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When and how does counterfactual thinking prevent catastrophes and foster group decision accuracy

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Abstract

Purpose – The purpose of the paper is to develop a theoretical framework with testable propositions discussing the role of counterfactual thinking in fostering accurate decision-making in groups and preventing catastrophes, being mediated by information searching, sharing, task conflict and conflict management mechanisms, moderated by task complexity, cognitive complexity, cognitive closure and tolerance of ambiguity.

Design/methodology/approach – A theoretical framework is formulated and propositions are postulated involving independent, mediating, moderating and dependent variables.

Findings – This paper recommends a helpful framework for understanding of how counterfactual thinking affects information searching, sharing and decision-making accuracy in groups, thereby preventing catastrophes.

Practical/implications – The proposed framework might be of assistance in managing complex group decision-making and information sharing in organizations. Decision-makers may become aware that activating counterfactual mind-set enables them to search for critical information facilitating accurate decision-making in groups leading to catastrophe prevention.

Originality/value – This paper adds value to the field of counterfactual thinking theory applied to group decision-making. Moreover, the paper provides a novel framework for group decision-making which sheds light on pertinent variables, which can either ameliorate or exacerbate the accuracy of decision-making by information searching and sharing in groups under varying context of high/low task complexity. The ramifications of task conflict, conflict management mechanisms, team diversity and size are explored alongside the moderating role of cognitive complexity, cognitive closure and tolerance for ambiguity.

Keywords Task conflict, Group decision-making, Cognitive complexity, Catastrophe prevention, Counterfactual thinking, Information search-sharing

Paper type Conceptual paper

Introduction

The Chernobyl nuclear plant disaster of 1986 which took place in its graphite nuclear reactor could have been averted if information regarding the fire in 1957 in Britain's Windscale nuclear plant having a similar graphite reactor was shared or accessible to the Soviet Union scientists. The Fukushima Daiichi nuclear plant accident in the unfortunate 2011 tsunami would never have occurred if the lessons of the causes and potential causes of the massive loss of coolant, the real cause of the Chernobyl graphite reactor disaster (Malone, 1987), had been seriously shared and examined in the past.

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Counterfactual thinking in organizational decision-making is a concept which seeks to avert accidents, fiascos, disasters of colossal damaging consequences while fostering greater accuracy and superior decision-making quality, leading to a variety of organizationally valued outcomes such as efficiency, innovation, cost reduction and gain of market share.

Counterfactual thinking, commonly exemplified by the expression "what might have been" involves a juxtaposition of an anticipated versus a real situation (Epstude and Roese, 2008) and is considered as one of the most pervasive phenomena taking place in human life. It is rather common that individuals regret the choices that they have been made and the actions that they have been taken. Counterfactual thoughts (CFTs) are elicited by events that nearly occurred (Kahneman and Varey, 1990) or when an unusual series of events led to a particular outcome (Kahneman and Tversky, 1982).

Epstude and Roese (2008) defined CFTs as "evaluative thoughts about imagined alternatives to the past events and they may serve the important beneficial functions of behavior and mood regulation". It can be either *upward counterfactual*, i.e. better alternatives, as compared to reality leading to regret or *downward* counterfactual, i.e. worse alternatives, as compared to reality leading to the feeling of relief.

Previous research has focused quite exclusively on judgments related to counterfactual events themselves, with particular attention to emotional reactions and causal judgment (Zeelenberg and Pieters, 2007). However, little investigation has taken place on how the counterfactual mind-set affects the unrelated tasks of information search, sharing and decision-making in groups.

The accuracy of decision-making largely depends on sharing and coordination of critical pieces of information, particularly when a decision is being made by a group of individuals and not just a single individual (Kiesler and Spoull, 1982). It is evident that decisions with far-reaching implications (e.g. economic and legal issues) are frequently made by a group of individuals. Utilizing teams to make decisions is frequently justified on the premise that groups are able to yield additional intellectual assets to tackle a problem, which is likely to increase the possibility of a superior decision (Vroom and Jago, 1988).

It is believed that by sharing information, the organization will benefit in the long run; however, while pooling information, groups have been found to have a propensity to discuss information that maintains the alternative favored by most of the team members (Brodbeck *et al.*, 2002). Failure to share information in an unbiased manner can impede an organization's decision-making quality, leading to reduced profitability. Besides, it can also lead to a damage to assets and the loss of life in extreme cases (Liljenquist *et al.*, 2004), for instance, terrorist attacks on September 11 on the World Trade Centre and the Pentagon. The formal Congressional report concerning the terrorist attack incriminated insufficient sharing of information as a possible factor (Senate Select Committee on Intelligence, and The House Permanent Committee on Intelligence, 2002).

Hence, building on the previous study (Galinsky and Kray, 2004), it may be argued that different counterfactual experiences (self vs other-referent and upward vs downward CFTs) can be instrumental in resolving the bias in information search and sharing in groups on the ground that counterfactual thinking increases the inclination of the team members to be more aware of relevant options and engage in mental simulation

during successive decision-making (Galinsky and Moskowitz, 2000), thereby facilitating decisions leading to catastrophe prevention.

The conceptual framework

We propose here a three stage conceptual framework (shown in Figure 1) of the relationships between references (self-referent and other referent), directions (upward and downward) of counterfactual thinking as independent factors, group decision-making process and first-level outcomes, e.g. accuracy, time taken and costs, which further result in end outcomes, e.g. mitigating catastrophic loss or intensification of likelihood of mishap. We propound that at Stage I, the influence of reference (self-other) and direction (upward-downward) of CFTs and feelings on the first-level and the end outcomes is mediated via information search and sharing and moderated by task complexity. Stage II involves the effect of information search and sharing on first-level outcomes like decision accuracy, time taken and the cost is mediated by task conflict in the team. Stage III involves the impact of task conflict on first-level outcomes and is moderated by cognitive complexity in the team, group cognitive closure, the tolerance of ambiguity and the conflict management mechanisms practiced by team members. The framework integrates activation of counterfactual thinking, resulting in improved information search and sharing when the task complexity is high, leading to group decision-making accuracy. Whereas the activation of counterfactual thinking will be directly leading to group decision-making accuracy when the task complexity is low that poses low information-processing needs and demands. The framework anticipates the positive relationship between self-referent/other-referent counterfactual experiences and group decision-making accuracy, although this relationship is anticipated to be stronger in the case of self-referent counterfactual experiences as compared to other-referent counterfactual experiences. Both self-referent and other-referent types of counterfactual experiences are expected to generate CFTs, which are likely to activate a counterfactual mind-set, including mood arousal – regret or relief. Counterfactual mind-sets increase the propensity to search and share for more relevant information, thus enhancing decision accuracy and other first-level outcomes.

