

“Evolution of Network- Formation, Decay and Churning: Evidence from a five year Ph.D. program in India”

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Abstract: *Network evolution is a topic which has been relatively less explored in the network literature. This study is an attempt to fulfil this gap by trying to understand evolution of networks using the context of a doctoral programme in India. In the current inductive study, two rounds of unstructured in-depth interviews of 12 doctoral students were conducted over a month's time. The results suggest three different outcomes in network evolutions namely, network formation, decay and churn and the factors impacting them. Network formation factors include academic / functional similarities, social / informal interactions, need for stable support system, linguistic and regional similarities and individual proactivity. Decay factors include academic / functional dissimilarity, spatial distance, unavailability of time, and lack of interest of the other party. Network churn factors include the structural aspects of the program, cognitive limitations of the individual and variations in interaction over time. Implications of the paper towards growing body of Network related research are discussed along with suggestions for the future research in this direction.*

(Key words- Network Evolution, Network Formation, Network Decay, Network Churning)

Introduction

Network based studies for a long time focused on the impact of an individual's network on other outcomes like career success or entrepreneurial success (Vissa, 2012). What factors impacted the network itself is something that researchers started focusing on only recently. Vissa (2011), Vissa (2012), Mariotti & Delbridge (2012) and Gulati & Srivastava (2012) were some of the recent studies along those lines. Vissa (2011) discusses how task complementarity and social similarity are two important factors in interpersonal tie formation while Vissa (2012) focuses on the networking style of an entrepreneur to explain the initiation of ties. Gulati & Srivastava (2012) try to explain how constrained agency affects an actors' structural position whereas Mariotti & Delbridge (2012) focus on how firms take strategic actions to overcome network redundancy and overload. We see that most of these studies focus primarily on how ties are formed and how the actions of the individual affect structural aspects of the network. Not many studies have tried to look at what factors determine the evolution of a network. We still have limited knowledge about how the network of an individual evolves over a period of time? What factors drive the tie formation and decay processes? What factors determine the churn in a network? These are some of the questions the current study is trying to address.

The present study tries to understand the evolution of an individual's network in an academic setting. Using the context of a doctoral programme in India, this study tries to understand what factors drive the formation, decay and churn in an individual's network. Most prior research on networks has used either the setting of a firm or entrepreneurs for their study. Very few studies have used an academic setting to understand networks.

There is paucity of studies on network formation of doctoral students, and even less for professional fields like management and business education. Examining the formation and decay of relationships a doctoral student has, will enhance our understanding on their support structure or hindering persistence. The experiences, as they happened to doctoral students, will give a better understanding of the phenomenon. It is important to note that a doctoral student can have relationships with peers, mentors, family and business partner. The present study focuses on formation and development of peer networks to whom they turn to discuss personal as well as professional problems. Examining the role of relationships, Higgins and Kram (2001) postulated 'developmental network' to provide a comprehensive theoretical explanation of the support these relationships provide. A developmental network provides two kind of support- psychosocial and career. Psychosocial support is related personal support, friendship, counselling beyond work environment, whereas career support involves exposure to professional opportunities. A doctoral student may seek any of these supports or even both.

Doctoral students in an institution do not have only dyadic relationship with mentor but rather have many relationships. To understand the formation of network of such actors and on what basis actor decides to further continue or cease any network, this study examine both individual attribute as well as structural properties of networks developed beyond dyadic relationships.

Overview & Significance of Study Context

We conducted our study of network evolution for Ph.D students in Indian Institute of Management Bangalore (IIMB) India. Established in 1973 in city of Bangalore in southern state of India-Karnataka, IIMB is one of the most reputed management institutions in India and world. IIMB offers several kind of management education program like Post Graduate Program (PGP), Executive Post Graduate Program (EPGP) and research program named as Fellow Program in Management (FPM) to name a few.

FPM is a Doctoral program of IIM Bangalore of 4-5 years of duration. The structure of the course is such that first two years is compulsory course work which includes doctoral courses in area of study, research method courses etc. After the first two years, student work on their own topic of thesis and there is hardly any common platform for social interaction. When students join the program, they have limited prior interaction with each other. Students join this program in batches (around 20-25) across various disciplines. The program is regular and full time but not necessarily fully residential. Student may opt to live in hostel in institute campus or to move out at any stage of program.

We studied some of the FPM students for our network queries because of the novelty and richness this courses offer to researchers in term of data. First, this course has long duration of five years comprising of various stages of program thus providing longitudinal evidence even in short term studies like the present one. Two, the demographics of students are much more heterogeneous compared to most of other academic programs (eg, 22-57 years age range, variety in marital status, representing almost all geographical and cultural parts of country, variety in terms of previous education and professional background and current area of research etc). Three, the specific feature of option to stay in or out of campus during FPM in IIMB provides unique setting for observing network behaviour because of distinctness of possible social interaction between students who are hostel residents and students who stay out (generally referred as 'Day Scholars'). The student who moved out in midst of program can further provide possibly more clear differential impact of this on their network outcomes. IIMB provides working cubicles (called FPM computer centre or FCC) to the students in their third year onwards and in specific cases to second year students too, which adds a new dimension to network outcomes.

Motivation for the study:-

It is generally observed that the network of the students is different in the first two years of the curriculum (course work period) as compared to the years post the course work. This study is attempting to find out whether this is a valid observation and if yes, what could be the reasons for it. Hence, purpose of the current study is two-fold. Firstly, we are trying to understand how the network formation happens for students in the programme. What factors aid in the formation of networks? Secondly, whether the network between students joining together decays substantially or changes over time? What could be the factors for this decay or change? Is it due to lack of common forums, lack of common interests etc.?

Rest of the paper is divided as below, Section 1 gives over view of the existing literature on network, and section 2 provides details of this largely inductive study, section 3 elaborates findings and discusses impact on literature, section 4 indicates limitations of the study and future research direction and section 5 concludes the paper while providing implications of the study.

