# ENTREPRENEURIAL NETWORKS AND KNOWLEDGE TRANSFER: THE MODERATING ROLE OF INCUBATOR/ACCELERATOR AFFILIATION

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## ABSTRACT

There is little empirical evidence on the issue of whether the relationship strength in entrepreneurial networks (RSENs) facilitates tacit knowledge transfer (TKT), and if so, whether incubator/accelerator affiliation affects the relationship between RSENs and TKT. The purpose of this paper is to understand how the startups affiliated to incubator/accelerator (private/public/private-public) are able to improve their innovation capability. This study examines various relationships within the empirical context of Indian manufacturing and service startups. We empirically provide some evidence that formal RSEN influences the extent of TKT, and hence, the innovation capability. The results support that startups in formal entrepreneurial networks gain more if they have public-private incubator/accelerator affiliation. To our knowledge, this is the first attempt to link RSENs to the TKT in the national system of innovation literature. This study also contributes to our understanding of entrepreneurial networks in a non-Western context, i.e., India. In terms of practical implication, it is not only entrepreneurial networks that play an important role in TKT, but also their relationship strength. Hence, we argue that TKT in entrepreneurial networks may be a source of critical competitive advantage for startups in the 21st century. In addition, results provide implication for developing relationship with the members in networks for tacit knowledge. These implications have the potential to direct the policy initiatives.

**Contribution/ Originality:** This is one of very few empirical studies which have investigated the linkages among relationship strength in entrepreneurial networks (RSENs), knowledge transfer, and innovation capability of startup firms in a non-Western context, i.e. India. The study has important managerial implications, and findings have the potential to direct private-public policy initiatives.

## 1. INTRODUCTION

The subject of networking has long been the focus of considerable interest to the disciplines of organizational behavior and management studies, particularly since Granovetter's observation that "economic action is embedded in ongoing networks of personal relationships rather than carried out by autonomous actors" (Granovetter, 1973).

1093

Entrepreneurship, in particular, has embraced networking theory as a mechanism for exploring the creation and development of new ventures. Entrepreneurial networks can be defined as the sum total of relationships in which an entrepreneur participates, and which help in the success of the firm by providing key resources. These relationships may be articulated through the mechanism of membership in formal organizations, through the links an entrepreneur develops with suppliers, distributors and customers, or through the utilization of social contacts, including acquaintances, friends, family and kin (Dodd and Patra, 2002). Hence, research into entrepreneurial networks falls into two principal categories: inter-organizational networks and the entrepreneur's personal network. Alternatively the two categories have been called inter-organizational and social networks (Brown and Butler, 1993) or formal and informal networks (Johannisson, 1986). Entrepreneurial networks have been shown to act as providers of psychological and practical support (Johannisson, 1986; 1987) of access to opportunities (Burt, 1993; Hills *et al.*, 1997) and of a host of other resources, including finance and information (Ostgaard and Birley, 1996). Indeed, it is difficult to see how venture creation is possible without access to an effective set of network relationships (Szarka, 1990).

The activities of national governments and international organizations like the OECD had during the 1960s and 1970s led to an immense interest in reasons why national growth rates differ and one of the explanations was differences in the research systems of different countries (Lundvall *et al.*, 2002). The concept of 'National Innovation System' (Freeman, 1995) has started taking center stage with increased attention in many developing countries, particularly in India. National Innovation System has been defined differently by various experts. For example, Freeman (1997) defines it as "the network of institutions in the public and private sectors whose activities and interactions initiate, import, modify and diffuse new technologies." The distinct role played by members of National Innovation System which consist of a number of enterprises both from public and private sector, universities, publicly funded R&D organizations, and policy makers. There must be a very strong networking amongst above-mentioned agencies.

The existing literature on entrepreneurial networks, highlight possible knowledge gap that needs to be addressed and empirically tested. First, although studies have acknowledged that startups benefit and achieve performance through their well-established formal and informal entrepreneurial networks (Johannisson, 1986; Brown and Butler, 1993) they did not provide a measurable definition of the relationship strength in entrepreneurial networks (henceforth, RSENs) which may act as a potential driver for tacit knowledge transfer, which then leads to innovation capability. Second, empirically, many studies about entrepreneurship and networks mainly follow a qualitative approach (Brüderl and Preisendörfer, 1998). Third, in most of the strategy literature, national system of innovation and startup performance are theoretically explained and there is lack of empirical evidence on the role of incubator/accelerator affiliation as moderator in the national system of innovation (Kumar and Kumar, 2016).

Addressing the knowledge gap, the goal of this paper is to analyze the relationships among RSENs, TKT and innovation capability. In this regards, the paper answers three key research questions: i) to what extent the relationship strength in entrepreneurial networks (RSENs) facilitates the TKT? ii) does the degree of tacitness of knowledge increase the innovation capability of the startups? and iii) does the incubator/accelerator affiliation influence the relationship between RSENs and the extent of TKT? While answering these questions, this study also contributes to our understanding of national system of innovation in a non-Western context, i.e., India.