Moreover, the framework also takes into account the effect of the direction of counterfactual experiences, i.e. upward and downward counterfactual experiences. Again, the framework anticipates the positive relationship between upward/downward counterfactual experiences and first-level outcomes, e.g. group decision accuracy. However, it is expected that upward counterfactual experiences will have a high positive relationship with group decision-making accuracy as compared to downward counterfactual experiences.

Furthermore, the framework acknowledges the role played by task complexity (for instance, meaningful task, task accountability and task novelty) in influencing the strength of the relationship between counterfactual thinking (reference and direction) and information search and sharing, eventually leading to accurate group decision-making. The framework also contemplates a direct relationship between activation of counterfactual thinking and group decision-making accuracy under a low task complexity situation, which forecloses the need for greater information search and sharing.

The framework contends that under low task complexity conditions, having low information-processing needs, there is low potential and likelihood of task conflict,

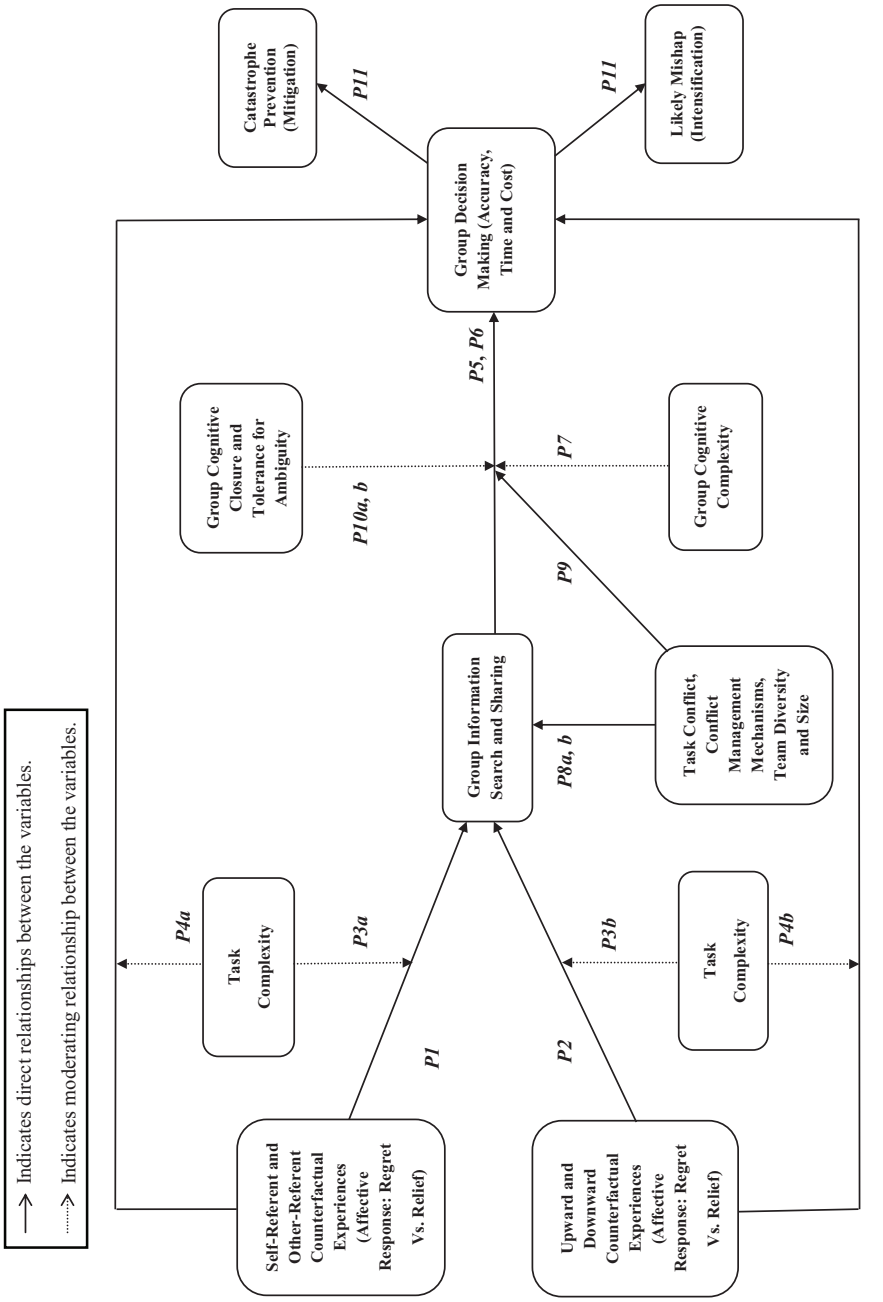

Figure 1.
A conceptual framework of relationships amongst independent, mediating, moderator and dependent variables

first-level outcomes like decision accuracy may be achieved with even low or moderate group cognitive complexity and standard norms and methods of conflict resolution, and closure would be feasible with low or moderate tolerance of ambiguity. However, a high task complexity situation places greater demands for information-processing capability to meet the requirement of information-processing needs. The framework supposes a greater task conflict under high task complexity and thus places a premium value on task conflict and a greater use of integrative conflict resolution methods with a high group cognitive complexity, a high need for closure and a high tolerance of ambiguity to result in positive outcomes.

Finally, we propound that positive first-level outcomes, especially group decision accuracy, should be positively related to either both end outcomes of catastrophe prevention and mitigation of the risk of loss or the intensification of the likely mishap. The framework notes the moderating influence of team demographic characteristics, e.g. team size, team diversity, the link between counterfactual thinking and information search and sharing on one hand and task conflict and group decision outcomes on the other hand. We discuss below the rationale for each of the independent factors, mediating factors and moderating factors on the first-level and end outcomes.

We show how, under the influence of different types of CFTs, i.e. self/other referent and upward/downward and different circumstances, e.g. when task complexity is high/low and cognitive complexity is high/low, have varying impacts on information search, sharing and decision-making in a group. We have identified different patterns of information processing and decision-making. These patterns illustrate how our framework is useful in locating these differences. Table I presents the summary of the impact of counterfactual thinking on information search, sharing and decision-making at high/low cognitive complexity and high/low task complexity conditions.

