

Title: Effect of an improvisational approach to new product development during a crisis: an empirical study of NPD teams in the field of chemistry and chemical engineering.

Authors: Yassir M. Samra, PhD
Jonathan B. Hartman, PhD
Gary S. Lynn, PhD
Richard R. Reilly, PhD

Abstract: For many years, past studies have supported the hypothesis that a traditional new product development process increases the odds of faster product launch and greater new product success. More recent studies have shown that an improvisational approach is also associated with a faster and/or successful new product launch. The two schools of the thought have addressed different environments in which new product development operates in. However, there seems to be a lacuna in the scholarship on new product development when studying the effects of a NPD process as the organization experiences a crisis. The purpose of this paper is to examine the possible moderating effect a crisis can have on the relationship between an improvisational approach and both the speed and the success of the new product launched. Using a specially designed questionnaire, 301 NPD project managers working on products associated with the field of chemistry and chemical engineering were asked their opinion of their team's use of an improvisational NPD process on their most recently completed NPD project, the degree to which they felt the NPD team was operating during crisis, as well as how fast they were in launching the new product and how successful the new product was in the market. The results indicate that while a crisis is positively associated with improvisation, speed and success, it does not moderate the relationship between an improvisational approach and neither speed nor success.

INTRODUCTION

Crises can have a debilitating effect on an organization (as the Bhopal tragedy had on Union Carbide) and yet they also can have an energizing positive effect on a firm (as the Tylenol scare had on Johnson & Johnson). Several studies have explored different events that have threatened the existence of an organization to find characteristics of both successfully and unsuccessfully resolved crises. As crises are threatening in nature, successful organizations react to a crisis quickly to abate the situation while unsuccessful organizations do not react fast enough to control the situation or do nothing at all hoping the situation will eventually resolve itself.

A crisis is a situation that was never predicted nor recognized as a threat until the event actually occurs. At this point, the employees of an affected organization perceive a high threat level to the stability of the organization. Such a threat can have a unifying effect on the employees of an organization to fight harder to save the organization from peril. In most cases, the crisis will financially subdue the organization (as Union Carbide eventually was bought out and Johnson & Johnson spent over \$200 million in a national recall). Crises generally fall into three categories: disasters (Bhopal tragedy), scandals (downfall of Enron), and product safety (deaths attributed to Tylenol). In addition to these three categories, an organization may experience a crisis as its position becomes threatened from the onset of unanticipated competition (like at Iomega) or from innovative products that do not meet the criteria of the market (the mathematical flaw in the Pentium chip). In this situation, new product development can be the answer to a crisis as it can generate a new profit stream to prolong the life of the organization and deliver it from the brink of extinction. The employees placed on a new product

development team, as members of the organization, can have a pivotal role to play in delivering the organization from the crisis.

For many businesses, NPD is essential to the growth (Cooper, 1984) as companies need to generate new products and services (Lynn & Reilly, 2002) to create or sustain a competitive advantage (Brown & Eisenhardt 1997; Mascitelli 2000). The NPD literature offers both a traditional (phased-review) and improvisational processes and empirical studies in NPD have explored outcomes of new projects under conditions of turbulence and uncertainty but surprisingly, the NPD scholarship has just begun to explore the phenomena of crisis and empirically assess its impact on the success of NPD projects (Akgun et al., 2006, Samra, 2005). Since a crisis is something that cannot be planned for, an improvisational approach to NPD seems more appropriate than a traditional one.

While the scholarship on crisis has viewed its impact on the organization as a whole, this study seeks to extend Tjosvold's (1984) work on the perception of a crisis at the team level by using NPD teams and their perceptions of an organizational crisis. In addition this study will extend Eisenhardt & Tabrizi's (1995) work on the use of different approaches in turbulent and uncertain environmental conditions by investigating the impact of an improvisational approach in a crisis situation. Using a data set of respondents across different industries in the chemical sector, an empirical test will determine whether an improvisational approach during a crisis can lead to better project outcomes.

