Exploring the relationship between governance, tie strength, and NPD performance

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Abstract: This paper examines the impact of governance modes (norm of flexibility, trust, and monitoring) on NPD cycle time and the mediating role of relational ties strength. Our sample consists of 112 firms that were involved in NPD relationships. The results of structural equation modelling suggest that the trust and norm of flexibility are positively related to strength of relational ties while monitoring and strength of relational ties are not significantly related. On the other hand, relational ties strength is positively related to NPD cycle time. Results also show that the impact of trust and norm of flexibility on NPD cycle time are mediated by the strength of relational ties. Finally, implications for research, theory, and practice are discussed.

Keywords: governance; trust; flexibility; monitoring; relational ties strength; new product development; NPD; cycle time.

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1 Introduction

A variety of empirical studies has shown that inter-firm relationships can improve growth and success. Extant literature has addressed this issue in new product development (NPD) relationships (e.g., Primo and Amundson, 2002; Rindfleisch and Moorman, 2001).

In general, it has been believed that involving partners in NPD processes results in fast project times (Yli-Renko et al., 2001), better product quality, and lower project costs (Ragatz et al., 1997). Gupta and Souder (1998) conducting a study with a large database of NPD projects, found that companies with short NPD cycle times involve suppliers to a significantly greater extent in their NPD processes than companies with long cycle times. However, there are scholars who believe that suppliers have little practical influence on the overall project technical success (e.g., Hartley et al., 1997) and even a negative impact on project development time if they delay their activities (e.g., King and Penleskey, 1992). Hartley et al. (1997) suggest that more research is needed to understand how to use suppliers effectively to improve product development outcomes.

Earlier, Thorelli (1986) had noticed that key ingredients for success in network relationships include the ties strength between members and the governing mechanism that is used to manage the network. Through current research, we examine Thorelli's notion of key ingredients of success, empirically.

We propose that inter-organisational governance mechanisms stimulate inter-organisational innovation. As Dyer and Singh (1998) point out, governance 'plays a key role' in the creation of inter-organisational innovations 'because it influences transaction costs, as well as the willingness of alliance partners to engage in value-creation initiatives'. On the other hand, strong-tie theory provides that frequent and long-lasting relationships are more conducive to support knowledge creation and innovation. Many of the studies accept that intensive social interactions facilitate the process of knowledge creation (e.g., Tsai, 2001).

Although these arguments are not new, little is known about the NPD governance and its impact upon NPD performance (Oke et al., 2008). The purpose of the present study is, however, to bridge the gaps identified above. Specifically, we aim to extend research by investigating how modes of governance and strength of relational ties relate to NPD cycle time.

We attempt to achieve this objective in two main ways. First, we derive a theoretical model explaining the relationships among governance modes, strength of relational ties, and NPD cycle time. Second, we test this theoretical model using survey data of 112 firms engaged in NPD projects.

2 Theoretical framework

2.1 Modes of governance

Since Williamson (1975) introduced markets and hierarchies as governance structure of organisations, various classifications of governance mechanisms have been suggested (e.g., Cannon et al., 2000; Heide, 1994; Lusch and Brown, 1996). Despite the fact that there are various forms of governance mechanisms, a closer examination of their definitions suggests that they are quite similar in nature. For example, the concept of legal bonds proposed by Cannon et al. (2000) is parallel to the meaning of explicit contracts found in Lusch and Brown (1996). We believe that trust and control are the underlying logic of various form of governance. This is in agreement with other scholars (e.g., Ryu et al., 2008) who believe that in fact trust and control are the basic modes of governance. This is also consistent with Nooteboom's (1999, 2002) arguments as he stated that governance should be extended to include the issue of trust.

Trust and control co-exist in relationships as each assume the existence of the other, refer to each other, and create each other (Mollering, 2005). This co-existence is also consistent with structuration theory (Giddens, 1984) as it addresses the issue of agency/structure duality.

There are two main streams of trust/control studies. First, some studies view control and trust as related issues (e.g., Mollering, 2005; Mohr, 2007). These scholars devoted attention to the question as to whether trust and control act as substitutes and/or complements. For example, Mollering (2005) offers a perspective on the relationship between trust and control by conceptualising the two concepts as a trust/control duality. Secondly, some other scholars have emphasised the effect of these constructs on outcomes (e.g., Dyer and Chu, 2003). Although these studies have shown mixed results, they suggest generally that trust and control are associated with inter-organisational performance. Rindfleisch et al. (2010) call for future research to help in clarifying the performance implications of governance modes under various contexts.

