

Managing Stress In Product Development Projects

Jongbae Kim
David Wilemon
Bob Schultz, USA

Abstract

Recognizing the importance of effective new product development (NPD) management, many studies have explored the determinants of both successful and unsuccessful development projects. The project team and its members are an important factor affecting NPD performance. Few studies, however, have focused on factors affecting project team member performance. Stress is one factor that can affect NPD performance as well as the quality of one's life. In this paper, we examine project team member stress, its sources, and the impact of stress on project participants. We also examine stress across various development phases. Several suggestions for minimizing the adverse consequences of stress also are examined. This study is exploratory and is designed to establish a platform for future research.

Introduction

The heart of the new product development (NPD) process is the project team. Project team members are the people who perform the work of product development. Whereas the composition, group process (communication), and work organization of project teams have been relatively well studied (Brown and Eisenhardt, 1995; Zirger and Maidique, 1990), few studies have focused on the stress project teams face in carrying out their assignments. Stress in psychology and biology is defined as any strain or interference that disturbs the functioning of an organism. Stress can affect the performance of team members which in turn can impact a project team's performance.

The emphasis on stress in work settings is not new. Moreover, research interest in stress continues to increase because of the many detrimental effects that organizational and job-related practices may have on employees (Lapidus, Roberts, and Chonko, 1997). Project team members in NPD are confronted, in many cases, with stressful situations that require them to adapt to new or changing customer demands, technical uncertainties, organizational ambiguities, and various types of conflicts. Moreover, stress in NPD is expected to increase considering the shortening of product life cycles, technological advances, intensified competition, and rapidly changing customer needs. Understanding the sources and consequences of project member stress is important in the quest to improve development performance. However, while a number of NPD practitioners have alerted us to the need to manage stress, empirical investigations of this phenomena have been limited.

Study Objectives

Our central concern is to understand the stress that project team members face in an NPD context. For this purpose, we empirically investigated the sources and consequences of project members' stress. Specifically, the following issues will be addressed:

- Project member's stress level
- Sources of stress
- Impacts of stress on project participants
- Differences according to personal characteristics
- Stress across various development phases
- Actions that can reduce stress

Our study also advances several managerial suggestions as well as stress-related issues to be further researched in NPD.

Concepts in Occupational Stress

Before examining our empirical data, important concepts relating to stress are reviewed in this section. *Stress* is defined as “an adaptive response, moderated by individual differences, that is a consequence of any action, situation, or event, that places special demands on a person” (Ivancevich and Matteson, 1996). Perhaps the most important word in the definition is “special” since significant or unusual situations rather than day-to-day minor adjustments of life, usually produce stress (DeFrank and Ivancevich, 1999). It is important to note that there is substantial disagreement over the definition of stress. Scholars often have different definitions and abide by those explanations most suitable to the pursuit of their particular interests.

A. Role of Stressors

Stressors are external events or conditions that affect the organism (Breznitz and Goldberger, 1993) and are considered an antecedent conditions to the demand or opportunity that will require an adaptive response on the part of a worker (Boehr, Walsh, and Tabor, 1976). A variety of dissimilar situations – emotional arousal, effort, fatigue, pain, fear, concentration, humiliation, and even great and unexpected success – are capable of producing stress; hence, no single factor can, in itself, be pinpointed as the cause of the reaction as such (Selye, 1993). *Job stressors* are defined as job demands, constraints (or opportunities), and job-related events or situations that may affect an individual's role fulfillment (Parasuraman and Alutto, 1984).

B. Stress Outcomes

The reaction to a stressful situation is called an outcome, and a negative outcome is called a *strain*. Typically, strains have been aggregated into three categories (Jex and Boehr, 1991; Lapidus, Roberts, and Chonko, 1997) – psychological and emotional strains including depression, burnout,

frustration and anxiety; physical strains including headaches, stomach aches, and cardiovascular disease; and behavioral strains including absenteeism, turnover, smoking, drinking, and marital problems. It is generally believed that stress impairs performance, but evidence provided by field studies has been both sparse and mixed (Parasuraman and Alutto, 1984). The experience of stress does not invariably lead to deterioration. It may facilitate growth by tempering arrogance and by enhancing our tenderness toward ourselves and others (Haan, 1993).

