



## The Study on Influencing Factors of Team Brainstorming Effectiveness

Zhenguo Zhao

School of Business, Tianjin Polytechnic University

Tianjin 300387, China

E-mail: xixiang123456@yahoo.com.cn

Jialin Hou

School of Business, Tianjin Polytechnic University

Tianjin 300387, China

E-mail: hjl629@163.com

### Abstract

Brainstorming is a creative and innovative tool. As a team problem-solving tool, team brainstorming can help the team conceive a lot of creative ideas and methods. Through a review of relevant literatures, this paper summarizes the three main factors of team brainstorming effectiveness: the heterogeneity of team composition, processing mode of team social information and interactive mode of team members. In addition, a conceptual model is built to show the interaction among the three.

**Keywords:** Team Brainstorming, Efficiency, Influencing Factors

Brainstorming is a creative and innovative tool. As a team problem-solving tool, it is perhaps the most popular and commonly used. Brainstorming is an approach to consciously leave team members unfettered to identify opportunities and challenges, choose a variety of issues and solve problems, as well as a way to generate ideas. This approach advocates producing derivative ideas and inconsistent thoughts. Successful team brainstorming can conceive more creative visions. The successful implementation of team brainstorming must possess the necessary conditions, and this paper will try to discuss some influencing factors of team brainstorming effectiveness.

### 1. The Basic Meaning of Team Brainstorming

The team brainstorming involves each participant generating new ideas in front of other people, which is aimed to promote a new combination of divergent ideas. Priority is given to the quantity and imagination of the vision.

Brainstorming (Osborn, 1957), a technique to produce visions, is extensively applied in the context of the team. Osborne's main concern is how to improve the team's creativity. Osborne (Osborn, 1957, 1963) provides a theoretical basis for the results of team brainstorming.

### 2. Influencing Factors of Team Brainstorming

#### 2.1 The heterogeneity of team composition

Osborne (Osborn, 1957, 1963) and other scholars proposed a number of prerequisites for the successful high-yield of team brainstorming (Grossman, Rodgers & Moore, 1989; Rawlinson, 1981). One particular consideration is that the team composition should have a heterogeneous structure. The different perspectives and different knowledge backgrounds with which team members to look at problems will offer more space and potential for the generation and impact of creative ideas. Thinking combinations of brainstorming compatible with intelligence will produce a very effective thinking resonance (Osborn, 1963). Careful choice of team brainstorming participants and attracting the participation of members from different backgrounds will maximize cognitive incentives, allowing the team to generate more ideas (Milliken, Bartel & Kurtzberg, 2003). In addition, the new vision provided by a team member may cause other members to generate new ideas and recommend the idea one would not think of if it is not in this way (Diehl, 1991; Stroebe & Diehl, 1994). Team diversity is the most essential conditions for maximizing cognitive incentives. (Diehl, 1991; Stroebe & Diehl, 1994).

The heterogeneity degree of team can be quantified by Blau heterogeneity index  $H = 1 - \sum P_i^2$  (Blau, 1972) or

$$H = -\sum_{i=1}^s P_i \times (\ln P_i)$$

Teachman diversity index (Teachman, 1980).

## 2.2 The processing model of team social information

Osborne (Osborn, 1957, 1963) believes that one of the reasons why the team has a higher creativity lies in the fact that there are a lot of stimulating factors in interactive teams. In other words, the cognitive advantage of team brainstorming is as follows: it is believed that the visions generated from teams can not be available if people think independently (Collins & Loftus, 1975). This is why the processing model of team social information has this kind of advantage.

Our knowledge is stored in the semantic network model. A group of conceptually related information is easier to remember than the conceptually unrelated information, and the relevant information tends to be recalled in groups, even if they appeared in groups in the past (integration, Bousfield, 1953; Mandler, 1967). Under normal circumstances, when people have to recall information, an initial offer of some classification labels can be helpful in recalling (the hints of information types, Tulving & Pearstone, 1966). In addition, if there is a conceptual relationship between the former word and latter word, it will help make the second word put forward (semantics should be provided in advance, Meyer, 1971; Neely, 1991). Clearly, the relevant information raised from a person's long-time semantic network model is an important step in the process of team brainstorming: one can not carry out effective brainstorming about the topics that they know nothing of.

According to associative memory model theory, the individual brainstorming of team members is linked into an interactive team through the process of paying attention. In the possible structure of the model, attention represents the fundamental probability of the fact that individual team members will regard the current thinking of others as their own next vision, which is to allow the existence of disparity when an individual is dealing with peers' opinions. Among the cognitive network characteristics, the availability of information is a decisive factor which is crucial to team brainstorming. Meanwhile, Coskun, Paulus, Brown and Sherwood (2000) pointed out: the outside beforehand provision can also promote the performance of interactive brainstorming team. Coskun et al. have also further demonstrated that what is also essential is the information presented in advance by the outside. The effectiveness provided continuously in advance is based on reducing the cognitive load caused by tracking the past idea. External messages offered in advance may liberate brainstorming participants, thus making them utilize cognitive resources specially in the development process of an interactive idea.

