Managerial Antecedents of Productivity Loss in Brainstorming

(Research in Progress)

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ABSTRACT

Brainstorming is a process used to efficiently generate ideas and make decisions. While, productivity loss in group brainstorming following the processes of production blocking, social loafing and evaluation apprehension. Prior research has explored determinants of the productivity loss and the effect of the productivity loss on the creative outcome. However, the relationships between managerial mechanism and the productivity loss are less established. Also, the antecedents and consequence of productivity loss need more investigation at the group level.

The objective of this study is to investigate the managerial antecedents of the productivity loss for the team in order to decrease the productivity loss. Empirical data is collecting by conducting a survey of software professionals. Analysis results will reveal the relationship between the certain managerial design and the productivity loss in team brainstorming. The results will also illustrate if certain productivity loss processes have a more significant effect on the team effectiveness.

Keywords: interdependence, productivity loss, brainstorming, team effectiveness

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1. Introduction

Brainstorming plays a role in producing ideas or making a decision, and it is essential to decision making in agile software development (ASD) team (Drury et al. 2012). Some obstacles, such as lack of participation or interaction, inability to justify an opinion, miscommunication, and conflict are commonly found in brainstorming process and leads to an unproductive and unfavorable outcome (Drury et al. 2012). Production blocking, evaluation apprehension, and social loafing have been regarded as three major processes that disturb the brainstorming performance (Zainol et al. 2012) and referred as productivity loss (Diehl and Stroebe 1987) or process loss (Bolin and Neuman 2006) in brainstorming.

In order to improve the functions of group brainstorming, numerous researchers have examined the antecedents of productivity loss in brainstorming groups, specifically in personality traits and team composition (Bolin and Neuman 2006). However, most of the study focused on the determinants of the productivity loss at the individual level. There is still a lack of investigation on the relationships between managerial mechanism and the productivity loss and the associated consequences at the group level. To fill this research gap, this study aims to investigate the managerial antecedents and consequence of the productivity loss for the ASD team. Among the material mechanisms, interdependence is considered as one important managerial design on a team to improve the output of team members (Courtright et al. 2015). Interdependence refers to the features of the team on the interrelation of team members (Wageman & Gordon, 2005). Centered on interdependence theory, the extent of interdependence affects how individuals interact with each other. Interdependence influences team members’ interaction pattern and determines their collective outcomes (Chang et al. 2012). Thus, it seems necessary to examine managerial mechanism to realize if the management can facilitate the productivity of brainstorming.

Therefore, we attempt to empirically examine the relationship among the interdependences, three major processes the production loss and the team performance, with the following research questions: Can a managerial mechanism reduce the productivity loss in team brainstorming? Which processes of productivity loss have a more significant impact on the team performance? Answering the questions will shed light on how the managerial mechanism improve the outcome of team brainstorming.

2. Literature Review

2.1 Interdependence and Team Performance

Interdependence represents the interrelated responsibilities between working members for converting the input into output (Kakar 2017). Previous research has
shown that individuals’ social interactions and work motives are different with different interdependence structure (Wageman and Gordon 2005), particularly task interdependence (Courtright et al. 2015). Task interdependence is defined as software development on schedule and with required quality for a timely and successful accomplishment of their own task (Stylianou and Andreou 2016). It may occur also to increase group performance because it develops the sense of responsibility for others’ work or because it develops the reward value of group accomplishment (Campion et al. 1993). Furthermore, Courtright et al. (2015) clarify task interdependence as the interconnectedness of team members which enable individuals to rely on each other for accessing important resources and creating workflow patterns that require members’ coordinated efforts. This means that in order for team members to accomplish their desire task, they must interact, share resources, and information or knowledge.

Moreover, when team members work interdependently to achieve a common resolve, they are more likely to see the added importance of teamwork than if they approached tasks independently and, therefore, to invest in team processes, including team learning and emotional support (Buljac et al. 2013). Based on the literature, we propose:

**Hypothesis 1:** Task interdependence is positively associated with team performance.

### 2.2 Productivity Loss in Brainstorming

Brainstorming is an important approach for IS development teams of adopting agile development methods, which emphasizes innovative, rapid delivery and flexible planning (Pressman 2005). For example, Scrum agile method priorities 15 minutes daily meeting focusing on daily achievement and obstacles of progress and the to-do tasks for the next day. Bolin and Neuman (2006) indicated that the main three production loss (production blocking, evaluation apprehension, social loafing) occurs in group brainstorming and decrease the group outcome.

