsden, 2005). The survey was conducted face-to-face, applied in similar conditions and took on average 54 min. We obtained responses from 27 key actors, understood as the ones that establish active relationships of knowledge transfer with other agents. The key informants sampling (Deaux & Callaghan, 1985), were identified and selected based on an informal interview with the FB owner and included family and non-family members (Distelberg & Blow, 2011). The age average was 45.8 years with a range from 25 to 63 years. Regarding gender, 5 (18.5%) were women and 22 (81.5%) were men. Seven had a managerial level (25.9%), 13 had a technical level (48.14%), and 7 were operatives

(25.9%). As it is common in family firms, the vast majority of employees had several years of experience in their job positions.

The dependent variable was measured following Borgatti and Cross (2003) recommendations, as well as previous studies (Rivera et al., 2020). We calculated the average of two estimates. The first one was the degree that person *i* shares knowledge with person *j*. The second one was the transposition of the degree to which person *j* shares knowledge with person *i*. In this way, it was possible to predict who shares knowledge with whom, rather than to obtain only the perception of KS.

The independent variables were proxies of the RC: mutual trust (Dhanaraj et al., 2004; Echambadi et al., 2001; Inkpen & Tsang, 2005; Kale et al., 2000; Moran, 2005; Tsai & Ghoshal, 1998), reciprocal commitment (Dwyer et al., 1987; Echambadi et al., 2001; Tsai & Ghoshal, 1998), norms and sanctions (Coleman, 1988; Wang et al., 2014), and ties strength (Dhanarajet al., 2004; Granovetter, 1973; Tsai & Ghoshal, 1998). A single item was used to answer all these questions (Borgatti & Cross, 2003; Ibarra, 1992) considering that these are adequate when individuals report their network relationships (Marsden, 1990). Table 1 shows the survey details.

We collected three control variables: age, gender, and hierarchy level. For gender, 1 corresponds to female and 0 to male. Regarding the hierarchy level, three categories were created: 0 represents the managerial level, 1 refers to the technical level and 2 indicates the operative level.

Analysis and Results

For each variable (KS, mutual trust, reciprocal commitment, norms and sanctions, and ties strength) we obtained an asymmetric matrix with a size of 27 rows and 27 columns. The next step was to use quadratic assignment procedure (QAP and MRQAP) to analyze the data and to test the hypothesized relationships.

To test hypothesis 1 (see Fig. 1), we included the variables KS, RC, gender, hierarchy level, and age. RC was calculated using the average of the mutual trust, reciprocal commitment, norms and sanctions, and ties strength matrices. In Table 2, QAP correlations are shown.

The correlation between KS and RC is positive, significant and below 0.7. Gender correlations with KS and RC are significant, below 0.7 but negative. Correlations between hierarchy level and age with the rest of variables are not statistically significant. In Table 3, results of the MR-QAP regression model for hypothesis 1 is shown.

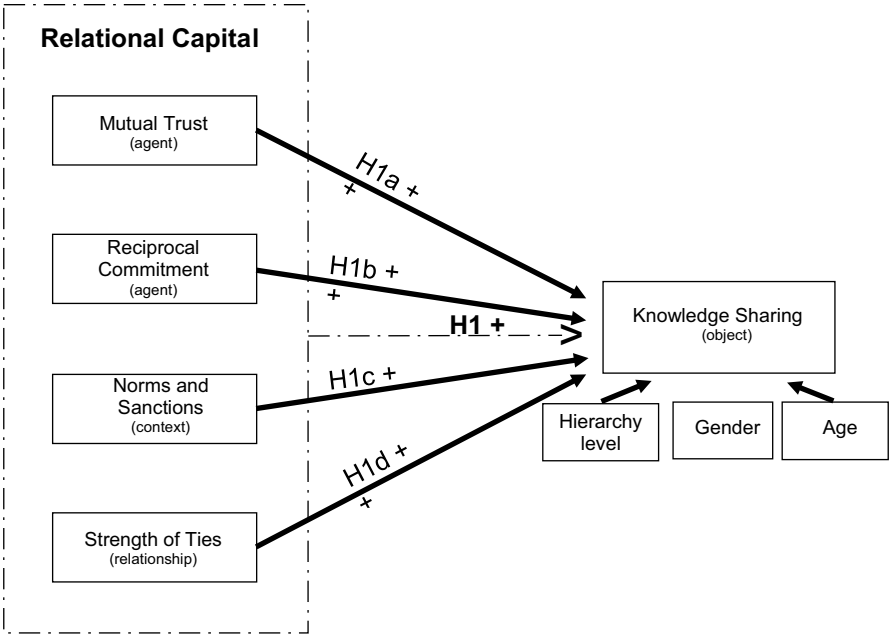
Model 1 is the baseline that incorporates only the control variables. Model 2 shows the best fit, explaining (R^2) 33.6% of the variance. Thus, hypothesis 1 is supported. RC exerts a positive and significant effect on KS ($\beta = 0.503$; $p < .01$). Moreover, none of the control variables are statistically significant. After finding support for hypothesis 1, the next step was to test the rest of the hypotheses (H1a, H1b, H1c, H1d). Therefore, we included in the analysis KS, each of the RC variables and the control variables. In Table 4, we present the QAP results.

Results show that all correlations between KS and the RC variables, as well as among the RC variables, are positive, significant and below 0.7, with the

Table 1 Variables, authors, and items

Variables	Authors	Contextualization	Items
Knowledge sharing	Borgatti and Cross (2003), Borgatti et al. (1999), Wasserman and Faust (1994)	Willing to share, to teach or transmit, his/her administrative or technical experiences, skills or abilities to solve problems arising at work (to make better decisions)	On a scale from "0" to "10," does person "X" share or is willing to share knowledge?
		Willing to share, to teach or transmit, his/her administrative or technical experiences, skills or abilities to solve problems arising at work (to make better decisions)	On a scale from "0" to "10," do you share or are willing to share knowledge?
Mutual trust	Dhanaraj et al. (2004), Echambadi et al. (2001), Inkpen and Tsang (2005), Kale et al. (2000), Moran (2005), Tsai and Ghoshal (1998)	The favorable belief that a person adequately performs his/her assigned work and activities according to his/her actions and previous history; what a person tells you that person will do in the best way; a person will make the right decisions at the right time (e.g., the handling of money, the supply of materials or raw materials, etc.)	On a scale from "0" to "10," how much do you trust in person "X"?
Reciprocal commitment	Dwyer et al. (1987), Echambadi et al. (2001), Tsai and Ghoshal (1998)	A person 's disposition to make commitments and fulfill them, to comply with an agreement, to not blame others for the scarcity of results, to respect timelines	On a scale from "0" to "10," how committed do you think person "X" is with other people?
Norms and sanctions	Coleman (1988), Wang et al. (2014)	The existence of (1) control policies and clear guidelines for the development of activities in the organization; (2) precise plans that allow the requirements of administrative and operative procedures to be accomplished	On a scale from "0" to "10," how do you evaluate the respect of norms and sanctions in person "X"?
Strength of ties	Dhanaraj et al. (2004), Granovetter (1973), Tsai and Ghoshal (1998)	The combination of the amount of time, the emotional intensity and the intimacy that formulate the tie	On a scale from "0" to "10," how strong is the relationship you have with person "X"?

