Is team cohesion a double edged sword for promoting innovation in software development projects?

Ashish Kakar  
Johns Hopkins University  
akakar1@jhu.edu

Adarsh kumar Kakar  
Alabama State University  
akakar@alasu.edu

Abstract

Creation of new knowledge in teams requires collaboration among its team members. Although individual creativity is important, no single individual possesses all the skills and knowledge necessary to deal with complexity in knowledge work. Therefore, team cohesion is considered a prerequisite in innovation. However, in this study we argue that team cohesion could be a double edged sword. It could even be detrimental to innovation at high levels of team cohesion. The findings of this study with 56 software projects quantitatively support this premise. These findings have useful implications for practitioners engaged in knowledge work.

Keywords: Team Innovation, Team Cohesion, Software Development.


ISSN 1943-7536(print) / ISSN 1943-7544(online)
Copyright © Association for Information Systems.
DOI: 10.17705/1PAIS.10404
Introduction

Software development is knowledge-intensive team activity (Robillard, 1999) rooted in innovation management (Conboy and Morgan, 2010). Studies have shown that innovation defined as “the intentional introduction and application within a job, work team or organization of ideas, processes, products or procedures which are new to that job, work team or organization” (West and Farr, 1990) plays a pivotal role in all aspects of software development (Gallivan, 2003). However, although, individual creativity and innovativeness are important and crucial, the creation of complex software products is rarely an individual undertaking but creative cooperation of the entire team (Leonard and Sensiper, 1998).

Therefore it is relevant to investigate the impact of team variables that promoting innovation. One of the most studied team variables in teaming literature is cohesion. Team cohesiveness is the degree to which team members like each other, identify themselves positively with the team and want to remain its members (Shaw, 1981). It reflects the degree of attraction among group members. A study of cohesiveness is considered essential for understanding group dynamics in teams (Zander, 1979). Two meta-analyses (Evans and Dion, 1991; Mullen and Cooper, 1994) have reported a positive relationship between cohesiveness and performance. Cohesive teams demonstrate increased collective efficacy and greater team success. Further, cohesive team members are less anxious and more satisfied, have higher self-esteem, conform to group norms, make personal sacrifices for the team, share responsibility for team failure and are less likely to indulge in social loafing.

But does team cohesion enhance innovation in software development projects? Studies in the past have shown that team cohesion is a necessary precondition for innovation (West and Farr, 1989; Woodman et al., 1993). However, there is a dearth of studies investigating the impact of team cohesion on innovation in software development projects. In this exploratory study we therefore attempt to answer the question: What’s the relationship between the team cohesive and team innovation in software development projects? We argue that both high and low team cohesion may actually be detrimental to innovation. This proposition is borne out by the findings of the study. These findings enhance our understanding on how team cohesion can be leveraged to engender innovation in software development.

Literature Review

Innovation

Ever since the introduction of the term by Drucker (1954), innovation, the systematic and effective implementation of new and improved methods of working and creation of novel and superior products and services, is increasingly considered essential for organizations to thrive or even survive in an uncertain and rapidly changing environment (Burpitt and Bigoness, 1997; West, 2002). Teams engaged in development of innovative products and knowledge creation, such as software development, face greater “ambiguity and confusion regarding what needs to get done” and “lack of knowledge about future events and consequences of specifications” than those involved in routine jobs (Sicotte and Langley, 2000). The resulting equivocality and uncertainty makes engendering innovation especially challenging (Kakar, 2017b).

Innovation subsumes creativity. It involves not only generation of new ideas but also their successful promotion and implementation (West, 2002; West, Hirst, Richter, and Shipton, 2004). However, team members are often adverse to the development of new ideas and processes (Anderson and West, 1996). Even when
team members have unique information, they are often ineffective at sharing their unique insights (Stasser and Titus, 1987). A team member having innovative ideas is likely to face resistance from other team members eager to avoid stress and insecurity engendered by anticipated change (Janssen, 2003; Jones, 2001). It may disrupt established ways of working and thinking within the group resulting in animosity towards its perpetrator. To overcome these challenges groups involved in innovation should not only be able to create an environment for stimulating innovation but embracing it as well.

