The impact of friendship ties on new product development student projects

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ABSTRACT: The competition between firms for more effective new product development (NPD) capabilities has posed the research question: what possibilities are there to improve traditional and knowledge based project team organisation by analysing the impact of social relationships between team members? The authors of this article tested the hypothesis that friendships have a positive impact on project team effectiveness using the cohesion social network metric. The methodology involves a combination of qualitative and quantitative methodologies applicable to social network analysis (SNA) research. Regression analysis results support the hypothesis and are in line with the existing literature. The experimental setup refers to undergraduate final year team projects on NPD and includes improvements in the standardisation of measurements of the relevant concepts.

INTRODUCTION

Increased competitive challenges, shortening product life-cycles, increased customer requirements, developing technology and globalisation have led to a further expansion of the need for reconfigured diverse project teams that develop innovative new products and services [1]. Project teams are transient in nature and are formed for the next new product development (NPD) project. The need for the study of NPD project teams involved in complex projects has been a topical research issue [2]. The creation of new knowledge requires social and business relationships between actors with different and complementary knowledge bases [3], while social capitalisation is based on value seeking behaviour [4] and external collaborations [5].

Social relations and relationships seem to have an impact on the performance of groups or teams; however, relevant research is limited [6]. A team member may have existing social relations (related to family, organisation, religion, language and other social ties that a person does not form intentionally), and has formed social relationships (intentional person to person social ties) with one or more team members, and may also develop both internal and external social relationships during the new project duration.

Personal friendship is a common and important social relationship. It is defined as the mutual social bonds between two people where they both invest time and energy to keep this relationship going [7]. The limited research until now shows evidence that friendship networks within groups in general correlate positively with performance [8-13]. Holmlund and Tornroos propose that network relationships can be characterised as an interdependence procedure of interactions among two actors [14]. Types of social relationships can be identified by analysing the structures of the social networks being developed within the group members and with the outside world. The links or ties may represent communication of any type of exchange between nodes [15].

The identification and measurement of social structures can be done using social network analysis (SNA) [16]. Social network analysis (SNA) is the scientific field that has developed metrics for relation and relationship measurement versus the so-called social capital, a term first coined by Bourdieu [17] and revised later by Putnam [18]. The most common SNA metric used for the calculation of a friendship social network is cohesion, and more specifically the density of the network, i.e. the total number of ties or relations divided by the total number of possible ties [19].

A key outcome of the limited existing studies is that the density of friendship ties within a group results in increased communication between team members and is assumed to increase knowledge transfer and co-operation [6]. The Hentonnen's [6] review shows that there has been no standard framework for the evaluation of NPD project effectiveness and, therefore, there is scope for further improvements by testing out the following hypothesis:

H1. *Cohesion of friendship relationships in new product development project teams positively influence project effectiveness.*

The current article presents the regression results for the social network metric (cohesion) of one relationship (friendship) in the relevant results section.

METHODOLOGY

The methodology used in this study is based on similar previous experimental studies [8][10][12], with improvements in the standardisation of the evaluation processes. The NPD projects are undertaken by final year business administration students of the Technological Educational Institute (TEI) of Larissa, Greece, who form project teams that may include engineering students from TEI, and external engineering and business consultants. Objective measures are used in the module for the evaluation of NPD projects based on standardised processes using canvases as described in the business model generation in Osterwalder and Pigneur [20].

The research approach followed is a combination of experimental design and the use of questionnaires. All 79 final semester students, aged over 22 years, working on their final semester project in the 2011 class at the Technological Institute of Thessaly, Larissa, Greece, participated in this experimental research, forming 17 teams of three-to-seven students from the same class as internal group members.

Their projects required the design and development of prototype business models for new product development presented as value propositions, i.e. product or service development and improvement processes in the related business models. New product development (NPD) value propositions involve research and creativity processes. The team could expand and/or co-operate with external partners and teams. The experimental approach has the advantage that the researcher can come back at any time in order to apply new or refined models to explain the collected information.

The team formation followed after:

1. A review made by the lecturers of Belbin's team role theory where each student self-evaluated his/her preferred team roles, i.e. plants, resource investigators, monitor evaluators, co-ordinators, implementers, completer-finishers, team-workers, shapers and specialists [21]. Students received instructions on how to maximise diversity and avoid conflicts. The minimum number of students as internal team members was three and the internal team should remain unchanged for the whole project duration. Teams were allowed to expand at any time by adding external consultants that could be students from other disciplines, professionals and employees from the company that they worked with.