LITERATURE REVIEW

Crisis

Most crises occur through a triggering event. Some scholars claim that crises are disastrous situations that severely threaten an organization. Specifically, Starbuck et al (1978) conjecture that crises originate as threatening events from either an organization's external environment or from defects within the organization itself. King (2002) claims that a crisis is an "unplanned event that has the potential of dismantling an organization" (p. 237). Pearson & Mitroff (1993) state that a crisis is a situation when the survival of the whole organization is in jeopardy. Also Pearson & Clair (1998) define an organizational crisis as a highly ambiguous infrequently occurring situation where causes and effects are unknown but threaten survival.

Another component of crisis is the sense of urgency to respond so that the situation does not continue to threaten the organization. If an organization is constantly facing adverse situations then it will grow accustomed to this environment. Yet any organization can experience a crisis (Shaluf et al, 2003). In fact a crisis is not simply an adverse situation but can be viewed as a disruption in time that requires the immediate attention of those in charge (Weick, 1977). Pearson & Clair (1998) assert that a crisis will require little time (if any) to respond to the event and will present the organization with a dilemma to make a decision on how to settle the situation. Others have compared organizational crisis to the event of a fire, claiming that in times of fire, organizations must react quickly to control and subdue the force of the fire before it claims the life of the organization (Smart & Vertinsky, 1984; Weick, 1993; Carter, 1997).

Thus a crisis consists of three parts: (1) a triggering event that (2) surprises and threatens the organization's existence and requires (3) an urgent response in order to change the potentially negative event to a more positive outcome (Hermann, 1963). Billings et al (1980) complement Hermann's model by introducing crisis as a measure of perception that values are seriously threatened, the individuals involved are uncertain that a practical response will work, and a quick response is necessary. But the idea of perceiving a crisis is extremely important as two individuals can perceive the same situation differently. For example, a crisis may be perceived by new residents living in the midst of a forest fire, but is not perceived as such by firefighters as the situation is certainly one in which they have received appropriate training for dealing with. While the former "never expects" or does not anticipate a fire, the latter knows exactly what to do.

Since crises are more subjective in nature, they can be artificially generated to evoke perceptions of a threatening situation. In a study by Kim (1998), the government of South Korea imposed a crisis on the "Korean" car industry. The new policy was to have Korean car companies develop their own models. By initiating a crisis situation rather than react to a triggering event, the Hyundai Motor Company was able to design and launch a Korean car, thereby moving Korean car manufacturers from the typical business of assembling foreign cars to designing their own. While Kim (1998) views crisis as both a danger and opportunity, this does not take into consideration Hermann's (1963) model of loss of values and threat to survival. The Korean car companies apparently did not view their companies as being in a crisis situation according to these criteria as their business of assembling foreign cars would not threaten their survival; but

the employees' perception of crisis was high nonetheless. The events do account for a rapid response, in the sense that Hyundai did develop cars rapidly in response to the government imposed crisis. This is also seen in a study by Barnett & Pratt (2000) where the authors found that organizations initiating a crisis on their employees had more successful outcomes. While the distinction can be made between a crisis that poses a latent threat and one that poses a "real" threat, the authors assert that there is no significant difference on the impact of each threat on the employees. In both cases, whether the threat is real or latent, the perception by the employees should be that a threatening situation has surfaced which requires immediate attention.

New Product Development Practices

Common formal processes in NPD tend to be associated with stable environments and with incrementally innovative products. In such times, NPD is predictable and the technology associated with the new product is known. Therefore, a structured approach is appropriate. But NPD isn't always straightforward. Scholars have suggested that sequential models may be too general to fit the demands of some products and services. For instance, structured models may be inappropriate for products requiring extraordinary speed, secrecy, address specific problems, or entail short production runs (Gwynne, 1997). They have also been shown to be rigid, and as a consequence, may reduce flexibility (Rosenthal, 1992). Indeed, scholars have suggested that they may be too structured for quickly changing competitive environments (Cooper 1994; Hoopes & Postrel 1999). To counter this, two models have been developed. The first is Cooper's (1994) flexible approach to NPD which revolves around being fluid and adaptable; incorporating "fuzzy gates" that are both situational and conditional was empirically