**Team Cohesion**

A study of cohesiveness is considered essential for understanding group dynamics in teams (Zander, 1979). Cohesion in teams is critical for keeping the team members aligned with common purpose and goals (Ramesh, Cao, Mohan, and Xu, 2006). Team cohesion is a one of the six key facets of Team Work Quality (Hoegl and Gemuenden, 2001). Without a sense of togetherness and belonging no meaningful collaboration is possible in groups. Further team cohesion promotes sharing of tacit knowledge amongst team members. Hardy, Eys, and Carron (1995) noted that team cohesion provides numerous psychosocial and work benefits outcomes of teams. Cohesive teams demonstrate increased collective efficacy (Paskevich, Brawley, Dorsch, and Widmeyer, 1995) and greater team success (Carron, Colman, Wheeler, and Stevens, 2002).

Cohesive team members are less anxious (Eys, Hardy, Carron, and Beauchamp, 2003), more satisfied (Widmeyer and Williams, 1991), have higher self-esteem ((Julian, Bishop, and Fiedler, 1966), conform to group norms (Prapavessis and Carron, 1997), make personal sacrifices for the team (Prapavessis and Carron, 1997), share responsibility for team failure (Brawley, Carron and Widmeyer, 1987) and are less likely to indulge in social loafing (Naylor and Brawley, 1992). Additionally, cohesiveness reduces dysfunctional conflicts. Breakdown in coordination are a significant contributor to bugs and design flaws (Petre, 2004). Empirical studies have shown that cohesive teams are effective (McGrath, 1984; Prapavessis and Carron, 1997; Sundstrom et al., 1990; Yang and Tang, 2004). They are more likely to produce better software products than those riddled with conflicts (Carmel and Sawyer, 1998).

**Hypothesis development**

Team members are often adverse to the development of new ideas and processes (Anderson and West, 1996). To enhance creativity, the group members “must inhabit a nonthreatening environment” (Mathisen et al., 2004), “built on trust and openness” (Ekvall, 1996) where they know it is safe to present new ideas and ways of doing things. Cohesion among team members is known to create a psychologically safe environment for team members to freely challenge the status quo and discover new ways of doing things (King et al., 1991). The strong bonds among members of cohesive teams make them willing to take risks as they can rely on the support of others (West, 1990). Some deleterious symptoms of lack of cohesion include political problems in teams (Bradley and Hebert, 1997) and “analysts not speaking with developers and testers remaining independent of the rest of the team” (Sawyer, 2004).

Further, cohesive teams by promoting trustworthiness amongst team members can reduce opportunistic, self-interest seeking behaviors by promoting sharing of knowledge for mutual benefit (Ensley, Pearson, and Amason, 2002; Edmondson, 2004). Knowledge sharing considered key for innovation (Smith, Collins and Clark, 2005) happens only when there is trust (Schippers, Den Hartog and Koopman, 2007). Team cohesion promotes sharing of tacit knowledge amongst team members
through informal interactions. For example technicians are known to learn more about repairing copiers by “hanging around swapping stories than from company manuals” (Fortune, 1991; Madhavan and Grover, 1998). Tacit knowledge sharing is particularly an issue in software development teams (Bjørnson and Dingsøyr, 2008) with business users (Conboy and Fitzgerald, 2010), and its other cross functional members (Ghobadi and D’Ambra, 2011; Highsmith, 2002) but is found to be prevalent in cohesive teams.

Cohesiveness results in social integration and sustenance of groups (O’Reilly et al., 1989). Studies have shown that cohesive groups coordinate better and display more altruistic behaviors (Hogg, 1992; Shaw, 1981). Team members willingly assist others, participate in group activities and consider group goals as their own (Henry, Arrow, and Carini, 1999). This is crucial for integration of diverse knowledge of team members required for innovation.