2.1.1 Control

Scholars have identified two major organisational control mechanisms: the unilateral control mechanism and the bilateral control mechanism (e.g., Heide, 1994; Weitz and Jap, 1995).

The distinction between unilateral and bilateral control is based on the extent to which both sides participate in decision-making (Weitz and Jap, 1995). Unilateral control arises from the controlling party's effort to influence its partner's action. It is based on the use of external measurement, such as measuring output or monitoring the behaviour of a partner (Heide, 1994). Bilateral control, on the other hand, is the reliance on a shared set of principles that coordinate the activities of both exchange parties (Heide, 1994; Weitz and Jap, 1995).

Our review of extant literature reveals that operationalisation of unilateral and bilateral control constructs have never been conducted; instead, these two constructs have been empirically studied through their various forms like monitoring, vertical control, norm of flexibility, or norm of information sharing (e.g., Ryu et al., 2006).

Monitoring and vertical control are two common forms of unilateral control. Through current research, we have chosen to emphasise the monitoring since:

- 1 it has received much less attention than vertical control, in general
- 2 it is believed that NPD networks are mainly horizontal (Oke et al., 2008).

Monitoring reflects the need to ensure that partner performances remain consistent with agreed-upon expectations (Yilmaz and Kabadayi, 2006).

On the other hand, Heide and John (1992) enumerate three relational norms as bilateral control mechanisms including norm of flexibility, norm of solidarity, and norm of information sharing. Norms are expectations about behaviours that are at least partially shared by a group of actors (Heide and John, 1992). We have chosen to emphasise the norm of flexibility because of some reasons. First, the norm of information sharing has received too much attention, in extant literature. Second, the positive relationship between norm of solidarity and mediation construct (relational tie strength) is quite expected. Third, the norm of flexibility appears to have particular relevance to uncertain and risky nature of NPD relationships. In the relational contracting literature, an actor's willingness to modify an agreement in order to bring it in line with environmental conditions is referred to as flexibility (Ivens, 2005).

2.1.2 Trust

Inter-organisational trust represents an organisation's expectation that another firm will not act opportunistically when dealing with that organisation (Gulati, 1995). Management scholars have recognised the role and importance of interfirm trust in industrial transactions (e.g., Gulati, 1995; Zaheer et al., 1998).

The role of trust in collaboration and the role of trust as a governance mode are the two basic issues that are focused on here. First, studies suggest that trust plays a constitutive role in the structuring of alliance relationships (e.g., Ring and Van de Ven, 1994). Secondly, it is well-established that inter-organisational trust arises from the need to compensate for the inherent incompleteness of control (e.g., Williamson, 1985) and implies the incorporation of relational elements into contracting (Macneil, 1980).

Figure 1 shows a summary of governance decomposition based on previous studies. It should be noted that these governance modes co-exist and they cannot be found pure.

Figure 1 Governance decomposition framework



* Scope of current research

2.2 Strength of relational ties

Much of the early research on tie strength draws on Granovetter's (1973) conceptualisation of ties with a focus on information flows among individuals. This scholar defined the strength of a tie as a combination of the amount of time, the emotional intensity, the intimacy (mutual confiding) and the reciprocal services that characterise a tie (Oke et al., 2008).

The tie strength construct, as a global construct, has been conceptualised as frequency of contact, relational embeddedness, relationship quality, resource commitment, and relationship orientation (Stanko et al., 2007). Mittal et al. (2008) also argue that, operationally, tie strength can be measured using a variety of variables such as the importance attached to the social relation, frequency of social contact, and the type of social relationship between the members of a dyad. Since interchangeable use of these constructs may be confusing, through current research, we focus on social/relational dimension of inter-organisational ties using the term 'relational tie'. This is different from embedded ties (Uzzi and Lancaster, 2003) or collaborative ties (Bunduchi, 2008) as these later ties, versus arm's length ties or transactional ties, involve both economic and social elements (Bunduchi, 2008). This distinction is consistent with Gulati and Garguilo's (1999) arguments who believe "relational ties highlight cohesive ties between social actors" that subsequently affect cooperation between those actors.