According to the SIAM (Search for Ideas in Associative Memory) theory, brainstorming is the repeated search for visions in the associative memory. It consists of two processes: phase of information activation, and phase of idea generation. Brainstorming process can be considered as a process of producing a series of thought chains. The thought chains are used to provide information, which is related to a certain question, in the specific semantic field. Prior to the each generation of a series of ideas, some thinking are required to activate information in another semantic field.

According to the SIAM theory, it is assumed that other people's ideas, an external motivation, will stimulate the production of new ideas, and it can reduce the information search hints and the time needed by information search memory. Therefore, it is assumed that the process of information sharing can strongly influence the thought process of team members. According to the incentive-envisaged semantic content, two positive effects are likely to appear, that's to say that different incentives may increase the width of the ideas generated, while a similar incentive will increase the depth of the ideas generated (Paulus & Brown, 2003). On the other hand, incentive ideas would interfere with thinking chains (cognitive interference). This may lead to the shrinkage of thinking chains and the loss of potential vision, increase the number of semantic conversion, and reduce the depth of the ideas generated. According to the SIAM theory, incentive ideas will increase the availability of semantic information, while reducing the time needed for information search memory. In the meantime, envisaged sharing is a more dynamic process. Envisaged sharing may lead people to gradually tend to produce cognitive consistency (Ziegler, Diehl & Zijlstra, 2000), which probability is very high in the relatively homogeneous team (Ziegler, etc., 2000; Larey & Paulus, 1999). When the team members have a diversity characteristic, the probability of cognitive consistency will be smaller, because the heterogeneous team deals with more semantic categories than the homogeneous team (Diehl, 1991; Stroebe & Diehl, 1994).

Therefore, when conducting the team brainstorming, attention should be paid to the following modes of social information processing: (1) Pause intervals. Studies by Mitchell and Horn (Mitchell, 1998; Horn, 1993) have shown that brainstorming participants' possession of some strategic pause intervals in the process of brainstorming will enable them to generate more ideas. In a team brainstorming environment, the short interval allows the individual to transform his own ideas from the previous viewpoint or understanding to a new angle or category. To some extent, intervals can be seen as an efficient way to overcome the restriction of cognition to one category of information. (2) Combination of individual and team brainstorming. Studies reveal the brainstorming of "team - individual" order is the mechanism of giving full play to advantages (Leggett, Putman, Roland & Paulus, 1996). The awareness promotion reflected in team

brainstorming extends to the individual brainstorming process. During this period the individual will no longer be obstructed by group constraints and continue brainstorming. In particular, when the team is composed of those heterogeneous individuals with knowledge in various related fields, the impact of the order is particularly important. (3) Mind writing method. The study found that conducting written communication among the team can generate more ideas than just as many people do individual brainstorming (Brown & Paulus, 2000). The study also showed that for the team made up of heterogeneous members, interactive written communication is very effective; secondly, those individuals benefit the most that can make the best balance between the two objectives of "paying attention to the other's vision and adhering to their own inner thinking chains".

### 2.3 The interactive mode of team members

The low yield of interactive teams relative to non-interactive teams is called "process losses" (Shepperd, 1993; Steiner, 1972). Studies have indicated that a lot of factors can influence process losses, and those factors mainly include the evaluation of other team members (Camacho & Paulus, 1995), lack of motivation brought about by an individual weak sense of work responsibility (Diehl & Stroebe, 1987), and competition by an interactive team for speaking time (creating obstacles; Diehl & Stroebe, 1991).

Findings show that team members can not effectively use this waiting time during which the other members speak (Diehl & Stroebe, 1991). This is the main reason for the creativity loss of team brainstorming. The mechanism plays an important role in the constraint of cognitive ability. Team members will face the challenge of listening to others, controlling the discussion, and at the same time suggesting the vision, which are counted as overloading in terms of the cognitive system. This is due to cognitive interference. There may be a most appropriate pace of information sharing, thus not only offering to other members the high level of motivation and cognitive incentives, but also not hindering the cognitive abilities of other members.

Team brainstorming should have the "social promotion" on the activity level. High-yield members may promote the high-output of other members. This is a simple process of competition (Brown & Paulus, 1996; Paulus & Dzindolet, 1993). The team must also have the effect of strengthening the society, which can be reinforced by visions. Team members may encourage each other in teams of perceptions to stimulate the relevant ideas. Motivation and cognitive motivation will be affected by external factors of the team. Team motivation is subject to factors such as competition within the team or between teams, task structure, coordinators and team leader. Cognitive incentives can be influenced by the task structure, envisioned sharing models, concepts, as well as information categories from external coordinators.

