

Factors affecting the nature of alliance governance and competitiveness

Viput Ongsakul

Dean, School of Business

NIDA Business School

National Institute of Development Administration

Bangkok, Thailand

Nakul Parameswar

Indian Institute of Management Jammu

Jammu and Kashmir, India

Sanjay Dhir

Department of Management Studies

Indian Institute of Technology (IIT) Delhi

Hauz Khas, New Delhi, India

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Abstract

Coordination needs in alliances; nature of alliance governance and competitiveness of alliances are interdependent dimensions in alliances. Coordination needs are affected by technology transfer and strategic complexity which might result in alterations in the nature and background of the alliance. This research examines the effect of complexity in technological transfer, strategic specifications of the partners and prior experience of the firm in the target country on the nature of alliance governance and alliance competitiveness. Total Interpretive Structural Model (TISM) has been developed to determine the hierarchy amongst these factors. The findings provide important inferences on the factors that affect competitiveness of contractual alliances. Results suggest that nature of alliance – being contractual agreement or a joint venture influences the competitiveness of the alliance.

Corresponding author: Sanjay Dhir

Email addresses for the corresponding author: sanjaydhir.iitd@gmail.com

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Introduction

Alliance governance has the options in the form of choice between contractual alliances (CA) and Joint Ventures (JV) that could determine its competitiveness (Harrigan, 1985; Doz and Hamel, 1998). These two forms lead to variations in the administration and form of governance proceedings of the collaboration (Culpan, 2009; Dhir and Mital, 2013a). Alliances help the firm gain access to knowledge and other resources while gaining legitimacy and therefore push the firm towards success (Glaister, 1998; Dhir and Mital, 2013b; Parameswar, Dhir and Ongsakul, 2018). The gravity of making these decisions has led a part of the firm's management devoting their time to making plans for future partnerships. The choice between the two forms of governance have already been studied by (Gulati and Singh, 1998; Oxley and Sampson, 2004). However, previous research has not followed a structured approach to examine the effect of factors on alliance governance system and its competitiveness. The factors affecting the choice of equity contribution by parent firms in alliance and further its impact on competitiveness. This study explores the effects of different factors in the nature of alliance i.e. contractual agreement or joint venture and on the shaping the competitiveness of the alliance.

The paper presents the literature review of the factors and build the need to examine these factors for their influence on nature of alliance and alliance competitiveness. Next, we discuss the methodology, data and results. We then conclude with discussion, implications and future work.

Governance and competitiveness in alliances

Prior research has explored the role of diverse factors on the nature of alliance and alliance competitiveness. Doz and Hamel, 1998 highlighted that equity participation differentiates the different nature of alliance – equity and non-equity. Further, it was observed that the equity participation affects the control exercised by parent firms on their alliance (Pan and Tse, 2000; Colombo, 2003). The control level exercised by parent firms determines the kind of coordination between parent firms building trust and minimizing opportunism (Parkhe, 1993; Hennart, Dong-Jae Kim and Zeng, 1998; Madhok, 2006; Bakker and Knoben, 2014; Parameswar and Dhir, 2018a, 2019). Therefore, JV are preferred nature of alliance in comparison to other contractual agreements. Further, effect of nature of alliance on alliance competitiveness has been scantily explored in literature (Ku, Gurumurthy and Kao, 2007; Chung and Beamish, 2010).

Internalization theory proposed by Buckley and Cason, 2016 takes into account coordination cost along with appropriation concerns. It believes that control is necessary to get rid of misappropriation but is subject to the costs affiliated with coordination and competitiveness. The variation and sharing of assets, learning potential and external exchanges would affect coordination and organisational efficiency as described by Rugman and Verbeke, 2003.