Section 1: Literature Review

A network is “*a set of relationships between two or more individuals*” (Kadushin, 2004). Network is considered faster, smarter, much more flexible and is considered to play an important role in disseminating information and facilitating activities. Networking is ‘*the process of contacting and being contacted by people in our social network and maintaining these linkages and relationships...a set of relations, linkages, or ties among people*’ (Burke, 1993). Accompanying with the wide application of networks, scholars are now making efforts to understand how networks are formed. Network scholars have started exploring the effects of social context on the networking pattern of an individual. The structure of an actors’ network is a result of his interactions with multiple actors. Few studies have focused on studying networking and socialization of doctoral students. Lovitts (2001) analysed socialization process and practices which can effect relationship building and found that orientation program and overall program plan help student understand the program and also familiarise with fellow students. The mentor-student relationship is also considered crucial for support development (Austin et al., 1999). The aim of the study is to analyse relationships beyond a dyadic focus. The academic world is ever changing and theories of graduate student socialization are required to examine and prepare next generation faculty (Austin & McDaniels, 2006). Given that new networks form throughout the journey of life, it is erroneous to assume that all relationships formed are carried lifelong. Relationships form and many of them weaken and disappear as time folds such that some observed today are gone tomorrow. The decay of relationship can be faster in acquaintances than in surviving relation, where people first become acquaintance and then relationship decay. Granovetter (1973) differentiated between weak ties and strong ties. Weak ties are characterised by occasional interaction and involves basic exchange of information and resources and the possibility of decay of weak ties are higher (Mariotti and Delbridge, 2012). A doctoral student has the choice of becoming associated with people and they base their initial association with someone depending on some or the other parameter. To dissociate from someone whom he associated initially may cost actor in exchange terms and forming a new relationship can be

time consuming, but still people do so. This study also attempts to analyse doctoral student's voluntary association with others from a given set of people. We intend to study the factors which lead a doctoral student to associate or disassociate from a particular set of people.

Moreover, formation of a network in any new organizational setting can be explained by borrowing literature of 'socialization'. Socialization can be defined as "*the process by which an individual comes to appreciate the values, abilities, expected behaviours, and social knowledge essential for assuming an organizational role*" (Louis, 1980, pp. 229–230). Often this socialization occurs in three phases (Feldman, 1981). The first phase is anticipatory phase, which is, even before entering the organization; newcomer sets some expectation about future interpersonal relationships. The second phase is encounter phase, where after entering the organization an individual starts understanding the procedures and practices of the organization. The last phase is settling-in, as a part of which newcomers starts balancing work and non-work activities. This study focuses on the formation, changes and dynamics of networks throughout the program of doctoral student including first year, pre-dissertation and dissertation stage. This is important because according to Chris Golde (Smallwood, 2004); the rate of attrition is unswerving across all the three stages of their journey.

Section 2:-Methodology

To understand the dynamics of network formation, the present inductive study adopted qualitative research method. Based on the definition and explanation an individual provides about a situation, researchers seeks to understand reality. Using grounded theory approach one can understand a phenomenon from the perspectives of the participants. Grounded theory is a method of discovering theory from data. The findings are used to comprehend a theory rather than freezing the theory. It is important to note that, "*grounded theory can be presented either as a well-codified set of propositions or in a running theoretical discussion, using conceptual categories and their properties*" (Glaser et al., 1967, p. 31) and it enables prediction and explanation of behaviour. According to Rossman and Rallis (1998), grounded theory contributes to the understanding of social phenomenon.

Overview of the Method:

Grounded theory is an inductive process of systematically gathering and analysing data based on which researchers formulate theory. The study do not start with preconceived notion or a

hypothesis to be proven, rather the researcher allows theory to emerge from the data and starts with general area of the study. The traditional way of detailed literature review is avoided at the outset of the study however brief overview of established understanding is preferable. The rationale for doing so is to keep researchers away from any biases and approach the study with open mind to the concepts and relationships that are expected to come out of the study. But this department of not reviewing the literature is followed only in the beginning of the study. Once the theory emerges and looks promising, it is advisable to relate the finding with the existing literature (Strauss and Corbin, 1998, p. 49). We restricted our idea and knowledge of the detailed literature to allow the theory to emerge from the interview.

Data Collection

One of the most important phases of qualitative study is the collection of data. This study involved theoretical sampling and semi-structured interviews with the respondents. The respondents were asked to recall their experience and approach towards network building and describe the related phenomenon.

Theoretical sampling is a process by which *'researchers consciously select additional cases to be studied according to the potential for developing new insights or expanding and refining those already gained'* (Taylor and Bogdan, 1998, pp. 26-27). It is different from statistical sampling which aims to represent a population. In comparison, theoretical sampling is used to select an appropriate sample to explore emerging concepts based the sensitivity of the researcher. Researchers do not need to specify beforehand the number of the respondents (Taylor and Bogdan, 1998, p. 92). But it is important to begin the study with a fair idea of the type of people to be interviewed. The plan should be dynamic in nature and researcher should be prepared to modify the plan, if required. The collection of data continues till theoretical saturation is achieved which is the point when no additional data leads to or adds to the categories being developed (Minichiello et al., 1995, p. 162).

While sampling for this study, researchers consciously made efforts to vary certain characteristics of the respondents in order to cover broad range of perspective. We interviewed 12 doctoral students from the field of management (eleven from IIMB and another one from management department of a premier science institute based in Bangalore to check validity), and there were four sampling dimensions. These are gender of the informant, year of the informant which varied from first year to fifth year, area specialization

of the informant and residence of the informants (hostellers and day scholars). There were eight male doctoral students and four female doctoral students. This ratio is justifiable given the proportion of female in the overall program. Duration wise, three students were from first year, two students each from second year, third year and fifth year and three from fourth year (two from IIMB and third from other institute) were sampled. These respondents were from different areas of specialization including organizational behaviour, production and operations management, information system, marketing, economics, qualitative methods, corporate strategy and public policy. Looking at their residential status, six of them were hostellers and the other six were day scholars. This means that each respondent had a unique configuration but shared some or the other dimension with few other respondents.

Since all the three authors are from the same institute as most of the respondents, special attention was given while approaching the respondents. We assured the respondents throughout the interview that the data collected will be kept confidential and will not be discussed in any other context.