tested and supported (Cooper & Kleinschmidt, 1995). The second is an improvisational model (Eisenhardt & Tabrizi, 1995; Moorman & Miner, 1998a); one that allows the NPD team to think in the midst of execution. In a widely cited study on new product development activities at two midsize firms, Moorman and Miner (1998a) found that improvisation can be an effective tool when an organization faces environmental turbulence that requires action.

Improvisation

To define improvisation, a literature review was conducted and various definitions were found. For example, Barrett (1998) describes improvisation as coming up with novel responses without a set plan and Bastien and Hostager (1988) define improvisation as inventing and executing new ideas. This stream states that improvisation is a deviation from normal routines or behavior. This is insufficient in part due to the fact that this is synonymous with the definition of creativity (Amabile, 1996). An example of this is when an organization designs a creative marketing strategy (Moorman & Miner, 1998b). The idea may be new and innovative but it is not necessarily improvisational.

On the other hand, improvisation is synonymous with creativity only under a time constraint or pressured situation. The dictionary defines improvisation from the Latin word “improvisus” meaning “unforeseen” as composing extemporaneously. Thus a new set of definitions for improvisation is found. For example, Crossan & Sorrenti (1997) define improvisation as intuition guiding action in a spontaneous way. Cunha et al (1999) define improvisation as the conception of action as it unfolds. Perry (1991) defines improvisation as formulating and implementing strategies in real time which is

echoed by Weick (1993) as improvisation has no distinction in time between composition and performance. Moorman & Miners' (1998b) definition of improvisation states that improvisation is when the planning and execution converge in time so that they occur simultaneously. In the example provided by Moorman & Miner (1998b) of a CEO responding quickly to a crisis, there is still a time gap between planning the response and executing the response to the crisis. Therefore, planning and execution are two discrete events (that do not necessarily converge in time). But the response is asserted to be improvisational as the amount of time that the CEO has is limited.

The jazz literature asserts that improvisation is composing on the spur of the moment. However, musicians may compose a solo that does not significantly differ from what has been played before; thus lacking creativity. Therefore, when a musician plays a jazz solo that (s)he has performed before; it meets the second criterion for improvisation but fails to meet the first. At this point, it is safe to say that an acceptable definition for improvisation contains both factors (creativity & spontaneity) and this is congruent with Zack's (2000) definition which states that improvisation involves maximal innovation in a short period of time; thereby combining both the creativity as well as simultaneity. This definition is in agreement with a later definition provided by Miner et al (2001) in which the authors still define improvisation as the degree to which composition and execution but accept the notion that pre-existing routines do not account for improvisation.

HYPOTHESES

Crisis & Improvisation

In threatening, situations, it is all too easy to rely on what one knows or what one has been trained to do (Barthol & Ku, 1959). This is seen in the airline industry where a captain does not rely on individual action but rather on the contingency plans that have been developed for the specific circumstance. Evaluation of pilot error accidents have found that the situation was (in some cases) worsened by relying on individual action (Disaster Database, 2002). Heath (1995) proposes that the more an organization experiences disasters, the more routine will be their response. The situation of an airline's engine failure indeed threatens the lives of those on board, but prior planning for this circumstance (and others) can limit the damage (Quarantelli, 1988). Yet it is impossible to have a structured response for every contingency since the number of possible crises is virtually infinite (Weick, 1988). In this dangerously unfamiliar situation, some degree of trial and error is present and as Bateson asserts: "An explorer can never know what he is exploring until it has been explored" (Weick, 1988: 305). Therefore, normal reactions to a crisis do not necessarily work because of the entirely new situation the organization is facing. In fact, Starbuck et al (1978) claim that a situation cannot be deemed a crisis if normal behaviors produce improvements. Therefore, in returning to the airline example of engine failure, it is realized that this situation should not be a crisis for the airline crew but perhaps is perceived as a crisis to its passengers.