Our research attempts to explain and analyze under the following steps: First, we introduce our dependent construct – the innovation capability of a startup. Second, we define the source of the innovation capability that is the extent of TKT. Third, we identify potential source of the TKT i.e. RSENs in our study. Fourth, we identify moderating role of incubator/accelerator (private/public/private-public) affiliation on a relationship between RSENs and the extent of TKT. Fifth, we provide propositions on how these sources ultimately affect innovation capability of the startups. RSENs is being taken into consideration as an explanatory variable. Other measurement

scales are defined after the necessary changes in the existing scales. We explain the data and method, and analyze the empirical findings. Finally, we conclude with the implications.

## 2. CONCEPTUAL OVERVIEW AND HYPOTHESES

Our discussions include four aspects: RSENs, extent of TKT, and incubator/accelerator (public/private/public-private) affiliation and innovation capability. These aspects of our discussions are important because the literature has little evidence on most of these areas and no clear pattern seems to be evident. We state below five illustrative hypotheses and provide brief rationale for them. Figure 1 illustrates our working conceptual model and provides clear understanding on these aspects examined in this study.
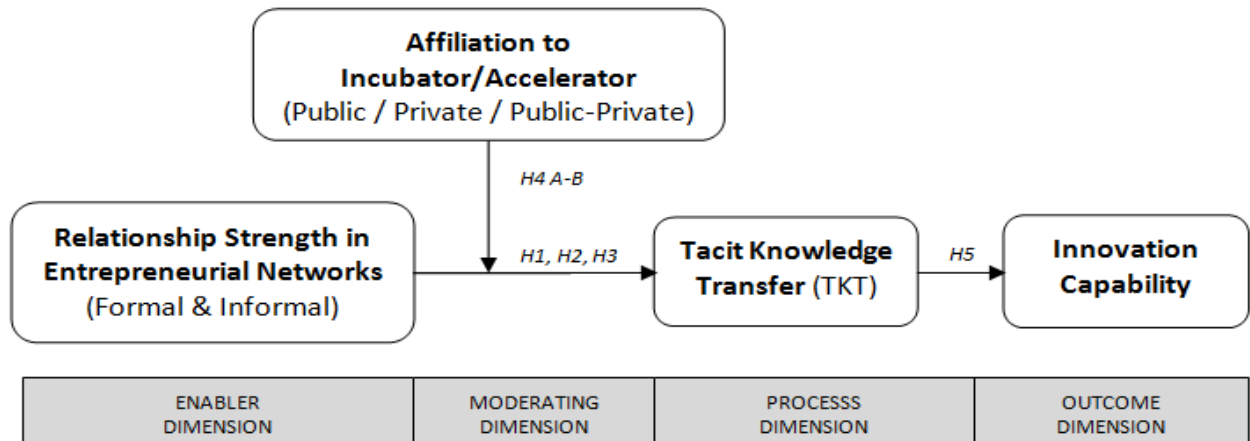


**Figure-1.** Proposed Model and Hypotheses

**Source:** Developed by the authors

### 2.1. Relationship Strength of Entrepreneurial Networks

Relationship strength is central to the relationship research (Granovetter, 1973; Morgan and Hunt, 1994). The three characteristics of close inter-firm relationships are frequent interactions, an extended history and intimacy or mutual confiding (Granovetter, 1973). Similarly, in the relationship marketing research, the nature of close relationship lies in its mutual trust, commitment, and high quality and frequent communications (Morgan and Hunt, 1994). In all environments, entrepreneurs must build reputation-enhancing relationships with outside resource providers who are willing to share valuable information, technology, and finance. In this regard, entrepreneurs use their own business and personal networks to establish new firms and the extent of the relationship strength within networks determines the success of many entrepreneurs. For example, social network contacts are the most needed by new and small businesses to overcome their difficulties in getting suppliers and customers at the early stage of business formation. Network relationship refers to a strategy that focuses on creating and maintaining a lasting relationship between entrepreneurs and their network (Premaratne, 2002).

Startups are usually those enterprises which are promoted by first timer entrepreneurs and are relatively recent in origin; have played and continue to play significant roles in the growth, development and industrialization of many economies the world over (CITT- Centre for International Trade and Technology, 2007). Startups often begin with a limited network and knowledge, where inadequate entrepreneurial knowledge may result in an adverse position (Haque et al., 2017). For the entrepreneur starting a business, entrepreneurial networks offer genuine benefits. Foremost among these are opportunities to build relationships. By cultivating membership in a network, a new entrepreneur can learn a great deal from others daily facing the same problems. There is a general believe in the literature that startups engaged in both formal and informal entrepreneurial networks achieve superior performance than that are engaged either in formal or in informal relationships (Kumar and Kumar, 2016). Research focusing on measuring network interaction in terms of frequency, intensity, and

durability has revealed that extensive networks are important to the growth of entrepreneurial ventures because they provide access to resources held by other actors within the network (Shaw and Conway, 2000; Neergaard and Madsen, 2004; Shaw, 2006).