The level of relational ties among collaborators positively affects reciprocal assistance (Hansen, 1999), increases cohesiveness (Gulati and Singh, 1998), lowers opportunistic withholding of knowledge (Yli-Renko et al., 2001), enhances

communication effectiveness (Dyer and Singh, 1998), reduces uncertainty (Dwyer et al., 1987), and enhances cooperation (Uzzi, 1996). A positive relationship between tie cohesiveness and knowledge transfer at the dyadic level has been empirically demonstrated (Regans and McEvily, 2003). The social capital literature also supports this assertion, as evidenced in the positive association between the relational dimension of social capital and ease of knowledge transfer (Tsai, 2001).

The role of governance modes in strengthening relational ties

Flexibility contributes to better coordination and stability in the relationship (Gundlach and Achrol, 1993) and leads to the effective implementation of business strategies and better performance (Bello and Gilliland, 1997). Flexibility in long-term business relationships positively influences relationship quality (Ivens, 2005). In a comparable study to current study, McComb et al. (2007) investigated the relationship between team flexibility and team cohesion. They found that team flexibility affects team cohesion positively. They argued that flexibility allows the team members to feel more accepted, more willing to stick together for the current project, and more willing to work together on future projects, i.e., more cohesive. Through some propositions, Fredericks (2005) stated that the flexibility and formation of inter-firm relationships are positively related. In intra-firm context, he asserted that there is a positive link between flexibility and cooperation.

Taken together, these arguments and findings suggest that bilateral control based on norm of flexibility is targeted at building in network members a sense of belonging and identification or normative commitment, which is likely to result in little relational distance and improve relational tie strength. Thus, we hypothesise that:

H1 Bilateral control based on norm of flexibility is positively related to relational tie strength in NPD relationships.

Conversely, in general, the use of unilateral control is likely to have an opposite effect on relational tie strength as efforts to enforce formal authority usually lead to relational tensions such as resentment and blaming the enforcer/controller (Lazega, 2000). Unilateral control mechanism may offend a partner's sense of autonomy (Ouchi, 1979) which in turn may hinder the development of social ties. The controlled party is less likely to exhibit voluntary cooperation and may try to shift to an alternate partner. Achrol (1997) argued that legitimate authority to coerce cooperation among channel members is not conducive to the evolution of a network organisation. Similarly, the use of coercive means is inversely related to commitment, a key aspect of relational norms and ties in networks (Cook and Emerson, 1978).

As the concern of current research is the study of monitoring, aforementioned debates show that most of the studies have paid attention to the issue of unilateral control in general rather than in particular forms of that. Few studies have pointed to the issue of monitoring or empirically have tried to investigate the role of monitoring in interfirm contexts. Perrow (1986) argued that monitoring is an obtrusive form of control, so it is likely to be ineffective or even negatively influence an exchange partner's behaviour. Ghoshal and Moran (1996) argued that the monitoring of a party creates negative feelings and it decreases the propensity to actively response to the request of the monitoring partner. Yilmaz and Kabadayi (2006) have found that the positive effect of trust on supplier flexibility, information sharing, and support decreases as the manufacturer

monitoring increases. Based on these findings and arguments we propose and test that the use of monitoring is likely to damage relational norms, cooperation, and accommodation between network members, thereby weakening the relational ties between members.

H2 Unilateral control in form of monitoring is negatively related to relational tie strength in NPD relationships.

Trust as another mode of governance is an essential element for communication (Morgan and Hunt, 1994) and cooperation (Rindfleisch, 2000). Trust is also positively associated with issues that presumably would increase propensity to social ties such as constructive dialogue and cooperative problem solving (Zand, 1972), cooperative involvement and commitment (Moorman et al., 1992), and satisfaction with the relationship (Anderson and Narus, 1990). In the innovation context, trust paves the way for informal network collaboration (Bidault and Jarillo, 1997) and collaborative innovation (Miles et al., 2000); hence, we suggest the following hypothesis:

H3 Trust is positively related to relational ties strength in NPD relationships.

2.3 NPD cycle time

Previous studies in the NPD context indicate that collaboration with an exchange partner associates with quicker product development processes (e.g., Yli-Renko et al., 2001; Oke et al., 2008). The quicker process can afford companies significant cost reduction, greater market segment coverage, and a dominant leadership role in the marketplace. NPD cycle time is defined as the pace of activities between idea conception and product implementation (Menon et al., 2002).

The role of relational tie strength in shortening NPD cycle time

Extant literature has examined antecedents of NPD cycle time (see Johnsen, 2009). The use of technological advancements such as computer-aided systems of design and manufacturing (CAD and CAM) and the practice of assigning product development to multifunctional teams are examples of widely discussed techniques for speeding products through the developmental process.

