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Network Relationships in Knowledge Intensive Business Services: Does it vary by Firm Age and Type

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Abstract
Knowledge intensive business services (KIBS) are becoming a key pillar of the services economy particularly in the Indian context. Network relationships with external partners is an important source of information, knowledge and technology. Network partners include customers, suppliers, select competitors and investors. These network relationships may vary as a firm grows in terms of age or depending on the firm type. KIBS firms have been classified into different age bands: 1 to 10 years; 11 to 20 years; and 21 years or above. In terms of firm type, KIBS firms have been typically classified into technical KIBS or professional KIBS. The study evaluates how network relationships in KIBS firms vary by firm age and type. There is limited literature in this area and the study provided crucial insights to KIBS firm of different ages and types on how best to leverage their network relationships. The study involved cross-sectional survey across a wide spectrum of KIBS firms based in India with 151 valid responses from middle to senior level executives. The study finds that network relationship with suppliers of KIBS firms 21 years or above is stronger as compared to KIBS firms upto 10 years old. Also the network relationship with investors of technical KIBS is stronger as compared to professional KIBS.
Keywords: Network Relationships, Knowledge Intensive Business Services, Firm Age, Technical KIBS, Professional KIBS.

Introduction

Business firms exist in a network of relationships with other firms. Networks provide crucial access to information, knowledge and technology and thus play an important role in growth and innovation of firms. Knowledge exchange between stakeholders may range from codified or explicit knowledge to tacit knowledge (Amara et al., 2009). While explicit knowledge is objective and can be transferred easily, tacit knowledge is subjective and thus may require interaction and explanation. External contacts with stakeholders help in generation of new ideas (Jong and Vermeulen, 2003).

This study has focused on Knowledge Intensive Business Services (KIBS) firms based in India. KIBS firms involve a high level of learning and exchange knowledge with

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their clients, suppliers and other partners (Landry et al., 2012). The knowledge that KIBS firms exchange with their clients may range from codified knowledge to a mix of tacit and codified knowledge (Tai-Shan et al., 2018). The study evaluates the impact of firm age and type on network relationships. KIBS firms have been classified into different age bands: 1 to 10 years; 11 to 20 years; and 21 years or above. Firm age may indicate the experience of a firm in collaborating with other businesses (Brettel and Cleven, 2011). Thus one may expect firms to have stronger network relationships with their external partners as they get older.

In the study, KIBS firms have been classified into technical KIBS (t-KIBS) and professional KIBS (p-KIBS) based on such classification by Corrocher et al. (2009). Technical KIBS provide technical services such as software consulting, database services, architecture and engineering services while professional KIBS provide business consulting services such as management consultancy, market research, media planning, legal services, accounting and auditing services etc. The study evaluates if the network relationships vary in terms of t-KIBS and p-KIBS.

Currently there is very limited literature on the impact of firm age or type on network relationships. It is important to study this as networks are an important source of information and knowledge and thus it is critical to understand how these relationships are effected in terms of firm age or type as this would enable firms of different types and at different stages of growth to most effectively leverage such relationships.

Network Relationships

The network relationships considered in the study are the networks of KIBS firms with customers (NC), suppliers (NS), select competitors (NCOM), and investors (NI). External contacts and collaborations are an important source of knowledge creation in firms and formal cooperation among firms facilitates this process while strong interactions with customers are particularly important in terms of process and organizational innovation (Trigo and Vence, 2012). There is intense interaction in terms of exchange of information and knowledge among KIBS firms and their clients (Huggins, 2010). Networks provide firms access to knowledge, resources and technologies and intensive social interactions between organizational actors is key to transfer of technical or market related knowledge (Inkpen and Tsang, 2005). A firm may collaborate with external network partners that include suppliers, customers, competitors and research organizations and this requires sustained effort on the part of the firm to reap benefits from these networks with a high degree of communication and knowledge exchange between network partners (Ren et al., 2013). There is a positive link between innovation in services and network relationships particularly when one considers the interaction with customers required in delivering services (Yung-Chang, 2019).