## 2.2. Tacit Knowledge Transfer (TKT)

The management of knowledge argued that startups enjoy a competitive advantage if they know how to protect their knowledge from expropriation and imitation by competitors (Liebeskind, 1996) and if they know how to effectively share with, transfer to, and receive knowledge from members in their entrepreneurial networks (Appleyard, 1996; Mowery et al., 1996). Knowledge could be explicit or tacit (Nonaka, 1994) and the issue of transferability is important (Kumar et al., 2016; Kumar and Dutta, 2017). In a resource-based view, the firm is seen as a bundle of tangible and intangible resources and tacit know-how that must be identified, selected, developed, and deployed to generate superior performance (Learned, 1969; Wernerfelt, 1984). With tacit knowledge, people are not often aware of the knowledge they possess or how it can be valuable to others. If tacit knowledge cannot be codified and can only be observed through its application and acquired through practice, its transfer between people is slow, costly, and uncertain (Kogut and Zander, 1992). A direct interface among the formal and informal network members permits direct observation of operations and enables the gradual and experimental learning that is essential for successful transfer of tacit knowledge (Davies, 1977; Killing, 1983; Osborn and Baughn, 1990). Further, tacit knowledge needs spatial proximity of knowledge-innovation and networking agents as it has to be communicated face to face. Effective transfer of tacit knowledge generally requires extensive personal contact, regular interaction and trust. In particular, this kind of knowledge can be revealed through practice in a particular context and transmitted through formal/informal entrepreneurial networks (Kumar and Kumar, 2016). There is a general believe in the literature that startups engaged in both formal and informal entrepreneurial networks achieve superior performance than that are engaged either in formal or in informal. Hence, relationship strength in entrepreneurial networks is considered as a potential source of the extent of TKT and expected to bring benefits such as gaining new tacit knowledge or accessing complementary knowledge from all network members. Thus,

> **Hypothesis 1**: The greater the relationship strength in formal entrepreneurial networks, the greater the extent of TKT.
>
> **Hypothesis 2**: The greater the relationship strength of informal entrepreneurial networks, the greater the extent of TKT.
>
> **Hypothesis 3**: The relationship between RSENs and extent of TKT is stronger when both formal and informal are considered together.

## 2.3. Incubator/Accelerator Affiliation

The National Science & Technology Entrepreneurship Development Board (NSTEDB), established in 1982 by the Government of India under the aegis of Department of Science & Technology (DST), is an institutional mechanism to promote knowledge driven and technology intensive enterprises. There are initiatives and programmes such as Science and Technology Entrepreneurship Parks (STEPs) with an objective of opening doors of self-employment for young science and technology graduates. With the maturity of STEPs in changing economic scenario, the DST established Technology Business Incubators (TBIs) in the year 2000. There are around 100 TBIs introduced by several ministries including DST (Santosh and Vinay, 2010). TBI has played a major role in building Innovation and entrepreneurship ecosystem for nurturing Technology based Entrepreneurship. The companies within Indian ecommerce space like Flipkart, Ola Cabs, Housing.com have benefited in their early stages through their incubator/accelerator affiliation (Kumar and Kumar, 2016). Of course without innovation, one cannot be called entrepreneur in this context. Innovation accelerates inclusion and sustainable growth with new products, new processes, new services, as well as through development of new business models and new markets (Szirmai et al.,

2011). The government has taken many initiatives towards strengthening the innovation ecosystem, the most important of which are: i) the establishment of the National Innovation Council, whose mandate is to coordinate various innovation-related activities, and ii) the new Science, Technology and Innovation Policy 2013, which is intended to promote entrepreneurship and science-led solutions for sustainable and inclusive growth.

Early on Johnson (1988) insisted on the importance of institutions for innovation and learning processes. The idea that institutions matter in economic change was more generally accepted for 'less developed countries' than for full blown market economies (Lundvall *et al.*, 2002). Incubators are defined as "support structures for enterprise creation"; support structures targeted at entrepreneurs and inventors prior to company formation are occasionally referred to as "innovation centers" (CERAM, 2002). In most countries, incubation activity is supported significantly by institutional mechanisms such as providing incubation space in a subsidized fashion to inventors to pursue the path to innovation. The innovation process reflects human initiative and creativity but it is also deeply influenced by the production activities and the institutional setting and List (1841) pointed to the need to build *national* infrastructure and institutions. The ecosystem for incubation could be visualized to comprise of public, private and public-private. Indian Government has created an extensive Science & Technology network based on the public-private partnership. Business Incubator provides innumerable opportunities to entrepreneurs to develop ideas into innovations. Some authors have argued that incubated firms have low failure rates compared to firms outside an incubator environment (Rothaermel and Thursby, 2005). The impact of incubators in fostering innovation has been significant and thus has given rise to an increase in the number of business incubators worldwide from less than 50 in 1980 to over 4,000 in 2005 (Barrow, 2001). Other studies found 87% of incubator graduates stayed in business in contrast to 44% of all firms (Molnar *et al.*, 1997). In India, number of incubators/accelerators grew by 40% from 80 in 2014 to 110 in 2015 and nearly 50% of the incubators/accelerators are setup outside metro, providing an opportunity to entrepreneurs from non-metro cities (NASSCOM, 2015). Hence, the thrust of this current paper is to investigate whether an association with the incubator/accelerator influences the relationship between RSENs and the extent of TKT. Thus, it is proposed:

> **Hypothesis 4-A**: *Affiliation to the incubator/accelerator (public or private or public-private) has a moderating effect on the positive relationship between formal RSENs and the extent of TKT.*
>
> **Hypothesis 4-B**: *Affiliation to the incubator/accelerator (public or private or public-private) has a moderating effect on the positive relationship between informal RSENs and the extent of TKT.*

### 2.4. Innovation Capability

Innovations form the lifelines of organizations (Wind and Mahajan, 1997) have become increasingly complex, costly, and risky due to changing customer preferences, extensive competitive pressure, and rapid and radical technological changes (Griffin, 1997). As a result, firms find it increasingly difficult to internalize innovations (Moorman and Rust, 1999). Acquiring knowledge and skills through network-collaboration has been considered an effective and efficient way of successful innovation (Adams *et al.*, 1998). Additionally, external knowledge, networking and relationships appear to be key driver of technological innovation (Martín-de Castro *et al.*, 2011). The resources used to develop an innovation capability are often tacit and idiosyncratic. For example, a firm's knowledge is a foundational resource that is often tacit and based on firm-specific routines and relationships (Kogut and Zander, 1992; Day, 1994; Johnson *et al.*, 2004). Utilization of such resources embeds the capability into the startup firm (Chauhan and Kumar, 2013a; Chauhan and Kumar, 2013b; Chauhan *et al.*, 2015; Puri and Kumar, 2015). Thus, tacit knowledge is a tremendous resource for all activities—especially for innovation. Innovation is underpinned by active networking and networks further create more innovations (Kumar and Kumar, 2017). Tacitness can generate significant benefits for startups and result in enhanced innovation capability and performance (Kumar and Kumar, 2016). Thus,

> **Hypothesis 5**: *The greater the extent of TKT, the higher the innovation capability of startups.*

## 3. DATA AND METHOD

The sample consists of 102 respondents from startups involving 24 enterprises in manufacturing and 78 in services. A wide range of industries is included in the sample frame, including telecom, auto component, chemicals, electrical equipment, computers and office machinery, pharmaceutical, ecommerce, tourism, information services and consultancy. A sample of about 300 startups incorporated between 2008-2015 were randomly selected from all the different states of India and covering virtually all forms of ownership of business taking help of the data base created by Science and Technology Entrepreneurship Parks, Ministry of Company Affairs, Technology Business Incubators and Funding institutions including venture capitalist etc. Questionnaires were sent to the founder (or founding teams) of 300 carefully selected startups with a covering letter introducing the importance of study. Responses were obtained from 102 out of 300 startups contacted - a 34.0 percent response rate. Out of the respondents, 11.76% of their startups are affiliated to public, 29.41% to private and the remaining 58.82% to public-private incubators/accelerators. The questionnaire was developed and refined on the basis of previous research. We pilot tested the face validity of these scales with four founders involved in such activities. All constructs were measured using multiple items. All items were measured using seven-point Likert-type scale. The reliability of the construct is reported in Table 1.

**Table-1.** Cronbach alpha

| Variables | Cronbach alpha |
|---|---|
| IC (Innovation capability) | 0.838 |
| TKT (Extent of tacit knowledge transfer) | 0.861 |
| $RSEN_{formal}$ (Relationship strength in formal entrepreneurial networks) | 0.837 |
| $RSEN_{informal}$ (Relationship strength in informal entrepreneurial networks) | 0.887 |
| HC (Human Capital) | 0.727 |

**Source:** Developed by the authors

### 3.1. Construct and Measures

The measure for the dependent variable—innovation capability— is adapted from Subramaniam and Venkatraman (2001). These indicators include: frequency of new product introductions, order of market entry, simultaneous entry in multiple markets, the ability to be responsive to market requirements, the ability to be competitive in terms of price and the ability to penetrate new markets. The measure for the extent of TKT was adapted from Kogut and Zander (1992). They are used to capture complexity, ease of communication, and observability of the information transferred. Relationship strength is measured by three items - the frequency of interactions, confidence in each other, and the desirability of maintaining the relationship (Granovetter, 1973). For this study, similar items are used to measure relationship strength in entrepreneurial networks (RSENs) for both formal and informal. For incubator/accelerator affiliation, one additional question is asked: 'is your startup a part of or affiliated to incubator/accelerator (public, private or public-private)'. $DA_{public}$ ,$DA_{private}$ and $DA_{pp}$ are dummy variable for the affiliation to public, private and public-private respectively (refer to Appendix).