We believe that relational tie strength can be an important antecedent for NPD cycle time as Achrol (1997) argues that for a network of firms engaged in NPD to be successful, alliance partners should build social bonds, strong ties and close relationships. Tiwana (2008), in a review of the past three decades (1976 to 2006) of research on social network configurations and strategic alliances, found that there is an inattention to the relationship between tie characteristics and performance. Lazega (2000) also argues that the way to control members and achieve success in a network setting is through building relationships.

While innovation necessitates recombination of ideas and knowledge from various sources (Obstfeld, 2005), there are findings and arguments of the facilitating role of tie strength in knowledge transfer and creation. Formerly, Coleman (1988) had stated that dense social networks facilitate intensive coordination and realisation of collective ideas. Strong ties are useful in transferring codified knowledge (Simonin, 1999) which is an important form of knowledge in implementation phase of innovation (Yli-Renko et al., 2001).

Drawing from strong tie theory (Granovetter, 1973) and knowledge-based view of relationships (e.g., Coleman, 1988; Tiwana, 2008; Simonin, 1999; Yli-Renko et al., 2001), we suggest that organisations engaged in NPD relationships should create strong ties to achieve objectives or project outcomes such as shortened NPD cycle times. Therefore, we suggest the following hypothesis:

H4 Strength of relational ties is positively related to (shortened) NPD cycle time in NPD relationships.

2.4 Strength of relational ties as a mediator

Although studies on the impact of governance mechanism on NPD are inadequate, extant research suggests that governance mechanism do affect firm performance (e.g., Cannon et al., 2000; Lusch and Brown, 1996). A review of the literature suggests that the choice of governance mechanism is critical to new product success (e.g., Rindfleisch and Moorman, 2001; Robertson and Gatignon, 1998). What is less known, however, is the process by which the governance mechanism affects performance (Oke et al., 2008). Hence, we test the extent to which the relationship between the use of governance mechanism and the NPD cycle time is mediated by the strength of relational ties between members in a NPD relationship.

H5 Strength of relational ties will mediate the association that norm of flexibility, monitoring, and trust have with NPD cycle time in NPD relationships.

3 Methodology

3.1 Sampling and data collection

In order to examine the hypothesised relationships, we utilised a survey research design. A questionnaire was designed and analysed to establish the required links. We identified firms that had been involved in different NPD projects from the database of an Iranian agency. These firms were SMEs engaged in NPD relationships. The number of their employees varies from 20 to 150. These SMEs were established to develop high technologies like aircraft and aerospace technologies in Iran's private sector. Most of these SMEs' partners are also Iranian firms. To maintain confidentiality, we agreed with participants that details of the relationships would not be divulged. Since most of the researches in NPD relationships, especially in high technologies, have been conducted in developed countries from the West or Far East, a different sample from the Middle East gives an opportunity to study less studied samples.

Managing director of each sampled firm was selected as the target informant. Respondents were asked to think about their major partner who had been involved in a NPD project when responding to the survey. An informant competency test was conducted in the pretest using the following questions: how long has your company been doing business with the major partner? How long have you been at your current position? Moreover, how much do you know about your major partner's products, assets, and capabilities (Kumar et al., 1992)? The pretest results indicated that the respondents' companies had on average eight years relationship with their major partner, and the respondents had held their current positions for five years. Furthermore, the respondents

appeared to be highly knowledgeable about their partners (mean = 5.9 on a 1-7 scale). As such, it was concluded that the target informants were qualified to answer the survey.

In the main study, target respondents from 200 firms, out of 422 firms registered in a database, were selected randomly to receive a questionnaire along with a cover letter with a request to complete the enclosed questionnaire. After two follow-ups, we had received 133 questionnaires of which 112 were used for hypotheses testing, i.e., an effective response rate of 56%. The sample size of 112 firms was felt to be sufficient to provide reasonable estimates in the structural equation analysis. A sample size approaching 100 is often thought sufficient for structural equation analysis, unless there are many indicators (Loehlin, 1992).

The 112 usable responses were tested for non-response bias by comparing early respondents with late respondents (Armstrong and Overton, 1977). The mean value for each focal measurement scale (i.e., norm of flexibility, monitoring, trust, strength of ties, and NPD cycle time) and the characteristics of the participating companies and the key informants (i.e., years of relationship with the major partner, years of experience with firm, familiarity with major partner) were compared across the two groups. The comparison results indicated no significant differences between the two groups (0.174 < p < 0.652).