Production blocking is defined as individuals either forgot their own ideas while listening to others or ignored others to remember their own ideas (Nunamaker Jr et al. 2015). According to Barki and Pinsonneault (2001), production blocking impairs performance when individuals unable to express good ideas due to the fact that (a) ideas become irrelevant, (b) people forget their ideas, (c) forgetting ideas, people rehearse ideas, which avoids them from producing new good ideas. In addition, previous research has evidence that these processes can function independently and lead to a decrease in both the quality and quantity of ideas produced in a brainstorming team (Bolin and Neuman 2006). Thus, production blocking will likely to negatively impact team performance.
Evaluation apprehension is defined as individuals did not contribute unpopular ideas for fear of negative consequences (Nunamaker Jr et al. 2015). While Bolin and Neuman (2006) interpret evaluation apprehension as a process loss that occurs due to the fear of being evaluated by other group members. They indicated that individuals made decisions based on satisfactory results rather than the optimal one, due to limited time and resources. Thus, evaluation apprehension hinders problem resolution and decrease the team performance.

Social loafing is defined as the tendency of individuals to lessen their effort in the presence of others (Bolin & Neuman, 2006). This is because team members expect their ideas to be collected and analyzed at the team level only, they may feel tempted to free ride on the effort of others (Diehl & Stroebe, 1987). The term free-riding is the same meaning as social loafing whereby, team members try to limit their effort in producing creative ideas (Zainol et al., 2012). Although many process losses for brainstorming teams have been identified, social loafing was among the three most considered constructs in brainstorming literature (i.e., Production blocking, evaluation apprehension, social loafing) (Bolin & Neuman, 2006). Thus, social loafing will likely to reduce team performance. Thus, we propose that

**Hypothesis 2:** Productivity loss in brainstorming is negatively associated with team performance.

### 2.3 Interdependence and the Productivity Loss

Team process includes the three production loss constructs of brainstorming (Diehl and Stroebe 1987). The process loss experienced by brainstorming groups has been extensively studied (Bolin and Neuman 2006). Previous studies provide the evidence about the impacts of task interdependence on various teamwork process (Wageman and Gordon 2005). Wageman and Gordon posit the role of task interdependence as a significant variable in team processes and performance (Wageman and Gordon 2005). Therefore, we suggest task interdependence might have impacts on team process dimensions (production blocking, evaluation apprehension, social loafing). Some studies implied that the production loss might be eliminated by allowing group members are to contribute their ideas simultaneously (i.e., production blocking) and anonymously (i.e., evaluation apprehension) (Nunamaker Jr et al. 2015) and by distributing associated tasks (i.e., social loafing) (Barrick et al. 2007).

According to the work of (Conboy et al. 2011), one of the key people challenges was that developers fear skill-deficiency exposur. Particularly, being evaluated in front of their peers. While interdependence enhances people’s need for cooperation among group members (Stewart and Barrick 2000). This needs would likely influence evaluation apprehension through feedback-areas. Thus,
interdependence among team members likely to reduce evaluation apprehension.

With interdependence, team members more willing to interact cooperatively with each other for information and input relevant to tasks (Stewart and Barrick 2000). In contrast, interdependence may cause social loafing due to the lack of participation and interaction. Drury et al. (2012) mentioned the lack of participation and interaction of team members might come from the dependence of junior members on a more senior members, control of an individual, shyness and poor team essence. Based on this reasoning, incorporating interdependence among team members likely to enhance social loafing. Thus, we propose

**Hypothesis 3:** Task interdependence is associated with productivity loss.

3. **Research Methods**

Questionnaires were mailed to IS professionals who are in the ASD team. To date, a total of 52 valid responses were received. The Partial Least Squares (PLS) technique was used to verify the measurement and structural models by using SmartPLS 3 software (Ringle et al. 2015).

All instrument considered for each construct were adopted from prior studies and are modified to suit our research domain. Specifically, all indicators were measured in team-level. All items were measured on a 5-point Likert scale, such that the greater the score, the greater extent the particular item occurs. The instrument of three production loss constructs was adopted from (Bolin and Neuman 2006). Task Interdependence (TI) refers to the extent to which team members need the information from one another to complete their work. The instrument of task interdependence was adopted from (Campion et al. 1993) and (Van Der Vegt et al. 2000). Production blocking (PB) describes the process loss in which individuals cannot contribute completely to the team, due to only one individual can share ideas with the team at a time. Evaluation apprehension (EA) describes the process loss in which individual fears being evaluated by the team. Social loafing (SL) describes the process in which individual effort is reduced in the presence of the team. Team Effectiveness (TE) defines the extent to which team members output quality expectations. The instrument of each construct was originally developed by (Hoegl and Gemuenden 2001).