### 3.2. Control Variables

The size of network indicates the number of different people an entrepreneur is communicating to during the business establishment process and even after the establishment. Startup or younger firms may face more severe challenges in tacit knowledge transfer because of their limited resource bases. Hence we controlled for *firm age* by calculating the logarithm of the number of years since a startup was founded. *Firm size*, which was calculated by taking the log of each startup's total number of employees, including founders (full-time equivalents).

There are strong evidences that founder human capital is an important resource for the startup performance. Founders' prior work experiences may indicate differences in skills and credentials. Research has shown that much

of an entrepreneurs knowledge is experientially based (Rae and Carswell, 2001). Steiner and Solem (1988) demonstrated that managerial background and experience of the owner/entrepreneur or lack thereof as a cause or contributing cause for the success or failure of a small business. Furthermore, prior experience as an entrepreneur has been found to be a good predictor of re-venturing and can contribute to future success (Vesper, 1980; Ronstadt, 1989). Batjargal (2005) in his research found that industry experience positively impacted firm revenue growth. Stam and Elfring (2008) calculated *human capital* by an equally weighted composite measure of three commonly used measures (Florin *et al.*, 2003): industry experience, start-up experience, and managerial experience obtained prior to founding the current venture. *Industry experience* was measured as the number of years of industry experience on a firm's founding team. *Start-up experience* was measured as the number of start-ups that a founding team had founded. *Managerial experience* was measured as the number of years that team members had worked in senior management functions.

### 3.3. Data Analysis

Hypotheses are tested in the following system of equations:

$$IC = \alpha_0 + \beta_0 (TKT) + e_0 \tag{0}$$
$$TKT = \alpha_1 + \beta_{11} (RSEN_{formal}) + e_1 \tag{1}$$
$$TKT = \alpha_2 + \beta_{21} (RSEN_{formal}) + \beta_{22} (RSEN_{formal} \times DA_{public}) + e_2 \tag{2}$$
$$TKT = \alpha_3 + \beta_{31} (RSEN_{formal}) + \beta_{32} (RSEN_{formal} \times DA_{private}) + e_3 \tag{3}$$
$$TKT = \alpha_4 + \beta_{41} (RSEN_{formal}) + \beta_{42} (RSEN_{formal} \times DA_{pp}) + e_4 \tag{4}$$
$$TKT = \alpha_5 + \beta_{51} (RSEN_{informal}) + e_5 \tag{5}$$
$$TKT = \alpha_6 + \beta_{61} (RSEN_{informal}) + \beta_{62} (RSEN_{informal} \times DA_{public}) + e_6 \tag{6}$$
$$TKT = \alpha_7 + \beta_{71} (RSEN_{informal}) + \beta_{72} (RSEN_{informal} \times DA_{private}) + e_7 \tag{7}$$
$$TKT = \alpha_8 + \beta_{81} (RSEN_{informal}) + \beta_{82} (RSEN_{informal} \times DA_{pp}) + e_8 \tag{8}$$
$$TKT = \alpha_9 + \beta_{91} (RSEN_{formal}) + \beta_{92} (RSEN_{informal}) + e_9 \tag{9}$$
$$TKT = \alpha_{10} + \beta_{10,1} (RSEN_{formal}) + \beta_{10,2} (RSEN_{informal}) + \beta_{10,3} (RSEN_{formal} \times RSEN_{informal}) + e_{10} \tag{10}$$

IC is the innovation capability; TKT is the tacit knowledge transfer; $RSEN_{formal}$ is the relationship strength in formal entrepreneurial networks; and $RSEN_{informal}$ is the relationship strength in informal entrepreneurial networks. $DA_{public}$ is a dummy variable for the public affiliation to incubator/accelerator; $DA_{private}$ is a dummy variable for the private affiliation to incubator/accelerator and $DA_{pp}$ is a dummy variable for the public-private affiliation to incubator/accelerator. For example, we operationalize the affiliation using a simple dummy variable which takes a value 1 if the firm is affiliated to public, private, or public-private incubator/accelerator and 0 if it is not the case.

## 4. RESULTS

### 4.1. Analytical Approach

We used ordinary least square (OLS) regression analysis to test our hypotheses. For all models, we used several regression diagnostics to assess whether modeling assumptions were satisfied. We checked for normality by conducting a Kolmogorov-Smirnov test, which supported the univariate normality assumption. In addition, we assessed the variance inflation factor (VIF) values and found no significant multicollinearity problems (VIF<2.00, Tolerance = .508).