3.2 Scale development

The scale development was carried out in two stages. First, the existing measures of the focal variables were collected from literature. Second, interviews were conducted with experts and managers to check the relevancy of the collected measures. Interviewees were selected from marketing, operations management, and strategy management scholars and managers in aircraft and aerospace industries. The interviewees helped us in selecting the context, the scales, and the target informants. All items were written as seven-point Likert-type scales anchored by one (strongly disagree) and seven (strongly agree) as endpoints. An English version of the questionnaire was first developed. Then, with the aid of management scholars, the translation back-translation method was used to develop a Persian version. The questionnaire was pre-tested using a sample of 30 companies, resulting in final modifications and clarifications.

The instruments used in this study are based on established measures utilised in previous studies. Based on the measure offered by Kumar et al. (1995) for trust, we used three items to measure the firm's understanding of and consideration for the partner's interests. Monitoring assessed focal firm monitoring over various exchange partner's decisions. The respondents were asked to report the extent to which the focal firm conducts the partner's performance review, formal vendor evaluation, and use of controls (Noordewier et al., 1990). In order to measure NPD cycle time, we used the scale offered by Primo and Amundson (2002). Finally, strength of relational ties was measured based on a scale offered by Oke et al. (2008). Based on the inputs from interviews with managers and experts, we concluded that the scale offered by Oke et al. (2008) do measure the strength of relational ties rather than transactional ties or embedded ties (i.e., both transactional and relational).

Based on confirmatory factor analysis (CFA), a scale was developed for each construct with a reduced set of items by removing the items with low factor loadings. Coefficient alpha for each construct was measured an internal reliability test. All Cronbach's alphas in Table 1 exceed the recommended minimum alpha value of 0.60. In

empirical studies, an alpha of above 0.60 is normally considered as adequate for assessing reliability (Rosnow and Rosenthal, 1998). Therefore, the scale items used in this study are considered reliable. In addition, each of the factor loadings was significant on their respective latent factor (p < 0.01); suggesting that each of the indicators captured the constructs they were designed to measure [two of the items offered by Kumar et al.'s (1995) were removed because of loadings less than 0.4].

Discriminant validity of latent variables was checked through Chi square difference tests. Constructs were tested in pairs to see if the restricted model (in which the correlation was fixed as one) was significantly worse than the freely estimated model (in which the correlation was estimated freely). The Chi square differences were highly significant, presenting evidence of discriminant validity. Chi square difference tests resulted in 16.35, 6.02, 10.07, 25.66, 15.42, and 37.14 for the pairs of norm of flexibility/relational tie strength, trust/relational tie strength, trust/NPD cycle time, norm of flexibility/NPD cycle time, relational tie strength/NPD cycle time, and trust/norm of flexibility (p < 0.001). Further, there were no inter-construct correlations in Table 2, over the 0.60 criteria, which is an indication of discriminant validity (Aiken and West, 1991). This (i.e., inter-correlations less than 0.6) also indicated that multicolinearity is not a potential problem for this research (Grewal et al., 2004). After the scale development process, a measurement model with good fit was identified (χ^2 = 141.43, df = 142, RMSEA = 0.001, TLI = 1, NFI = 0.89, GFI = 0.88).

Variables	Items	Factor loadings	Reliability
Monitoring (MO)	MO1	0.70	0.70
	MO2	0.64	
	MO3	0.58	
	MO4	0.70	
Trust (TR)	TR1	0.74	0.64
	TR2	0.74	
	TR3	0.81	
Strength of ties (ST)	ST1	0.72	0.69
	ST2	0.70	
	ST3	0.74	
	ST4	0.70	
Norm of flexibility	NF1	0.74	0.71
(NF)	NF2	0.71	
	NF3	0.72	
Cycle time (CT)	CT1	0.84	0.72
	CT2	0.81	
	CT3	0.76	

 Table 1
 Factor loadings and reliabilities

In summary, the scale development process resulted in measures with adequate level of validity and reliability for hypotheses testing. The factor loadings and the reliability measures of each focal construct are reported in Table 1.