Approaching and interviewing informants:

After selecting the sample, all the respondents were approached through telephone, mails and personally. We invited informants to participate in the interview process and asked for their consensus. Out of twelve respondents approached 11 agreed to participate while one could not because of his scheduled travelling plans and hence we approached another person with similar dimensions and he agreed to participate also. This signifies low possibility of any non-response bias. Before interviewing, the respondents were briefed about the study. The interviews were conducted at various places as per the convenience of the respondents. The hostellers preferred their hostel rooms where as day scholars chose class rooms, their cubicles and common areas to participate. The interviews were conducted in two phases. The first round of interview was semi structured in nature and was open ended which lasted for 15 to 25 minutes. The question that guided the first interview were focused to elicit information about informants personal background, his networks before joining the program, his relationship with fellow doctoral students after joining the program and with juniors and seniors. The second round of interview lasted for 5 to 7 minutes and name generator technique was used to push respondents to think of their networks in specific ways. Respondents in their first year of program were asked to write 10 names that they interacted in each semester of first year while other students were asked to name 10 people whom they

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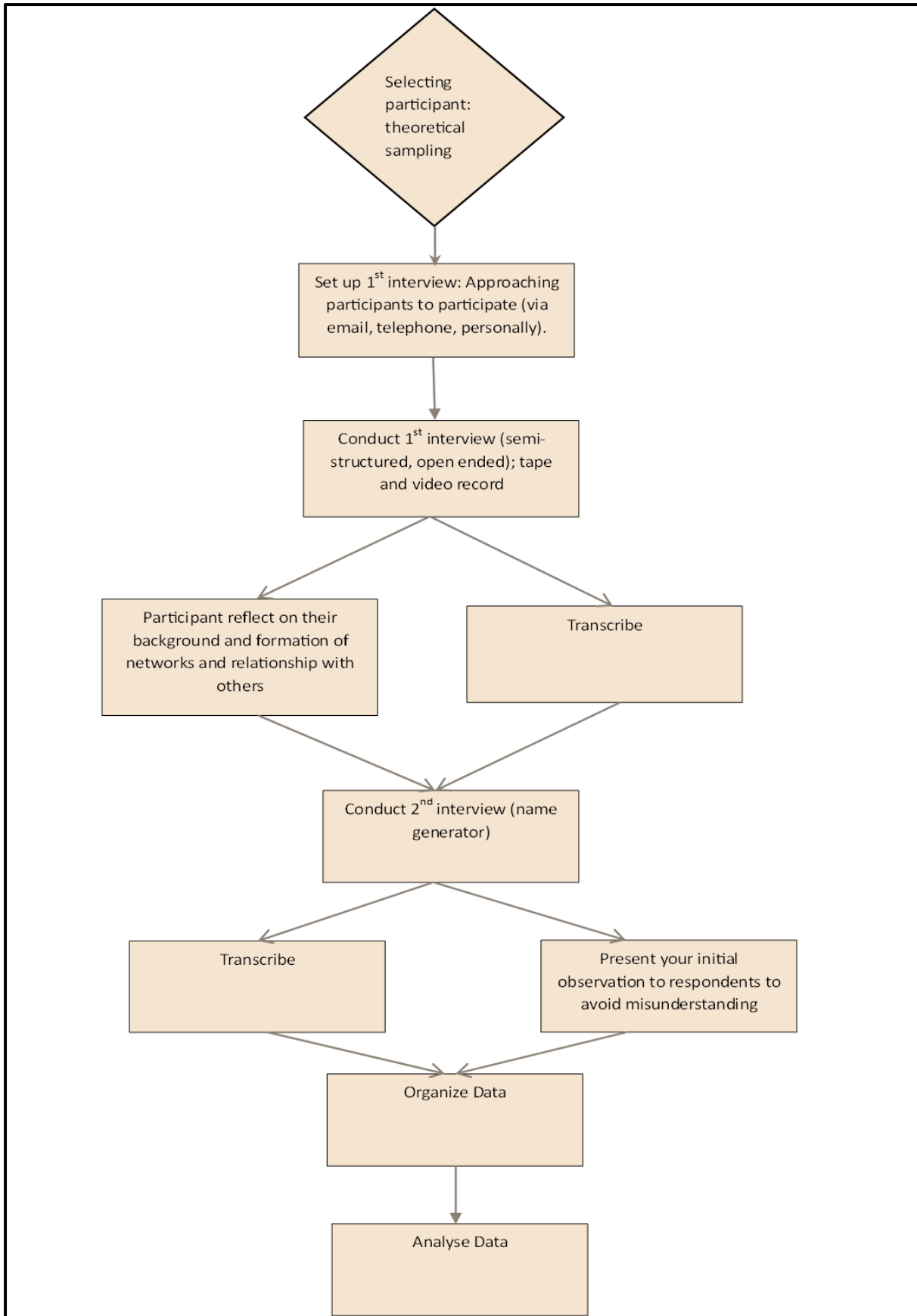


Figure 1: Data collection process

interacted most in each of all their years till now in program. Respondents were given an exhaustive list of all doctoral students enrolled between 2004 and 2013 as a memory aid to reduce recall and recency bias. This list was given only to eleven respondents from IIMB as the twelfth respondent was from different institute for which such list was not available with the authors. Thus over all, we used roster recall with fixed choices as also used by Krackhardt and Stern (1988) in their study of friendship network in a university.

We studied is ego-centred network and hence alters were not approached. At least two researcher were present for all the interviews, while some interviews were conducted by all three of them. All interviews were recorded using two devices with the informant's permission. This was done to eliminate possibilities of disturbance in any of the device because of noise or technical issues. At the end of the interviews respondents were briefed about the understanding of the researcher to eliminate mis-interpretation. The interviews were then transcribed and considerable efforts were made to maintain confidentiality.

Coding

Coding for this study was done in several phases comprising of two researchers working independently and jointly in different phases. After the two rounds of interview data was transcribed, two of the authors independently coded the entire data in what is called open coding (Glaser & Strauss, 1967). This method of coding has been widely recommended in such studies particularly involving grounded theory approach (Strauss & Corbin, 1998). Method involves coding without any pre-conception of data and without any defined theme by the coders. First round of coding objective of entire interview data in this particular study was to divide data into as many themes as possible according to researcher's own assessment. Both researchers coded the data into a total of 52 themes. These themes described coder's perspective on all possible distinct behaviour and actions of the respondents as per interview data.

After the first round of coding, both the coders jointly decided on bracketing similar items (codes) across two coding, leading to all emerging themes possible out of coding by both coders. There were some overlapping initial items of one coder with respect to initial items of other and vice-versa. They were suitably divided or copied in both places with consensus. The remaining items (i.e for which there was no agreement) were put distinctly. This led to 24 different patterns of behaviour/circumstances leading to important network characteristics. From these 24 patterns, coders agreed upon ten distinct themes based on

behaviours/circumstances related to individual's network factored in these patterns. After identifying these, coders observed three broad categories of network outcomes emerging from these ten themes- those leading to network formation of individual, network decay of individuals and to flux or churning of network. To reflect both generalisations on these three categories of network outcomes as well as to maintain the insights and richness data provides, coders decided to divide these ten themes across three network outcomes as discussed above. This provided Fair Avenue to throw more light on the circumstances and behaviour leading to network outcomes. By this process of coding, finally emerged were five themes of network formation, four themes of network decay while the churning in network was agreed to be single theme category.