Source: Own elaboration



Notes: "+" means a positive effect.
Source: Own elaboration.

Fig. 1 Research model. "+" means a positive effect. Source: Own elaboration

exception of the correlation between reciprocal commitment and mutual trust, which is 0.75. Regarding gender, all correlations with the dependent and the independent variables are significant, below 0.7, and negative. Hierarchy level is only correlated with ties strength and age only with Reciprocal commitment, but both effects are weak.

To test for the rest of the hypotheses, the process consisted of running different models in order to compare the adjusted *R*-square. In Table 5, the results are presented.

Model 7 presents the best fit, explaining 34.5% of the variance. All hypotheses are supported, with the exception of H1b, which is related with Reciprocal commitment.

Table 2 QAP correlations

		1	2	3	4	5
1	Knowledge sharing	1				
2	Relational capital	0.576***	1			
3	Gender	−0.226***	−0.285***	1		
4	Hierarchy level	−0.017	−0.007	0.098		
5	Age	0.040	0.058	−0.016	−0.061	1

Italicized values are not significant

*$p < .1$; **$p < .05$; ***$p < .001$

Table 3 MRQAP models

		Models	
		1	2
1	Intercept	8.800***	4.619***
2	Relational capital		0.503***
3	Gender	−0.557***	−0.164
4	Hierarchy level	0.019	−0.013
5	Age	0.095	0.016
	R-square	0.052	0.336
	Adj *R*-square	0.048	0.332

Italicized values are not significant. All significance based on 10,000 permutations. Dependent variable: Knowledge sharing

*$p < .1$; **$p < .05$; ***$p < .001$

The strongest effect on KS is from Mutual trust ($\beta = 0.239$; $p < .01$). The results in model 7 supports our proposal in terms of having trust as a variable that operationalizes the dimension related to the agent, norms and sanctions as the dimension of the context, strength of ties as the relation and knowledge as the object that is transferred in the act. Regarding the control variables, none of them are significant in the model, which from an statistical point of view has no implications because MRQAP produces parameter estimates with a randomization permutation technique (Borgatti & Cross, 2003). Moreover, when using SNA as a method, the addition of the controls commonly improves the models but only in a modest way, which suggests that the independent variables are the ones associated in a significant and material way with the dependent (Zach & Hill, 2017) and have a theoretical grounded justification (Bernerth et al., 2018). Figure 2 summarizes the results.

Table 4 QAP correlations with RC variables disentangled

		1	2	3	4	5	6	7	8
1	Knowledge sharing	1							
2	Mutual trust	0.550***	1						
3	Reciprocal commitment	0.469***	0.755***	1					
4	Norms and sanctions	0.316***	0.316***	0.406***	1				
5	Strength of ties	0.422***	0.583***	0.453***	0.200**	1			
6	Gender	−0.226***	−0.254***	−0.222***	−0.212*	−0.193***	1		
7	Hierarchy level	−0.017	−0.000	−0.042	−0.055	0.072*	0.098	1	
8	Age	0.040	0.030	0.070*	0.022	0.057	−0.016	−0.061	1

Italicized values are not significant

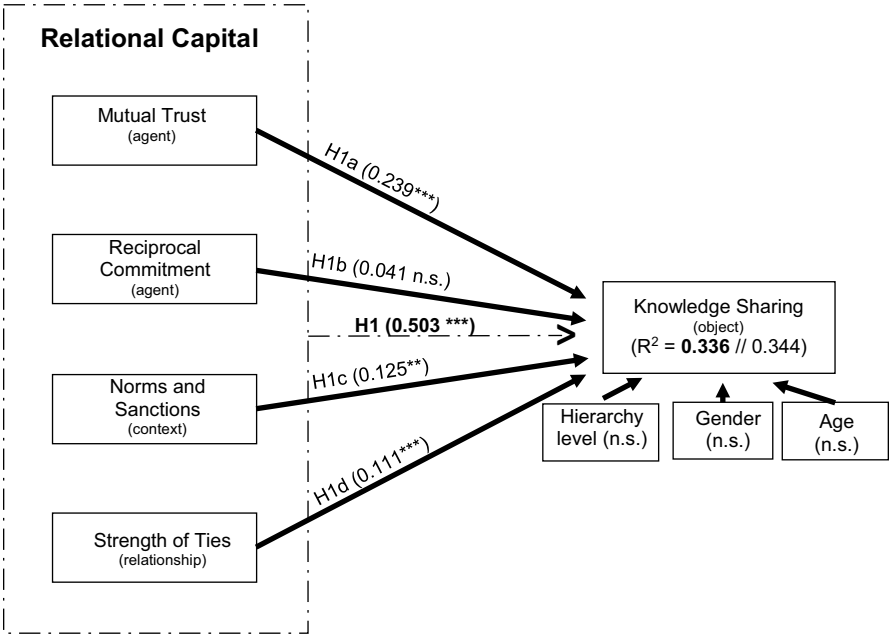
*$p < .1$; **$p < .05$; ***$p < .001$

Table 5 MRQAP with RC variables disentangled

		Models						
		1	2	3	4	5	6	7
1	Intercept	8.800***	6.118***	6.277***	7.024***	6.188***	4.804***	4.863***
2	Mutual trust		0.313***				0.215***	0.239***
3	Reciprocal commitment			0.294***			0.041	
4	Norms and sanctions				0.242***		0.116**	0.125**
5	Strength of ties					0.299***	0.110***	0.111***
6	Gender	−0.557***	−0.225**	−0.319**	−0.413**	−0.360**	−0.155	−0.156
7	Hierarchy level	0.019	−0.015	0.037	0.042	−0.072	−0.024	−0.029
8	Age	*0.095*	0.057	0.020	0.083	0.034	0.030	0.038
	R^2	0.052	0.310	0.235	0.127	0.200	0.345	0.344
	Adj R^2	0.048	0.307	0.231	0.122	0.196	0.339	0.339

Italicized values are not significant. All significance based on 10,000 permutations. Dependent variable: Knowledge sharing

*$p < .1$; **$p < .05$; ***$p < .001$



Notes: ***p<.001 ** p<.05 *p<.1 n.s. means not significant.
Source: Own elaboration.