Coordination from the perspective of knowledge is important because it paves the path for integration of information (Grant and Baden-Fuller, 2004; Shrotriya, Sushil and Dhir, 2017; Parameswar, Dhir and Ongsakul, 2018; Bamel, Dhir and Sushil, 2019). If we look from the viewpoint of resources equity investment provides access to complimentary resources. Resources are desired by firms when forming alliances to gain competitiveness. Alliances are also formed for the creation of product (Pfeffer and Nowak, 1976; Rothaermel and Deeds, 2004), knowledge (Kale, Dyer and Singh, 2002; Dhir, Mital and Srivastava, 2015; Rudy, Miller and Wang, 2016; Dhir and Mital, 2018) or capabilities (Colombo, 2003; Rothaermel and Deeds, 2006; Makino *et al.*, 2007). Technical knowledge can be transferred through CA but holding an equity leads to using effort and an effortless flow of knowledge (Makino, Lau and Yeh, 2002; Dhir *et al.*, 2019). JV along with their advantage come with its costs (Balakrishnan and Koza, 1993; Makino and Neupert, 2000). CA should be preferred unless there is an explicit need for coordination, in which case the costs may become redundant (Inkpen and Currall, 2004; Meyer *et al.*, 2009).

Literature Review and Identification of Factors

Literature on CA has examined the role of multiple factors on the competitiveness of CA. However, in this paper we restrict the study to include 8 factors identified by practitioners (through focus group discussion) considered as important in determining the competitiveness of CA.

Industry Type

CA is imperative in any type of industry – pharmaceutical, retail, real estate, automobile, space research etc. and play an important role in the efficient functioning of the industry (Dikova and van Witteloostuijn, 2007; Morschett, Schramm-Klein and Swoboda, 2010). From another view, the type of industry in which the alliance is formed will influence the competitiveness of the CA since the dynamics of the industry will determine the role of CA and its importance. A CA in a developed and mature industry may not add much value as compared to a CA in a developing and new industry (Contractor, 1989; Wang and Blomstrom, 1992; Saggi, 2002; Dhir and Sushil, 2017; Bamel, Dhir and Sushil, 2019). The industry type will determine the need for a CA and decisions in the alliance governance thereby influencing competitiveness of CA (Kumar, 1995; Dasgupta, 2000).

Strategic Specification

Strategic specifications, the second dimension, takes into account all facets of managing and forming the alliance (Reuer and Ariño, 2007). The time frame mentioned in the contract is used as a measure of strategic specifications. An undermined time frame has a high probability of development or variations in the factor market, product or working conditions. Suppose there is an advancement in

technology, the new machinery is one of a kind, difficult to operate and hence involves risk (Hamilton and Nickerson, 2003) and leads to strategic complexity. Such unpredictable conditions will cause scepticism and strategic reforms will have to be made. Therefore, an open-ended alliance is formed as partners cannot stipulate a time frame for the attainment of organisational objectives (Reus and Rottig, 2009). Hence strategic specifications demonstrate itself through open ended alliances.

On the other hand, alliances which have a specified lifetime show lower strategic complexity (Turowski, 2005; Dan and Zondag, 2016; Dhir and Dhir, 2018; Parameswar and Dhir, 2018b). A limited time frame will cause less uncertainty in the factor market, product or participants as any major change won't take place. Therefore, it is easier to make a contract under such steady conditions. A contract cannot accustom itself to unstable conditions. Therefore, the strategic specification of the CA will influence the competitiveness of the CA.

Prior Presence of the Company

Prior firm operations in a country influences CA formation. Alliances are a means for parent firms to venture into uncharted territory - exploration, that is new a country/market/products/services (Kogut and Singh, 1988; Madhok, 1997; Dussauge, Garrette and Mitchell, 2004). On the other hand, CA are formed to carry out expansion - exploitation, scaling up/mass production/consolidation. The first scenario shows that the partner has no knowledge about the functioning of the country market/products/services risk to forego the CA. However, in the second scenario, the parent firms have experience functioning in the country/market/products/services (Gulati, Lavie and Singh, 2009). In a way the CA is an important linchpin for the parent firms to operate and the lack of experience enhances the competitiveness of the CA as parent firms will be eager to explore with all that they possess. In the second scenario the parent firms have first-hand experience of doing business in the country/market/product/service and possess functional knowledge. Possessing this knowledge helps lower the need for CA and thereby undermine the competitiveness of the CA. Previous occupancy in the alliance country influence the parent firms' interest towards the CA and thereby influence its competitiveness.