After deciding on the categories and themes under those categories, researchers sought to check the reliability of the same and employed the techniques suggested by previous studies (Armstrong et al, 1997; Burla et al., 2008; Kurasaki, 2000; Hruschka et al., 2004). The unit of analysis for checking the inter-rater agreement was the individual quotes of respondents which were coded on these themes. To elaborate, the coding by both coders under each theme was listed in spread sheet and same quotes under themes were notified as '1' when they match for both coders and '0' when they don't match. Then average of this agreement on every theme was calculated in percentage dividing total agreement by total number of quotes. Authors also checked validity by sending the final coding results back to two of the randomly chosen respondents for their view. Both respondents found it right categorisation of their network data. However, one of them did not agreed with one of the themes. But considering complete agreement by one respondent and 90% (nine out of ten) by other, authors were reasonably convinced of validity of themes. After doing this for all ten themes (five for network formation, four for network decay and one for network churning), researcher sought to check the overall robustness of the inter-rater agreement. In order to do the same, the weightage average of all the themes was aggregated and again checked for agreement. Weights were given by the total number of coding (respondent quotes) in each theme. The final overall inter-rater agreement was about 80 % which was quite high given the open coding method being followed. The detailed results will be discussed and analysed in next section.

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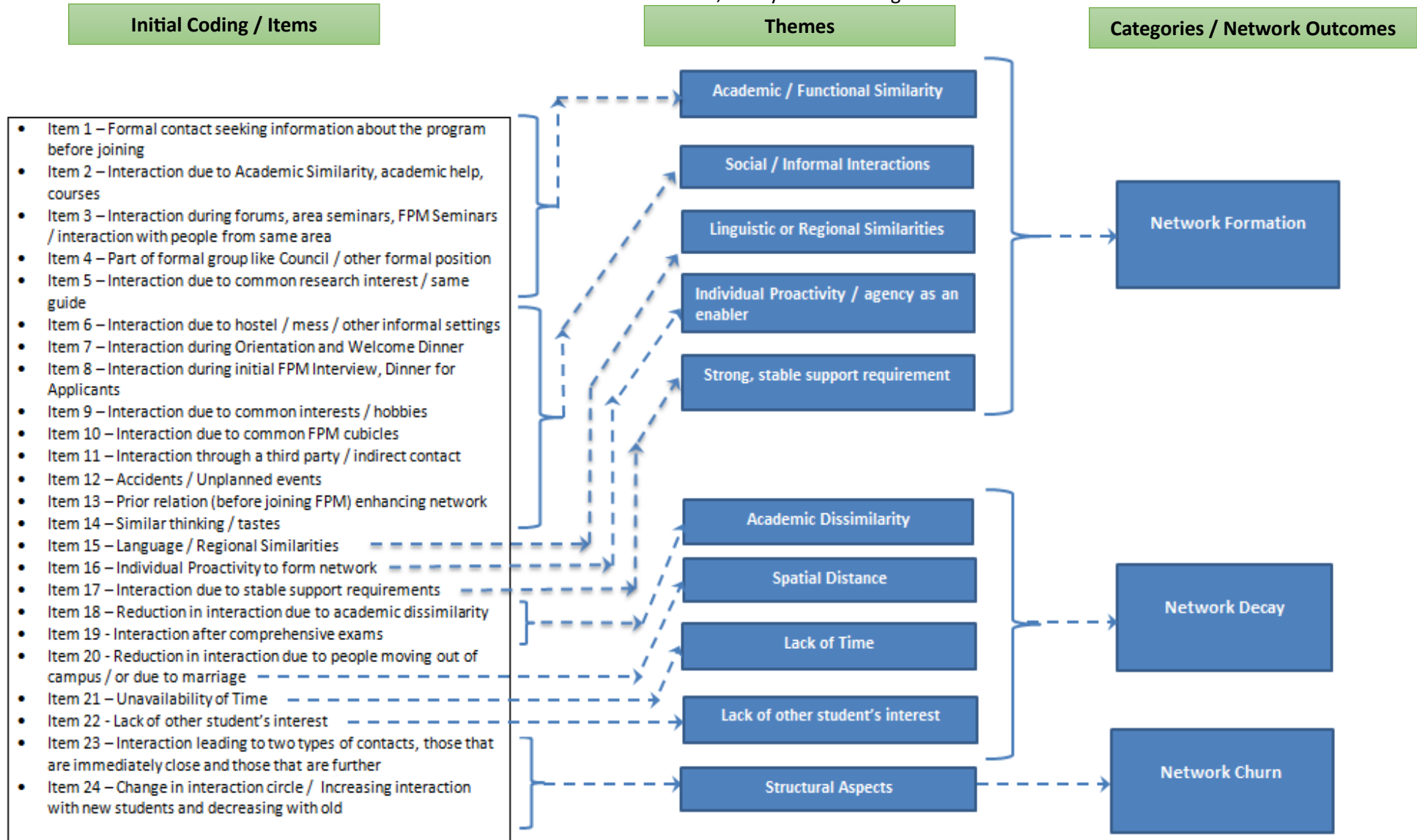


Figure 2: Coding Process

Section 3:-Data Analysis, Findings & Discussion

Our Inductive Study helped us identify three broad themes regarding the phases in the evolution of the network of a doctoral student, namely, network formation, network churn and network decay. We identified the factors which lead to network formation, its churn and decay. We explain these in detail in the coming sub-section.

3.1 Factors Aiding Network Formation

Factors aiding network formation are those which directly or indirectly determine how an individual's ties are formed at the time of joining the doctoral program. In our study we could identify five major factors. These are - Academic / Functional Similarity, Social / Informal Interactions, Strong, stable support requirement, Linguistic or regional similarities & Individual Proactivity / agency as an enabler

3.1.1 Academic / Functional Similarity

Those ties which are formed due to similar academic or functional needs can be categorized under this heading. A doctoral program provides many such professional / academic forums like coursework, seminars, and similar research interests. Many of these came up as prominent sources of interaction among doctoral students in our inductive study. A few examples have been mentioned in table 1 below.