Counterfactual thinking, information search and sharing in group decision-making

The explosion of NASA's space shuttle Challenger took place merely 73 seconds after its take-off. It is a significant instance of a colossal wrong group decision-making. The report by the Presidential Commission investigating the disaster stated that insufficient sharing of information contributed significantly to the catastrophe. Despite the fact that information was accessible which demonstrated that low temperatures could result in glitches in the shuttle, these data were not broadly distributed. As the main decision-makers were not made aware of that information (Presidential Commission on the Space Shuttle Challenger Accident, 1986), they had decided to continue with the disastrous launch, in spite of freezing air temperatures that morning.

According to probability estimations, items of information that are shared among more team members have a statistically higher likelihood of being revealed during group interactions (Larson *et al.*, 1998). In a group, some information might be accessible to all the team members, whereas some of it might be accessible only to a few members. As a larger percentage of the entire information accessible to team members consists of the shared information, therefore the proposition formulated by them may be inclined toward the common information and it is also verified in a biased manner (Schulz-Hardt *et al.*, 2000). As a result, information that is unshared is least likely to be considered by the team members, though discussing more of the unshared information would be more advantageous because that would build their collective knowledge base (Larson *et al.*, 1994).

Table I.
Displaying different patterns of information processing and decision-making by contrasting reference and direction of counterfactual thoughts (CFT) on the dimension of cognitive complexity and task complexity

Task complexity	Cognitive complexity	Reference of counterfactuals		Direction of counterfactuals	
		Self-referent CFT	Other-referent CFT	Upward CFT	Downward CFT
High task complexity (information need is high)	High cognitive complexity	Self-critical; self-implicating; more mental simulations occur; utilizing extensive information, incorporating information more competently; high cognitive capacity and span of attention; taking less time to make decisions; and eventually endorsing correct decision	Attribution of responsibility to someone else; less mental simulation occur; looking for the opinion of other people to verify one's position; capacity to utilize extensive information; taking more time to decide; and eventually affecting decision accuracy positively	Rumination and recrimination; negative affect; high cognitive activity; various alternatives considered; extensive information utilized to make a quick/accurate decision; cautious analysis of information; eventually favoring the correct decision	Positive affect, high cognitive capacity but low focus on improvement; less motivated to search wider for information; comparatively taking more time to arrive at a conclusion; and eventually affecting the decision accuracy positively
	Low cognitive complexity	Feel strained to search for critical information; sufficing with limited or few quickly available alternatives; low capacity to process information; taking more time to decide; and eventually affecting the decision accuracy	Low capacity to focus on critical information; wider information is not amalgamated into a coherent position; less information is utilized to make a decision; and eventually affecting the decision accuracy	Negative affect generated reinforces the range of cognitive activities; critical information is searched but less information is processed; experience cognitive strain; and eventually affecting the decision accuracy	Low focus on multiple perspectives; wider information is not amalgamated; comparatively less information is used to make a decision; and eventually affecting the decision accuracy
Low task complexity (information need is low)	High cognitive complexity	High cognitive capacity; even though not much information searching is required, still more information search is preferred; careful scanning of the available information; quick identification of critical alternatives; and leading to very quick judgment/decision	Possesses the ability to use extensive information; investing less time and cognitive effort to gather the critical pieces of information; available alternatives are analyzed carefully; and leading to quick decisions	Ability to scrutinize and synthesize ample amount of information; and feel more pressure to search and analyze extensive information because of tendency to search for more information to make sure nothing important is left out, even though the need for information is low	High information-processing capacity; might judge a task as insufficiently challenging, eventually not allocating their cognitive resources to the focal task/decision to be done/taken; and eventually affecting the decision accuracy
	Low cognitive complexity	Low cognitive capacity and span of attention; very little information is availed to make decisions; less stress as lower need for information is perceived; holds a very casual approach towards task; and takes more time to decide	Lack the ability to use extensive information; takes more time to conclude; accepts nearest available solution; may not value or fails to notice important information; and suboptimal decisions as a result	Incompetent in identifying the critical information; feels less pressure to search for extensive information; experiences less cognitive strain; and eventually affecting the decision accuracy	Inability to analyze information; do not feel motivated enough to look for critical information; might prefer consultation with experts; an element of confusion and lack of confidence prevails; and takes more time to conclude

Despite this fact, research has revealed that when individuals noticed unshared information, they still paid more attention to information that was shared (Larson *et al.*, 1994). Janis (1982) reported a similar decision-making bias known as "group think", which is a biased decision-making process in which pressure or desire for consensus within the team leads to illogical or dysfunctional group decision-making.

There is an enormous body of research on counterfactual framing or mind-set focusing on individual decision-making (Galinsky and Moskowitz, 2000; Wolf, 2010) but very few studies have been done on group decision-making. It is not mandatory that counterfactual mind-sets will have a similar impact on group decision-making as it has on individual decision-making. As previous research has shown, factors that influence individual decision-making do not affect group decision-making on several occasions, instead they tend to have contradictory effects on group decision-making. Liljenquist *et al.* (2004) demonstrated that counterfactual mind-sets would only benefit decision-making accuracy when it is activated at the group level. It was noticed that creating group norms of consensus and critical thoughts on decision-making had a pronounced effect when the team was involved in discussions and arrived at a judgment, on the other hand, this group norm manipulation had no impact on individual decision-making (Postmes *et al.*, 2001). In another study, accountability manipulation was found to have damaging effects on group decision-making (Stewart *et al.*, 1998), whereas Tetlock (1992) displayed that it had a favorable impact on individual decision-making.

Research literature on group problem-solving (Stasser *et al.*, 1989; Kray *et al.*, 2006) reveals that though efforts have been made to increase information sharing in groups, results were not overtly positive. It was established that making a decision appear more significant had a counterproductive effect and resulted in reducing the rate of information sharing in teams (Larson *et al.*, 1994). Furthermore, increasing the size of the group and accountability also failed to decrease a biased focus on shared information (Stasser *et al.*, 1989).