Effective organizations utilize employee networks to achieve operational efficiency as well as facilitate innovative activities and networks may be designed to optimize the flow of ideas within the organization and outside with network partners (Cross et al.,

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2010). As a firm's involvement in its networks increases, its ability to access information from a variety of sources increases (Bell, 2005). Networks provide access to market resources as networked firms grow by cooperation with their partners and also such firms are open to sharing information and technical competencies with their network partners (Kulmala and Uusi-Rauva, 2005). Contemporary innovation processes may take place across industries and may be distributed across a number of networked firms (Levén et al., 2014). In network theory, markets are considered as a system of relationships among customers, suppliers, competitors and other actors (Coviello and Munro, 1995). Inter-organizational networks provide access to resources beyond what markets or vertical integration in a firm may be able to offer (O'Donnell et al., 2001). Networks provide access to heterogeneous knowledge in terms of diversity in technology, information, products, skills or know how (Fang, et al., 2017). When it comes to partnership with competitors or coopetition, firms may prefer to cooperate with those players who are indirect competitors in the market and thus are perceived as more trustworthy and complementary (Kraus et al., 2018).

Firm Age and Network Relationships

As firms age, they may gain more experience in collaborating with external partners (Brettel and Cleven, 2011). Although younger firms are more dynamic than older firms, once firms start operations only then they learn that how productive and profitable they are in actual and what are their competitive advantages and unique selling propositions (Lawless, 2014). Younger firms operate in the context of high level of uncertainty and are thus more likely to explore new ideas and technologies but they do face shortages in terms of external and internal financial resources while on the other hand, firms with more experience are more likely to exploit market opportunities (Pellegrino, 2018). The relationship between firm age and performance is non linear as performance increases initially due to organizational learning and then may plateau or even decrease (Coad et al., 2018). Intensity of organizational innovation has a positive relationship with firm age as mature firms are able to accumulate knowledge and experience and actively develop external relationships (Dukeov et al., 2018). Firms which are older may gain more benefits from collaborations with research organizations as they become more inert and may have difficulty in internal innovations (Yu and Lee, 2017). There is a difference in how dynamic network capability operates in younger and older firms (Chen et al., 2020). Firm age moderates back office and front office service capabilities in small and medium enterprises and while younger firms may benefit from more front office capabilities, older firms may need to focus more on building back office service capabilities (Valtakoski and Witell, 2018).

Firms which are younger and have been established recently are less likely to collaborate with suppliers or customers (Tether, 2005). Entrepreneurial capabilities in terms of recognizing and exploiting opportunities generally accrue over time as firms learn and gain experience (Withers et al., 2011). This may be explained as it takes time to establish trust with external stakeholders. In the study the firms have been classified

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into 3 different age bands as described earlier. Figure 1 describes the conceptual framework of the study and the following hypotheses are proposed:

H_{01}: There is a significant difference in NC of firms 21 years old or above and firms upto 10 years old.

H_{02}: There is a significant difference in NS of firms 21 years old or above and firms upto 10 years old.

H_{03}: There is a significant difference in NCOM of firms 21 years old or above and firms upto 10 years old.

H_{04}: There is a significant difference in NI of firms 21 years old or above and firms upto 10 years old.

Firm Type and Network Relationships

The study has focused on knowledge based services firms also called as KIBS which are further classified as professional and technical KIBS as provided in details in Appendix A. The study evaluates if there is a variance in network relationships based on firm type. As compared to p-KIBS, t-KIBS are more likely to collaborate with external partners while at the same time innovation patterns across KIBS are heterogeneous and cut across the traditional classification of KIBS into t-KIBS and p-KIBS (Corrocher et al., 2009). Technical or t-KIBS are highly innovative and may combine product and process innovations and focus on technological innovations (Miles, 2008) and t-KIBS stand out in terms of innovation (Miles et al., 2019). Firms with focus on technology are likely to cooperate with suppliers and research institutions (Trigo and Vence, 2012). Technical KIBS are more likely to focus on products and marketing as compared to professional KIBS (Amara et al., 2009). Cooperation with customers and suppliers is important in case of p-KIBS for innovation (Freel, 2006). As technology based projects require funding, thus t-KIBS are likely to have closer relationship with investors who may also provide strategic guidance to such firms. While p-KIBS may focus on adoption of new technologies, t-KIBS may focus on creation of new technologies (Santos-Vijande et al., 2013). Thus the following hypotheses are proposed:

H_{05}: There is a significant difference in NC of t-KIBS and p-KIBS

H_{06}: There is a significant difference in NS of t-KIBS and p-KIBS

H_{07}: There is a significant difference in NCOM of t-KIBS and p-KIBS

H_{08}: There is a significant difference in NI of t-KIBS and p-KIBS

Research Method and Approach

The study has evaluated the role of firm age and firm type on network relationships of knowledge based service firms. Sareen and Pandey (2015) have developed the measurement instrument and tested for reliability and validity. The research design involved cross-sectional survey that was administered electronically across the wide spectrum of KIBS firms. Survey respondents were middle to senior level executives of KIBS firms. Finally 151 valid responses were received and sample size was adequate for multivariate analysis.

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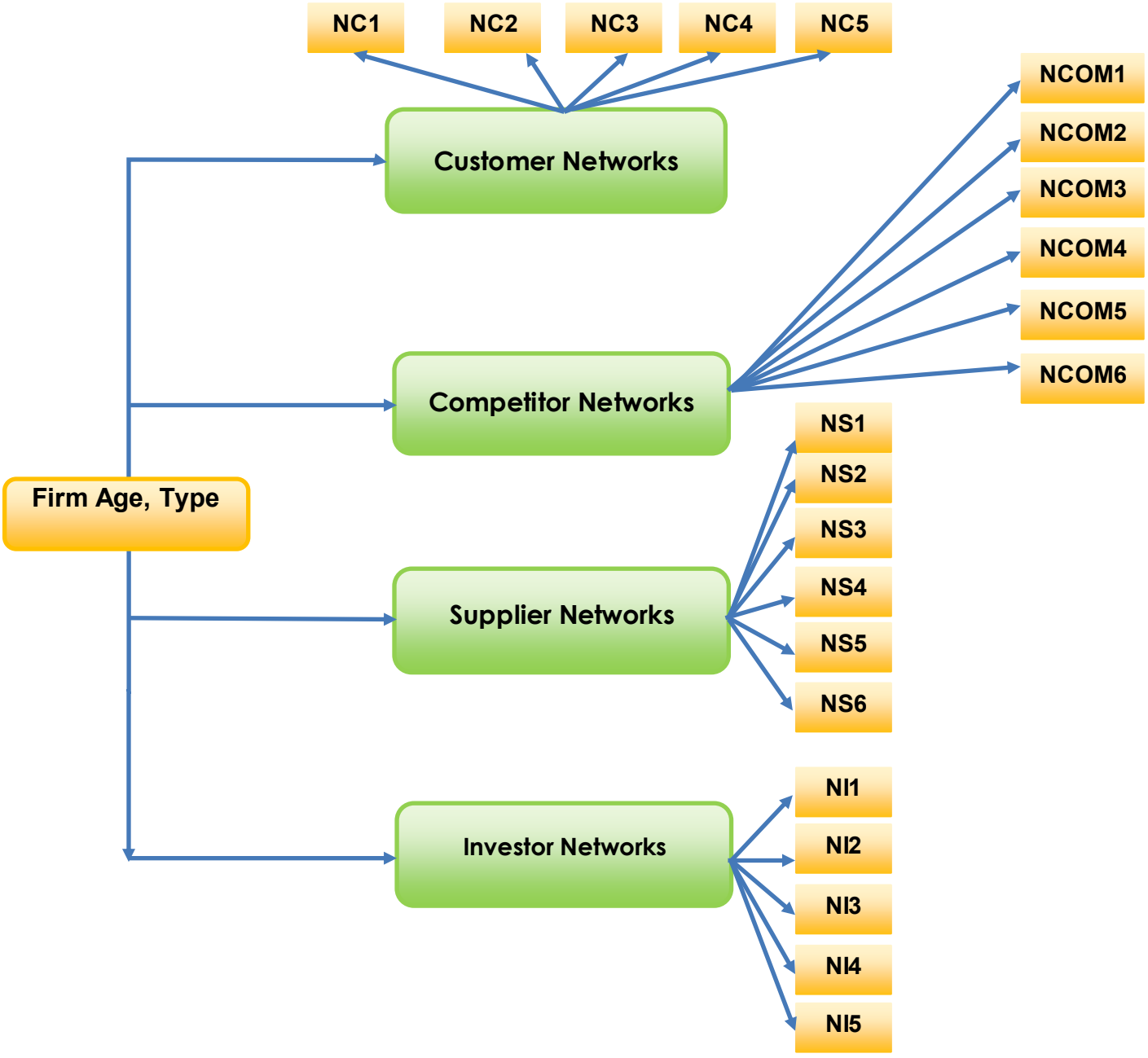
Figure 1: Conceptual Framework