Internal Coordination and Complexity

The emergence of complexity can be linked to the complications of managing subparts, organisational customs and standard techniques in the manufacturing of goods (Mesquita and Brush, 2008) influences the functioning of the CA. Gulati and Singh (1998) have come to the conclusion that if partners depend on each other, they will experience more complexity and coordination costs would automatically increase and undermine competitiveness. Complexity in CA depicts the adversities formed between participants while performing alliance tasks. With increased interdependence between parent firms in a CA, the need for the CA further increases and undermine competitiveness. Strategic complexity is the second element and is explicit to all interactions in the entire domain necessary to accomplish its objectives. CA vary in terms of the amount and nature of technology transfer. CA with an aim for technology transfer have purpose more important than competitiveness. The parent firms of such CA will lay emphasis on the process of technology transfer and undermine competitiveness of the CA.

Number of Existing Alliance

More the number of CA in the industry lesser will be importance for each CA (Kale and Singh, 2009; Mohr and Puck, 2013). Moreover, multiple CA by firms will not allow parent firm to focus and undertake diligent decision making. More the number of CA, lesser the likelihood of each CA being competitive (Gulati, 1998). Furthermore, being part of many CA will increase the governance cost for the firm and undermine competitiveness gained from the CA.

Nature of Alliance

CA extend from a supplier-buyer agreement to a JV and are usually categorized based on extent of equity and the nature of governance system (Harrigan, 1988; Kogut, 1988; Barringer and Harrison, 2000). As compared to other types of CA, a JV is a distinct legal entity created to fulfil a purpose (Das and Teng, 2000a; Culpan, 2009). This makes the JV operations distinct from the parent firms' operations and possess a decision-making body of its own. Such an arrangement makes the JV a distinct organization operating in

the industry and thereby gain its own competitiveness distinct from the parent firms. JV tend to gain more competitiveness as compared to other types of CA.

Methodology

Data and Method

This study employs Total Interpretive Structural Modelling (TISM) (Sushil, 2017b, 2017a; Bamel, Dhir and Sushil, 2019; Hasan, Dhir and Dhir, 2019) for hierarchically depicting the role of each factor on the other and competitiveness of CA. The data is obtained by undertaking Focussed Group Discussion (FGD) with practitioners working in organizations involved in CA in India. During the FGD, emphasis was laid on making the practitioners understand the objective of the study and further gain their insights on the relationship between the factors.

TISM is an extension of Interpretive Structural Modelling (Warfield, 1974; Haleem *et al.*, 2012; Dubey *et al.*, 2017). An ISM interprets the links between the identified elements and the direction of the links between each pair of elements. ISM helps in identifying the contextual relationship between the identified elements of the issues and shows how the elements are related to each other (Sushil, 2017b; Shibin *et al.*, 2018). However, ISM is not competent to explain the interpretation of the related links. Hence, TISM is used to overcome this limitation. Figure 1 depicts the different steps involved in TISM