Examples of Academic / Functional Similarity

- In our times we also had the FPM seminars. In our area one would think we have **the area level seminars. That definitely puts us back in touch.** - (A Fifth Year Student)
- Ya obviously **if you have common classes with someone you tend to speak to that person so much...** quite a bit. So [name1]... [name1] and I had a lot of common classes. [name2], of course because he is from area he had common classes. – (A fourth year student)
- So in first year, mainly [name1] and [name2] were in my close network **because they were from OB and HR group. We keep on interacting about course work** and thing... which courses to take and who we should talk to and all that. - (Another fourth year student)
- Well, first of all one develop friendly relationship with every one and **then I think it becomes little area specific** because you tend to have discussions with your seniors, how they got about their course work. (a Third year student)
- And the second team whom I can call them insiders, **who are along with me in the course work, the interaction has increased** – (A second year student)
- so, basically my groups are all closer people which are those people with whom I had classes. For me **academics was the reason of forming friends.** – (A first year student)

- I think primary reason that **how the bond forms, it is through classroom interaction mainly** because that is how we meet regularly every period. (Another first year student)
- We were 12 of us, so all the assignments, projects late night studies, some subjects which we didn't understand we used to do together, that kind of a network was formed – (Ph.D. student from other institute)
- [name1] and [name2] came in because we have common faculty adviser and we were working in common topic so we interacted quite a bit. – (A fourth year student)

Table 1: Academic / Functional Similarity

3.1.2 Social / Informal Interactions

Interactions based on academic or functional similarity represented one set of factors aiding network formation. Another equally important factor is represented by those ties which are borne out of social / informal interactions. The major difference between these social interactions and the one under academic settings is that these occur in a more casual, informal and at times in a non-academic setting unlike academic interactions which are primarily driven by academic needs. Important factors resulting in informal interactions were – hostel blocks, mess facility, common interests, FPM cubicles (FCC), sports etc. A few examples are mentioned in table 2 below.

Mess and hostels provide a very common forum for such social interactions. Another similar forum is the FPM cubicles occupied by doctoral students. These forums result in students coming together and discussing various types of issues – both academic and non-academic. Another strong factor of social / informal interactions is common tastes and interests be it movies, visiting temples, shopping, sports or music.

Examples of Social / Informal Interactions

- [name1], I met through [name2] but then we **go to temple** and all of those things together. – (A Fifth year student)
- And [name1] started to coming to cubicle and [name2]... –third year she also used to coming to cubicle. [name1] started coming to cubicle from 2nd year so we started discussing. Generally we discuss the POM related issues or POM professors- cribbing about them. - (A third year student)
- ...jaise [name1] was running in the evening so I meet her in the evening sometime, this day [name2] is **learning music** from me so we interact. Or another reason why I keep seeing [name3] is because she stays right across - (A second year student)
- we have certain **liking for specific places** and we started going out and we have gone

a lot together. So that is one more reason how people get added or deleted. (A first year student)

- ...and we used to have this **Friday we will meet** and who is doing what research...Sab log **TV room** mein aa jaate hain aur phir kuch saath mein Hindi program dekh lete hain to use bhi network ban jaata hai, phir who network mess mein extend ho jaata hai, phir who network **gymkhana** mein bhi extend ho jaaat ahi. (P.hd student from other institute)
- Second circle is **hostel, in the mess interaction**....we keep meeting everyday in the mess. That is the second circle. – (A fourth year student)
- So, [name1] and [name2] came in because of **cricket**. I got to know them because cricket only. - (Another fifth year student)

Table 2: Social / Informal Interactions

In both type of interactions – those due to academic or functional similarity as well as those which are due to social / informal settings – we see that our findings have similarities with the various phases of socialization suggested by Feldman (1981). In both cases we see interaction prior to joining the program for academic / professional reasons like understanding the coursework, course structure etc. and for informal reasons like meeting for dinner, on social forums etc., thus suggesting a similarity with the anticipatory phase of Feldman (1981) which was discussed earlier.

The following quotes by both Fifth year students throw more light on this –

“So [name 1] was my mentor. He mailed a couple of times, and given that he was my senior in strategy I would say that my interactions with him were much more than anybody else from my area.” – (A Fifth year student)

“because of process of applying, I came across and spoke to around, I think 4 people or 5 people about the FPM program...then I got in touch with two other seniors through official route. I think I found somebody on Pagalguy or something like that.” – (Another Fifth year student)

Similar to the encounter phase of Feldman (1981) we have new entrants interacting with the seniors at the mess, hostels, courses, academic seminars etc. This is suggested by the following quotes from the study.

“the seniors, so with them our main interaction happened during orientation.” – (A First year student)

“Juniors has always been a very personal interaction for me. I see most of them, most of them I met in the mess or you know first you have the FPM inauguration ceremony” - (A Fifth year student)

Finally in the settling-in phase we see students managing clear academic and non-academic peer groups within the same program. Some interactions are more due to academic setting while others are due to the informal setting in hostels and FPM cubicles.

“..third year onwards you do very consciously network for professional reasons as well.” - (A Fifth year student)

“[name 1], [name 2] were not from my area but still we used to have dinner together. Like me, [name 1], [name 2] were living in same block...they stayed on my floor so that was the big reason that, we used to go for dinner and these were the mainly reasons say same floor and same block” - (A Fourth year student)

3.1.3 Strong, stable support requirement

An important factor that emerged in the formation of network in the doctoral program was the requirement of a strong and stable support system. The doctoral program is a long duration program (4-5 years on an average) and it has its share of uncertainties associated with it. The eminent need for a stable support system was considered to be a major driver for tie formation in the program. The table 3 below has a few examples of this factor.

An interesting finding was the fact that this factor was highlighted more by those students who were done with their coursework and comprehensive exams. This could be because the duration of coursework is more structured and planned and it involves regular interaction amongst the students. Once this period is over, students start working on focused topics. It is during this post coursework and post comprehensive exam period that students feel the need for a strong support network which can provide emotional support as well as advice. Hence we notice more senior students pointing this need as a major driver for formation for networks.

Another interesting aspect is that most students who talk of the importance of a strong support system are those living in hostels away from their families and relatives. It seems that hence students seek such a support system to compensate for the lack of regular interaction of people members. Also, most Day Scholars tend to live with their families outside campus; their need for a strong support system within the campus is not that strong as they already have a similar system at their homes.

This is similar to settling-in phase suggested by Feldman(1981) and discussed in previous sub-section.