Finally, Galinsky and Kray (2004) and Stasser and Stewart (1992) could show some positive results. Galinsky and Kray (2004) revealed that a counterfactual mind-set encourages the consideration of alternatives and further influences subsequent cognition and performance, although they focused only on a single referent (other-referent) and direction (upward) of counterfactual thinking. Stasser and Stewart (1992) proposed that framing a task as a problem having a single answer enhanced the sharing of exclusive information as compared to structuring the task as a subjective or critical one because of which the groups looked for a consensus to complete the task. Framing is explained as a process of structuring, integrating and interpreting information cues in a given event (Lewicki *et al.*, 2006). Individuals can be primed into self/other and upward/downward groups by exposing them to different counterfactual scenarios (Galinsky and Kray, 2004). Postmes *et al.* (2001) reported that constructing group norms that encouraged critical thinking and questioning as opposed to group norms that promoted consensus led to greater acknowledgement of exclusive information and higher precision in decision-making. Hence, it can be anticipated that the attribution of responsibility, i.e. self-referring (actions taken by oneself) and other-referring (actions taken by someone else), can lead to different outcomes, as Rye *et al.* (2008) have shown in their research that more the negative event was perceived within one's individual control (responsibility on self), the higher participants scored on

self-referent upward CFTs than on downward CFTs. However, there still remains a lack of conclusive findings on this issue. The self-other dimension has not received as much attention in the literature as the dimensions of direction and structure, mainly in the area of information search, sharing and decision-making. Given that activating counterfactual thinking encourages an enduring cognitive orientation (Galinsky and Moskowitz, 2000), it is expected that counterfactual stimulation will improve group information search, sharing and decision accuracy.

It is also important to mention that when people encounter a negative emotion, such as regret, they feel that some problems need to be resolved. Subsequently, they are more likely to examine issues more exhaustively and efficiently. In brief, negative emotional states might evoke counterfactual ruminations (Roese and Hur, 1997). Researchers have revealed that rumination is positively related to verbal intelligence. It is likely that more verbally intelligent individuals are capable of considering past and future events in a more detailed way, leading to more intense rumination and worry (Penney *et al.*, 2015). Likewise, Talarico *et al.* (2009) asserted that when individuals are sad, they try to explore solutions to resolve extensive problems. Therefore, counterfactual thinking is likely to aid this goal. Roese (1999) also proposed that counterfactuals tend to be elicited by events that require corrective actions. To be specific, unanticipated failures, threats and disasters (events that also evoke negative emotions) have a propensity to foster counterfactual thinking (Roese and Hur, 1997).

Self-referent counterfactuals may do well at producing mental simulations and the consideration of alternatives because this type of counterfactual is more self-critical and self-implicating than other types and is likely to lead to more upward counterfactuals (Sherman and McConnell, 1995). Generation of upward counterfactuals is expected to result in "regret" and negative affect. Negative (compared to neutral) affect may work as a warning sign that goal progress is unsatisfactory or problematic. Counterfactual regret is a backward-looking emotion indicating an unfavorable appraisal of a decision. It is a distressing feeling, coupled with a clear sense of self blame regarding its causes and intense desires to undo the present situation (Zeelenberg and Pieters, 2007). On the other hand, positive affect indicates sufficient progress toward goals (Schwarz, 1990). Therefore, it might be argued that self-referent thoughts should in general play a more prominent role in information search, sharing and decision-making as compared to other-referent thoughts, because focusing on one's own prospects to alter future outcomes might be critical to individual thinking (Isenberg, 1991). In addition, for self-focused thoughts, there is a direct link from an upward comparison to a behavioral intention and eventually to changed behavior (Morris and Moore, 2000). We therefore propose:

P1. Self-referent counterfactual groups will perform better in terms of increased information sharing and search as compared to other-referent counterfactual groups.

P2. Upward counterfactual groups will exhibit greater sharing and search of critical information as compared to downward counterfactual groups.

The moderating role of task complexity

Past studies have revealed that activating a counterfactual mind-set can facilitate performance on tasks that require convergent thinking (Kray *et al.*, 2006). Further,

positive and negative affect generated by CFTs is also likely to play an important role in handling the difficulty levels of a task. The Affect Infusion Model (Forgas, 1995) emphasizes that tasks which demand elaborate and substantive processing are more liable to be influenced by affect, as the mood will selectively prime affect-related thoughts and memories to be utilized when making a decision. On the other hand, tasks that can be resolved using easy and direct processing strategies show little or no affect infusion (Forgas and George, 2001). In this vein, it can be argued that decision-makers will engage in more elaborate and substantive information processing when decisions are to be made regarding catastrophe prevention, as such accidents are more emotionally challenging. This is also one of the ways suggested by Zeelenberg and Pieters (2007) to prevent future regret, wherein individuals attempt to improve the quality of the decision process and results by extensive internal (memory) or external information search. Summerville (2011) also revealed a remarkable principle about *counterfactual seeking*, i.e. individuals not only visualize alternative results but also scrutinize alternative results. Specifically, if individuals are dissatisfied with their results, they tend to seek more information about the alternatives, even if this exploration elicits regret. Blay *et al.* (2012) asserted that negative affect improves information search efficiency particularly when there is a high level of risk (catastrophic situation), whereas positive affect distracted participants, making their search less efficient. Affective responses (regret vs. relief) are likely to obstruct decision-makers' capability to efficiently search for information and they might either expand information search, thus escalating search costs and costs of missed deadlines, or make a decision with insufficient data, thereby increasing estimated costs of decision error.

Furthermore, the generation of self-focused, upward counterfactual comparisons demands more multifaceted cognitive processing of the incident than other comparisons (Morris and Moore, 2000), which is also likely to be aided by high task complexity. Scholars have argued that one way of enhancing employee performance and personal outcomes is by enriching the job (Faturochman, 1997). Similarly, numerous studies on job crafting and the Job Demands–Resources (JD–R) model proposed that workers craft their jobs by controlling the level of job demands (increased demand for information processing) and job resources (available information), depending on their needs (high need for information-processing capability because of environmental complexity) (Bakker and Demerouti, 2014; Petrou *et al.*, 2012; Tims and Bakker, 2010), hence, paving the way for the emergence of team-based, matrix and network organization design. Task complexity can have varying effects on the end result because individuals employ different decision-making strategies according to the level of task complexity (Payne, 1976). Newell and Simon (1972) made it apparent that in executing multifaceted or complex tasks individuals use diverse heuristics, which would keep the information-processing demands regarding the situation within the limits of their restricted capability.