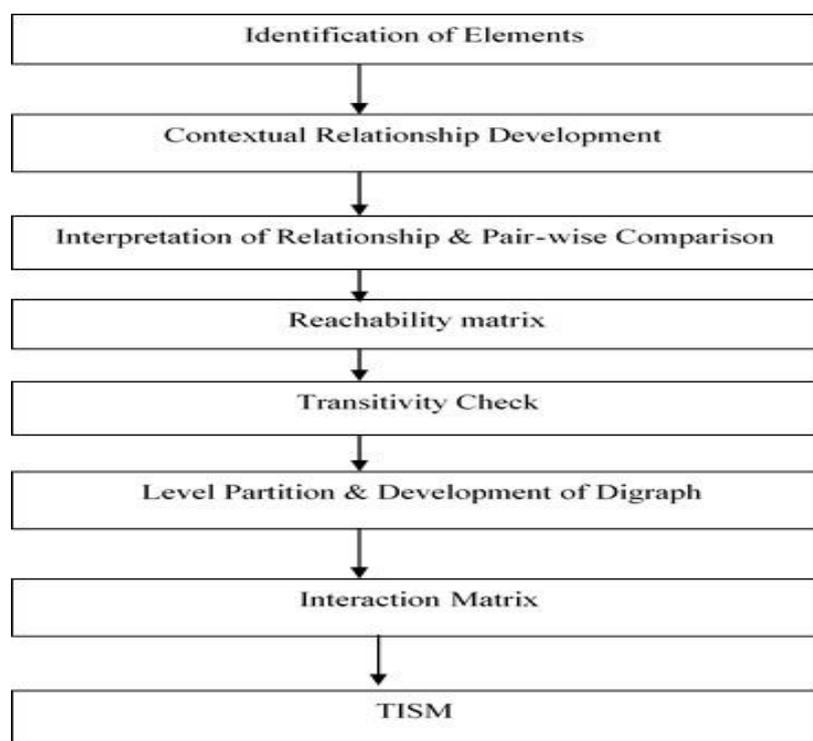


Figure 1: Steps in TISM

The process of TISM starts with the identification of elements. The second step involves the description of contextual relationships among the identified elements. The step shows that whether element A will influence the element B. This step is carried out for all the elements. The third step provided the relationship and explanation of relations between the two elements. Interpretation is performed to attain in-depth knowledge. After the interpretation, pairwise comparison is performed between the elements. All the identified elements are compared pairwise starting with the first element. The comparison between the elements is coded with Yes (Y) or No (N). In fourth step, reachability matrix is built. The Y and N codes are converted with 1 and 0 in the reachability matrix. Fifth step involves the transitivity check of the relations. The transitivity is checked with rule, i.e., if A-B and B-C, the A is related to C. The link found transitive in the matrix is coded as 1*.

After the transitivity check, the level partition is used to determine the level of the elements in the hierarchal structure. The elements having same interaction set and reachability set are positioned on the top level and then eliminated from the further set of elements until the level of each element is found. Once level is determined, hierarchy of elements is drawn, and links are used to show the relationship between the identified elements. An interaction matrix is made to provide the relevant interpretation from the knowledge base. Finally, TISM is developed by combining the digraph and interpretations by using interaction matrix. In TISM, the nodes are replaced by interpretation in the digraph.

TISM for Factors influencing CA Competitiveness

The identified elements by using literature review have been used to build the hierarchal structure by applying TISM technique. The technique helps to build the relationship among the elements. In this study, we have identified a total of eight elements in the context of alliance research based on the broad literature support and the relationship between the elements has been found. Based on the concept and technique TISM model has been build up. Table I shows the elements, contextual relationship, and interpretation between the elements.

Table 1: Elements, contextual relationship, and interpretation for identified elements

Element Code	Element	Contextual relation	Interpretation
C1	Internal coordination	Element A will influence/enhance element B	How or in what way an element A will influence/enhance element B?
C2	Internal complexity		
C3	Strategic Specification		
C4	Prior presence of the company		
C5	Nature of alliance		
C6	Competitiveness of JV or CA		
C7	No of existing alliance		
C8	Industry type		

The contextual relationship has been found was “element A will influence or enhance element B”. The interpretive logic knowledge-base has been built up. Existing literatures were applied to build the reachability matrix for this study. Appendix I (See Exhibit 1) shows the interpretive logic-knowledge base for this study. The reachability matrix is made on the basis of concepts (See Exhibit 2). Also, the transitivity is checked i.e. “if element A relates to element B and element B relates to element C, then element A is transitively related to element C”. The reachability and antecedents of all identified elements are extended in the matrix (See Exhibit 3) from the reachability matrix.

Reachability set is comprised of an assembly of elements itself and other elements which help to understand and the antecedent set is comprised of a set of elements itself and other elements which help attaining it (Singh and Sushil, 2013; Dubey *et al.*, 2015). The elements common in both reachability set and antecedent are allocated at the set of the intersection. The elements that are common in reachability and intersection are put into the top-most-level group (level I group). Again, these top-level elements are excluded from the next step and the process is repeated till all levels of each element are found. The digraph is built up by using the level of the elements (See Exhibit 4). This graph consists of links (both transitive and direct) between the elements which shows the relationship among the elements.