3.3 Analysis

Holmbeck (1997) has suggested that mediation models are best estimated using structural equation modelling (SEM). Based on Anderson and Gerbing's (1988) recommendations, we specified and tested measurement model prior to introducing the elements of structural model. Accordingly, we first estimated a measurement model using LISREL 8.53. We then estimated a structural model. Finally, we conducted model comparison to test direct effects represented in Hypotheses 1 to 4 and nested model comparison to test our mediation hypotheses represented in Hypothesis 5. A nested model test was used where the indirect effects model was compared to the direct effects model. The direct effects model posited that norm of flexibility, trust, and monitoring affect NPD cycle time directly. The indirect effects model implies that there should be no direct effects between norm of flexibility, trust and monitoring and the NPD cycle time, that is, strength of ties mediates the relationship among them.

To assess the measurement and structural models, we relied on common fit indices including the Chi square (χ^2), Chi-square relative to the change in degrees of freedom (χ^2 /df), goodness-of-fit statistic (GFI), normed-fit index (NFI), Tucker-Lewis coefficient (TLI) also called the Bentler-Bonett non-normed fit index (NNFI), and root-mean-square error of approximation (RMSEA).

4 Results

Table 2 presents means, standard deviations, and zero-order correlations among the studied variables. Zero-order correlations provide an initial examination of the hypotheses linking constructs.

Variables	Means	SD	TR	МО	NF	ST
TR	3.946	1.202	1			
MO	3.894	1.096	-0.402(**)	1.00		
NF	3.462	0.920	0.265(**)	-0.249(**)	1.00	
ST	3.745	1.044	0.517(**)	-0.468(**)	0.440(**)	1.00
СТ	3.709	1.112	0.498(**)	-0.406(**)	0.563(**)	0.405(**)

 Table 2
 Descriptive statistics and correlations

Note: ******p < 0.01

Figure 2 displays the causal model. The fit indices of this structural model showed a good fit to the data ($\chi^2 = 148.28$; df = 145; GFI = 0.88; TLI = 0.99; NFI = 0.88, RMSEA = 0.014).

Results of the structural equation modelling support hypothesis 1 ($\beta = 0.43$, t = 3.54), hypothesis 3 ($\beta = 0.57$, t = 3.55), and hypothesis 4 ($\beta = 0.80$, p < 0.01). Hypothesis 2 was not supported ($\beta = -0.21$, t = -1.47).

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Hypotheses 5 predicted that strength of relational ties would mediate the effects of governance modes on NPD cycle time. This hypothesis was tested through a series of nested model comparisons. Table 3 shows the results.

 Table 3
 Comparison of structural equation models

Model	χ^2	df	$\Delta \chi^2$	GFI	TLI	NFI	RMSEA	Significant added paths
Basic model (1)	148.28	145		0.88	0.98	0.98	0.01	
NF-CT(2)	148.28	144	0.00	0.88	0.98	0.98	0.01	-
TR-CT(3)	147.36	144	0.92	0.88	0.99	0.97	0.01	-
Fully saturated (4)	141.43	142	6.85	0.89	1.00	0.97	0.01	-
Rival (5)	141.43	142	6.85	0.89	1.00	0.97	0.01	TR-CT

Model 1 represents the basic model. This model does not have direct paths from independent variables to NPD cycle time. Against this fully mediated model (Model 1), we tested three nested models. In Models 2 and 3, we added direct links from norm of flexibility and trust to NPD cycle time. Model 4 is a fully saturated model in that we added two direct paths both from norm of flexibility and trust to NPD cycle time. Our mediation hypotheses would be supported if the fit of Model 1 (fully mediated Model 1) would not be improved by the addition of direct paths to NPD cycle time.

As shown in Table 3, the differences between Chi squares were not significant for Model 1 compared with Models 2, 3, or 4. Under the rules of model parsimony (Oke et al., 2008), these results suggested that the basic model, Model 1, best fitted the data. Hence, we concluded that strength of relational ties mediated the effect that modes of governance have with NPD cycle time. Furthermore, none of the direct added paths was significant. Path coefficients from norm of flexibility to NPD cycle time (Model 2), trust to NPD cycle time (Model 3), and fully saturated model with two direct paths from both norm of flexibility and trust to NPD cycle time (Model 4), were respectively equal to -0.02(t = -0.1), 0.31(t = 1.9), and -0.07(t = -0.28)/0.48(t = 1.77).