Another example of a crisis event was the infamous Mann Gulch fire (Weick, 1993) where many of the firefighters perished. At first, the team of firefighters attempted

to pass the gulch towards a river that would lead them to safety. As the flames quickly approached, the team leader, Dodge, decided to change direction and attempt to lead his crew up a steep hill to avoid the approaching flames but was unsuccessful. After relying on logical solutions, the final act (of desperation) of Dodge (and to the amazement of his crew) was that he ordered his crew to abandon their firefighting tools and lit a fire in front of them and ordered them to lie in this ring of fire with him. No one heeded their superior's call and while they tried to outrun the fire, only two other members had survived unburned (a third survived but due to his burns, died the next day). It took 450 men and five days to get the 4,500 acre Mann Gulch fire under control, a fire that was originally classified as being between 10 to 99 acres. The Forestry Service held an inquiry and determined that had the crew obeyed Dodge's order to lie in the escape fire, they would have been saved.

The reason for a detailed description of this event is to illustrate that high-pressure environments are generally considered to be infertile grounds for improvisation (Cunha & Cunha, 2001) as they do not provide sufficient time to think creatively (Amabile, 1996). Weick (1993) asserts that when people are put under pressure, they respond in their most habituated ways. He continues by saying, "What we do not expect under life-threatening pressure is creativity" (Weick, 1993: p. 639). Therefore we can conclude that under times of crisis, the one thing we don't expect is improvisation, however if it is done, it can be very rewarding.

The NPD literature has yet to empirically establish an association between crisis and improvisation. While several factors associated with new product success have been observed in turbulent environments, they have not been tested in crisis situations. It is

important to understand the distinction between turbulence and crisis. The dictionary defines turbulence as a state of unrest or disturbance, while crisis is defined as an unstable or crucial time or state of affairs in which a decisive change is impending, thereby implying that a crisis has a much higher degree of threat. Industries that are constantly turbulent and the successful firms in the industry have acclimated themselves to change (Brown & Eisenhardt, 1997) and therefore turbulence becomes part of their doing business. Crisis on the other hand can develop from a steady state. When a crisis does occur, the rules essentially get thrown out the window (Weick, 1993) and the NPD team has to arrive at novel solutions quickly. Thus as the literature accepts that improvisation can be a useful tool throughout NPD and a crisis, the following is hypothesis is presented:

Hypothesis 1: For a firm in crisis, higher threat levels as perceived by the NPD team will be positively associated with higher levels of improvisation by the NPD team.

Crisis & Outcomes

Since a crisis is a threat to survival, urgent (re)action is necessary to abate the situation. An organization typically has neither the luxury nor the time to analyze several responses nor to develop a manner with which to execute them in hopes of delivering itself from the crisis; rather the crisis will worsen the situation if action is not swiftly taken.

In sports (particularly American football) there are countless moments when a team sits on the brink of elimination with little time left to score and manages to overcome enumerable odds to become victorious in the most unorthodox fashion (Katz, 2001). One may argue that in sports, the perception of a crisis is not as threatening as it

might be in an organizational setting (lives aren't being lost and there's always next season). But the lesson is still the same; in a crisis situation, time is limited before the situation exacerbates and all is lost. A perceived crisis can be successfully resolved by immediately addressing the threatening nature in hopes of a successful resolution. A company can prepare only so much for a crisis but it can never eliminate the possibility of one occurring. Therefore, if a crisis does exist, then a rapid response is required to quell the situation. If left unattended, the crisis can have further detrimental effects on the organization.

In NPD, crisis can be a good thing as it presents the NPD team with an opportunity to shine and deliver the organization from its (financial) peril. To do so, the NPD team must react immediately to the crisis and develop (and launch) this new product quickly. Formally stated:

Hypothesis 2a: For a firm in crisis, higher threat levels as perceived by the NPD team will be positively associated with speed to market..