Finally, TISM structure is build up by using diagraph and information from interaction matrix (See Exhibit 5).

Results and Discussion

This study attempted to explore the effect of identified elements on the competitiveness of CA. We tried to understand influence of elements, relationship between the elements, relative importance and the

role of elements in promoting the competitiveness and performance of Joint ventures and alliances with the help of TISM technique. ISM is not capable to analyse the mutual relationship between the elements, so we used TISM analysis for this study (Yadav, Sushil and Sagar, 2015; Sushil, 2017a). We identified eight important elements that are affecting the competitiveness of joint venture. The elements are internal complexity, internal coordination, nature of alliance, industry type, prior presence of the company, strategic specification and others mentioned above in the literature review. These identified elements were drawn from the existing literature. After identification of the elements we build up a hierarchical model of identified elements in the context of alliance or joint ventures. We have used TISM approach in order to identify the relationship and transitive links among the different elements of alliance. Data collected from Focussed Group Discussion (FGD) involving managers working in strategic alliances was utilized to build TISM.

Findings suggest that Competitiveness of CA (C6) has occupied the top most level in the TISM model. This denotes that competitiveness of the CA is the most important factor that is laid emphasis to by the practitioners who suggested that all the factors are structured in order to gain competitiveness. Internal coordination (C1) and prior presence of the company (C4) are at the second level. Internal coordination determines the level of interaction between parent firms. Prior presence of the company in the target market helps in shaping the decision of parent firms. Firms with prior presence leverage their experience in building up competitiveness in their alliance (Luo, 1997; Reuer, Zollo and Singh, 2002; Shukla and Mital, 2016; Dhir, Dhir and Samanta, 2018). The elements C1 and C4 show the importance of effective exchange of information, experience and skills for having better competitiveness of joint ventures.

Nature of alliance (C5) lies on the third level. It affects both the elements on the second level and have transitive link with competitiveness of JV. The nature of alliance shows the importance of resources, technology, management style and managerial interactions have direct effect on the internal coordination of the firms and prior presence of the company. The linkages between the factors cumulatively affect the competitiveness of the alliance.

Internal complexity (C2) and number of existing alliance (C7) lies at the fourth level and have high driving forces on other elements. C2 and C7 have also relationship with each other. These two elements are having directly or indirectly influence on C1, C4, C5 and finally C6. The Internal complexity shows the importance of willingness, trust and method of communication between partner firm and the influence on the competitiveness. Again, number of existing alliances depicts the significance of business objectives, techniques, agreements, and market access on competitiveness of the CA. Strategic specification (C3) lies at the fifth level in the hierarchical model. C3 directly influence C2 and C7. Industry type (C8) is one of the most driving forces in the present analysis. Industry type influences the all the elements directly or indirectly as it lies at the bottom in the hierarchal structure. Industry type supports the degree of organization's interdependence and competitive actions in order to select the best suitable strategy for the business. Overall, the TISM model suggests that competitiveness of CA is shaped up by other factors (Exhibit 5 depicts the final TISM model with explanations for each relationship). Amongst the other factors industry type lies at the bottom of the TISM model suggesting that it's the most important driving factors that affects all the other factors. Strategic specification, internal complexity and number of alliances appear in level 2 and 3 respectively. Nature of alliance is determined by strategic specification and internal complexity. Further, internal coordination and prior presence along with nature of alliance drives the competitiveness of the alliance.

Implication of the study

The study is amongst a few research efforts attempting to explore the drivers of choice of nature of alliance and further competitiveness of the alliance (Sklavounos and Hajidimitriou, 2014). For the academicians, this study explores the effect of different factors on the nature of alliance and its competitiveness through qualitative data and development of hierarchical modelling. This is approach to examine antecedents to a dependent factor is scantily used especially in alliance literature. Academicians need to look beyond empirical quantitative analysis-based models to examine the causation. Using qualitative data collected based on FGD, the study takes into account the practical realities of business world. This is of significance to practitioners as the subjective relevance of the antecedents are taken into

in this study. Further, the hierarchical model provides the rank order of factors as per their significance on the nature of alliance and its competitiveness.