### 4.2. Results

Table 2 provides descriptive statistics and zero order correlations among the variables used in the regression analyses. The average startup had been in business for four years and had twenty one employees. Significant

positive correlations existed between RSEN$_{formal}$ and RSEN$_{informal}$ (r=.70, $p$<.01). It thus appears that, on average, startups with formal networks strength also sustained extensive informal networks strength.

**Table-2.** Means, Standard Deviations, and Correlations[a]

| Variables | Mean | s.d. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. IC | 4.64 | 1.19 | | | | | | | | | |
| 2. TKT | 4.22 | 1.47 | .323** | | | | | | | | |
| 3. RSEN$_{formal}$ | 4.54 | 1.27 | .759** | .287** | | | | | | | |
| 4. RSEN$_{informal}$ | 4.85 | 1.50 | .804** | .191 | .702** | | | | | | |
| 5. Public affiliation | 0.17 | 0.38 | -.374** | -.008 | -.234* | -.275** | | | | | |
| 6. Private affiliation | 0.44 | 0.49 | .297** | .109 | .207* | .245* | -.411** | | | | |
| 7. Public-private | 0.38 | 0.48 | -.010 | -.105 | -.028 | -.035 | -.364** | -.699** | | | |
| 8. Startup age[b] | 0.46 | 0.32 | .119* | -.073 | .280** | .079 | -.116 | .191 | -.104 | | |
| 9. Startup size[b] | 1.09 | 0.47 | .310** | .005 | .258** | .257** | -.143 | .344** | -.240* | .435** | |
| 10. HC | 5.64 | 5.70 | .131 | .094 | .147 | .120 | .078 | .163 | -.227* | .202* | .173 |

[a] $n$=102; [b] Log-transformed; *$p$ <.05; **$p$< .01; Two-tailed tests.

Table 3 depicts results from our analysis. We used ordinary least square (OLS) regression analysis to test the hypotheses. At the first step we entered the control variables and main effects of the RSEN for both formal and informal variables separately. Hypothesis 1 suggests a positive relationship between formal RSEN and TKT. The formal RSEN explained a significant share of the variance in TKT (model 1: $R^2$ = .115, $p$<.05), in strong support of H1, and suggests that formal RSEN facilitates extent of tacit knowledge transfer in entrepreneurial networks.

**Table-3.** Results of OLS Regression Analyses[a]

| Model of Innovation capability (H5) | | | | | Parameter estimate | | p-value | | |
|---|---|---|---|---|---|---|---|---|---|
| TKT (the extent of tacit knowledge transfer) | | | | | 0.262272 | | 0.00093*** | | |
| Models of Tacit Knowledge Transfer (H1, H2, H3 & H4 A-B) | | | | | | | | | |
| Variables | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 | Model 6 | Model 7 | Model 8 | Model 9 | Model 10 |
| Controls Startup age Startup size Human capital | -0.811 | -0.838 | -0.926† | -0.845† | -0.466 | -0.478 | -0.570 | -0.511 | -0.869 | -0.182 |
| | -0.056 | -0.069 | 0.042 | 0.038 | -0.052 | -0.062 | 0.002 | 0.022 | -0.025 | -0.873 |
| | 0.021 | 0.019 | 0.021 | 0.024 | 0.024 | 0.023 | 0.022 | 0.026 | 0.022 | 0.040 |
| Main effects RSEN$_{formal}$ RSEN$_{informal}$ | 0.379** | 0.383** | 0.402** | 0.275* | | | | | | 1.155*** |
| | | | | | 0.188† | 0.187† | 0.235* | 0.109 | 0.432** / -0.063 | 0.471* |
| Including moderating items RSEN$_{formal}$ × DA$_{public}$ RSEN$_{formal}$ × DA$_{private}$ RSEN$_{formal}$ × DA$_{pp}$ | | 0.063 | -0.157* | 0.112† | | | | | | |
| Including moderating items RSEN$_{informal}$ × DA$_{public}$ RSEN$_{informal}$ × DA$_{private}$ RSEN$_{informal}$ × DA$_{pp}$ | | | | | | 0.037 | -0.147* | 0.116* | | |
| Two-way interaction RSEN$_{formal}$ × RSEN$_{informal}$ | | | | | | | | | | -0.139* |
| $R^2$ | 0.115 | 0.118 | 0.165 | 0.144 | 0.052 | 0.054 | 0.107 | 0.092 | 0.117 | 0.187 |
| Adjusted $R^2$ | 0.078 | 0.072 | 0.121 | 0.100 | 0.013 | 0.005 | 0.061 | 0.044 | 0.071 | 0.136 |
| F (n=102) | 3.151* | 2.583* | 3.800** | 3.245** | 1.354 | 1.103 | 2.313* | 1.937† | 2.544* | 3.654** |

[a] Unstandardized regression coefficients are reported. †$p$<0.10, *$p$<0.05, **$p$<0.01, ***$p$<0.001.