Yet, team cohesion is not a panacea for engendering innovation. Team cohesion imposes psychological costs on its members (Prapavessis and Carron, 1996). Team members are torn between the pressure of measuring up to the expectations of other team members and the display of restraint by not criticizing other team members when they fail to contribute. Further highly cohesive team teams may spend a lot of time socializing rather than focusing on the tasks at hand. High team cohesiveness can also lead to ineffectual decision making such as the Abilene paradox (McAvoy and Butler, 2009). Abilene Paradox is a decision taken by a group which no individual decision maker would have taken (Harvey, 1974). This kind of dysfunctional decision making occurs because of the desire to maintain group cohesion.

Further, McAvoy and Butler (2009) argued that high cohesion levels may be more susceptible to group think and may not generate the most creative solution to problems due to increased conformity and conservatism in problem-solving approaches (McAvoy and Butler, 2009). In groupthink, socio-psychological factors prevent dissension and the individual accepts the view of the group as correct (Manz and Sims, 1987). Groupthink is detrimental for innovation. In groups with strong ties such as in highly cohesive teams team members often reject opposing views in an effort to maintain cohesion. To summarize, based on the arguments made in this section we expect that both at low as well as high levels of cohesion will not be conducive for innovation.

Method

To test this argument empirically we conducted a survey with development team members of 56 software projects. The developers were employees of a large Indian software development organization with operations across the globe. The 56 projects included software development for 32 companies across 8 countries in North America, Europe and Asia. The study was completed over a 5-year period involving 321 developers who answered a pen and pencil questionnaire based survey at the end of completion of their projects. The response rate was 86%. The subjects were between 21-39 year old, 174 males and 147 females who worked on software development projects involving between 6 to 16 team members. The average age of the subjects was 28.4 years, and the average number of team members working on the projects was 5.7.

Variables used in the Study

Tested measures from prior literature were used to capture data pertaining to the independent variable, team cohesion, and the dependent variable, team innovation. The Yu and Chu (2007) list of 7 items was used for measuring team cohesiveness (C1
Team Innovation was measured using the scale of 8 items (I1 to I8) developed by (Burpitt and Bigoness, 1997). For a complete list of items in these scales see Appendix A. These measures used a 9-point Likert scale with anchors of 1 (strongly disagree) and 9 (strongly agree). Scale items were averaged to create an overall value for each construct. Responses were coded such that high levels of the constructs are represented by high values. Some items were reverse coded.

Control Variables

In the past 30 years a staggering number of studies have investigated various antecedents of innovation. However, making a clear sense of them all is difficult as the effects reported in these studies considerably vary in both the direction and the magnitude (Kratzer, Leenders, and Van Engelen, 2006). However some team variables have consistently shown in literature to significantly impact innovation (e.g. Katz, 1982; West and Anderson, 1996; Hülsheger, Anderson and Salgado, 2009). We therefore control for the effect of these variables in the study which included team size (see Huang, 2013), team diversity (and shared experience. We used the Kakar (2017a) composite measure for team diversity and Zheng (2012) measure for shared experience.

Procedure

Subjects answered a paper-and pencil based survey. Data on independent variables, and control variables was collected from the subjects in the first round of the study. Data on the dependent variables, team innovation was collected in the second round a week later. Previous research demonstrates that the temporal separation between measures reduces potential effects due to Common Method Variance (Sharma, Yetton, and Crawford, 2009).

Method of Analyses

To establish reliability and validity of the measures used in the study factor analysis was performed and internal reliabilities were examined. Moderated Hierarchical Multiple Regression (MHMR), a widely recommended method (Cortina, 1993), was conducted to assess the impact of team cohesiveness on team innovation. MHMR reveals how well the independent variable predicts the dependent variable, after extracting variance due to control variables in the regression equation.