Limitation and future research

The limitation of the study is lack of empirical validation. The study has limitation on generalizability. This can be overcome by undertaking the study in a different context.

This study will shed light on the role played by coordination concerns when firms make decisions regarding alliances. It will distinguish appropriation needs from coordination needs. This study proposes that JV structures are preferred as a result. Also, the presence of a technological component in an alliance will have an important role in the nature of alliance. Our research will be able to analyse the nature of complexity and comes to the conclusion that various kinds of complexity does not lead to firms opting for JVs. Usually, firms prefer to take care of these complexities through contractual alliances, which is at odds with our hypothesis. This is in accordance with research done by Colombo in 2003. This opposite nature of firms can be credited to the fact that firms would be interdependent on each other cancelling out the need for a JV or equity structure. Research by Garcia-Canal, 1996 states that alliances formed for pure technological activities will be formulated through a contractual alliance and it is clear that transfer of technology does not affect equity stake according to our findings. Contractual alliances are easy to carry out in case of a specified time period for the alliance. This is in accordance with our research which states that JV structures are preferred in case of an open-ended alliance.

According to Zahra et al, 2000 firms which have previous occupancy in alliance country and operate in the same sector as that of the alliance will prefer a contractual alliance as it would cost the firm less. The firm already has knowledge of the environment of the alliance country and does not need a JV to safe guard itself.

Conclusion

Our research does not take into account alternatives to forming alliances. By participating in networks (Gulati, 1998; Ahuja, 2000) or using physical co-location (Zucker, Darby and Armstrong) firms can obtain the same benefits they would have gotten through alliances. This does not limit our research as firms choose between forming an alliance or its alternatives beforehand and our research starts after they have made this decision. We do not measure appropriation and coordination concerns directly but through circumstantial factors alliance nature. Hence a partner firm might get rid of appropriation through the right contractual clause and hence opt for CA. We have focused on equity investment at the time alliance was announced and not examined its evolution. Therefore, the study contains limitations which can lead to more research. There can be several extensions to our study. Our study can be expanded to different industries, compared with the results of acquisitions or a more detailed analysis of only one factor can be done.

Our research has important connotations for managers as it provides information as to when an expensive JV structure can be avoided. These circumstances include when the nature of the alliance is strategically simple but technologically simple, countries have identical IPPR regimes, firm has previous occupancy in alliance country, or it operates in the alliance industry. If these circumstances do not present themselves then a JV structure is required to fulfil coordination and control needs and make for a successful partnership.

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Exhibit 1- Interpretive logic - knowledge base