Fig. 2 Research model and results. *$p < .1$; **$p < .05$; ***$p < .001$; n.s. means not significant. Source: Own elaboration

Discussion and Conclusions

Theoretical Contributions

The main purpose of this paper was to find evidence to test how the agent, the context, and the relationship impact the object (Rivera & Carrillo, 2016). More specifically, we operationalized the agent with the variables mutual trust and reciprocal commitment, the context with norms and sanctions, the relationship with strength of ties, and the object with knowledge. Because of the relevance of social interaction, and the favorable conditions of family environments to promote them, it becomes more relevant to increase an understanding of the specific organizational elements that align into RC, thus facilitating KS (Cabrera-Suárez et al., 2001; Miller & Le Breton-Miller, 2006; Rivera & Carrillo, 2016; Tagiuri & Davis, 1996). In this research, by breaking down RC into a more comprehensive concept, the authors were able to identify and test which variables affect the transfer of knowledge in a family business context. To be more specific, this study offers clear evidence of at least two important theoretical aspects: (1) the identification of a set of four variables that describe the quality of relationships in a family business firm, and (2) given those variables, the understanding of how they affect the transfer of knowledge.

Previous research has demonstrated that RC can be represented by mutual trust (Carey et al., 2011; Granovetter, 1985; Kale et al., 2000; Nahapiet & Ghoshal, 1998), as well as mutual reciprocity and commitment (Mathwick et al., 2008; Wasko & Faraj, 2005). However, this article offers a more comprehensive perspective by including two additional factors, which are norms and sanctions (Coleman, 1988; Wang et al., 2014) and the strength of ties (Granovetter, 1985). In this sense, this research contributes to the literature by developing and testing a proposal that follows the basis of a three-dimensional, multivariable approach to measure RC (Rivera & Carrillo, 2016). On the one hand, it is three-dimensional because it consists of three broad theoretical categories that affect RC: the agent dimension, which involves personal characteristics (i.e., mutual trust and reciprocal commitment), the contextual dimension, which regards the characteristics of the context where relationships are established (i.e., norms and sanctions) and the relational dimension which refers to characteristics of each relationship (i.e., strength of ties). On the other hand, it is multivariable because each dimension has at least one variable to measure it.

By highlighting the role of RC within family firms, the results of this research complement previous studies that stressed the role of trust and personal interaction in organizational relationships (Gulati, 1995; Zaheer et al., 1998). However, the evidence in this research also shows that RC is linked not only to agent variables in general, but also to context and relational variables (such as norms and sanctions and strength of ties).

More specifically, our study confirms previous research by proving trust to be a powerful dimension. Scholars agree that it is the most important driver of social interactions (Nahapiet & Ghoshal, 1998). Besides, family firms are often depicted as being high in trust (Steier, 2001), which increases the level of openness and opportunities for tacit knowledge to be created and shared over time (Koskinen, 2003; Tagiuri & Davis, 1996). Similarly, our results also confirm the relevance of the context of the family firm, through its norms and sanctions, to be a key factor in the process of KS. Other studies have also

found that formal rule and norm create clear paths for collaborators to interact in a healthy way, thus enhancing the process of KS in family firms (Danes et al., 2009; Kondra & Hurst, 2009; Newell & Swan, 2000). Finally, our study confirms that tie strength is transcendental to KS because it is an indicator of people's social cohesion in the types of relationships they develop with each other (Reagans & McEvily, 2003). In other words, if it is assumed that the transfer of knowledge is a collaborating behavior, thus the quality of connections between people is an essential component of such behavior.

On a different vein, results from our study refute previous literature regarding the role of reciprocal commitment on KS. Past studies have found that reciprocal commitment is beneficial for organizations in KS activities, because it eases the ways in which collaborators respond positively to each others' inputs (Jo & Joo, 2011; Lin, 2007; Srirama et al., 2020). However, our results showed no statistical effect of reciprocal commitment on KS. This can be explained by the high correlation between mutual trust and reciprocal commitment, as well as by the reciprocity component present in both variables, which is irrefutable regarding the KS process (Emerson, 1976).

Finally, our study modifies the measurement of RC in the following way. Considering the validity and reliability of our results, we argue that in order to measure RC and its influence in the transfer of knowledge in the context of family business, the use of one variable for each dimension is insufficient. In other words, from a more comprehensive perspective, RC should include three variables (i.e., trust, norms and sanctions, and ties strength) when studied in the context of family firms.

Methodological Contributions

We agree with Debicki et al. (2020) that previous studies have not paid particular attention in measuring RC by using variables (other than trust) (Herrero & Hughes, 2019) within the context of family firms, involving family members and non-family members, and using relational data. A particularly salient contribution of this research is the consideration of reciprocity and symmetry as essential properties to evaluate the relationship between variables in order to understand the joined ongoing exchanges between people. From the researchers perspective, this study contributes, in methodological terms, because the evaluation of each variable of the proposed hypotheses was not unidirectional but bidirectional. For instance, the use of a quantitative method to capture the phenomenon under investigation was shown to be an effective methodological approach. To our knowledge no previous studies were found that applied social network analysis (SNA) to collect relational data about the transfer of knowledge and RC in a family firm. Based on Social Exchange Theory (Emerson, 1976), the current study contributes methodologically speaking by suggesting the adoption of the SNA approach in collecting and analyzing relational data in family firms, as well as including both family members and non-family members in the analysis.

Practical Contributions

The question of whether the familial aspects of a firm hamper or facilitate the sharing of knowledge is important (Chirico, 2008), because this can affect the way in which all organizational decisions and strategic capabilities are viewed. Our findings

suggest that the greater the RC between agents *i* and *j*, the greater the extent to which agents *i* and *j* transfer knowledge. Thus, motivating and promoting the establishment of quality relationships between agents within the firm seems to be an important first step that family business can take. The main suggestions derived from this research for those in charge of creating and maintaining relationships as well as on transferring knowledge in organizations are the following:

First, organizations should create a time and space to foster the development and nourishment of trust-based relationships among employees. In such efforts, organizations should encourage the involvement of the founder, as it has found to be a pillar in the cultivation of stewardship principles that both family and non-family members identify as a requirement to build and maintain trust in the organizations (Eddleston et al., 2010).

Second, to create norms and policies that promote a healthy growth of the organizations. Literature on this topic has proven that establishing and enforcing clear norms and policies within family firms, paves the way to greater cooperation efforts, which are essential to the KS process (Kondra & Hurst, 2009; Newell & Swan, 2000). Consequently, family firms could be expected to perform better in terms of innovation and adaptation, which results in the quicker response to the demands of their environment.

Third, reinforce and strengthen the types of relationships that have proven to be productive for the family business, both at a professional and personal level. Previous studies on KS have highlighted the importance of promoting and facilitating the participation of collaborators at all levels in the creation and development of ideas that transform the organization through a more competitive path (Lawson et al., 2009). When ties are stronger, then collaborators are also more emotionally involved in the firm's processes (Tagiuri & Davis, 1996), which increases their sense of identity and social cohesion amongst themselves, thus enhancing KS.