Examples of Strong, stable support requirement

- [name1] you might still include because we used to chit chat whenever I feel boredom and depressed with my research work, we used to talk and then. ... then see [name2] I started interacting but now academic part has just vanished. – (A fourth year student)
- it is important that you identify with three four people whom you can always talk to when you are depressed...I keep discussing lots of personal issues with him because I feel comfortable discussing with him...you need some outlet of stability in this place...because you have other pressure (A fifth year student)
- After that I think from third year onwards it is more than academic reasons it is about support system sort of why relations grow...mostly it's been a comfort level, especially in such a rigorous program I thought that it ... I mean you can cope with the work related and you can ask for help to anyone but it was more of the support and having a friendly rapport with people. – (Another fifth year student)
- .So if you have some support group stability, you feel comfortable, discussing joys and sorrows..thats good for you to get through the program. – (Another fifth year student)

Table 3: Strong, stable support requirements

3.1.4 Linguistic or regional similarities

Linguistic and regional similarities emerged as a very strong driver of tie formation in the doctoral program from our study. Students felt that it was easier to strike a conversation with someone from the same geographical region or someone with speaking the same language. This ease of conversation further resulted in the tie formation between two individuals.

One of the reasons for language / regional similarities being a strong factor could be that it acted as a good ice-breaker between people. It has also been noticed in some of the previous studies on networks with most noteworthy being Vissa (2011) which was also in Indian context. Moreover, commonality in language / geography gave impetus to other types of interactions like watching movies of same language, discussing issues specific to one's region etc. Moreover, having people around from similar geography or knowing one's language could also act as a major comforting factor.

Examples of Linguistic or Regional similarities

- One primary reason may be mother tongue or the same state thing. ... But people like [name1] who have joined first year and [name2] and all that met because he is Mallu and I am also a Mallu. i.e we are Keralites...[name 3] and we have interacted primarily because we have common mother tongue – (A third year student)
- In the first dinner night when we met formally we met every seniors, so those of us who came across from similar geographical area, we did have a better bonding. Because primarily because, we can discuss our own city related issues and etc. (A first year student)
- she is also Malayali then we for the Malayali meeting and all of that and then it sort of grew from there (A fifth year student)
- Ya but [name1] was two years senior...but may be because he is Tamilian we started interacting and watched movies together and something something.. (Another fifth year student)
- His name was [name1], he was also from Kerala. And that was first kind of network that I established. – (Ph.D. student from other Institute)

Table 4: Linguistic or regional similarities

3.1.5 Individual proactivity / agency as an enabler

Another interesting enabler of tie formation in the doctoral program was individual proactivity / agency. An individual's conscious attempts to form network went a long way in establishing ties with others. Vissa (2012) had talked about two distinct networking styles - network broadening and network deepening in case of entrepreneurs.

“Network broadening refers to the extent to which an entrepreneur reaches out to new people and establishes interpersonal knowledge about them.”

“Network deepening refers to the extent to which an entrepreneur strengthens ties to existing personal network contacts by time pacing inter-actions with them, overlaying friendships over purely business relations, and preserving existing ties.”

In our study we see examples of both types of networking styles being employed by students to form networks. Some examples of individual proactivity are given in table 5 below.

We see that when a student says that he/she is *“always in search of new group you can identify yourself with”* it is similar to Vissa's (2012) network broadening style where the idea is to reach out to new alter.

Similarly another student mentions - *“In second year, he was quite ok and there was personal problem with him. We also thought, we will help him out in solving the problems and hence we started interacting with him more frequently”*. This is again similar to Vissa (2012) network broadening style wherein the individual establishes interpersonal knowledge about alter. The above two cases were examples of network broadening styles.

When another one of the students says – *“I go to FCC whenever possible and there those people come. So I speak to them there”*. It suggests a temporal aspect of the relation which is suggested in the network deepening style of Vissa (2012).

Another student says – *“let say I had married and moved out of campus, something like that, I still during the course of the day, will keep meeting these people and keep talking”*. This suggests an attempt to preserve the network even when there are events which are hampering it, an aspect of network deepening activity according to Vissa (2012).

Examples of Individual proactivity / agency as an enabler

- I approached and introduced myself and that’s how the talk started. - (A first year student)
- I go to FCC whenever possible and there those people come. So I speak to them there. - (A fourth year student)
- In second year, he was quite ok and there was personal problem with him. We also thought, we will help him out in solving the problems and hence we started interacting with him more frequently - (A third year student)
- let say I had married and moved out of campus, something like that, I still during the course of the day, will keep meeting these people and keep talking. (A fifth year student)
- [name1], I still chat on gmail, fb, inspite of her not being in IIMB - (Another fourth year student)
- always in search of new group you can identify yourself with - (A fifth year student)

Table 5: Individual proactivity / agency as an enabler

In our study we see doctoral students using both networking styles suggested by Vissa (2012) in their networking activities. We would like to believe that both styles have their benefits and are relevant in this context to establish one’s network. Our study does not throw any light on which style could be more impactful of the two. Future research could focus on that aspect.

3.2 Factors Leading to Network Decay

Network Decay has been a relatively less studied phenomenon in the literature despite its vast significance (Mariotti & Delbridge, 2012). In the present study, we attempted to discern various factors associated with the decay of the network thus adding the literature by opening constituent of black-box of network decay. In methodological terms, we attempted to find the independent variable while keeping network decay as dependent variable.

As mentioned earlier, the study employed grounded theory approach and through open coding of unstructured interviews pertaining to network evolution/network life cycle of the respondent (12 Doctoral students in various management domains) looked at network decay phenomenon. From the initial coding as mentioned in methodology section authors identified four broad reasons of network decay- academic/functional dissimilarity, Spatial Distance, lack of time and lack of interest of other student for having network with focal actor.

3.2.1 Academic / Functional Dissimilarity

This has been one of the prominent reasons for the network decay with certain individuals. As described in earlier section, FPM program involves two years of classroom study followed by independent thesis work. Till the time classroom study is there, it provides an automatic platform for the interaction and network but as soon as it finishes (and even during class work when courses are different for various areas) network seem to decay particularly with the persons of different academic areas. As some of the examples of respondent quotes show in table 6, the contacts which have gone in different academic direction seem to have less chances of remaining in close network. There can be many other reasons apart from lack of physical classroom setting like reduction in common topics to discuss, less need for seeking/providing help etc.