C. The Study of Stress and Its Evolution

The field of ‘occupational stress’ has gone through four phases of development (Holt, 1993). The first phase was marked by efforts to find simple cause and effect relationships, largely of this type: stress → illness or even death. The second phase was marked by increasing differentiation of independent and dependent variables and of the cause-effect chain. The latter often was expressed in terms of explicit theories; for example, environmental stressors → perceived stress → strain → illness. The third phase according to Holt was signaled by the emergence of theories and designs in which interactions and moderator variables played an explicit role. Finally, in the emerging fourth phase, awareness of the complexity of the phenomena has resulted in multidisciplinary research and movement away from linear conceptions of cause and effects toward explanatory models influenced by system theories, incorporating various feedback loops.

Methodology

Our sample consisted of fifty-eight (58) project team participants involved in four product development teams. Three of the project teams were from the same company but represented three different strategic business units (SBUs). These three teams were involved in developing technology-based medical devices. The fourth team was involved in developing hardware components for the telecommunications market. Each team was approximately the same size and all major functional departments were represented on each team. All of the teams were managed by a matrix management approach. All the teams had recently completed a successful project. Success was determined by meeting profit and market share targets. Table 1 shows additional characteristics of our sample.

Table 1. Characteristics of the Sample (n=58)

<u>Years of Organizational Experiences</u>	
1 year or less	5.2%
2-5 years	12.1%
6-10 years	15.5%
11-19 years	43.1%
20 years or more	<u>24.1%</u>
	100.0%

<u>Age</u>	
20 to 29	7.1%
30 to 39	39.3%
40 to 49	26.8%
50 to 59	21.4%
60 or older	<u>5.4%</u>
	100.0%

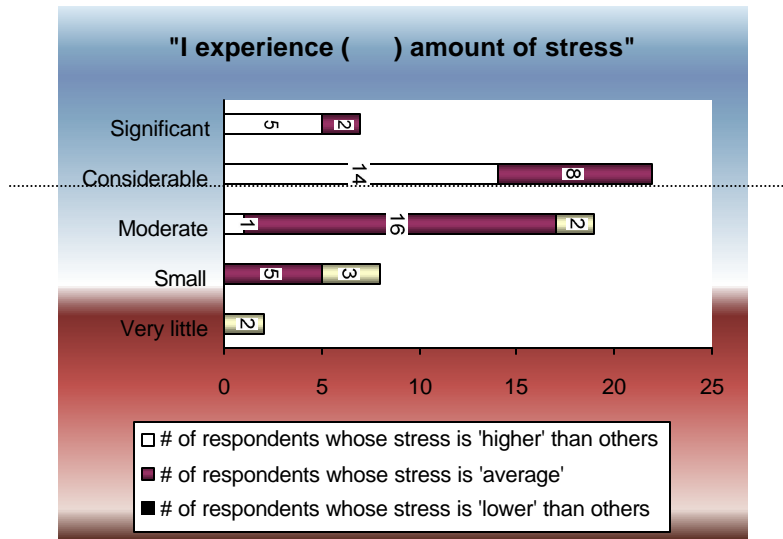
<u>Functional Area</u>	
Marketing	14.3%
R&D	14.3%
Manufacturing	33.9%
Engineering	28.6%
Others (e.g., Distri- Bution, Quality)	<u>8.9%</u>
	100.0%

Findings

A. How Much Stress Is Encountered?

In order that the issue of managing stress in NPD has meaning, the amount of the stress and the impact of stress on project performance needs to be considered. When asked how much stress is faced in carrying out his/her project work, fifty percent of the respondents said, “stress is more than moderate” (above the dotted line in Table 2). Thirty-five percent of the respondents also perceived their stress as higher than the stress of coworkers. The result shows that the portion of ‘higher than others’ increases as perceived stress level increases (correlation = .70, $P < 0.01$).

Table 2. Stress Levels Experienced (n=58)



In this paper, the stress faced reflects the stress encountered in an NPD context. It is, of course, difficult to completely separate job stress from other stresses. As Holt notes (1993): “People’s feelings about their work are highly overdetermined and almost always mixed (ambivalent), hence not easily ascertained by a few blunt, direct questions with precoded answers; work takes place in a multilayered social and cultural context in which many important and often conflicting values intersect; workers are also members of families (e.g., Grover, 1999), and of social, religious, recreational, political, educational, and other institutions, from which they derive a mixture of costs and benefits, of stress and support, interacting with their work lives in highly variable ways depending on the person, the occupation, and other factors.”