Note: The above figure is author's own compilation. The constructs for measuring different aspects of networks have been adapted from Sareen and Pandey (2015).

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Data Analysis and Discussion

Impact of Firm Age on Network Relationships

The study evaluates the impact of firm age on network relationships with customers, suppliers, select competitors and investors. The data has been analyzed in terms of 3 groups: Firms with age of: 1 to 10 years belong to Group 1; 11 to 20 years belong to Group 2; and 21 years or above belong to Group 3.

Network Relationship with Customers

Table 1 describes the analysis of variance of the variable NC with respect to firm age. Table 2 presents multiple comparisons of NC by firm age.

Table 1: Analysis of Variance of NC by Firm Age

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	3.088	2	1.544	4.082	.019
Within Groups	55.993	148	.378		
Total	59.082	150			

Table 2: Multiple Comparisons of NC by Firm Age

(I) Age		Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
1	2	.02470	.14433	.985	-.3322	.3816
	3	-.27489	.11799	.070	-.5666	.0169
2	1	-.02470	.14433	.985	-.3816	.3322
	3	-.29959	.12937	.072	-.6195	.0203
3	1	.27489	.11799	.070	-.0169	.5666
	2	.29959	.12937	.072	-.0203	.6195

In Table 2, it is observed that there isn't any significant difference among the groups ($p>.05$). It may be noted that the difference between Group 3 and Group 1 has moderate significance ($p<.10$) and the same is the case between Group 3 and Group 2 ($p<.10$). This suggests that firms which are 21 years or older may have stronger customer relationships as compared to firms in other age bands. Thus the hypothesis, *H_{01}: There is a significant difference in NC of firms 21 years old or above and firms upto 10 years*

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old, is rejected at 95% confidence level. The same hypothesis may be accepted at 90% confidence level. The results suggest that it is likely that as firms get older, their relationships with their customers get stronger as more trust is established.

Network Relationship with Suppliers

Table 3 describes the analysis of variance of the variable NS with respect to firm age. It is observed that there is a significant difference among the groups ($p<.05$). In Table 4, it may be noted that difference between Group 3 and Group 1 is significant ($p<.05$). Thus network relationship with suppliers of firms which are 21 years or older are stronger as compared to firms less than 10 years old. Thus as expected, firms which are 21 years or older are likely to have well developed supplier relationships as compared to younger firms. The findings confirm the hypothesis, *H_{02}: There is a significant difference in NS of firms 21 years old or above and firms upto 10 years old.*

It may be also noted that there is no significant difference between Group 3 and Group 2 thus indicating that supplier relationships stabilize once a firm is in existence for more than 10 years.

Table 3: Analysis of Variance of NS by Firm Age

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	3.377	2	1.688	3.669	.028
Within Groups	68.095	148	.460		
Total	71.471	150			

Table 4: Multiple Comparisons of NS by Firm Age

(I) Age		Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
1	2	-.06101	.15916	.929	-.4546	.3326
	3	-.32251*	.13012	.049	-.6443	-.0008
2	1	.06101	.15916	.929	-.3326	.4546
	3	-.26150	.14267	.190	-.6143	.0913
3	1	.32251*	.13012	.049	.0008	.6443
	2	.26150	.14267	.190	-.0913	.6143

*The mean difference is significant at the 0.05 level

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Network Relationship with Select Competitors

Table 5 describes the analysis of variance of the variable NCOM with respect to firm age. It is observed that the differences between groups are not significant (p>.05). Thus there is no significant difference in NCOM across different age bands. Thus the hypothesis, *H_{03}: There is a significant difference in NCOM of firms 21 years old or above and firms upto 10 years old,* is rejected. This shows that network relationship with select competitors is independent of firm age and even younger firms may attempt to develop such relationships in line with firm strategy.