Model 5 is a rival model that is not nested within Models 1, 2, 3, or 4, but is used to provide further support for our hypothesised model (Model 1). An emerging consensus in

structural equations modelling is that research should compare rival models (Bollen and Long, 1992). A non-parsimonious rival view that is equally extreme would be one positing only direct paths from each of the antecedents to the outcomes, thereby making relational tie strength similar to the antecedents (i.e., trust, monitoring, and norm of flexibility). This rival model, however, allows no-indirect effects. Although the results ($\Delta df = 3$, $\Delta \chi^2 = 6.85$, p = 0.08) show that the difference between the basic model and the rival model is not significant and also there is not considerable difference between overall good-fitness of the two models, the results of the rival model show that only one of paths (i.e., trust-NPD cycle time) is supported. Thus, we concluded that modes of governance have indirect influence on NPD cycle time through strength of ties.

5 Discussion and conclusions

5.1 Theoretical contributions

The main aim in presenting this research was to contribute to the understanding of the modes of governance and their relationships with success in NPD relationships. Thus, we examined how different modes of governance including norm of flexibility, monitoring and trust relate to the strength of relational ties between members and NPD cycle time. In particular, we found that the use of monitoring by a member of relationships is not significantly related to the strength of relational ties between members while the existence of trust and enhanced norm of flexibility within a relationship has a positive influence on strength of relational ties. These results are consistent with prior research in related areas where scholars have found that trust influences joint endeavours positively (e.g., Morgan and Hunt, 1994; Rindfleisch, 2000) and norm of flexibility stimulates efforts for the mutual benefit of alliance partners (Weitz and Jap, 1995). Theses results are not consistent with those reported by other scholars who found the use of monitoring is negatively associated with collaboration (e.g., Lazega, 2000; Perrow, 1986). The non-significant relationship between monitoring and relational tie strength may be explained by the assertion offered by Yilmaz and Kabadayi (2006) as they made a distinction between standardised monitoring and exclusive monitoring mechanisms that are less intrusive, more customised, and less likely to signal non-relational expectations. This implies that our general assessment of monitoring may not be accurate as we expected. However, a clearer conception and a clearer operationalisation of this construct may be a direction for future research.

In addition, we found that the strength of ties is strongly related to NPD cycle time. The expectation that relational tie strength should enhance new product success can be explained in terms of social ties and relational embeddedness suggested in interfirm studies and knowledge-based view of relationship (e.g., Cohen and Levinthal, 1990; Hansen, 1999; Moorman et al., 1992; Rindfleisch and Moorman, 2001). For example, Hansen (1999) finds that weak ties among team members hinder the transfer of knowledge in NPD activities resulting in longer project completion time. Social ties encourage different organisations in a network to integrate and combine specialised knowledge that is central to NPD (Cohen and Levinthal, 1990). Social ties also encourage relationship-specific investments that lead to faster development times (Dyer and Singh, 1998).

Finally, we found that the relationships between modes of governance and the NPD cycle time are mediated through strength of ties. This is perhaps the most important result of this research. Previous research has established the relationship between modes of governance and performance (e.g., Dyer and Chu, 2003). However, the process by which governance mechanism affects performance has not received considerable attention. Thus, our findings, along with findings reported by Oke et al. (2008), offer some initial insights regarding the potential mechanisms through which modes of governance influence NPD success.

5.2 Limitations and future directions

This paper has both theoretical and methodological limitations. The first has to do with the issue of generalisability. Our sample was drawn from an Iranian agency database list of SMEs that had been involved in NPD projects. To provide evidence of generalisability, future research is needed to replicate our findings in other settings or networks. While current study focuses only on a particular institutional environment, scholars (Dyer and Chu, 2003) have noticed, cultural differences between institutional environments may influence the development of interfirm relationships.

Governance mechanism is embedded in the wider context of organisational structure, extra-organisational factors (Flamholtz et al., 1985) and potential contextual variables such as industry type and firm size. These factors may influence the relationships found in this study so they should be examined in future studies.

The data for this analysis were obtained from a single informant for each relationship. Kumar et al. (1993) have suggested that choosing the appropriate key informant could alleviate some of the potential problems. We have invested a considerable amount of time to identify a person that is well informed about the interfirm relationship in question. It remains vigorously debated in the literature whether multiple respondents from each interviewed firm are necessary to ensure the validity of results such as those of this study (John and Reve, 1982).

Another limitation is that we have only focused on total NPD cycle time. While this study just focuses on time and do not consider the quality and other potential benefits of the collaborative NPD, the effects of governance mechanisms and strength of ties have not been examined in various stages (development, implementation, or diffusion of innovations) of innovation process. The factors affecting the adoption and implementation of innovative ideas may differ from those that affect the generation of those ideas.