Past studies further revealed that research which utilizes an intricate task and a difficult goal might well lead to better task performance, attributable to the effects of cognitive and motivational processes (Campbell and Gingrich, 1986). Task complexity that becomes even more important when arriving at the accurate decision is dependent on searching and sharing of relevant information which is unequally distributed in a group, as inadequate searching and sharing of information is likely to result in an inaccurate decision and low task complexity is likely to worsen the case by reducing the

motivation of team members to exert any extra effort to search for more alternatives. The processing limits inherent in cognition also act as a constraint, which implies that efficient and systematic categorization of information is critical to superior task performance in many situations. Dane and Pratt (2007) reported that task complexity plays the role of a significant factor in influencing the effectiveness of intuition as a decision-making approach. Complex tasks require adding structure through contextual information search related to a decision or problem. Johnson (1988) asserted that contextual information aided incremental accuracy of high knowledge individuals as compared to novices. Devine and Kozlowski (1995) found that both low and high knowledge individuals searched for more information and showed similar probabilities of making the correct decision when the task was ill-structured than when it was well-structured. Payne (1976) also revealed that the information processing leading to a superior alternative varied as a function of task complexity. They also found that when faced with a more complex decision task, individuals utilized decision strategies which resulted in a search of the mutable amount of information across various choices. Therefore, it is proposed that:

P3(a). Self-referent counterfactual groups will search and share for more relevant information as compared to other-referent counterfactual groups when the task complexity is high than when it is low.

P3(b). Upward counterfactual groups will search for and share more relevant information as compared to downward counterfactual groups when the task complexity is high than when it is low.

P4(a). Self-referent counterfactual groups will exhibit greater group decision accuracy as compared to other-referent counterfactual groups when the task complexity is low than when it is high.

P4(b). Upward counterfactual groups will exhibit greater group decision accuracy as compared to downward counterfactual groups when the task complexity is low than when it is high.

Counterfactual thinking and decision-making in groups: the mediating role of information searching and sharing

It is evident that the information exchange process is necessary for effective team performance, particularly for arriving at an accurate decision in a group. Moreover, the influence of counterfactual thinking (reference and direction) on decision-making is likely to be stronger when information search and sharing is high in contrast to when it is low, because arriving at an accurate decision is largely dependent on the number of relevant pieces of information searched and shared in a group. Galinsky and Moskowitz (2000) argued that a salient counterfactual raises awareness of multiple options which enables individuals to make better decisions. It is possible that because of exposure to a counterfactual mind-set in a preceding context, people were led to ask more hypothesis-disconfirming questions; there was increased cognitive flexibility and that they assisted in overcoming functional fixedness, apparently by increasing the accessibility of alternative hypotheses. Another reason could be that negative affect generated by CFTs might work as a general alarm or signal, which subsequently reinforces the range of cognitive activity (Lieberman *et al.*, 2002).

Leach and Patall (2013) showed that upward counterfactual thinking mediated the effect of decision-making orientation on satisfaction with one's college major, motivation for the task, competence in the major and academic performance. Similarly, Hafner *et al.* (2012) revealed in their study that satisfaction was higher with limited as opposed to extensive choices when the cognitive load was low and the number of CFTs produced mediated this effect. Moreover, counterfactual thinking has been shown to amplify the scrutiny of persuasive message content (Krishnamurthy and Sivaraman, 2002), enabling decision-makers to differentiate between strong and weak arguments. Consequently, we propose:

P5. Self-referent as compared to other-referent counterfactual thinking will have a high positive impact on group decision accuracy when mediated by greater information searching and sharing under the condition of high task complexity rather than low task complexity.

P6. Upward as compared to downward counterfactual thinking will have a high positive impact on group decision accuracy when mediated by greater information searching and sharing under the condition of high task complexity rather than low task complexity.

Information searching and sharing, and decision-making in groups: Cognitive complexity as a moderator

Growing organizations perform decision tasks that are no longer simple and repetitive, rather they are becoming more intricate and complex and beyond the management and the capability of a single individual (Sundstrom *et al.*, 2000). Teams play an important role in solving the increasing complexity of a task because numerous group tasks still include an assortment of cognitive processes, for instance, critical thinking, problem-solving and decision-making (Choi, 2010) and also involve various types of cognitive demands, for example, pooling and organizing assets or efforts of individual members (Cooke *et al.*, 2003). Subsequently, the study of team level cognition can be vital in understanding group behavioral patterns and practices in a better way so that performance variations between teams can be understood.

Dispositional factors, therefore, are quite likely to play an important role in the manner individuals make decisions. Scholars have expansively investigated numerous dispositional variables that affect decision-making choices, for example, tolerance for ambiguity, self-efficacy, risk taking and cognitive motivation (Forbes, 2005). Despite common scholarly conformity that the majority of these dispositional characteristics can be traced back to differences in information processing (Iederan *et al.*, 2009), the role of group cognition in decision-making and counterfactual thinking remains somewhat underexplored.

To make accurate decisions, certain scholars have recognized the significance of cognitive complexity, according to which organizational problems are considered from multiple perspectives (Bartunek *et al.*, 1983). According to Kiesler and Spoull (1982), accurate decisions cannot be made without a sufficient amount of information. Hence, the specific manner in which a group seeks out as well as comprehends information is of immense importance in developing a framework for accurate group decision-making.

Cognitive complexity characterizes the complexity of an individual's cognitive structure. Cognitive complexity is defined by two main structural components that are

"differentiation" and "integration". Differentiation is the number of constructs used to explain a situation, while integration indicates the number of relations among the discriminated dimensions (Boyacigiller *et al.*, 2004). Past studies have tried to investigate cognitive complexity as a factor explaining human performance in a broad range of domains, for instance, predictive accuracy (Bieri, 1955; Crockett, 1965), interpersonal attraction (Adams-Webber, 2001), leadership (Zaccaro, 2001), negotiation (Pruitt and Lewis, 1975), creativity (Quinn, 1980), communication (Burleson and Samter, 1990) and decision-making (Choi, 2010; Iederan *et al.*, 2009). However, the majority of the studies focused on investigating the effects of cognitive complexity at the individual level of task performance (Stone *et al.*, 1994) and not at the group level of task performance.