Results and analyses

The results of factor analysis procedure done using IBM® SPSS® Statistics Version 19 showed (see appendix B) that the 2 factors extracted represented each of the 2 scales for Team Cohesion and Team Innovation. All items of a scale loaded on the respective factors. Convergent and discriminant validity between scales were evident by the high loadings within factors (> .50) and no cross loadings (> .40) between factors (see Appendix B). The Cronbach’s coefficient alpha for each factor extracted was greater than .70 (Table 1).

### Table 1. Internal Reliability of Scales

<table>
<thead>
<tr>
<th>Name of the scale</th>
<th>Cronbach’s Alpha</th>
<th>N of Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>Team Cohesion</td>
<td>0.818</td>
<td>7</td>
</tr>
<tr>
<td>Team Innovation</td>
<td>0.889</td>
<td>8</td>
</tr>
</tbody>
</table>
Is team cohesion a double edged sword for promoting innovation / Karkar A. and Karkar A. K.

Before analyzing the results of MHMR in Table 2, the normal probability plot was examined to ascertain normal distribution of residuals. The Variance Inflation Factor (VIF) option was included in the analyses to explore the extent of multicollinearity in the results. All the VIF values were less than 1.5 indicating a lack of multicollinearity in results (Hair, Black, Babin, Anderson, and Tatham, 2006). Grubbs (1969) outlier test was performed to test for outliers. No outliers were found.

The initial MHMR results (Model 1 in Table 2) show that Team Cohesion did not impact Team Innovation significantly. However, after the squared term for Team Cohesion was introduced (Model 2, Table 1) then Team Cohesion was found to have a significant impact on Team Innovation. The coefficient for squared term for Cohesion (Cohesion^2) was found to be negative and significant indicating an inflexion point after which an increase in cohesion had a negative impact on team cohesion. The inflexion point was found at team cohesion value of 5.3 indicating that increasing team cohesion until midpoint (approximately) had a positive impact on team innovation and thereafter it had a negative impact. Thus both low and high team cohesion are not conducive for innovation. The optimum impact was at slightly above midpoint of the 9 point Cohesion scale with 1 representing the lowest level of Cohesion and 9 being the highest.

**Conclusion**

Software development is an innovative process. It involves creation of new codified knowledge in the form of a software product from the embedded knowledge resident in individuals with diverse domains of specializations. An understanding of how team processes impact innovation is therefore relevant for the theory and practice of software development in particular and knowledge work in general. Past studies have shown that cohesion is a prerequisite for team innovation. However, our investigations qualify this finding by demonstrating a curvilinear relationship between team cohesion and innovation. The study findings through a comprehensive and systematic investigation of software development projects show that enhancing cohesion up to a certain moderate level impacts team innovation positively, but as anticipated, high levels of team cohesion can be counter productive for promoting team innovation.

The implication for practitioners is clear. Practitioners should therefore be aware that team cohesion can be a double-edged sword with potential to both harm and
promote innovation. The work environment for knowledge work in general and software development in particular is rapidly changing. Increasingly cross-functional teams are utilized to develop new products and services. Such cross functional teams deployed from multiple disciplines and knowledge areas lack hierarchical authority (Bligh et al., 2006). Further, employees have to confront ambiguity and change while performing knowledge work such as software development. To innovate, employees need to ask questions freely, seek and engage in tasks and approaches that are unproven. These are risky behaviors as the employee may be seen by their peers as ignorant, incompetent, or even disruptive (Edmondson, 2002) resulting in negative impact on the image their peers may have about them. Work in such teams can therefore only be successfully accomplished through a collaborative team culture where people like to work with each other and can express their views freely without fear of retribution or negative socio-psychological effect. Managers should therefore not only interact with employees in such a manner that create high quality relationships and cohesion among team members (Fletcher, 2007) but also be wary of situations when cohesion rises to the levels where maintaining relationships within team become more important than engendering innovative work outcomes.