   The project management or co-ordination role evolved from within the project team. The selection of a real world company preferably would be a team task. The module leader provided assistance for contacting interested firms in case of difficulty. Teams managed their project schedules independently, their sole responsibility being to attend the module weekly workshops. The teams worked in real companies on real projects with real work conditions evaluated within a real world framework.

2. A review made by the lecturers on: a) project type; b) quality, time and cost constraints; and c) the project effectiveness evaluation framework. The project involved the selection of a company where the project team would create the current canvas of the company's business model and add canvases for NPD. The quality was evaluated by the lecturers as a function of documented creativity and innovation additions in the Osterwalder and Pigneur canvas building blocks [20].

   The time was recorded automatically for each new canvas electronic submission on the e-class electronic platform used for teaching and learning support. The cost was counted as the internal team size multiplied by the duration in weeks. The effectiveness measure was a benchmark of total marks between project teams as percentages of the mark awarded to the best project. The total mark for a project was the sum of marks for the canvases, divided by the cost and 5% per day subtracted for late project submission. The mark for each canvas was calculated as the sum of quality products multiplied by quantity marks awarded for each of the nine building blocks divided by the time elapsed since the previous submission.

In addition to the social network data accumulated on the e-class platform, a structured questionnaire was used for the collection of team attributes and the tabulation of relationships. The standard procedure proposed by Katz, Lazer, Arrow and Contractor was used where each team member filled-in their relations with other group members on a relational table included in the questionnaire [22].

The relationships recorded were friendship before the project, collaboration in past projects and the communication attributes (frequency, duration, direction) for each of the different communication platforms being used. The boundary of the network was defined by the first level links that has been the norm in similar studies.

Measuring social relationships requires the use of social network analysis (SNA) methodologies in addition to the traditional statistical analysis. The calculations are facilitated with the use of suitable SNA software, in this case UCINET [23] software for SNA calculations and SPSS [24] for the statistical calculations.

RESULTS

The data in Table 1 are tabulated in order of increasing friendship density.

Table 1: Group data tabulated in order of friendship density.

A/A	Company	#Students	#Males	#Females	#Externals	Proj_ effect	Friend_ density
1	Marris S.A.	3	3	0	2	7.7	0.0
2	Hotel Business Redesign	6	4	2	4	4.8	0.0
3	IKEA S.A., Larissa Branch	4	4	0	0	5.8	0.0
4	Hotel Business Redesign	5	2	3	1	5.3	0.2
5	Korres S.A.	3	0	3	1	7.4	0.3
6	Snail Farming Business Plan	3	3	0	0	0.0	0.3
7	Laro S.A.	4	2	2	0	7.2	0.4
8	Hotel Dafni Business Redesign	7	4	3	4	2.6	0.5
9	Konstadinidis Group	4	1	3	2	8.7	0.6
10	Berloni Proteas	4	4	0	1	4.8	0.8
11	ELAIS S.A.	5	3	2	0	6.3	0.8
12	Mastic SPA	7	3	4	1	4.7	0.8
13	SOYKOS S.A.	6	4	2	3	4.9	0.8
14	EPSA Beverage S.A.	6	3	3	4	5.3	0.8
15	Sprider S.A.	5	0	5	1	6.3	1.0
16	JU-GO Sailor Moon	4	0	4	1	7.7	1.0
17	Cloud Computing Co	3	2	1	1	10.0	1.0

The analysis was done using the Curve Fit regression with ANOVA.

The model was tested for sensitivity to special cases by running all possible data combinations, i.e. a) by using all 17 groups; b) by using the 16 groups after removing the one with zero effectiveness (project 6 had no-submission); and c) by just the 13 groups after removing all zero values for both effectiveness and friendship density.

The most important SPSS tables for data combination b) are presented here. Similar tables have been produced for all three data combinations. The significance (sig.) level outcome of regression analysis for all data combinations is 0.0 (zero), that is lower than 0.5 and indicates evidence of a significant dependence between project effectiveness (PROJ_EFFECT) and cohesion or density (FRIEND_DENSITY) of project team friendship relationships at the 95% significance level.

Table 2 presents the model description produced by SPSS and the dependent and independent variables.

Table 2: Model description.

	Model Name	MOD_3
Dependent Variable	1	PROJECT EFFECTIVENESS
Equation	1	Linear
	Independent Variable	FRIENDSHIP DENSITY
	Constant	Not included
	Variable Whose Values Label Observations in Plots	Unspecified

Table 3 presents the ANOVA results. The friendship density variable seems to explain 46.7 % of the effectiveness level achieved with 95% confidence. The results for the different data combinations are all between 46% and 47% and indicate that the analysis is not sensitive to the omission or addition of the special cases with zero values in either the dependent or the independent variable.