Fourth, encourage the involvement and interaction of family members with non-family members. This will help to open more channels of communication that allows for a more effective flow of ideas, experiences, knowledge, as well as the creation of an organizational culture that is more participative and inclusive. Consequently, it will facilitate the family to continue building on the family legacy, which other studies have proven as fundamental for the KS process in the family business (Botero et al., 2021; Distelberg & Blow, 2011).

Finally, the family business should foster the measure of the variables proposed in this research to help people establish and maintain quality relationships over time, hence monitoring how the working environment is improving. Consequently, the firm should be able to create strategies and programs that more specifically target and promote collaborative dynamics among all of its members, which in turn should enhance the KS process across the firm.

Research Limitations and Future Research

Even though our case study is representative of family firms in the manufacturing sector in Mexico, it is only one company. Future work could investigate the methodology and model here proposed in a variety of contexts in terms of geographical location, sector, sizes, level of family involvement, among many other possibilities.

Appendix

Knowledge transfer

	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11	L12	L13	L14	L15	L16	L17	L18	P1	P2	P3	P4	P5	P6	P7	P8	P9
L1		9.5	9.5	9.0	10.0	9.0	9.5	8.5	9.5	9.5	8.7	8.7	9.0	8.2	9.0	7.7	9.1	8.5	8.5	6.0	8.0	8.5	8.5	8.0	7.5	8.7	8.7
L2	9.0		10.0	8.8	10.0	10.0	9.0	8.7	10.0	9.0	9.0	10.0	9.7	8.9	9.1	9.0	9.6	10.0	9.5	8.2	8.2	10.0	8.5	8.4	8.3	8.3	7.5
L3	9.0	10.0		10.0	7.5	9.5	10.0	9.5	9.0	9.0	9.3	9.3	10.0	9.3	10.0	9.3	9.0	9.0	9.5	7.5	9.0	10.0	8.5	10.0	8.5	9.3	9.3
L4	7.5	9.0	9.5		9.0	9.0	9.0	7.5	8.5	9.0	9.0	7.8	8.5	7.0	7.5	8.3	6.5	7.5	6.5	7.8	7.9	8.6	7.5	8.8	7.0	7.5	8.1
L5	9.5	9.5	8.5	9.5		9.0	9.5	8.7	9.5	9.5	9.0	9.1	9.3	8.7	8.5	9.5	8.9	9.0	8.5	7.5	8.5	8.6	9.5	10.0	8.2	7.7	8.5
L6	9.0	10.0	10.0	9.0	9.0		10.0	9.0	9.0	10.0	9.3	9.3	10.0	7.5	9.5	9.3	8.0	10.0	9.0	7.5	7.0	9.5	8.0	8.0	7.9	7.9	8.5
L7	9.0	10.0	10.0	9.0	10.0	10.0		10.0	9.5	9.0	9.5	9.5	9.2	8.7	8.6	8.9	8.9	9.5	9.5	10.0	9.0	10.0	8.5	8.3	8.1	8.2	6.3
L8	9.0	7.5	8.5	8.0	8.6	8.5	9.5		8.5	8.0	8.5	8.5	8.2	8.5	8.4	8.7	8.7	9.0	8.5	10.0	8.0	8.6	8.3	8.1	8.0	8.0	7.3
L9	9.5	10.0	8.5	8.2	10.0	9.5	9.5	9.0		8.0	8.9	8.9	9.1	8.6	8.5	8.7	8.8	8.7	8.5	8.4	6.5	9.0	8.3	8.1	8.0	8.1	7.5
L10	9.0	9.5	8.0	9.5	9.5	8.5	8.5	8.0	8.5		9.0	9.5	9.5	9.0	10.0	8.9	8.5	10.0	9.0	7.5	8.5	10.0	8.5	9.0	8.5	9.0	8.5
L11	7.6	9.5	9.0	9.5	6.8	9.0	9.0	9.0	8.8	9.5		9.0	8.5	8.5	9.0	9.1	8.0	9.0	8.3	9.0	9.0	8.1	8.5	8.3	8.2	8.3	8.3
L12	8.1	9.5	9.0	7.8	8.8	9.0	9.0	9.5	8.7	10.0	9.5		9.0	8.5	9.0	9.5	8.0	9.0	8.2	9.0	8.1	8.6	8.4	8.2	8.1	8.1	6.5
L13	8.5	10.0	9.5	9.0	8.7	10.0	8.4	8.4	8.6	9.5	9.0	8.5		9.0	9.0	8.4	8.0	9.0	8.1	10.0	8.0	8.0	8.4	8.1	8.0	8.1	6.3
L14	7.6	9.5	7.5	8.0	8.3	7.5	8.0	8.1	8.2	9.5	8.5	7.5	8.5		9.0	9.0	8.0	8.0	7.7	7.5	7.5	7.5	7.9	7.7	7.6	7.6	6.0
L15	7.5	9.5	7.0	3.5	4.5	9.0	8.0	8.2	8.2	10.0	7.5	9.0	8.0	8.5		4.0	9.0	6.0	7.7	7.0	9.0	7.5	8.5	8.8	7.6	7.7	6.5
L16	8.1	9.5	9.0	7.8	9.3	9.0	8.6	8.7	8.8	8.8	8.4	9.5	9.2	8.7	9.1		8.9	9.4	8.3	8.6	8.1	8.6	9.0	8.3	8.2	8.2	6.3
L17	9.0	9.5	9.0	8.5	8.8	8.5	8.5	8.6	8.7	9.0	9.0	9.0	9.0	9.5	10.0	9.5		10.0	8.2	8.0	8.0	8.0	8.4	8.2	8.1	8.1	8.5
L18	8.0	9.5	9.0	8.0	9.5	10.0	9.5	9.5	8.8	9.0	8.5	10.0	8.0	8.5	9.5	9.6	9.5		8.3	9.5	8.2	8.2	9.0	8.3	8.2	8.3	8.6
P1	8.5	9.5	7.5	6.5	8.5	6.5	9.0	6.0	6.5	7.0	6.7	8.7	8.9	8.4	8.3	8.5	8.6	8.5		3.5	4.5	7.5	7.0	7.5	5.5	6.7	6.5
P2	9.5	9.5	7.0	8.0	10.0	7.0	8.0	10.0	8.3	9.5	9.0	8.0	10.0	7.7	9.0	9.2	8.6	10.0	7.0		9.0	7.5	7.0	10.0	5.5	5.0	9.0
P3	7.5	9.5	9.5	5.4	9.5	6.5	7.0	5.5	6.5	5.5	6.5	8.4	8.6	8.1	9.0	7.9	8.3	8.3	9.0	3.5		7.5	8.5	9.0	4.0	7.4	1.5
P4	9.0	10.0	10.0	9.4	9.4	10.0	10.0	9.4	9.0	9.5	9.4	9.5	9.2	8.6	8.5	9.4	8.8	8.8	9.5	10.0	9.0		9.5	10.0	7.5	9.4	9.0
P5	8.0	7.9	6.0	5.4	6.5	5.4	8.4	8.6	8.7	6.0	8.8	8.9	9.1	8.6	6.9	9.4	8.8	9.4	6.0	6.5	6.5	8.0		9.0	4.0	5.4	5.5