The informal RSEN failed to explain a significant share of the variance in TKT (model 5: $R^2 = .052$, $p > .10$), thus no support for Hypothesis 2. This suggests that informal RSEN doesn't facilitate to the extent of TKT in entrepreneurial networks. Interestingly, informal RSEN together with the private incubator/accelerator affiliation showed significant direct relationship with TKT (model 7: $R^2 = .107$, $p < .05$). That means the informal RSEN leads to the extent of TKT when private incubator/accelerator affiliation moderates the relationship.

Further, both formal and informal RSEN together showed direct relationship with TKT (model 9: $R^2 = .117$) but statistically insignificant in support of H3 without considering their interactions in between. In addition, to examine the two-way interaction between formal and informal RSEN, this addition increased the explained variance in TKT (model 10: $R^2 = .187$, $p < .01$) and statistically significant. This implies a positive effect on TKT of the interaction between formal and informal RSENs.

The moderating effect of public-private affiliation on the relationship between formal RSEN and TKT is positive and statistically significant (model 4: $R^2 = .144$, $p < .01$). This suggests that the public-private affiliation enhances the relationship between the formal RSEN and the extent of TKT. Indian Government has created an extensive Science & Technology network based on the public-private partnership. These public-private incubator/accelerators provide innumerable opportunities to entrepreneurs to develop ideas into innovations in the formal setup (i.e. formal RSEN). Hence we argue that, in formal networks, public-private affiliation to incubator/accelerators plays an important role for the development of entrepreneurship initiatives and activities, especially in an emerging economy like India. Also, the moderating effect of private affiliation is negative, but statistically significant (model 3: $R^2 = .165$, $p < .01$), in support of H4-A. As stated above, the informal RSEN together with the private incubator/accelerator affiliation showed significant direct relationship with TKT (model 7: $R^2 = .107$, $p < .05$), in support of H4-B. This implies that the informal RSEN leads to the extent of TKT under the private affiliation of incubator/accelerator. Finally, we find support for H5, because the coefficient for TKT is positive and significant (b=0.26, $p < 0.001$). This suggests the extent of TKT transfer affects the firm innovation capability in the entrepreneurial networks.

## 5. DISCUSSION AND CONCLUSION

From both phenomenon and theoretical perspectives, our understanding of tacit knowledge transfer (TKT) in entrepreneurial networks remains in its infancy. Our research offers a modest attempt to understand, within the empirical context of Indian manufacturing and service firms, the strategic importance of both formal and informal, relationship strength in entrepreneurial networks that lead to startup innovation capability. Our central thesis is that the TKT in entrepreneurial networks constitutes an important driver to the innovation capability. After controlling for various startup-level variables, we find that the TKT in entrepreneurial networks drives the innovation capability. Our findings add to the extant literature, which suggest that TKT in entrepreneurial network may be a source of critical competitive advantage.

To investigate whether Indian manufacturing and service firms in their entrepreneurial networks built innovation capabilities through tacit knowledge, and if so, whether incubator/accelerator (private/public/private-public) affiliation affects the relationship between RSENs and the extent of TKT, several hypotheses are tested with system of equations. We find the importance of relationship strength for the extent of TKT. The extent of TKT acts as a potential source of innovation capability. The impact of incubators/accelerators in fostering innovation has been recognized and found significant in the management studies and this gives rise to an increase in the number of business incubators and accelerators worldwide. In this regard our findings suggest: The public-private affiliation to incubator/accelerator enhances the relationship between the formal RSEN and the extent of TKT. Hence we argue that, in formal entrepreneurial networks, public-private affiliation to incubator/accelerators plays an important role for the development of business activities, especially in a context of emerging economies like India. The informal RSEN leads to the extent of TKT under the private affiliation to the

incubator/accelerator. In this regard entrepreneurs use their own business and personal networks, known as informal networks, to establish new firms and the extent of the relationship strength within networks determines the success of many entrepreneurs.

In general, we empirically provide some evidence that formal and informal relationship strength in entrepreneurial networks influence the extent of TKT, and the tacit knowledge obtained from the network members affects their innovation capability. Extant literature suggests that both formal and informal networks play a critical role in entrepreneurship. We also argue that developing a close relationship with the network members is important in obtaining tacit knowledge. Hence, we placed special emphasis on the strength of the relationship in entrepreneurial networks.

## 5.1. Contribution and Implication

Our study draws from the literatures of entrepreneurial networks, tacit knowledge and national system of innovation, and we make important contributions to each. This is the first attempt to take into account the relationships between RSENs, extent of TKT and innovation capability. We are able to do this by using a sample of startups incorporated in-between 2008-2015. Startups are from all the different states of India, and covering virtually all forms of ownership of business taking help of the data base created by Science and Technology Entrepreneurship Parks, Ministry of Company Affairs, Technology Business Incubators and Funding institutions including venture capitalist. In contrast, most prior literature has either focused on formal or informal entrepreneurial network and has not considered both together under the empirical settings. Our findings make important contributions to the existing literature.