In addition, many NPD studies have shown a strong correlation between speed and success. Therefore, if indeed a crisis is a good thing, then it will be positively correlated with both speed and success. Thus the following is hypothesized:

Hypothesis 2b: For a firm in crisis, higher threat levels as perceived by the NPD team will be positively associated with higher levels of success in new product development and launch.

Improvisation & Outcomes

With regard to the NPD scholarship, it has been empirically tested that proficiently using a structured approach will yield positive outcomes (Cooper & Kleinschmidt, 1986, Cooper & Kleinschmidt, 1987; Lynn et al, 1999; Millson & Wilemon, 2002; Samra et al, 2008, Shepherd & Ahmed, 2000). However, based on the

preceding arguments, if this is the standard traditional approach to NPD, then it should not have any positive significance on the outcome of a new product in a crisis situation. On the other hand, there is support for the use of improvisation throughout new product development in uncertain and turbulent environments (Brown & Eisenhardt, 1997; Eisenhardt & Tabrizi, 1995). But a crisis is far more threatening in nature than a turbulent or uncertain environment because it contains not only an uncertainty factor but also the perception that the entire organization's survival is in question from this perilous situation. In fact, turbulent environments can be a part of the NPD team's industry (Eisenhardt & Tabrizi, 1995) as the more exposed the NPD team is to change, the more likely they will be able to adapt to rapid changes associated with turbulent environments.

As for uncertain environments, they are the midpoint between a turbulent environment (where changes can be anticipated) and crisis (where the threat level is extremely high and imminent). Uncertain environments are uncharted for NPD teams and differ from turbulent environments as they are not simply changes that the team can adapt to rather they are environments where the NPD team must decide if they wish to enter. In a crisis, the company in question is in peril and it is imperative to respond to the situation at hand. The NPD team can still function in this newly created uncertain environment, but like the rest of the organization, it may feel threatened by the onset of the crisis. As successfully resolved crises require creative answers, the NPD team can improvise to be successful. As previously mentioned in the preceding hypothesis, both speed and success are highly correlated and since a crisis can occur at random to any organization and it is completely unpredictable and unrecognizable as a potential threat, the following hypotheses are presented:

Hypothesis 3a: A firm in high crisis will exhibit a stronger relationship between improvisation and speed in the NPD process than a firm in low/no crisis.

Hypothesis 3b: A firm in high crisis will exhibit a stronger relationship between improvisation and new product success than a firm in low/no crisis.

METHODOLOGY

Hypotheses 1 & 2 suggest that as the perception level of a crisis increases, so does the frequency of improvisation as well as the likelihood of both a faster and more successful product launch. To test this, a bivariate correlation matrix will indicate any support for these hypotheses. Hypotheses 3a & 3b will require using a hierarchical regression model with three blocks. The first two will contain the variables improvisation and crisis, respectively, while the third will contain a new variable that consists of the cross-product between improvisation and crisis. If a significant result is found in the third block, then a new dichotomous variable will be created to differentiate between a firm in high crisis and one in low crisis. Finally a new set of regressions should be able to empirically demonstrate that improvisation is more closely related to positive outcomes during a crisis than not.

Sample

To test our hypotheses, a questionnaire was developed based on previous research (Billings et al, 1980; Cooper & Kleinschmidt, 1987; Cooper, 2001; Davenport & Prusak, 1998; Day 1994; Locke et al, 1981; Lynn, 1998; Moorman & Miner, 1998a & b; Schein, 1993). After designing and refining the questionnaire, we selected a contact person in a variety of US based chemically-related companies (based on the North American Industry Classification System of the US Census Bureau) to participate in this study. We asked the contact person in each company to select a project manager or senior team

member (respondents are primarily product/project managers, senior team members or department managers and directors) who was with the project from pre-prototype through launch. Lukas and Ferrell (2000) and Podsakoff and Organ (1986) found that managers rely on their own self-reports and provide reliable and objective data. Also, Huber and Power (1985) note that simply averaging multi sources is less likely to be accurate than using a key informant. After the selection of the respondents, they were informed that their responses would remain anonymous and their responses will not be linked to a company or product name. This increased the motivation of informants to cooperate without fear of reprisals. To improve the accuracy of retrospective reports, recent projects were selected to eliminate the elapsed time between the events of interest and the collection of data. Of the 301 “contact people” asked to participate, 244 of them returned a questionnaire (an 81.1% response rate), of which 55 had sufficient data to be included in both the correlation and regression analyses.