Cognitive complexity suggests that individuals vary in their capacity to process information as per their level of cognitive complexity; for instance, individuals high on cognitive complexity will be inclined to seek out a wider range of information, cautiously consider all the pertinent factors and amalgamate them into a coherent position and utilize extensive information to arrive at a conclusion, whereas individuals low on cognitive complexity utilize comparatively less information to make a decision and consider only one perspective and maintain it rigidly (Driver, 1987). Studies have confirmed that individuals high on cognitive complexity interpret information in a multidimensional way and incorporate information more competently (Schroder *et al.*, 1967). One of the focal ideas in the cognitive complexity theory is that individuals vary in their information-seeking behaviors when they perform different cognitive activities like problem-solving, decision-making and planning. These activities are principally dependent on their cognitive complexity levels (Driver, 1987). Moreover, cognitively complex decision-makers are capable of synthesizing the relationship between different strands of information, are more logical in decision-making tasks and invest more time in analyzing the information in sight (Curseu, 2006).

Organizational decision-making involves intense environmental complexity, uncertainty and volatility (Cyert and March, 1963). Therefore, the cognitive complexity of the decision-maker is a central requirement for a successful decision-making process. Still not many researchers have explored the effect of different cognitive orientations on information search, sharing and group decision-making. Therefore, we propose:

P7. Information search and sharing will be positively associated with group decision-making accuracy when the group cognitive complexity is high rather when it is low.

The mediating role of task conflict, conflict management mechanisms, team size and diversity

Decision-makers are embedded in a context, i.e. their own prior private experiences and knowledge regarding the situation, which influences how threatening any situation is to be considered by them. Thus, it might be said that near-miss information changes people's frames of reference. For instance, a certain likelihood of a hit that might have felt dangerous previously may feel less risky now, as they escaped uninjured in the past (Dillon *et al.*, 2010). Therefore, it is not necessary that all team members generate upward counterfactuals (regret) instead of downward counterfactuals (relief) after facing a near miss. This is exactly what happened in their study as reported by Teigen and Jensen (2010) whose interview protocols confirmed that in case of tsunami survivors,

downward counterfactuals were at least 10 times more frequent than upward counterfactuals. Thus, different experiences are likely to generate intra-group conflict. Tinsley *et al.* (2012) have showed that this near-miss effect is robust, as it seems to implicitly affect the thoughts decision-makers use as inputs to make their choices.

It is evident that teams comprise individual members having different expertise, skills and knowledge; with team heterogeneity comes the diversity in cognitive bases and the viewpoints of team members which enhances the richness of shared information and increases the quality of decisions made (Hambrick *et al.*, 1996). However, in a homogeneous team, collaborative and joint decision-making behaviors are attained easily and less conflict takes place as compared to a heterogeneous team. The quantity and quality of the information shared during decision-making is likely to suffer in homogeneous teams. However, team diversity brings greater creativity and innovation (Lewis *et al.*, 2006). However, a disparity in various perspectives among the team members causes conflict (Amason and Schweiger, 1997) and makes the information sharing more difficult. Thus, team size becomes important as well because collaborative conflict management mechanisms may or may not work with an increased team size. According to the literature on group dynamics, increasing the size of a group brings in opposing forces that influence group performance differently (Shaw, 1981). A larger team has greater cognitive assets that are likely to improve the teams' knowledge, performance and lead to creativity, as studies have revealed that some amount of conflict can foster innovation (Lu *et al.*, 2011). However, larger teams also undergo problems of control and collaboration leading to declined performance and conflict (Smith *et al.*, 1994). Previous studies have shown a strong positive correlation between team size and both cognitive and affective conflict (Amason and Sapienza, 1997). Amason (1996) also identified the positive and negative sides of task conflict (cognitive conflict/constructive conflict), defined as "the conflict based on the substance of the task that the group is performing" (Jehn, 1995).

Recent meta-analytic analyses (Greer *et al.*, 2012) revealed that a high level of task conflict is negatively associated with stable performance. De Dreu and Wiengart (2003) have proposed a curvilinear relationship between task conflict and innovation and other team performance measures. More recently, Weingart *et al.* (2015) have suggested that conflicts entail a "spiral of perceptions and reactions of parties that contextualizes the directness and oppositional intensity of conflict expression". Thus, optimum or moderate intensity of task conflict is likely to be positively associated with team and organizational decision-making.

Conflict also depends upon the relationship between the team members, i.e. interaction between team members can be cooperative or competitive (Vollmer, 2015). If these conflicts are not handled appropriately, particularly in a hazardous situation, results are likely to be destructive rather productive (affective conflict). For example, if some members of a decision-making team have survived (almost no damage) a catastrophe (relief), they are less likely to go with the evacuation decision, whereas the members who have lost almost everything in a catastrophe (regret) are likely to take decisions to evacuate. Team members are expected to opt for the second decision option only if the conflict is resolved. Thus, heterogeneity of perspectives in teams has positive effects on organizational decision-making when the teams engage themselves in task conflict and avoid affective conflict. Moreover, Fischer *et al.* (2000) showed that preferences about uncertainty affect decision time and inaccuracy as a function of the

inconsistency among the attributes of an option (attribute conflict hypothesis). If one team member is ambivalent about his choice for building levees versus building wetlands and another member is not, a detrimental decision might take place. For example, in the aftermath of Hurricane Katrina, both the public and the media alike questioned why a large number of individuals failed to evacuate the Gulf Coast and why the authorities and first-responder organizations were so under-prepared (Daniels *et al.*, 2006). The surmised cause could be previous experiences related to such catastrophes and unresolved conflicts. Citizens who survive a catastrophe previously often fail to take actions in the future (Lindell and Perry, 2000). The team members can invalidate the damaging effects of heterogeneity through accurate intervention mechanisms. A high-quality decision will only result if the demographic diversities and differences of opinion are managed effectively by appropriate conflict management mechanisms. For instance, when team members adopt a prosocial motivation (preventing a catastrophe) and recognize cooperative outcome interdependence, they tackle differences of opinion and other types of conflict in a better way, learn more, share more information and perform efficiently when the task reflexivity is high (De Dreu, 2007). The above arguments lead us to the following propositions:

P8(a). Task conflict led by cooperative (collaborative) conflict management mechanism will enhance extensive information search, sharing and group decision-making.

P8(b). Large and diverse teams, compared to small and less diverse teams, will be positively related to task conflict and would result in more accurate decision-making under the use of collaborative rather than dominating conflict management mechanisms.