Table 5: Analysis of Variance of NCOM by Firm Age

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2.810	2	1.405	2.015	.137
Within Groups	103.186	148	.697		
Total	105.996	150			

Network Relationship with Investors

Table 6 describes the analysis of variance of the variable NI with respect to firm age. It is observed that the differences between groups are not significant (p>.05). Thus there is no significant difference in NI across different age bands. Thus the hypothesis, *H_{04}: There is a significant difference in NI of firms 21 years old or above and firms upto 10 years old,* is rejected. As expected, investor relationships depend more on the nature and stage of growth of a firm and not on the age of the firm.

Table 6: Analysis of Variance of NI by Firm Age

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	3.357	2	1.679	2.012	.137
Within Groups	123.474	148	.834		
Total	126.832	150			

Impact of Firm Type on Network Relationships

The study also evaluates the impact of firm type on network relationships as the KIBS firms have been classified into t-KIBS and p-KIBS as detailed in Apendix A. In order to evaluate the differences between the 2 groups, a t-test was conducted. Table 7 provides the group statistics for firm type where t-KIBS have been given the code 72 while p-

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KIBS have been given the code 74. Table 8, presents the independent-samples t-test for firm type.

Table 7: Group Statistics for Firm Type

Variable		N	Mean	Std. Deviation	Std. Error Mean
NC	72	70	4.0686	.65043	.07774
	74	81	3.9704	.60755	.06751
NS	72	70	3.6714	.69561	.08314
	74	81	3.5494	.68488	.07610
NCOM	72	70	2.8690	.85451	.10213
	74	81	2.7181	.82733	.09193
NI	72	70	3.9857	.76543	.09149
	74	81	3.5852	1.00239	.11138

Note: Codes 72 and 74 represent t-KIBS and p-KIBS respectively

Table 8: Independent-Samples t Test for Firm Type

		Levene's Test for Equality of Variances		t-test for Equality of Means				
Variable		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
NC	E	.411	.522	.959	149	.339	.09820	.10245
	U			.954	142.437	.342	.09820	.10296
NS	E	.657	.419	1.084	149	.280	.12205	.11258
	U			1.083	145.164	.281	.12205	.11271
NCOM	E	.131	.718	1.101	149	.273	.15094	.13708
	U			1.098	144.363	.274	.15094	.13741
NI	E	5.083	.026	2.726	149	.007	.40053	.14694
	U			2.779	146.859	.006	.40053	.14413

Note: In the table E represents equal variances and U represents unequal variances respectively for Levene's test for equality of variances

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In Table 8, in terms of significance ($p<.05$), it is observed in the table that the t-test for equality of means is not significant in case of all variables except for NI. For NI, the t-test is significant ($p<.01$). Thus network relationships with investors differ significantly between t-KIBS and p-KIBS and the hypothesis, *H_{08}: There is a significant difference in NI of t-KIBS and p-KIBS,* is accepted. As observed in Table7, NI for t-KIBS is stronger as compared to NI for p-KIBS. Also, as observed in Table 8, there is no significant difference between the two firm types in terms of network relationships with customers, suppliers and select competitors. Thus the following hypotheses are rejected:

H_{05}: There is a significant difference in NC of t-KIBS and p-KIBS

H_{06}: There is a significant difference in NS of t-KIBS and p-KIBS

H_{07}: There is a significant difference in NCOM of t-KIBS and p-KIBS

This shows that network relationship with investors are stronger in t-KIBS as compared to p-KIBS. Investors may play an important role in providing strategic guidance to t-KIBS while in case of network relationship with customers, suppliers and select competitors, there is no significant difference between t-KIBS and p-KIBS.