Examples of Academic / Functional Dissimilarity

- first one being that the courses demand is that some of the **area specific courses are different than my area** i.e. IS. So it becomes very difficult to interact. (A first year student)
- So in and out happened (in close circle) **because classes were together or not together**, not because of preference. (A second year student)
- we **don't have any commonality in terms of work** and things that's why things kind of faulted off. – (A fifth year student)
- In fourth year, **change was drastic, now only focus was on dissertation**, friend circle declined, (A fourth year student)
- After comprehensive those **connections have also become slightly loose, because**

they don't come every day, we meet more people from the hostel. (another fourth year student)

- Apart from that meeting have got reduced, the **regular sort of meeting we have when we were having classes. Those have reduced.** – (A third year student)

Table 6: Academic / Functional Dissimilarity

3.2.2 Spatial distance

Spatial distance signifies another major reason for network decay. The student who moved out of hostel at different stage of program expressed significant decay in network. The student who lived outside campus from the beginning showed less network compared to people living inside campus. The reasons include socialising over meals in mess; common functions in hostel and ease of access to other person. Few other reasons that came out of study include marriage of the students in current social group and absence of students from campus due to academic / non-academic reasons. Table 7 provides a quick overview of few respondent comments in this regard. Normally this phenomenon was observed critically by students in advance stage of program i.e. third year onwards.

Examples of Spatial Distance

- like [name1], he used to stay in the hostel in first two semesters. We used to talk very often at least once or twice a week. Now that he has moved out of campus, I barely see him. Or [name2], same thing, we shared a few courses, now I haven't seen him for the whole semester. (A second year student)
- if you look at the people who are staying outside they normally don't have much network. (A third year student)
- she stays outside and she had some different responsibility so it is very difficult to meet (A first year student)
- a lot of them went out of campus, so that again the interaction became limited. (A fifth year student)
- but last year also she was not very much in the campus- going to Kozhikode and marriage whenever she used to come I used to talk to her (A fourth year student)

Table 7: Spatial Distance

3.2.3 Lack of Time

Lack of time refers to unavailability of time with focal student for maintain previous network relationships leading to decay in network. Some examples of such observations are listed in table 8 which also further clarify the time factor. Lack of time is generally due to demanding structure of course work in first two years and also towards finishing stages of thesis. Another important dimension, which this study has captured partially in the next sub-section on churning, is the relation of time unavailability with respect to preference for certain

individual in the available time. However, the case for genuine unavailability of time also exists and that's why we chose to include this as network decay factors and inter-coder agreement supports our assessment.

| Examples of Lack of Time |
|--|
| <ul style="list-style-type: none"> • May be due to the structure of the program where I am engaged in the program. Or may be coz of engagement of the other person. (A second year student) • We interact less bcoz she may have less time for me or I may have less time for her. (A fourth year student) • It reduces in the third term because not much meeting have occurred because of the council in the third term (A first year student) |

Table 8- Lack of Time

3.2.4 Lack of other student's interest

This is one of the finer insights of the study. In almost all the social settings, network sustains with mutual agreement and in lack of one actors interest, it breaks. The similar case was observed in our data too: some of the earlier formed network reportedly broke due to lack of interest of one or some individuals with respect to focal student. This also reflects the changing preferences of individuals in terms of ties and puts evolution of the network ties into picture. However, lack of other's interest can be further divided into two categories- first, where the other actor has taken this as conscious decision and second, where the inter-personal aspects of the other person's behaviour led to decay in network. This study accounts both types in one group due to small sample of the latter case. Table 9 provides glimpse of this factor in our data.

| Examples of Lack of other's interest |
|---|
| <ul style="list-style-type: none"> • In the first year he was closed to FP but later on he went to sports and he basically started mingling with the PGP so that's it. (A fourth year student) • Some people get a lot more focused and would not want to know about a broader this. Then the interactions come down a lot. (A fifth year student) • [name1] as in don't talk much to people (Another fifth year student) • She seemed to be a very nice person but we couldn't get along. I mean it depends upon the personality. Aise log hote hain ki we talk very close, very close hona chahte hian, kuch log highly professional hona chahte hain. (Ph.D. Student from other institute) |

Table 9: Lack of others' interest

In sum, we have identified some of the factors of network decay which, though evident in present context of doctoral students, can be generalised in other settings too. Academic dissimilarity may refer to functional dissimilarity in business contexts and entrepreneurs/employers may be subject to tie decay with the actors who turned in different direction or whose activities no longer are in same/ required activities domain of entrepreneur. In the same vein, lack of spatial proximity may refer to physical distance between two actors in business domain which may hamper socialisation resulting in decay in tie.

Unavailability of time with entrepreneurs is well documented in literature (eg. Vissa, 2012). Our study adds to that literature by supporting the view that entrepreneurs like students in rigorous Ph.D. program, lack time and thus attempt to optimise available time over selective contacts. Possibly, she may not be able to give time to even selected contacts leading to decay in ties or weakening of the tie. Another important similarity is the stage of student/entrepreneur, as noticed in our study, unavailability of time was shown more prominently by students in their 3rd year onwards, entrepreneur also in their advance stage of venture have lesser time available for maintaining ties. Others' lack of interest as a factor in network decay can be understood as other actor's preference for continuing tie with focal actors both due to deliberate action due to optimisation of time over importance or due to networking style (Vissa, 2012).

Overall, network decay phenomenon in the present study not only contributes to network literature but also has useful implications for the entrepreneurship literature. The results of present inductive study are also sufficiently generalizable over other contexts.

3.3 Network Churning

Network churning refers to change (addition and deletion) in actor's network. The mainstream social network literature has increasingly started paying attention to the Network churn (eg. Vissa, 2012). Our study also found important evidences in and factors for network churning. Some of the examples in table 10 below provide snapshot of this specific aspect of network outcome. With several respondents suggesting two circles of ego network- inner, close, small (and strong tie) circle and outer circle, they also indicated the flux in these circles as well as alters joining from outside in one of those two circles. The nuance in this effect comes from two further possibilities- one, strategic choice of the student to shuffle or add/delete her network tie according to professional/personal requirements and two,

circumstances such as lack of common interaction platform clubbed with lack of time or intention to seek/ continue with the same network.

The main reasons that can be figured out are the network handling capacity of individual, differences in initial interaction with individual vs. later detailed interactions and structural aspects of the program itself which lead to distinct preferences of network alters at different stage of program.

Through studies in context of doctoral students, like network decay, network churning has important implications for the network outcomes in general. Again taking the case of entrepreneur, network churning can refer to entrepreneurs' conscious strategic choice to shuffle her network alters as well as lack of time resources to follow or maintain the particular tie.