The moderating role of tolerance for ambiguity and cognitive closure

Different individuals have different conflict orientations that influence their decisions. Active and open-minded decision-makers are likely to have a greater tolerance for ambiguity and will search for more information to resolve the conflict rather that jump to conclusions. On the other hand, weak decision-makers are prone to cognitive closure (the tendency to reach the conclusion quickly, frequently without gathering sufficient information, coupled with ambiguity-aversion (Kruglanski and Webster, 1996) and are likely to use more heuristic information processing (Mellers *et al.*, 2015) to reduce the conflict. Past research has revealed that experts who had a greater need for cognitive closure rejected the counterfactual scenarios demonstrating their theories wrong while they accepted counterfactual scenarios proving their theories right (Tetlock, 1998). In behavioral decision research, experts have been shown to rely on heuristics in making judgments, although heuristics frequently result in faulty decisions (Kahneman, 1991). Whereas, as per cognitive science, research experts exhibit superiority over novices in almost every aspect of cognitive functioning, from memory and learning to problem-solving and reasoning. Experts are likely to perform better than the common public, as they possess highly developed attention capabilities, wisdom of what is important, the capability to recognize exceptions to rules and pre-thought solutions to dicey situations (Dillon *et al.*, 2010). We therefore posit:

P9. Task conflict will affect group decision-making adversely when the group cognitive complexity is low rather than when it is high, especially in a high task complexity condition.

P10(a). Task conflict will affect group decision-making adversely when the groups' need for cognitive closure is high rather than when it is low.

P10(b). Task conflict will affect group decision-making favorably when the groups' tolerance for ambiguity is high rather than when it is low.

Counterfactual thinking, decision-making and catastrophe prevention

For organizational decision-makers, stakes are high when their decisions can either prevent or precipitate industrial accidents or amplify damage created by natural forces. To avert any detrimental consequences of their decisions, it becomes enormously important for the decision-makers to take preventative measures in advance, for what could go awry in future by construing the present, making sense of the past experiences and drawing a lesson from it. However, learning experiences for catastrophes and disasters are extremely limited, because such accidents are uncommon. To prevent the occurrence of any such tragedy, decision-makers are required to reflect and draw insights from previous mistakes, near misses and anticipate forthcoming potential threats likely to transpire. Dillon and Tinsley (2008) proposed that one recommendation for identifying and preventing near-misses or catastrophes could be by considering the worst-case scenarios. For example, one must ask, "could the outcome have been different? Or could the outcome have been even worse (indicates counterfactual thinking)?"

Disasters gather attention when they take place, and organizations usually draw important lessons from evident failures adopting new actions in response. For instance, the USA witnessed various security policy modifications after the terrorist attacks of September 11 and emergency management and shelter policy revisions following Hurricane Katrina (Dillon *et al.*, 2014). Decisions considering such events are made on the basis of both available information and past experiences or information (Fishbein and Ajzen, 2010). One example of such personal past experience is "a near-miss". A near miss is an event, which has some probability of a negative (even fatal) outcome and some probability of a positive (safe) outcome, where the actual outcome is non-fatal. It is a "miss" because the end result is non-fatal and it is "near" in the sense that individuals realize that a negative or fatal outcome had some likelihood of taking place (Dillon and Tinsley, 2008). To be precise, escaping a disaster systematically changed individuals decision-making by triggering them to make more risky decisions (Dillon *et al.*, 2014). Dillon *et al.* (2014) revealed that if observers focus on the resilience (a catastrophe could have but did not happen, i.e. a catastrophe was successfully avoided: feeling of relief) of the near miss (to a large extent, focusing on the "miss" rather than the "near"), they are less likely to alter behaviors after an event. Recognizing events as vulnerable (wherein a disaster almost happened) near misses (generating regret) will promote more feelings of risk and higher intentions to alter behavior. In another study, it was found that with resilient near misses, those who had no salient information about potential harm decreased their mitigation behavior. Whereas vulnerable near misses, which highlighted damage information, led to mitigation action (Dillon-Merrill *et al.*, 2012).

Norm theory (Kahneman and Miller, 1986) suggests that each outcome or event brings its own post-computed norm or frame of reference into existence through CFTs. Affective reactions are a result of the comparison between these post-computed norms and the actual outcome. In regret theory, it is believed that the decision-maker has prior information about all probable actions and the associated results for every state of the world (Bell, 1982). However, in the majority of real-life judgments, not all possible actions or states of the world are known, for instance, catastrophes. In such cases, as norm theory proposes, decision-makers can visualize possible consequences that would have occurred, had things been altered, i.e. they can create counterfactuals. In this manner, decision-makers actually "pre-compute the post-computed thoughts" (Miller *et al.*, 1990). Similarly, Zeelenberg *et al.* (1998) reported that when individuals pre-computed behavior-focused counterfactuals (counterfactual in which the results are undone by altering something that was under one's personal control), the probable future regret will be made prominent and regret aversion/minimizing options will be encouraged, further affecting the preference and choice (risk-averse or risk-seeking) of the decision-maker. This is in line with the subjective expected utility model or SEU (Savage, 1954), as after encountering a hazard, individuals retrieve relevant information from their memory regarding that hazard (or similar disasters). This results in appraisals of probabilities, consequences and how they will be amalgamated, and based on this, an explicit assessment of the threat of the disaster is made. Once the risk is estimated, decision-makers have to choose explicitly which behavior to engage in (Dillon-Merrill *et al.*, 2012).

Learning from near misses becomes difficult because there are only some outcomes from which generalizations can be made, but if decision-makers initiate a vigorous processes of inference (what caused the near miss) and make hypothetical cases about what could occur by changing the parameters (counterfactuals/prefactuals), it is possible that learning how to avoid close calls might take place (Dillon and Tinsley, 2005). Morris and Moore (2000) looked at how "close calls", i.e. mishaps that nearly happened, by investigating airline accident reports, they revealed that individuals developed more tangible ideas about how they would enhance their behavior when close calls were generated "self-focused upward counterfactuals". Therefore, if individuals reflect about how they could have improved the situation because of a near-miss experience, the probability to learn lessons regarding how they should act in the future increases.