4. **Data Analysis**

The initial analysis results based on the 52 valid responses, most indicators in this study have factor loadings higher than 0.7, and the rest are higher than 0.6 except indicators TI2 and EA3. The convergent validity and construct validity of all constructs are ensured since the AVE and Cronbach’s alpha respectively exceeds the threshold of 0.5 and 0.7, as recommended (Fornell and Larcker 1981). Table 1 shows the descriptive statistics, including the values of mean, standard deviation, skewness,
and kurtosis for each variable.

**Table 1  Descriptive properties of variables**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean</th>
<th>SD</th>
<th>Skewness</th>
<th>Kurtosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>TI</td>
<td>3.88</td>
<td>0.94</td>
<td>-0.68</td>
<td>0.22</td>
</tr>
<tr>
<td>PB</td>
<td>2.14</td>
<td>0.9</td>
<td>0.71</td>
<td>0.6</td>
</tr>
<tr>
<td>EA</td>
<td>2.35</td>
<td>0.93</td>
<td>0.59</td>
<td>1.01</td>
</tr>
<tr>
<td>SL</td>
<td>2.07</td>
<td>0.87</td>
<td>0.95</td>
<td>1.87</td>
</tr>
<tr>
<td>TE</td>
<td>3.87</td>
<td>0.81</td>
<td>-0.79</td>
<td>1.23</td>
</tr>
</tbody>
</table>

Table 2 shows correlations coefficient among the considered variables, in which the correlation between pairs of constructs are lower than 0.80 and the square root of AVE (shown in the diagonal), reflecting discriminant validity.

**Table 2  Correlations among constructs**

<table>
<thead>
<tr>
<th></th>
<th>TI</th>
<th>PB</th>
<th>EA</th>
<th>SL</th>
<th>TE</th>
</tr>
</thead>
<tbody>
<tr>
<td>TI</td>
<td>0.8</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PB</td>
<td>-0.39</td>
<td>0.79</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EA</td>
<td>-0.23</td>
<td>0.6</td>
<td>0.83</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SL</td>
<td>-0.35</td>
<td>0.62</td>
<td>0.46</td>
<td>0.76</td>
<td></td>
</tr>
<tr>
<td>TE</td>
<td>0.33</td>
<td>-0.7</td>
<td>-0.5</td>
<td>-0.67</td>
<td>0.83</td>
</tr>
</tbody>
</table>

*Notes:* The diagonal line of the correlation matrix indicates the square root of AVE

Based on the initial data analysis, the path coefficients between the productivity loss and team effectiveness is 0.02 (for hypothesis 1). The path coefficients between the productivity loss and team effectiveness are -0.42, -0.07 and -0.36 respectively for production blocking, social loafing and evaluation apprehension. These results potentially support only the influence of production blocking and evaluation apprehension on team effectiveness in hypothesis 2. The path coefficients between task interdependence and the productivity loss are -0.39, -0.22 and -0.34 respectively for production blocking, social loafing and evaluation apprehension, potentially supporting hypothesis 3.

5. Conclusion

The research finds that a managerial mechanism, such as task interdependence of team members, may reduce some productivity loss of brainstorming. Among the productivity loss processes, production blocking has a more significant impact on the team performance. The results also imply that productivity loss of brainstorming plays
fully mediates the effect of task interdependence on team effectiveness. These findings illustrate how task interdependence can be used as a managerial mechanism to improve the outcome of team brainstorming.

The contributions of this study are supposed to be twofold. First, we contribute to team research and brainstorming literature by providing additional solid evidence. Second, this study will shed light on how task interdependence influence production loss process of brainstorming, which in turn lead to team effectiveness.

This study has some limitations. First, common method variance might have inflated or deflated the magnitude of the relationship between variables when both they were obtained from the same respondent. The results of Harman’s single factor test showed that CMV is not a potential issue in our study. Second, First, the research conveys results with limited samples of 52 participants. We still keep collecting data for having a bigger sample size with the hope to better support the proposed hypothesis.

Reference
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