It is quite interesting to note that network churning will be a result of interaction of network enabling and network decay factors. Hence, looking at churning can reflect the underlying network formation and decay processes and their resultant effect. This makes network churning even more important. Future researcher can use churning as result to understand other network outcomes. This will put more light in our understanding of the network.

Examples of Network Churning

- I have started interacting more with [name1] because she is part of competition of strategy course ... [name2], who was there in (my list) in term 1 and now in term 3 but not much in term 2. (A first year student)
- this circle, we can call it a concentric circle keeping the person at the core, ... So people may jump from one circle to other circle, (A second year student)
- I was close to my area people but later not much. (A fourth year student)
- you don't meet everyone that often but then ya I would say it kind of changes (A third year student)
- see of course friend circle change, once you enter the program...(A fifth year student)
- aise kaafi saare permutations combinations hote hain. I tried with somebody, fir who bad experience hota hai. Ki hamara achha nahi...agar timespan mein dekha jaaye to one year to poora hi up and down tha (Ph.D. student from other Institute)

Table 10: Network Churning

Section 4: Limitations & Future Research

The study is exploratory in nature and hence the conclusions are not definitive regarding the dynamics of network formation. The sample size is small and includes doctoral students from management only hence homogeneous. But the authors tried to bring in within sample

variation by including different dimensions. Also the small sample in qualitative research is not a big concern as the focus is on unveiling and elucidating the rich experience from the case studies than on population representation (Eisenhardt, 1989; Yin, 1994). As the context was set in an educational setting, the relationships found cannot be generalized to other settings and is certainly a question for future research. Scholars can emphasis on replicating the study on other settings, as mentioned in previous section (with respect to entrepreneurial setting). The authors are from same institute as the respondents and hence possibility of biases creeping in cannot be overruled. But this may not be a limitation because; in case of false responses authors can intervene and check for discrepancies. Further, the assurance of maintaining confidentiality made respondents open up, after initial hesitation. Another limitation of the study is that we considered only peer relationship. As mentioned earlier, doctoral students may have multiple relationships with others like mentors, faculties, family, friends outside college and even friends inside college but from different program. We tried to look on the developmental networks, as mentioned by Higgins & Kram (2001), of a doctoral student which provides two kinds of support, psychosocial and career-related. It is reasonable to consider peers to form their developmental network because they form an immediate circle of network with whom they are working. Network scholars can explore type of ties a doctoral student can have but the authors suspect that this can lead to an evolution of a complex network structure. The study is ego-centred and future studies can consider analysing ego-alter networks in this kind of study. The features of ego-alter network and implications are worth exploring and can improve our understanding on co-evolution of a network. The authors do not make any claim about the strength of the ties. Finally, the authors cannot control for personality factors of the informants which can have an impact on the kind of relationships an individual has such that extroverts are expected to have more people in his network as compared to introverts. To minimize the effect of this determinant, all the three authors discussed and consciously sampled those doctoral students who are neither too extrovert not too introvert.

Section 5: Conclusion & Implications

Many students are now joining doctorate programs (The PhD Factory, Nature, 2011) and the trend shows no signs of slowing. In 2011–12 Indian government made major investments in research and higher education, including one-third increase in the higher-education budget. India's population is young and the number of graduates is increasing and a projection of

20,000 doctorates per year by 2020 has been speculated (The PhD Factory, Nature, 2011) by many master brains.

One of the major concerns in the doctoral programmes is high attrition rates among doctoral students (near fifty percent) (Lovitts, 2001). The rate is alarming keeping in mind the cost of recruiting and training the doctoral students.

The reasons for leaving a doctoral program can vary and may include personal reasons, lack of individual motivation (Golde, 1998), even the program characteristics (Austin, 2002). In order to find solutions to these problems, it is important to understand the procedural and structural issues a doctoral student faces. Most of the studies examining the persistence of doctoral students have focused on a dyadic 'student-advisor' relationship (Nettles & Millett, 2006; Paglis, Green, & Bauer, 2006). These studies stress on the role of the advisor as one providing feedback and developmental support to doctoral students. Though, the vitality of the role of an advisor is unquestioned in a doctoral programme it is too narrow to assume absence of any other support structure a doctoral student can have. This additional support can be the network of their peers and other fellow doctoral students throughout the various stages of their programme. Our current study attempts to throw some light on what factors determine a doctoral student's network formation and what factors are responsible for decay in their network over a period of time. We believe that the current study paves the way for many future studies to understand the doctoral programme better and collectively such studies can provide useful insights to policy makers and administrators on how to design and develop doctoral programmes to be rigorous yet enjoyable.

To sum up, the present study, as a minimum, enhances our understanding of network evolution in a social setting. The paper may be seen as first step in direction of opening the floodgates for the network studies pertaining to different stages and associated factors of network evolution of individuals' network. Though the context of the study has been academic program, it is fairly generalizable over other individual and organisational context as well, as we have briefly discussed in the case of entrepreneurship. Future research can undertake different context and various aspects associated with present study to help our objective of furthering our knowledge about micro-foundations of networks.

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Appendix 1:-Unstructured Questionnaire Used For Study

Demographic Information

1. Name:
2. Gender:
3. Age :
4. Prior Work Experience and Organization Name:
5. Tenure:
6. Number of organizations worked for in the past:

Broad Set of Questions for I and II Year FPM Students

- How many people did you know in the FPM program before joining? How did you get to know them?
 - Do you still have contacts with them?
- Currently, whom all in the FPM Program do you interact with on a regular basis (from your batch-mates as well as seniors / juniors)?
- What factors do you see responsible for your current ties in the FPM Program? (Is it based on same region, language, alma mater, area, interests etc?)
- How do you see your ties (contacts) changing post your comprehensive exams? Do you feel you will be interacting with the same set of people you interacted with prior to comprehensive exams?
- If you feel there could be less interactions with a particular set of people, what reasons do you think could be responsible for the same?

Broad Set of Questions for III Year FPM Students and above

- How many people did you know in the FPM program before joining? How did you get to know them?
 - Do you still have contacts with them?
- During the first two years of the program, whom all in the FPM Program did you interact with on a regular basis (from your batch-mates as well as seniors / juniors)?
- What factors do you see responsible for your ties then in the FPM Program? (Was it based on same region, language, alma mater, area, interests etc.?)
- How did your network change post your comprehensive exams? Were you interacting with the same set of people after the comprehensive exam as you were prior to comprehensive exams?

What do you feel could be the reasons for the change in interactions after the comprehensive exams?