	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11	L12	L13	L14	L15	L16	L17	L18	P1	P2	P3	P4	P5	P6	P7	P8	P9
P6	8.6	8.7	8.5	8.0	9.3	8.2	8.2	8.4	8.4	8.3	8.5	8.7	8.9	8.4	8.7	8.5	8.6	8.5	7.0	8.0	8.5	8.0	8.5		7.5	6.0	5.5
P7	8.0	9.1	8.0	7.5	9.0	8.7	8.7	8.8	8.9	8.8	9.0	9.2	9.4	8.9	8.7	9.0	9.1	9.0	8.0	7.5	7.2	8.0	7.5	8.5		8.0	7.2
P8	9.1	8.8	9.0	8.1	8.6	8.3	8.3	8.5	8.6	8.3	8.7	8.8	9.0	8.5	8.4	8.7	8.7	8.7	4.5	5.0	2.5	5.0	8.5	5.0	8.0		8.1
P9	8.6	10.0	8.5	8.0	7.8	8.0	6.7	8.2	8.0	8.0	8.2	7.5	8.7	8.0	9.5	8.7	8.4	8.9	8.5	9.5	7.7	10.0	8.5	9.0	5.6	7.9	

Trust

	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11	L12	L13	L14	L15	L16	L17	L18	P1	P2	P3	P4	P5	P6	P7	P8	P9
L1		9.0	9.0	8.0	10.0	9.0	9.0	9.0	9.0	9.0	8.0	8.0	8.0	8.0	8.0	9.0	8.9	9.0	9.0	9.0	8.0	8.0	8.0	7.0	7.1	6.7	6.0
L2	10.0		10.0	7.2	10.0	10.0	8.2	8.3	10.0	10.0	10.0	10.0	8.2	8.3	7.3	9.1	8.9	10.0	10.0	7.5	10.0	10.0	6.5	6.6	7.1	6.7	6.3
L3	10.0	10.0		10.0	10.0	10.0	10.0	9.0	10.0	7.0	10.0	10.0	6.0	6.0	6.0	8.0	10.0	10.0	10.0	8.0	10.0	8.0	6.0	6.0	5.0	6.0	5.0
L4	9.0	8.0	10.0		9.0	7.0	7.0	6.0	8.8	7.0	8.0	8.0	6.0	6.0	7.0	7.0	6.0	6.0	7.0	7.5	6.6	8.3	6.5	6.6	7.0	7.0	6.3
L5	10.0	9.0	4.0	8.0		8.0	7.0	8.3	9.0	6.0	3.0	9.0	8.2	8.3	2.0	9.0	8.9	9.0	4.0	7.0	5.0	8.3	8.0	8.0	7.1	6.7	6.0
L6	10.0	10.0	10.0	9.0	8.0		10.0	8.0	9.0	10.0	10.0	10.0	8.0	9.0	9.0	10.0	10.0	10.0	9.0	9.0	9.0	9.0	6.5	6.6	7.1	6.7	8.0
L7	10.0	10.0	10.0	10.0	10.0	10.0		10.0	10.0	10.0	10.0	10.0	8.2	8.3	7.3	9.1	8.9	10.0	10.0	10.0	8.0	10.0	6.5	6.6	7.1	6.7	6.3
L8	8.0	6.0	7.0	7.2	6.0	7.0	10.0		9.0	7.0	9.0	9.0	8.2	8.3	7.3	9.1	8.9	8.0	6.0	10.0	5.0	6.0	6.5	6.6	7.1	6.7	6.3
L9	10.0	10.0	8.0	7.2	10.0	9.0	10.0	9.0		9.0	8.0	9.0	8.2	8.3	7.3	9.1	8.9	8.5	8.0	8.0	8.0	8.0	6.5	6.6	7.1	6.7	8.0
L10	10.0	10.0	9.0	10.0	10.0	10.0	8.0	8.0	9.0		9.0	10.0	9.0	9.0	9.0	9.1	9.0	9.0	9.0	9.0	8.0	9.0	9.0	8.0	9.0	8.0	8.0
L11	9.0	9.3	7.0	9.0	8.6	7.0	8.2	8.0	8.8	8.0		8.0	8.0	8.0	8.0	8.0	8.0	8.0	7.9	7.5	6.6	8.3	6.5	6.6	7.1	6.7	6.3
L12	8.6	10.0	7.7	7.2	8.6	8.3	8.2	8.0	8.8	10.0	9.0		9.0	7.0	8.0	10.0	10.0	10.0	7.9	10.0	6.6	8.3	6.5	6.6	7.1	6.7	7.0
L13	10.0	10.0	10.0	10.0	8.6	10.0	8.2	10.0	8.8	9.0	8.0	8.0		9.0	9.0	10.0	9.0	8.0	7.9	10.0	6.6	8.3	6.5	6.6	7.1	6.7	6.3
L14	8.6	9.3	7.0	8.0	8.6	7.0	8.2	8.3	8.8	8.0	8.0	7.0	7.0		7.0	9.0	7.0	7.0	7.9	7.0	6.6	8.3	6.5	6.6	7.1	6.7	7.0
L15	0.0	9.0	9.0	1.0	0.0	10.0	8.2	8.3	8.8	10.0	8.0	9.0	9.0	10.0		10.0	10.0	2.0	7.9	8.0	9.0	8.3	6.5	6.6	7.1	6.7	5.0
L16	8.6	9.3	7.7	7.2	8.6	8.3	8.2	8.3	8.8	7.9	8.0	9.0	8.2	8.3	7.3		8.9	8.5	7.9	7.5	6.6	8.3	6.5	6.6	7.1	6.7	6.3
L17	8.6	9.3	9.0	9.0	8.6	9.0	8.2	8.3	8.8	9.0	9.0	9.0	9.0	9.0	9.0	9.0		9.0	7.9	7.5	6.6	8.3	6.5	6.6	7.1	6.7	8.0
L18	10.0	10.0	10.0	9.0	10.0	10.0	10.0	9.0	8.8	10.0	9.0	10.0	10.0	10.0	10.0	10.0	10.0		7.9	10.0	6.6	8.3	6.5	6.6	7.1	6.7	8.0