First, controlling for various other startup characteristics we empirically provide some evidence that formal RSENs influences the extent of TKT, and the extent of TKT affects the startup innovation capability. Hence, it is not only entrepreneurial networks that play an important role in TKT, but also their relationship strength. Our findings argue that TKT in entrepreneurial networks may be a source of critical competitive advantage for startups in the 21st century. Second, an incubator/accelerator affiliation has a moderating effect on the relationship between RSENs and extent of TKT. The results support that startups in formal entrepreneurial networks gain if they have public-private incubator/accelerator affiliation. The results provide important implications for developing relationship with the members of the entrepreneurial networks for tacit knowledge and its effects on firm innovation capability. Tacit knowledge related studies have never been more important than they are today because of continuous changing competitive environment. Therefore, the implications of this research are important for executives and scholar alike seeking understanding of the management of the relationship with the formal and informal network members that facilitates tacit knowledge and innovation capability. These findings have the potential to direct the policy initiatives. This study also contributes to our understanding of entrepreneurial networks in a non-Western context, i.e., India.

## 5.2. Limitations and Future Research

In spite of making several contributions, this study also addresses few limitations. First, our study pertains to the issue of the generalizability of studies. The conclusion we draw here are indicative, but we assert that they may be applicable to other settings/emerging economies as well Chittoor *et al.* (2009). Second, we use major classification in our conceptualization and empirical testing of incubator/accelerator effects, although we acknowledge that the other types or incubation support system may exhibit unique response in the context of entrepreneurial networks. Third, additional large-sample of data may attempt to refine and validate relationships among several independent, independent and moderating variables and formulate new ones. Fourth, this study focused on empirical studies to link TKT enablers and firm innovation capability in entrepreneurial networks. The study, however, did not consider all enablers that are critical for TKT. Fifth, instead of using dummy variable for

incubator/accelerator affiliation; future work can take the help of other fine measures to establish linkages between incubator/accelerator and their affiliation to the public, private or public-private. Sixth, other control variable like technology and business diversity may be taken into consideration while studying relationship strength in entrepreneurial networks. Despite these limitations, we believe our analysis provides important and novel perspectives and a potentially rich area for theory building (Kumar *et al.,* 2017) thus is open- i.e. the role of relationship strength in facilitating the tacit knowledge in entrepreneurial networks.

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## APPENDIX: MEASURES USED IN THE STUDY

**Innovation Capability** (reliability = 0.838)

With respect to your competitors, please rate how your product / service category currently fares, on the following dimensions: (1 = Much worse than competitors, 7 = Much better than competitors)

1. Frequency of innovations
2. Being first to the market with innovative products/services
3. Ability to price competitively
4. Simultaneous entry in multiple markets
5. Ability to penetrate new markets
6. Ability to be responsive to market requirements

**Tacit Knowledge Transfer** (reliability = 0.861)

Please indicate the characteristics of the information acquired in entrepreneurial networks. The information your startup required:

1. Was simple (1): Was complex (7)
2. Was easy to precisely communicate through written documents (1): Was difficult to precisely communicate through written documents (7)
3. Was obvious to all startups (1): Was subtle nuances known only to a few startups in entrepreneurial networks (7)
4. Was easy to identify without personal experience in entrepreneurial networks (1): Was difficult to identify without personal experience in entrepreneurial networks (7)

**Relationship Strength in Formal Entrepreneurial Networks** (reliability = 0.837)

Considering formal entrepreneurial networks, please rate relationship strength in terms of: (1 = Much lower in formal entrepreneurial networks, 7= Much higher in formal entrepreneurial networks)

1. Frequency of interactions
2. Confidence in each other
3. Desirability of maintaining the relationship

**Relationship Strength in Informal Entrepreneurial Networks** (reliability = 0.887)

Considering informal entrepreneurial networks please rate relationship strength in terms of: (1 = Much lower in informal entrepreneurial networks, 7= Much higher in informal entrepreneurial networks)

1. Frequency of interactions
2. Confidence in each other
3. Desirability of maintaining the relationship

**Human Capital** (reliability = 0.727)

Please answer the following in terms of:

1. The number of years of industry experience on a firm's founding team. (----)
2. The number of start-ups that a founding team had founded. (----)

3.   The number of years that team members had worked in senior management functions. (----)

**Incubator/Accelerator Affiliation**

1.   Is your firm a part of or affiliated to a private incubator/accelerator? (Yes / No)

2.   Is your firm a part of or affiliated to a public incubator/accelerator? (Yes / No)

3.   Is your firm a part of or affiliated to a public-private incubator/accelerator? (Yes / No)