Measures

For this study, questions were measured on a Likert-type scale from 0 = strongly disagree to 10 = strongly agree. Table 1 provides a summary of the measures.

Table 1: Summary of Measures

Dependent Variable	
Success	To operationalize new product success, six questions were asked referring to how well the project met volume, sales, profit, ROI, and market share expectations. All items loaded onto one factor and the mean was used as the variable. References: Cooper, 1994; Cooper, 2001
Speed	To operationalize speed, four questions were asked. Since a multi-company and multi-industry sample was used, the speed-to-market differences in the nature of projects were controlled by using relative measures. This approach and item content were similar to that of Kessler and Chakrabarti (1999). Speed-to-market was assessed by comparing actual performance to pre-set schedules, company standards and similar competitive projects. Reference: Kessler & Chakrabarti, 1999
Independent Variables	
Improvisation	To operationalize improvisation, the following three questions were asked: (1) the team figured out the NPD process as it went along versus following a rigid well-defined plan, (2) the team improvised in developing the product versus strictly following the plan, and (3) the team improvised in commercializing this product versus strictly following the plan. Items were adapted from Moorman and Miner (1998b). The mean of these items was used as the variable. Reference: Moorman & Miner, 1998a & b
Moderating Factor	
Crisis	Three questions were asked to measure the perception level of crisis. Specifically, respondents were asked the level of crisis in within their organization, environment, and with their customers that their current project would help solve. Reference: Schein, 1993

Measure Validity & Reliability

Before testing the proposed model, the structure and reliability of the constructs were assessed. To measure each construct, a factor analysis was performed (on the items asked in the questionnaire) along with a varimax rotation method and Kaiser normalization to validate the number of constructs used as well as to confirm whether the items mentioned for each construct were indeed capturing their respective construct (Tabachnick & Fidell, 2001). After the extraction of components with an eigenvalue > 1.00, four variables remained explaining 78.6% of the variance. A loading factor value

of 0.5 and above in each component in the varimax rotated component matrix validated the items as acceptable measurements of the constructs.

Each variable in the model consisted of the average of the items in each component. To ensure the practicality of the measures, an Alpha reliability test was performed. All Cronbach's alphas (see Table 2) were above the minimum acceptable level of 0.7 as recommended by Nunally (1978).

Table 2: Measures and Reliability

Predictor Variable	No. Items	Mean	Standard Deviation	Alpha
Improvisation	3	5.56	2.21	0.76
Moderating Variable	No. Items	Mean	Standard Deviation	Alpha
Crisis	3	4.58	2.32	0.74
Dependent Variables	No. Items	Mean	Standard Deviation	Alpha
New Product Success	6	5.36	3.02	0.97
Speed To Market	4	5.44	2.64	0.85

RESULTS

To determine if a crisis can present an opportunity, positive bivariate correlations between *crisis* and each of the two outcomes must be found. The results presented in Table 3 illustrate that indeed there is a positive correlation between *crisis* and *improvisation*, thus supporting H1. The results also show that *crisis* significantly correlates with both *speed* and *success*, thus supporting both H2a & H2b. Also it is worth mentioning that *speed* was significantly related to *success*, which is consistent with past studies (Cooper & Kleinschmidt, 1994 & 1986).