	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11	L12	L13	L14	L15	L16	L17	L18	P1	P2	P3	P4	P5	P6	P7	P8	P9
P1	8.0	9.0	0.0	0.0	9.0	0.0	8.0	8.0	8.0	5.0	0.0	9.0	8.2	8.3	7.3	9.1	8.9	8.5		0.0	0.0	5.0	0.0	0.0	0.0	0.0	0.0
P2	5.0	9.3	5.0	7.2	8.0	7.0	6.0	10.0	8.8	10.0	7.0	9.0	10.0	8.3	5.0	10.0	8.9	10.0	7.0		5.0	10.0	5.0	10.0	10.0	8.0	10.0
P3	7.0	9.0	4.0	3.0	8.0	9.0	5.0	6.0	5.0	4.0	6.0	9.0	8.2	8.3	4.0	9.0	8.9	8.5	5.0	0.0		9.0	4.0	4.0	6.0	7.0	0.0
P4	10.0	10.0	9.0	8.0	10.0	10.0	10.0	10.0	10.0	9.0	10.0	10.0	8.2	8.3	7.3	10.0	8.9	8.5	10.0	10.0	8.0		9.0	10.0	9.0	10.0	10.0
P5	9.0	9.0	7.0	6.0	9.0	7.0	8.2	8.3	8.8	7.0	8.0	9.0	8.2	8.3	9.0	9.0	8.9	9.0	9.0	6.0	6.0	9.0		8.0	9.0	6.0	7.0
P6	9.0	9.3	7.7	3.0	10.0	8.3	8.2	8.3	8.8	7.0	8.0	9.0	8.2	8.3	9.0	9.1	8.9	8.5	4.0	6.0	7.0	7.0	8.0		9.0	8.0	5.0
P7	8.0	9.3	8.0	8.0	8.6	8.3	8.2	8.3	8.8	7.9	8.0	9.0	8.2	8.3	7.3	9.1	8.9	8.5	8.0	4.0	6.0	7.0	7.0	7.0		7.0	5.0
P8	8.6	9.3	7.7	7.2	8.6	8.3	8.2	8.3	8.8	7.9	8.0	9.0	8.2	8.3	7.3	9.1	8.9	8.5	7.9	7.5	6.6	8.3	6.5	6.6	7.1		6.3
P9	8.6	10.0	7.7	7.2	8.6	8.0	5.0	5.0	7.0	0.0	8.0	8.0	8.0	8.0	5.0	8.0	8.9	8.5	9.0	8.0	0.0	10.0	7.0	5.0	7.1	6.7	

Norms sanctions

	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11	L12	L13	L14	L15	L16	L17	L18	P1	P2	P3	P4	P5	P6	P7	P8	P9
L1		9.3	8.3	8.0	6.5	7.8	8.8	8.3	8.0	8.0	7.9	7.4	7.6	8.8	8.4	8.1	7.9	8.0	5.3	7.5	5.8	8.0	8.0	7.3	6.8	5.7	8.8
L2	9.3		9.0	8.8	7.3	8.5	9.5	9.0	8.8	8.8	8.6	8.1	8.4	9.5	9.1	8.8	8.6	8.8	6.0	8.3	6.5	8.8	8.8	8.0	7.5	6.4	9.5
L3	8.3	9.0		7.8	6.3	7.5	8.5	8.0	7.8	7.8	7.6	7.1	7.4	8.5	8.1	7.8	7.6	7.8	5.0	7.3	5.5	7.8	7.8	7.0	6.5	5.4	8.5
L4	8.0	8.8	7.8		6.0	7.3	8.3	7.8	7.5	7.5	7.4	6.9	7.1	8.3	7.9	7.6	7.4	7.5	4.8	7.0	5.3	7.5	7.5	6.8	6.3	5.2	8.3
L5	6.5	7.3	6.3	6.0		5.8	6.8	6.3	6.0	6.0	5.9	5.4	5.6	6.8	6.4	6.1	5.9	6.0	3.3	5.5	3.8	6.0	6.0	5.3	4.8	3.7	6.8
L6	7.8	8.5	7.5	7.3	5.8		8.0	7.5	7.3	7.3	7.1	6.6	6.9	8.0	7.6	7.3	7.1	7.3	4.5	6.8	5.0	7.3	7.3	6.5	6.0	4.9	8.0
L7	8.8	9.5	8.5	8.3	6.8	8.0		8.5	8.3	8.3	8.1	7.6	7.9	9.0	8.6	8.3	8.1	8.3	5.5	7.8	6.0	8.3	8.3	7.5	7.0	5.9	9.0
L8	8.3	9.0	8.0	7.8	6.3	7.5	8.5		7.8	7.8	7.6	7.1	7.4	8.5	8.1	7.8	7.6	7.8	5.0	7.3	5.5	7.8	7.8	7.0	6.5	5.4	8.5
L9	8.0	8.8	7.8	7.5	6.0	7.3	8.3	7.8		7.5	7.4	6.9	7.1	8.3	7.9	7.6	7.4	7.5	4.8	7.0	5.3	7.5	7.5	6.8	6.3	5.2	8.3
L10	8.0	8.8	7.8	7.5	6.0	7.3	8.3	7.8	7.5		7.4	6.9	7.1	8.3	7.9	7.6	7.4	7.5	4.8	7.0	5.3	7.5	7.5	6.8	6.3	5.2	8.3
L11	7.9	8.6	7.6	7.4	5.9	7.1	8.1	7.6	7.4	7.4		6.7	7.0	8.1	7.7	7.4	7.2	7.4	4.6	6.9	5.1	7.4	7.4	6.6	6.1	5.0	8.1
L12	7.4	8.1	7.1	6.9	5.4	6.6	7.6	7.1	6.9	6.9	6.7		6.5	7.6	7.2	6.9	6.7	6.9	4.1	6.4	4.6	6.9	6.9	6.1	5.6	4.5	7.6
L13	7.6	8.4	7.4	7.1	5.6	6.9	7.9	7.4	7.1	7.1	7.0	6.5		7.9	7.5	7.2	7.0	7.1	4.4	6.6	4.9	7.1	7.1	6.4	5.9	4.8	7.9