Table 3: ANOVA[a] results.

	Sum of Squares	df	Mean Square	F	Sig.
Regression	466.781	1	466.781	34.623	0.000
Residual	202.229	15	13.482		
Total	669.010	16			
The independent variable is FRIENDSHIP DENSITY					
a. The equation was estimated without the constant term					

Figure 1 presents the plot of the observations and the graph of the model equation.
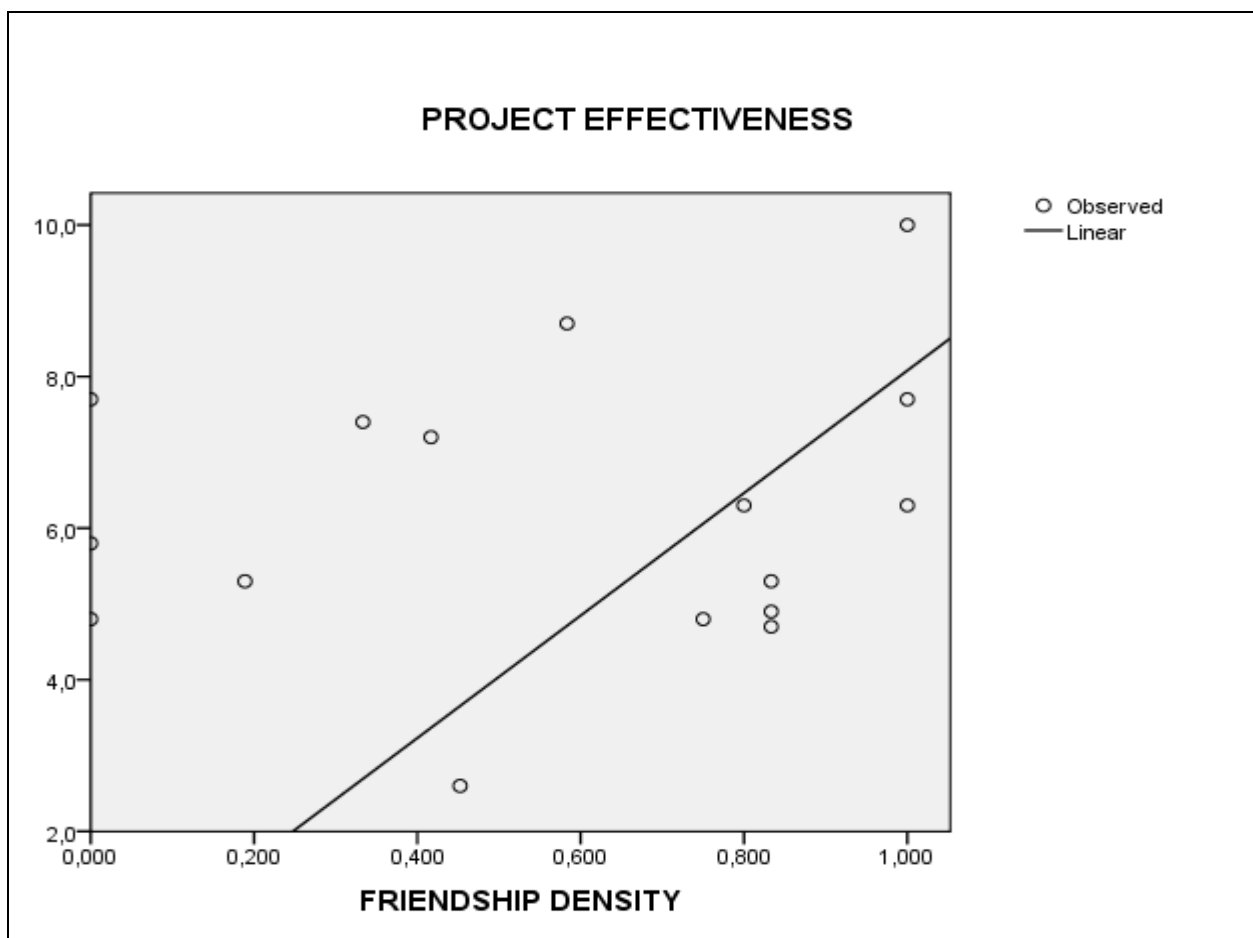

Figure 1: Project effectiveness versus friendship density.