Table 3: Bivariate Correlations (N = 55)

	New Product Success	Speed to Market	Crisis	Improvisation
New Product Success	1			
Speed to Market	0.568**	1		
Crisis	0.197*	0.360**	1	
Improvisation	0.011	0.041	0.294**	1

* p < 0.05; ** p < 0.01

Hypotheses 3a & 3b sought to assess the degree to which predictor variable *improvisation* along with *crisis* explained the variance of project outcomes *speed* and *success*. To find support for the final two hypotheses, two regression models were used to assess the fit of the model and the impact of the predictor variable on both *speed* and *success*. In each case, the first variable in the model included the predictor variable *improvisation*. The next variable in the model was the moderating variable *crisis*. The final variable in the model included a cross-product between *improvisation* and *crisis* to determine any interaction effect between the two variables. If so, the results would indicate that improvisation may be better in times of crisis than in times of stability.

Speed to Market

The variable *improvisation* was found to have a non-significant impact on *speed*. The squared correlation ($R^2 = 0.000$, $p < 0.979$) was not significantly different from zero. On the other hand, the variable *crisis* was found to have a significant impact on *speed* as the squared correlation ($R^2 = 0.157$, $p < 0.005$) was significantly different from zero. The final block in the regression results indicates that there is no significant interaction between *improvisation* and *crisis* ($R^2 = 0.161$, $\Delta R^2 = 0.004$, $p < 0.625$), thus demonstrating no support for H3a.

New Product Success

The variable *improvisation* was found to have a non-significant impact on *success*. The squared correlation ($R^2 = 0.001$, $p < 0.833$) was not significantly different from zero. The variable *crisis* was found to have a marginally significant impact on *success*. The squared correlation ($R^2 = 0.046$, $p < 0.063$) for *crisis* was partially significantly different from zero. The final block in the regression results indicates that

there is no significant interaction between *improvisation* and *crisis* ($R^2 = 0.05$, $\Delta R^2 = 0.004$, $p < 0.604$), thus demonstrating no support for H3b.

DISCUSSION & FUTURE RESEARCH

Through empirical examination of outcomes of NPD (speed & success), its proposed antecedent (improvisation), and moderator (crisis), this study demonstrates associations between these variables. Generally, the data support the propositions of this research. Significant relationships were confirmed between crisis and improvisation, as well as crisis and outcomes (both speed and success); however improvisation was not associated with positive outcomes of NPD. These findings increasingly confirm the theory that a crisis is not only something to avoid but can serve as an opportunity to shine and prosper.

The findings suggest openings for managers of NPD teams to promote beneficial outcomes of NPD. As with any effort to launch a product, active encouragement and involvement throughout the difficult time associated with a crisis is important. In times of crisis, levels of anxiety become elevated and NPD team members may hesitate and second-guess themselves. Therefore, management can be involved with the project to ensure that it is on track and tasks are executed proficiently. The fact that a crisis is positively associated with outcomes suggests that there are other factors that can influence the results of NPD.

The results also illustrate that while a crisis may lead to improvisation, this does not necessarily mean that team improvisation will have more of a significant impact on new product success under crisis conditions than not. This finding is surprising as crisis is defined as containing an element of surprise in the sense that it is not anticipated, yet it

is extremely threatening and requires an immediate response. On the other hand, the investigated sector for this study was limited to chemical based companies. The industries included petrochemicals, pharmaceuticals, and semiconductors – where due to potentially hazardous chemical exposure and strict quality control standards – improvisation may not be an option in developing a new product. Therefore, it can only be inferred that a crisis may lead the NPD team to improvise, however, the team performed other tasks associated with NPD that would lead to successful outcomes during a crisis.

The primary limitation of this study is that it considered the chemical sector; a sector that is more closely related to goods as opposed to services. The use of an improvisational approach may be more appropriate for new service associated products as reliability does not significantly affect the user's interface with the product. For future research, it is suggested to compare the chemical sector to a more service-based sector such as telecommunications or healthcare. If dissimilar results are found, then perhaps the use of improvisation throughout NPD should be limited to companies that provide services and not goods.

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