Conclusion

The study evaluates the impact of firm age and firm type on network relationships in the context of knowledge based service firms. Firm age has been classified in terms of 3 different age bands (1 to 10 years; 11 to 20 years; and 21 years or above). Also KIBS firms have been classified into professional or p-KIBS and technical or t-KIBS. Network relationships are important source of information, technology and knowledge in KIBS firms. Thus it is important to study how these network relationships may be impacted by firm age and size. In terms of network relationship with customers or NC, it is found that although there is no difference across age bands at 95% confidence level but when one considers 90% confidence level, then firms which are 21 years or older have stronger network relationships with customers as compared to firms in other age bands. This suggests that as knowledge based firms grow older, they may establish better customer relationships.

In terms of supplier relationships, it is observed that there is a significant difference in network relationship with suppliers between firms 21 years or above in age and firms upto 10 years old. Generally, supplier relationships are seen far more crucial in case of manufacturing firms as suppliers form a crucial part of production and supply chains. In case of KIBS firms generally suppliers play more of a supporting role although it is found in the study that even in case of KIBS firms, supplier relationships get stronger as firms becomes older. This may be due to the reason that mutual trust and understanding increases with time. Also, it is observed that in case of network relationships with select competitors and investors, there is no significant difference across firms belonging to different age bands. This shows that while other network relationships aren't effected by firm age, relationships with suppliers and customers may get stronger with firm age.

In the study, when the network relationships have been evaluated in term of firm type (t-KIBS or p-KIBS), it is found that only in case of network relationship with investors,

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there is a significant difference between t-KIBS and p-KIBS. This shows that in case of investors in technology based KIBS, beyond providing funds for business requirements, such investors may play an important role in firm strategy and direction as they bring crucial insights about markets and competitive scenario.

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Appendix A: Classification of Knowledge Intensive Business Services

Sector	Description	Type
72	**Computer and Related Activities**	
72.1	Hardware Consultancy	t-KIBS
72.2	Software Consultancy	t-KIBS
72.3	Data Processing	t-KIBS
72.4	Database Activities	t-KIBS
72.6	Other computer related activities	t-KIBS
73	**Research and Development**	
73.1	Research and experimental development in natural sciences and engineering	t-KIBS
73.2	Research and experimental development in social sciences and humanities	t-KIBS
74	**Other Business activities**	
74.11	Legal Activities	p-KIBS
74.12	Accounting, bookkeeping, auditing activities and tax consultancy	p-KIBS
74.13	Market Research	p-KIBS
74.14	Business and Management Consultancy	p-KIBS
74.20	Architecture and engineering activities and other technical services	t-KIBS
74.3	Testing activities and technical analysis	t-KIBS
74.4	Advertising	p-KIBS
74.5	Labour recruitment and provision of personnel	p-KIBS
74.8	Other professional or business services	p-KIBS

Note: The above classification has been adapted from Corrocher et al. (2009)

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Appendix B: Details of Items belonging to Network Relationships

a. Network Relationship with Customers (NC)

Code	Item
NC1	We maintain regular communication with our customers
NC2	We fully understand the needs expressed by our customers
NC3	Customers provide detailed specifications for new services
NC4	Customers regularly provide feedback and suggestions for improvement
NC5	We frequently exchange knowledge with our clients

b. Network Relationship with Suppliers (NS)

Code	Item
NS1	We work with our suppliers just as if we are in the same team
NS2	We frequently exchange knowledge with our suppliers
NS3	Our firm regularly takes initiatives to help development of suppliers
NS4	We often work with our suppliers to make joint bids/proposals to customers
NS5	Our firm often engages in collaborative planning with suppliers
NS6	We maintain regular communication with our suppliers

c. Network Relationship with Select Competitors (NCOM)

Code	Item
NCOM1	Select competitors are a regular source of new ideas
NCOM2	Our firm maintains regular communication with select competitors
NCOM3	We frequently exchange knowledge with select competitors
NCOM4	We share resources with select competitors in order to complement mutual strengths
NCOM5	We work with select competitors to make joint proposals/bids to customers
NCOM6	We engage in collaborative planning with select competitors

d. Network Relationship with Investors

Code	Item
NI1	Our firm maintains regular communication with investors
NI2	Investors regularly provide critical information about competitive scenario
NI3	We frequently exchange knowledge with our investors
NI4	Investors play an important role by providing strategic direction to our firm
NI5	We update our investors regularly about significant developments in our business

Note: The constructs for the above network relationships have been defined by Sareen and Pandey (2015).