Our study cannot rule out the possibility that relational tie strength can help to build trust over time or can enhance norm of flexibility (i.e., reverse causality). In any model in which causality is suggested, longitudinal studies provide stronger inferences. Thus, the model developed and tested in this study could benefit from a longitudinal design.

Further research might consider other mechanisms for governing relationships, such as the exchange of hostages, mutual transaction-specific investment, reputation (Bond et al., 2004), and inter-organisational embeddedness (Rindfleisch and Moorman, 2001) – and other factors facilitating inter-organisational innovation.

Tiwana (2008) believes that knowledge integration construct theoretically mediates the link that tie characteristics have with alliance performance. This is also a subject for further investigation.

5.3 Managerial implications

An important question for managers in charge of inter-organisation collaborative innovation efforts is how to orchestrate activities in order to achieve successful project outcomes. Based on two critical ingredients of success (i.e., governance and relational tie strength), current research examined the relationship between modes of governance and relational tie strength and their influence on NPD cycle time.

This research points to four managerial implications:

- 1 the importance of norm of flexibility between organisations
- 2 the need to encourage inter-organisational trust
- 3 the significance of relational tie strength for innovation in NPD relationships
- 4 the use of plural inter-organisational governance mechanisms.

Two modes of governance (i.e., trust and norm of flexibility) were found to have significant impact on strength of ties. As individuals may form economic exchange relationships or social exchange relationships, the second type of relationship that involves social exchanges was found to be especially important here. Thus, the formation of affiliations based on trust and flexibility would seem to be of considerable value. This finding has highlights the need for a relational governance mechanism to have an effective NPD relationship. Trust between organisations and enhanced flexibility encourage the firms to exploit more potential synergistic benefits from the relationships. Although innovative processes are complex and risky, significant positive effect of relational norms (i.e., trust, norm of flexibility) on relational tie strength imply that managers of different firms should work close but flexible to support innovation. Contrary to our predictions, monitoring has no significant impact on relational tie strength.

The positive link between strength of relational ties and NPD cycle time also has implications. For example, the finding highlights the importance and centrality of relational ties to relationship outcomes. Managers of inter-organisational relationships should not just focus on task orientation but they also need to find different ways of building and developing collaborative social ties between relationship members as these are critical to the achievement of relationship performance.

An important finding of our study is the finding that the relationships between the governance modes and NPD project outcomes are mediated by the strength of relational ties between relationship members. Our findings suggest that efforts to build governance mechanism are better directed at collaborating rather than focusing directly on project outcomes since relational tie strength mediates the relationship between governance and NPD cycle time.

This research also indicates how firms can most effectively influence inter-organisational innovation through the employment of a combination of governance mechanisms. Although plural structures of governance mechanisms have received attention in the prior literature (Heide, 2003), the results presented here illustrate that trust and norm of flexibility work together to facilitate inter-organisational innovation. Overall, understanding when to adopt various types of governance modes is a critical decision for managers of the firms engaged in NPD relationships, since we found that it has an indirect impact on the performance of firms.

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Appendix

Norm of flexibility (Heide and John, 1992)

- NF1 Both our firm and exchange partner expect that each company will be flexible to the other company's request for changes.
- NF2 Both our firm and exchange partner expect to be able to make any adjustments necessary to cope with changing circumstances.
- NF3 Both our firm and exchange partner are generally flexible to each other when dealing with unexpected circumstances.

Trust (Kumar et al., 1995)

- TR1 Though circumstances change, we believe that this partner will be ready and willing to offer us assistance and support.
- TR2 When making important decisions, this partner is concerned about our welfare.
- TR3 In the future, we can count on this partner to consider how its decisions and actions will affects us.

Monitoring (Noordewier et al., 1990)

- MO1 Our firm regularly conducts performance review of exchange partner.
- MO2 Our firm monitors exchange partner's inventory level.
- MO3 Our firm addresses exchange partner's performance through a formal vendor evaluation programme.
- MO4 The relationship our firm has with exchange partner makes use of many controls.
- NPD cycle time (Primo and Amundson, 2002)
- CT1 This project was completed in significantly less time than similar projects that we have been involved in
- CT2 The time to complete this project was about normal for a collaborative activity.
- CT3 This was one of the fastest projects that we have been involved in

Strength of ties (Oke et al., 2008)

- TS1 We believe that the members of this network work towards attaining similar goals.
- TS2 We would be interested in continuing our relationship with other members of this network even after the project ends.
- TS3 Even if we had other options, we would remain in this relationship.
- TS4 There is very little friction between the participants.