	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11	L12	L13	L14	L15	L16	L17	L18	P1	P2	P3	P4	P5	P6	P7	P8	P9
L14	8.8	9.5	8.5	8.3	6.8	8.0	9.0	8.5	8.3	8.3	8.1	7.6	7.9		8.6	8.3	8.1	8.3	5.5	7.8	6.0	8.3	8.3	7.5	7.0	5.9	9.0
L15	8.4	9.1	8.1	7.9	6.4	7.6	8.6	8.1	7.9	7.9	7.7	7.2	7.5	8.6		7.9	7.7	7.9	5.1	7.4	5.6	7.9	7.9	7.1	6.6	5.5	8.6
L16	8.1	8.8	7.8	7.6	6.1	7.3	8.3	7.8	7.6	7.6	7.4	6.9	7.2	8.3	7.9		7.4	7.6	4.8	7.1	5.3	7.6	7.6	6.8	6.3	5.2	8.3
L17	7.9	8.6	7.6	7.4	5.9	7.1	8.1	7.6	7.4	7.4	7.2	6.7	7.0	8.1	7.7	7.4		7.4	4.6	6.9	5.1	7.4	7.4	6.6	6.1	5.0	8.1
L18	8.0	8.8	7.8	7.5	6.0	7.3	8.3	7.8	7.5	7.5	7.4	6.9	7.1	8.3	7.9	7.6	7.4		4.8	7.0	5.3	7.5	7.5	6.8	6.3	5.2	8.3
P1	5.3	6.0	5.0	4.8	3.3	4.5	5.5	5.0	4.8	4.8	4.6	4.1	4.4	5.5	5.1	4.8	4.6	4.8		4.3	2.5	4.8	4.8	4.0	3.5	2.4	5.5
P2	7.5	8.3	7.3	7.0	5.5	6.8	7.8	7.3	7.0	7.0	6.9	6.4	6.6	7.8	7.4	7.1	6.9	7.0	4.3		4.8	7.0	7.0	6.3	5.8	4.7	7.8
P3	5.8	6.5	5.5	5.3	3.8	5.0	6.0	5.5	5.3	5.3	5.1	4.6	4.9	6.0	5.6	5.3	5.1	5.3	2.5	4.8		5.3	5.3	4.5	4.0	2.9	6.0
P4	8.0	8.8	7.8	7.5	6.0	7.3	8.3	7.8	7.5	7.5	7.4	6.9	7.1	8.3	7.9	7.6	7.4	7.5	4.8	7.0	5.3		7.5	6.8	6.3	5.2	8.3
P5	8.0	8.8	7.8	7.5	6.0	7.3	8.3	7.8	7.5	7.5	7.4	6.9	7.1	8.3	7.9	7.6	7.4	7.5	4.8	7.0	5.3	7.5		6.8	6.3	5.2	8.3
P6	7.3	8.0	7.0	6.8	5.3	6.5	7.5	7.0	6.8	6.8	6.6	6.1	6.4	7.5	7.1	6.8	6.6	6.8	4.0	6.3	4.5	6.8	6.8		5.5	4.4	7.5
P7	6.8	7.5	6.5	6.3	4.8	6.0	7.0	6.5	6.3	6.3	6.1	5.6	5.9	7.0	6.6	6.3	6.1	6.3	3.5	5.8	4.0	6.3	6.3	5.5		3.9	7.0
P8	5.7	6.4	5.4	5.2	3.7	4.9	5.9	5.4	5.2	5.2	5.0	4.5	4.8	5.9	5.5	5.2	5.0	5.2	2.4	4.7	2.9	5.2	5.2	4.4	3.9		5.9
P9	8.8	9.5	8.5	8.3	6.8	8.0	9.0	8.5	8.3	8.3	8.1	7.6	7.9	9.0	8.6	8.3	8.1	8.3	5.5	7.8	6.0	8.3	8.3	7.5	7.0	5.9	

Reciprocal commitment

	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11	L12	L13	L14	L15	L16	L17	L18	P1	P2	P3	P4	P5	P6	P7	P8	P9
L1		9.0	9.0	8.0	10.0	9.0	9.0	9.0	9.0	9.0	7.0	8.0	8.0	8.0	8.0	9.0	8.9	9.0	9.0	9.0	8.0	7.0	9.0	8.0	9.0	8.0	8.0
L2	10.0		10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	6.9	7.5	7.1	7.0	10.0
L3	8.0	10.0		9.0	9.0	10.0	10.0	8.0	8.0	9.0	8.0	10.0	7.0	6.0	6.0	9.0	9.0	9.0	9.0	7.0	9.0	9.0	8.0	8.0	6.0	6.0	6.0
L4	10.0	10.0	10.0		10.0	9.0	8.0	7.0	8.3	8.0	8.0	7.0	6.0	6.0	6.0	8.0	7.0	8.0	8.0	7.8	6.6	8.5	6.9	7.5	8.0	8.0	7.2
L5	9.0	8.0	3.0	5.0		8.0	3.0	8.0	8.0	3.0	2.0	9.1	8.7	7.8	2.0	8.0	8.9	8.0	3.0	8.0	2.0	8.5	8.0	8.0	7.1	7.0	8.0
L6	10.0	10.0	9.0	9.0	9.0		10.0	8.0	10.0	10.0	10.0	10.0	10.0	8.0	8.0	10.0	8.0	10.0	9.0	9.0	8.0	9.0	6.9	7.5	7.1	7.0	8.0
L7	10.0	10.0	10.0	10.0	10.0	10.0		10.0	10.0	10.0	10.0	10.0	8.7	7.8	7.5	9.2	8.9	10.0	10.0	10.0	8.0	10.0	6.9	7.5	7.1	7.0	7.2
L8	8.0	8.0	8.0	7.8	9.0	8.0	9.0		9.0	9.0	9.0	9.0	8.7	7.8	7.5	9.2	8.9	9.0	7.0	9.0	9.0	8.0	6.9	7.5	7.1	7.0	7.2