**APPENDIX A. Measures Used in the Study**

<table>
<thead>
<tr>
<th>Team Cohesiveness (Yu and Chu, 2007)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I am not happy with my share of resources for performing my tasks</td>
</tr>
<tr>
<td>I am unhappy with the level of my team’s desire to excel</td>
</tr>
<tr>
<td>This team does not give me enough opportunities to improve my personal performance</td>
</tr>
<tr>
<td>I do not like the way the team is managed</td>
</tr>
<tr>
<td>Members of our team would rather go out on their own than get together as a group</td>
</tr>
<tr>
<td>Members of our team do not stick together outside the context of work</td>
</tr>
<tr>
<td>Our team members have conflicting aspirations in terms of team performance</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Team Innovation (Burpitt and Bigoness, 1997).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Using skills they already possess, this team learns new ways to adapt those skills to develop new products that can help attract and serve new markets</td>
</tr>
<tr>
<td>The team seeks our information about new markets, products and technologies from sources outside the organization</td>
</tr>
<tr>
<td>The team identifies and develops skills that can improve their ability to serve existing</td>
</tr>
<tr>
<td>The team identifies and develops skills that can help attract and serve new business needs</td>
</tr>
<tr>
<td>The team learns new ways to apply their knowledge of familiar products and technologies to develop new and unusual solutions to familiar, routine problems</td>
</tr>
<tr>
<td>The team seeks out information on products and techniques that may be useful in solving</td>
</tr>
<tr>
<td>The team seeks out and acquires information that may be useful in developing multiple solutions to the same problem</td>
</tr>
<tr>
<td>The team seeks out and acquires information that may be useful in satisfying needs</td>
</tr>
</tbody>
</table>
APPENDIX B. Results of Factor Analyses

<table>
<thead>
<tr>
<th>Items</th>
<th>Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>I1</td>
<td>0.938</td>
</tr>
<tr>
<td>I2</td>
<td>0.896</td>
</tr>
<tr>
<td>I3</td>
<td>0.899</td>
</tr>
<tr>
<td>I4</td>
<td>0.795</td>
</tr>
<tr>
<td>I5</td>
<td>0.855</td>
</tr>
<tr>
<td>I6</td>
<td>0.935</td>
</tr>
<tr>
<td>I7</td>
<td>0.902</td>
</tr>
<tr>
<td>I8</td>
<td>0.916</td>
</tr>
<tr>
<td>C1</td>
<td>-0.078</td>
</tr>
<tr>
<td>C2</td>
<td>0.072</td>
</tr>
<tr>
<td>C3</td>
<td>0.009</td>
</tr>
<tr>
<td>C4</td>
<td>0.023</td>
</tr>
<tr>
<td>C5</td>
<td>0.043</td>
</tr>
<tr>
<td>C6</td>
<td>-0.083</td>
</tr>
<tr>
<td>C7</td>
<td>-0.015</td>
</tr>
</tbody>
</table>
References


organizational psychology, 13(2), pp. 269-299.


About the Authors

Adarsh Kumar Kakar is a Ph.D in Management Science (MIS track) with an interest in investigating software development processes and practices. He has over 3 decades of experience in the software industry and has worked as consultant for many Fortune 500 companies including British Airways and Saudi American Bank. He is currently working as an Associate Professor in the department of Computer Information Systems at Alabama State University. He has over 20 publications in respectable journals including Computers in Human Behavior, Information and Software Technology, Journal of Computer Information Systems, Interacting with Computers, AIS Transactions on Human-Computer Interaction, ACM Transaction of Management Information Systems and International Journal of Human Computer Studies.

Ashish Kakar has a BS (Computer Science) from National University of Singapore. He has over a decade of experience in the Indian software industry. He has presented 4 papers in SAIS (Southern Association of Information Systems) and 2 papers in AMA (American Marketing Association) conferences Currently Ashish is pursuing MS (Information Systems) from John Hopkins University.