S. No	Element codes	Pairwise comparison	Y/N	Interpretation	Reference
1	C1-C6	Internal coordination will enhance the competitiveness of JV	Y	Helps to achieve target and there is effective exchange of attitude and information	Kale et al., 2002; Luo and Tung, 2007; Park and Ungson, 1997
2	C2-C1	Internal complexity will influence Internal coordination	Y	It reflects willingness, mutual trust, judgement, management style and methods of communication between the partner firm	Das and Teng, 2000; Lavie and Rosenkopf, 2006
3	C2-C5	Internal complexity will influence nature of alliance	Y	Bring higher transaction risk and affect decision making process to organizations and alliance	Reuer et al., 2002; Tomkins, 2001
4	C2-C6	Internal complexity will influence competitiveness of JV	Y	Transitive	
5	C2-C7	Internal complexity will influence number of existing alliances	Y	The partner tends to become distrustful and it leads to malfunction of existing alliance	Park and Ungson, 1997
6	C3-C2	Strategic specification will influence Internal complexity	Y	Specification in strategy is required to identify the employee needs, analyse the knowledge gaps within the partner firms	Benbya and McKelvey, 2006; Borys and Jemison, 1989
7	C3-C7	Strategic specification will influence number of existing alliances	Y	Strategic specification is necessary for improving management practices and coordination between sponsoring firm	Stuart, 2000; Yu et al., 2015
8	C4-C6	Prior presence of the company will influence competitiveness of JV	Y	Prior presence of the company helps in terms of experience, assets, consumer base, market, knowledge and skills to better manage the alliance	Delios and Beamish, 2001; Park and Russo, 1996
9	C5-C1	Nature of alliance will influence Internal coordination	Y	Difference in management style, operation, technology and resources affects coordination among partner firms	Gulati et al., 2000
10	C5-C4	Nature of alliance will influence prior presence of the company	Y	Diverse resources, skills, managerial interaction and characteristic of alliance affects the prior presence of the firm	Kale, Dyer & Singh, 2002; Heimeriks & Duysters, 2007
11	C5-C6	Nature of alliance will influence competitiveness of JV	Y	Transitive	
12	C7-C2	Number of existing alliances will influence internal complexity	Y	New knowledge, techniques, cultural difference and knowledge gap increases the chance of conflicts	Gulati et al., 2000
13	C7-C4	Number of existing alliances will influence prior presence of the company	Y	Share experiences, resources, know-how and consumer base helps to easily gain market access	Heimeriks and Duysters, 2007

14	C7-C5	Number of existing alliances will influence nature of alliance	Y	New set of alliance and partners have different objectives, techniques, agreements and market	Dussauge et al., 2004
15	C7-C6	Number of existing alliances will influence competitiveness of JV	Y	Transitive	
16	C8-C2	Industry type will influence internal complexity	Y	Transitive	
17	C8-C3	Industry type will influence strategic specification	Y	Supports the degree of firm's interdependence and competitive actions to select a business strategy	Das and Teng, 2000b; Hitt et al., 2004
18	C8-C7	Industry type will influence number of existing alliances	Y	Transitive	

Exhibit 2 - Reachability matrix

Elements	C1	C2	C3	C4	C5	C6	C7	C8
C1	1	0	0	0	0	1	0	0
C2	1	1	0	0	1	1*	1	0
C3	0	1	1	0	0	0	1	0
C4	0	0	0	1	0	1	0	0
C5	1	0	0	1	1	1*	0	0
C6	0	0	0	0	0	1	0	0
C7	0	1	0	1	1	1*	1	0
C8	0	1*	1	0	0	0	1*	1

Exhibit 3- Partitioning the Reachability matrix into different levels and Final

Elements	Reachability Set	Antecedent Set	Intersection Set	Level
<i>(a): Iteration-1</i>				
C1	16	125	1	
C2	12567	2378	2	
C3	237	38	3	
C4	46	457	4	
C5	1456	257	5	
C6	6	124567	6	I
C7	24567	2378	27	
C8	2378	8	8	
<i>(b): Iteration-2</i>				
C1	1	125	1	II
C2	1257	2378	27	
C3	237	38	3	
C4	4	457	4	II
C5	145	257	5	
C7	2457	2378	27	
C8	2378	8	8	
<i>(c): Iteration-3</i>				
C2	257	2378	27	
C3	237	38	3	
C5	5	257	5	III
C7	257	2378	27	
C8	2378	8	8	
<i>(c): Iteration-4</i>				
C2	27	2378	27	IV
C3	237	38	3	
C7	27	2378	27	IV
C8	2378	8	8	
<i>(c): Iteration-5</i>				

C3	3	38	3	V
C8	38	8	8	
<i>(c): Iteration-6</i>				
C8	8	8	8	VI

S. No.	Element Codes	Elements	Level in the TISM
1	C6	Competitiveness of JV or Contractual Agreement	I
2	C1	Internal Coordination	II
3	C4	Prior Presence of the Company	II
4	C5	Nature of Alliance	III
5	C2	Internal Complexity	IV
6	C7	No of existing alliance	IV
7	C3	Strategic Specification	V
8	C8	Industry Type	VI