Research considering how near misses affect group decision-making will be a reasonable next move to prevent catastrophes (or be well prepared for catastrophes). As many decisions are made by teams in organizations when a natural calamity is impending, like mandatory evacuation instructions, the organizational decision-making milieu is equally imperative (Dillon-Merrill *et al.*, 2012). As disappointments constitute lessons "learned in blood" (Madsen and Desai, 2010), near-miss identification is considered as one of the most promising possibilities for reducing mishap rates and improving safety without the costs related to large accidents (Rerup, 2009). Near misses are normally produced by the same preconditions that generate disastrous failures, except that they transpire much more recurrently and without the harmful aftereffects. Therefore, being able to recognize near-miss events presents numerous low-cost prospects for organizations to identify and correct hazardous conditions before a failure transpires (Rerup, 2009). Hence, we propose:

P11. Sharing of vulnerable (regret) near-miss information will be more likely to facilitate groups decision to take mitigating action for an approaching catastrophe, whereas sharing of resilient (relief) near-miss information will be more likely to facilitate group decisions leading to the intensification of mishap.

Discussion and directions for future research

In this paper, we addressed the question of how counterfactual thinking affects organizationally valued outcomes at the first level, e.g. accuracy of group decisions, time taken and costs incurred as well as the end outcomes of catastrophe prevention and intensification of the likelihood of mishap. We made an effort to formulate a theoretical framework to integrate these contextual and dispositional variables presenting a comprehensive picture of the dynamics of decision-making in groups and its outcomes. Towards this end, we developed a set of propositions regarding the relationship among pertinent independent, mediating, moderating and dependent factors in group decision-making leading to first-level and end outcomes.

The paper contributes to the existing literature in several important ways. First, we highlight the significant contribution of the counterfactual mind-set extending far beyond the boundaries of currently prevailing knowledge of individual decision-making processes to encompass group decision-making at different organizational and inter-organizational levels having far reaching end outcomes, e.g. catastrophe aversion and the intensification of likelihood of mishaps, i.e. industrial accidents and terrorist strikes, apart from regular first-level outcomes of accuracy of decision-making, time taken and costs incurred.

Second, the paper establishes the primordial role of group information search and sharing mediating the impact of counterfactual thinking on group decision-making outcomes. This mediating link between counterfactual thinking and decision-making outcomes contends a minimal role of information searching and sharing in the case of low complexity of problem tasks because of a low need for information searching and sharing and a low demand for information-processing capacity and might directly result in positive outcomes.

Third, while the demand for information searching and sharing becomes more salient when the problem task is more complex, there is an emergent demand for high information-processing capability, which is fulfilled by high group cognitive complexity. Group cognitive complexity is a premium requirement for logical inferences after combining disparate pieces of shared information and agreement and consensus is facilitated when cognitively complex minds emphasize logical argumentation.

Fourth, the framework identifies the critical role of task conflict and conflict management mechanisms in case of mixed groups of counterfactual mindsets. The role of task conflict and conflict management mechanisms is limited in cases of homogeneous groups of counterfactual thinking. The importance of group size is emphasized here. Large size and diversity has the potential for greater divergent thinking but also has greater task conflict and thus collaborative resolution mechanisms are emphasized.

Fifth, past research on counterfactual thinking and decision-making has primarily focused on other-referent and individual decision-making. The present work will be an

extension in the field of counterfactual thinking and decision-making by incorporating other pertinent contextual variables that were neglected in the past studies.

Finally, the paper also recognizes the importance of tolerance for ambiguity and need for cognitive closure as significant moderators of the link between information searching and sharing and decision outcomes at all levels under task conflict conditions of mixed or heterogeneous groups, or no conflict conditions of homogeneous counterfactual groups.

Future studies can benefit from making a comparison of the levels, i.e. individual vs group, at which different types and directions of CFTs are activated and its influence on decision-making. In future, this research can be extended in the direction of creativity and analytical problem-solving as well. Further, future research may also explore the role of other dispositional factors apart from cognitive complexity (for example *locus* of control) in the context of counterfactual thinking, information searching, sharing and decision-making.

Implications for managerial practice

The theoretical framework will improve managerial understanding and practice in a number of important ways. It will result in managerial awareness about the effects on group performance of the activation of different types of counterfactual mind-sets at the group level, which can be useful in identifying the beneficial (or detrimental) effect of different types of counterfactual thinking on decision-making *per se*.

The paper suggests factors that may lead managers to make accurate decisions quickly. Managers frequently encounter difficulties in team construction which affect the accuracy of decision-making in group. Therefore, the issue we examine is practically relevant for managers. Managerial awareness of counterfactual mind-set activation at the group level is beneficial for enhanced performance because of the analytic mental simulations associated with it which can enrich their understanding of how the teams would perform in a succeeding task. We have further contended that group cognitive complexity positively affects group decision-making accuracy and managers can benefit from this information and create more efficient work teams by constituting teams having a particular dispositional orientation.

However, in the context of task complexity, it is important that managers are made to understand that even if relevant information searching and sharing is high in the group, it might still not lead to group decision accuracy (as an overload of information might lead to confusion or inaccurate decisions), until that information is organized and integrated appropriately to make correct choices. This is only possible when the cognitive complexity of the group is also high. On the other hand, not much searching or sharing of information is needed in the group to reach at an accurate decision when the task complexity is low, and then counterfactual thinking activation can directly lead to group decision accuracy even overriding the need for group cognitive complexity. The information-processing perspective of organization design (Galbraith, 1977) and the organizational job design model (Hackman and Oldham, 2010) support the argument. Another major implication of counterfactual thinking is its potential to prevent the occurrence of disasters or catastrophes in organizations, those which can have profound damaging consequences – human, material and financial. Considering the case of the Bhopal disaster in which the release of methyl isocyanate from a Union Carbide India plant resulted in 3,000 deaths and over10,000 causalities (Shrivastava, 1987). Had the

management taken its safety and security issues more seriously by estimating the probabilities of such events, the devastation could have been averted. It is apparent that phenomena like these are rare and limited experiential data are available based on which decisions could be made regarding adequate safety measures. In complex or ambiguous situations, managers frequently rely on heuristics to simplify decision-making even at the cost of avoiding ambiguous information (Kunreuther and Meszaros, 2002) when focusing on the problem from multiple perspectives could prevent the very accident. Managers can thus learn to avoid complicating a simple task by their complex cognitive juggernaut, and not have to lose sight of task complexity through cognitive simplification or by using heuristics.

The Bhopal accident undoubtedly acted as an important trigger for other chemical firms enabling them to make an extensive search of information related to adequate safety measures and deciding on the actions needed to be taken to avoid future disasters. Prior to the Bhopal gas tragedy, the firms only focused on decreasing hazards to employees inside the gate, but after the Bhopal case, they measured the catastrophic potential of their chemicals on neighboring surroundings (Kunreuther and Meszaros, 2002).

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