	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11	L12	L13	L14	L15	L16	L17	L18	P1	P2	P3	P4	P5	P6	P7	P8	P9
L9	10.0	10.0	8.0	7.8	10.0	9.0	9.0	9.0		10.0	9.0	9.1	8.7	7.8	7.5	9.2	8.9	9.1	7.0	8.0	8.0	7.0	6.9	7.5	7.1	7.0	8.0
L10	9.0	10.0	8.0	9.0	9.0	9.0	8.0	7.0	9.0		8.0	10.0	9.0	8.0	9.0	9.2	9.0	9.0	9.0	9.0	8.0	9.0	9.0	8.0	9.0	9.0	8.0
L11	8.0	9.0	7.0	9.0	8.6	8.0	8.0	8.0	8.3	9.0		9.0	9.0	9.0	9.0	9.0	9.0	9.0	7.3	9.0	8.0	8.5	6.9	7.5	7.1	7.0	8.0
L12	8.9	10.0	8.0	7.8	8.6	8.6	7.8	8.0	8.3	10.0	10.0		9.0	7.0	8.0	10.0	10.0	10.0	7.3	10.0	6.6	8.5	6.9	7.5	7.1	7.0	7.0
L13	10.0	10.0	10.0	10.0	8.6	10.0	7.8	10.0	8.3	9.0	8.0	9.0		8.0	8.0	9.0	8.0	8.0	7.3	9.0	6.6	8.5	6.9	7.5	7.1	7.0	7.2
L14	8.9	9.5	8.0	8.0	8.6	7.0	7.8	8.0	8.3	9.0	8.0	8.0	9.0		8.0	8.0	8.0	8.0	7.3	7.0	6.6	8.5	6.9	7.5	7.1	7.0	7.0
L15	10.0	10.0	9.0	2.0	8.0	10.0	7.8	8.0	8.3	9.0	10.0	8.0	9.0	5.0		10.0	10.0	10.0	7.3	10.0	10.0	8.5	6.9	7.5	7.1	7.0	9.0
L16	8.9	9.5	8.0	7.8	8.6	8.6	7.8	8.0	8.3	8.6	8.0	9.1	8.7	7.8	7.5		8.9	9.1	7.3	7.8	6.6	8.5	6.9	7.5	7.1	7.0	7.2
L17	8.9	9.5	8.0	9.0	8.6	9.0	7.8	8.0	8.3	9.0	9.0	9.0	9.0	9.0	9.0	9.0		9.0	7.3	7.8	6.6	8.5	6.9	7.5	7.1	7.0	8.0
L18	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	8.3	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0		7.3	10.0	6.6	8.5	6.9	7.5	7.1	7.0	9.0
P1	8.0	9.0	5.0	5.0	8.0	5.0	8.0	5.0	5.0	5.0	5.0	9.1	8.7	7.8	7.5	9.2	8.9	9.1		0.0	0.0	8.0	0.0	0.0	0.0	0.0	0.0
P2	5.0	10.0	5.0	7.8	5.0	7.0	5.0	7.0	8.3	8.0	5.0	9.1	9.0	7.8	5.0	10.0	8.9	10.0	5.0		5.0	5.0	5.0	10.0	10.0	10.0	10.0
P3	10.0	9.0	6.0	4.0	5.0	9.0	5.0	5.0	5.0	9.0	5.0	9.1	8.7	7.8	5.0	10.0	8.9	9.1	4.0	4.0		9.0	5.0	5.0	5.0	5.0	2.0
P4	9.0	10.0	10.0	10.0	10.0	10.0	8.0	7.0	9.0	8.0	10.0	10.0	8.7	7.8	7.5	10.0	8.9	9.1	4.0	7.0	5.0		8.0	9.0	8.0	10.0	8.0
P5	6.0	7.0	5.0	5.0	6.0	5.0	7.8	8.0	8.3	9.0	8.0	9.1	8.7	7.8	9.0	9.0	8.9	9.0	8.0	10.0	8.0	9.0		10.0	7.0	6.0	9.0
P6	8.9	9.5	8.0	7.8	8.6	8.6	7.8	8.0	8.3	8.6	8.0	9.1	8.7	7.8	7.5	9.2	8.9	9.1	5.0	4.0	5.0	8.0	8.0		9.0	8.0	5.0
P7	9.0	9.5	9.0	9.0	8.6	8.6	7.8	8.0	8.3	8.6	8.0	9.1	8.7	7.8	7.5	9.2	8.9	9.1	9.0	5.0	7.0	9.0	8.0	8.0		7.0	5.0
P8	8.9	9.5	8.0	7.8	8.6	8.6	7.8	8.0	8.3	8.6	8.0	9.1	8.7	7.8	7.5	9.2	8.9	9.1	7.3	7.8	6.6	8.5	6.9	7.5	7.1		7.2
P9	8.9	10.0	8.0	7.8	8.6	8.0	5.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.9	9.1	8.0	8.0	0.0	10.0	8.0	8.0	7.1	7.0	

Ties strength

	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11	L12	L13	L14	L15	L16	L17	L18	P1	P2	P3	P4	P5	P6	P7	P8	P9
L1		10	9	10	10	10	9	8	10	10	7	7	7	6	7	10	8	10	9	9	9	9	9	9	8	8	7
L2	10		10	9	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	7	8	7	7	10
L3	9	9		9	7	9	9	9	8	9	9	8	9	7	8	9	9	9	9	8	9	9	2	2	2	2	4

	L1	L2	L3	L4	L5	L6	L7	L8	L9	L10	L11	L12	L13	L14	L15	L16	L17	L18	P1	P2	P3	P4	P5	P6	P7	P8	P9
L4	10	10	10		8	8	8	5	10	7	10	6	5	6	6	7	5	6	8	8	8	9	7	8	7	7	7
L5	10	10	7	6		8	7	9	8	9	7	9	9	8	5	8	8	8	7	8	8	9	8	8	7	7	7
L6	10	10	9	8	8		10	10	10	10	10	10	10	8	8	8	8	10	8	9	9	9	7	8	7	7	9
L7	10	10	10	9	9	10		10	10	10	9	8	9	8	8	9	8	10	9	10	6	10	7	8	7	7	6
L8	8	8	9	9	9	9	10		10	9	10	10	9	8	8	9	8	9	8	10	7	9	7	8	7	7	7
L9	10	10	8	8	10	9	10	9		10	9	9	9	8	8	9	8	9	7	8	8	7	7	8	7	7	7
L10	10	10	9	9	10	9	8	9	10		10	10	10	10	9	9	8	10	8	10	8	10	8	8	8	8	8
L11	9	9	8	9	9	9	8	8	10	9		9	8	8	8	8	8	8	8	9	8	9	7	8	7	7	8
L12	9	10	8	8	9	9	9	8	10	10	10		10	9	9	10	8	10	9	8	8	8	7	8	7	7	8
L13	10	10	10	9	9	10	9	9	10	9	8	9		9	8	10	8	8	9	10	8	9	7	8	7	7	7
L14	9	9	8	9	9	8	9	9	10	9	9	9	9		9	9	9	8	9	9	8	9	7	8	7	7	9
L15	6	10	5	1	2	10	9	9	10	9	9	8	9	9		10	8	4	9	5	9	9	7	8	7	7	0
L16	9	9	8	8	9	9	9	9	10	9	9	9	9	8	8		8	9	9	8	8	9	7	8	7	7	7
L17	9	9	8	8	9	8	9	9	10	6	8	9	9	9	9	10		9	9	8	8	9	7	8	7	7	8
L18	9	6	4	8	9	9	9	8	10	10	10	10	10	9	10	10	10		9	9	8	9	7	8	7	7	6
P1	9	9	6	5	9	8	9	8	9	8	6	9	9	8	8	9	8	9		8	8	9	8	8	5	5	8
P2	6	9	5	8	9	9	10	10	10	10	8	9	10	8	8	10	8	10	10		5	7	5	10	8	5	10
P3	9	9	9	5	8	9	4	7	10	7	8	9	9	8	9	8	8	9	9	4		9	8	8	4	6	4
P4	10	10	10	10	10	10	10	10	10	10	10	10	9	8	8	10	8	9	10	10	10		10	9	10	10	10
P5	9	10	7	8	9	8	9	9	10	7	9	9	9	8	10	10	8	10	9	8	8	10		7	10	10	9
P6	8	9	8	5	9	9	9	9	10	7	9	9	9	8	9	9	8	9	8	7	8	8	8		9	7	6
P7	8	9	8	8	9	9	9	9	10	9	9	9	9	8	8	9	8	9	8	5	8	8	7	9		9	6
P8	10	9	8	10	10	9	9	9	10	9	9	9	9	8	8	9	8	9	10	0	10	10	6	7	10		0
P9	10	10	9	9	9	10	8	9	10	9	10	10	10	10	8	10	9	8	10	9	7	10	9	8	7	7	

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