The boldtext specifies variables selected at different levels

Exhibit 4 - Diagraph after hierarchical partitioning with the polarity of links (ISM)

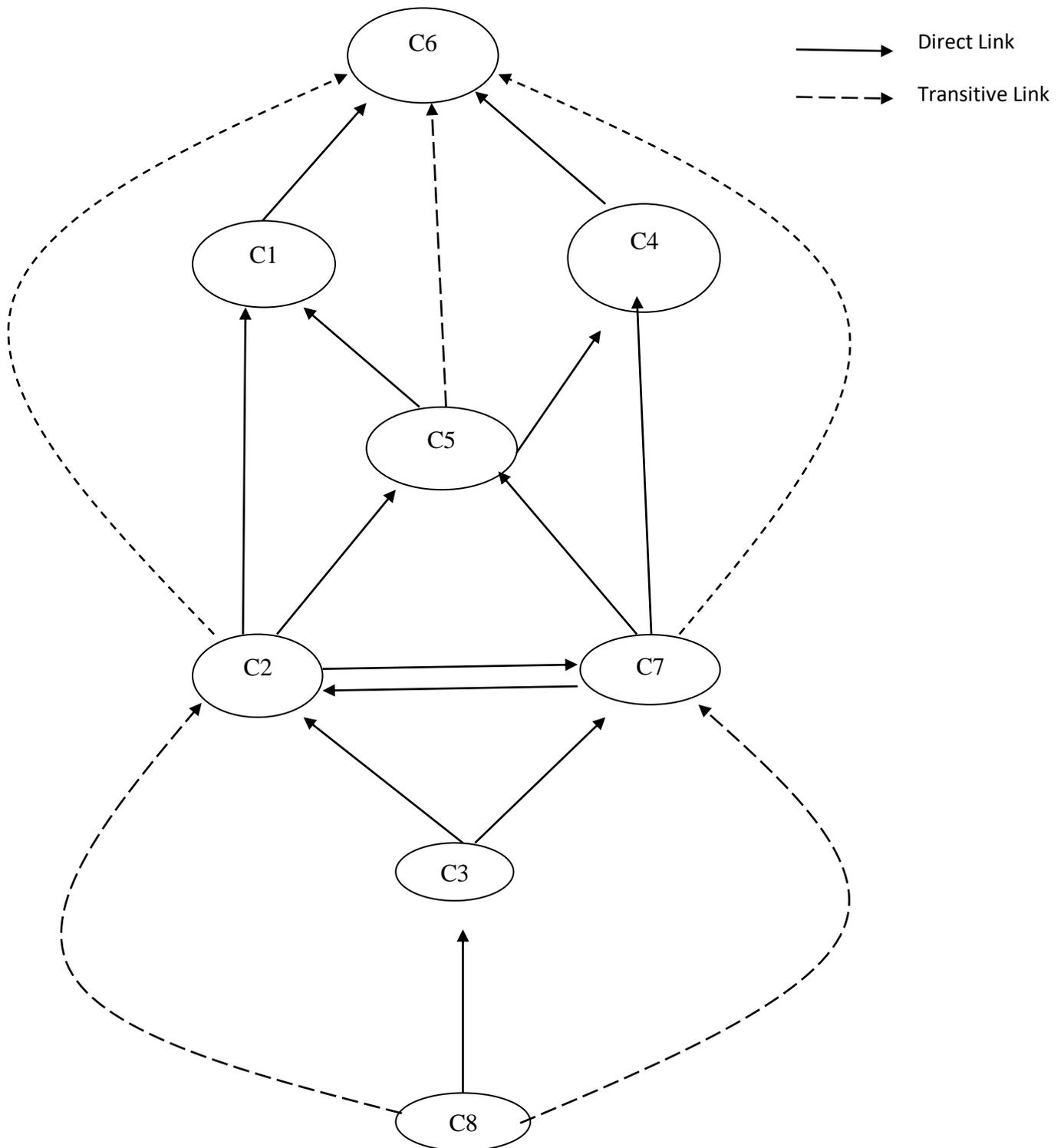


Exhibit 5 - TISM