The social comparison theory elaborates on the fact that information from others has a large impact on the motivation. Festinger (1954) suggested that the people themselves will always have a driving force to compare yourself and others in terms of viewpoints and capacity. He held that people always harbored a degree of uncertainty about our own pinions and abilities, and attempted to reduce this uncertainty by means of comparison. Studies suggest that, if emphasis is placed on responsibility and related performance, social sharing may lead to competition. If the appropriate feedback mechanisms can be established during the brainstorming, team members will make an upward comparison (Paulus, Larey, Putman, Leggett & Roland, 1996), or else they will make a downward comparison (Paulus & Dzindolet, 1993; Dugosh & Paulus 2001). Hence, social comparison process can influence the brainstorming team in a variety of ways. For those teams adopting the upward comparison method, having a team culture with its emphasis on high standards or high performance is very important (Gammage, Carron & Estabrook, 2001). The other is the degree of trust within the team. If team members believe each other's motives, then they will make up for those deficiencies brought about by members who do not have high motivation (Williams & Karau, 1991).

Based on the aforementioned analysis, when teams are conducting brainstorming, the following points should be noted: (1) Concern assessment, lack of motivation and obstacle creation ought to be minimized in the process of group interaction (Pinsonneault, Barki, Gallupe & Hoppen, 1999 ). (2) The team should carry out an effective brainstorming training and employ coordinator or specially trained persons to bring the team into the continuing operation and high-motivation state (Osborn, 1957). (3) A feedback mechanism needs to be established. If a higher standard for comparison or a positive feedback is given to an individual or team brainstorming participants, the number of generated visions will be increased (Paulus & Dzindolet, 1993; Coskun, 2000). (4) A coordinator must be set up. A coordinator can ensure that the team avoids some unexpected difficulties (Grossman, etc., 1989; Sutton, Hargadon, 1996). (5) Task rules need to be drawn up. The rules of Osborne brainstorming (1957, 1963) help creative teams to work more effectively. At the same time, additional guidance can increase the effectiveness of the brainstorming process, or be conducive to the formation of an additional motivation for the participants. Putman (2001) found some basis supporting this valid hypothesis: those individuals or teams who receive additional guidelines may use fewer words to express their point of view. (6) The appropriate team leader ought to be appointed. Studies confirmed that the executive leadership is very effective for producing or generating of ideas, while the transformational leadership provides an incentive for individuals' persevering in those ideas and implementing it as much as possible. In fact, perhaps the most effective leader is one with combined traits of both above-mentioned leaders (Avolio & Bass, 1988).

### 3. Conclusions

Through the aforementioned analysis, it can be seen that as an effective tool to solve problems, the team brainstorming must meet certain requirements to really play its role.

First of all, team brainstorming participants should have a certain degree of heterogeneity, as this will be conducive to enhancing the performance of team brainstorming.

Secondly, the processing mode of team social information should be consistent with the laws of our knowledge memory, information search, as well as envisaged utilization, thereby making the social information of team fully utilized so as to improve the actual performance of team brainstorming.

Finally, an interactive mode of team members should be able to overcome obstacles arising from team interaction. Positive measures and actions should be taken to ensure that the team interaction is kept in a sound condition. Only in this way can the role of team brainstorming be maximized.

In short, all three above-mentioned factors should be equipped and left in an interacting state, which would maximize the effectiveness of team brainstorming. (For details, please refer to attached Fig. 1)

### References

H. James Harrington., Mitch Manning., & David Angel. (2006). *Making Teams Hum*. Chico:Paton. Press.L.L.C.

Paulus P. B., & Nijstad B. A. (2003). *Group Creativity: Innovation Through Collaboration*. Cambridge: Oxford University Press.

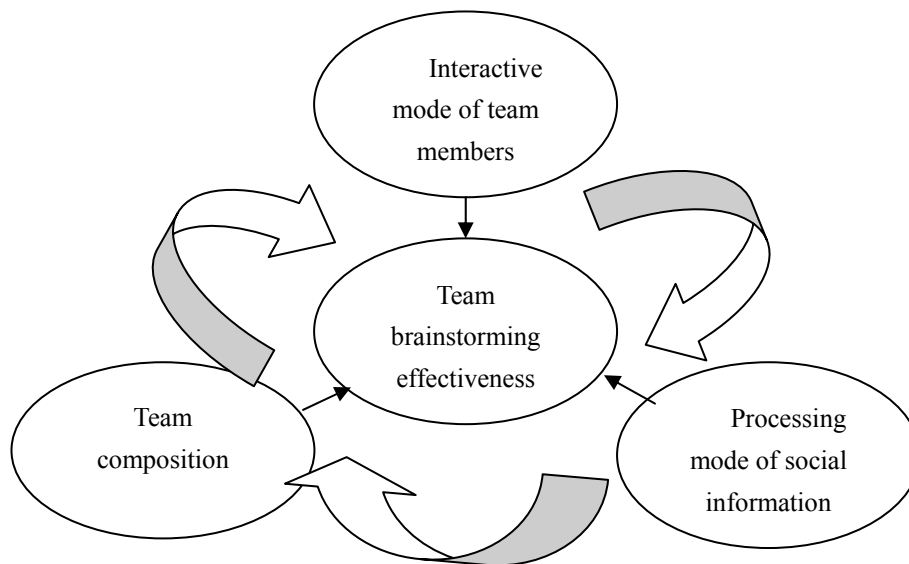


Fig 1. Influencing factors of team brainstorming effectiveness