Regression analysis gave the same results whether or not the data were included that was zero for the effectiveness variable (no submission) or for both the effectiveness and the friendship variables.

In the following paragraph the results are discussed for the special cases (outliers) where either variable is zero:

Group 6 with the snail farming business plan project consisted of three male students one of whom considered the two others as his friends but the relationship was not reciprocal, while the other two were strangers to each other. The students did not have any external ties with companies and seemed to lack the motivation for the project selected.

Group 1 (Marris SA project) consisted of motivated students who selected and approached a company in a professional manner. It operated smoothly and achieved high marks working professionally both internally and with the external consultants.

Group 2 followed the Belbin [21] role diversity and other diversity instructions discussed in the relevant theory of the module and achieved the maximum team role and sex diversity, and also worked with the maximum number of external consultants. The team co-operated well in their choice of project (Hotel Business Redesign) and was successful in their

search for external consultants. They achieved a high mark which, when divided by the cost (team size), resulted in a medium effectiveness measure.

Group 3 (IKEA SA project) was formed from students who did not have any friendship ties and came together after most of the other groups were formed. Their group showed medium effectiveness because of the project complexity and their inability to get sufficient external consultation.

Figure 2 presents the graphs of the relevant outlier groups as produced by the Netdraw component of the UCINET software.
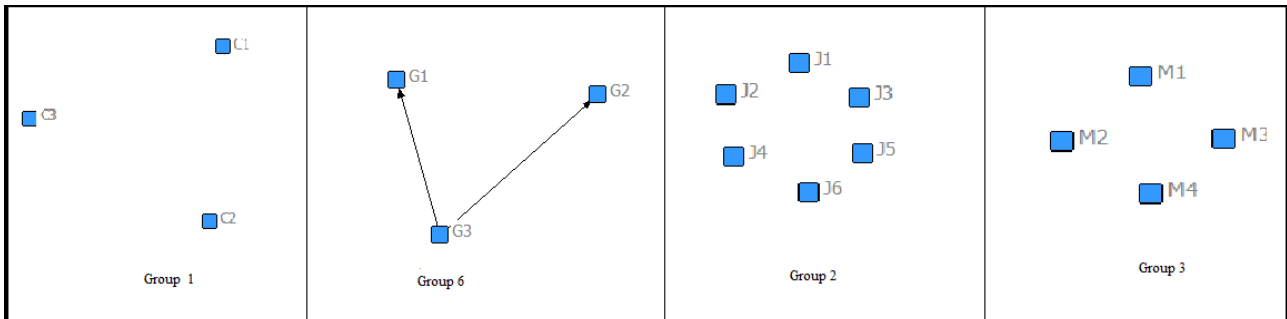

Figure 2: Graphs of outliers' friendship social networks.

CONCLUSIONS AND DISCUSSION

The results confirm the authors' research hypothesis that previous friendship ties in project teams make more effective NPD projects, and so agree with previous research findings where friendship groups perform better than acquaintance groups [10] and increased internal friendship increases constructive controversy that in turn enhances performance [12].

A weakness in the study, as in similar previous studies, is the small number of groups that may exist in one class and the small size of groups [6]. The sensitivity analysis showed that the results are not influenced by the special cases of zero values in either the dependent or the independent variable. Further testing with more groups of larger sizes could be continued using the same standard comparative effectiveness measures used in this first study.

Most of the projects had a medium to high complexity in relation to the average student's level of skills and knowledge. In the detailed tabulation of the marks done by the lecturers of the module, it was observed that a significant percentage of the grades received were based on work that can be done independently by division of work between members, and the skills required for this are common for the average student. This is not different though from what is happening in similar real world projects.

Further research is under way on using project complexity as a moderating variable in order to provide a better understanding of the development of social processes under environmental conditions of varying complexity. Research is also continuing on testing for larger size groups, with expected smaller densities where social clustering coefficients related to local densities might also have an impact. Moreover, research continues on how the competition for resources or other real world problems influences the evolution of project team capabilities and friendship social networks over time and what their impact would be on project effectiveness. Students in the module meet socially not only with their team mates but also with members of other teams and learn of their progress.

Learning by social diffusion in the wider class network minimises information asymmetry created by individual learning or project group learning. Also, formal learning during classes where questions and answers and discussions take place has a similar impact. Observed during the semester was a continuous improved benchmark between teams. Further research is required on the hypothesis that wider social and organisational network relationships might have a greater impact in less complex projects where information asymmetry is easier to alleviate.

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