B. What Are the Major Determinants of Stress?

Identifying the causes of stress in NPD is necessary in order to manage stress. Since a project team is at the heart of the product-development process, the stress the project team member faces in carrying out work has diverse sources. For example, causes of stress in NPD are related to such factors as to what roles individuals perform on projects; with whom they work with (team members) in accomplishing their job; the organizational and work situations in which they perform their assignments; and, how the job is carried out. As to “whom they work with in accomplishing their job,” NPD is a multi-disciplinary process, therefore project team members work and interact with many kinds of functional specialists. Internally, they work with other project team members and the team leader, senior management, and other related functional workers. Externally, they often deal with several suppliers, channel members, customers, and in some cases regulators.

Based on our literature review and on our exploratory survey on the causes of the stress in technology-based companies, eighteen stressors related to NPD were developed (Table 3). All responses were obtained on a five-point strongly agree-strongly disagree scale.

Table 3. Major Determinants of Stress (n=58)

Stressors	Mean ^a /S.D. (% of “Doesn’t apply”)	Heavy Stressed Group	Low Stressed Group	T-Value
Lack of clear objectives	4.16/.70 (1.7%)	4.25	4.10	0.57
Poor internal communication among team or departmental members	4.15/.68 (6.9%)	4.27	3.78	1.69
Lack of adequate time (or unrealistic deadlines)	4.07/.75 (1.7%)	4.11	3.90	0.64
Lack of information to carry out my responsibilities	3.98/.76 (0.0%)	3.90	4.20	-1.07
Poor cooperation between departments	3.98/.76 (0.0%)	4.03	3.50	1.83 ^b
Failure of others to complete tasks/accept accountability	3.97/.84 (0.0%)	4.21	3.20	3.25 ^d
Lack of necessary resources	3.89/.82 (3.4%)	3.96	3.40	1.90 ^b
Lack of senior management support	3.82/.95 (1.7%)	3.89	3.60	0.81
Work overload	3.70/1.14 (6.9%)	4.18	2.38	4.50 ^d
Changes occurring during a project	3.55/.91 (3.4%)	3.69	3.00	2.06 ^c
Personality conflicts with supervisor/team leader	3.47/1.31 (15.5%)	4.08	2.50	3.20 ^d
Disagreements about task-oriented issues with other team	3.44/.96 (10.3%)	3.59	2.88	1.72 ^b

members				
Personality conflicts with other team members	3.42/1.18 (1.7%)	3.75	2.88	2.01 ^c
Participating in multiple projects	3.42/1.24 (1.7%)	3.72	2.40	2.93 ^d
Disagreements about task-oriented issues with supervisor/team leader	3.32/.89 (13.8%)	3.61	2.50	3.18 ^d
Challenging task assignments where solutions are not known	3.24/1.05 (5.2%)	3.21	2.63	1.29

^a On a 5-point scale where 5 = strongly agree and 1 = strongly disagree.

^b $P < 0.1$. ^c $P < 0.05$. ^d $P < 0.01$.

Sources of stress are found to have different impacts. ‘Lack of clear objectives,’ ‘poor internal communication among team or departmental members,’ and ‘lack of adequate time’ were found to be the most important stressors. Among them, ‘lack of clear objectives’ has already been identified as one of the important job stressors in other stress-related studies (e.g., Jamal, 1984).

Table 3 shows that these stressors are differently perceived between the ‘heavy stressed group’ (respondents with more than moderate stress) and the ‘low stressed group’ (respondents with less than moderate stress). ‘Work overload’ is significantly higher for the ‘heavy stressed group’. Research indicates that individuals with heavy workloads often report high levels of anxiety, frustration, fatigue, and job dissatisfaction. These stress outcomes can adversely impact job performance and involvement as well as increase turnover intention (Boehr, Walsh and Tabor, 1976; Spector, Dwyer, and Jex 1988).

Stressors can be grouped according to similar characteristics. For example, one respondent remarked, “participating on projects is stressful since I have multiple project responsibilities, and have conflicting priorities.” The stressors in our study are broadly divided into four groups by factor analysis: ① **teamwork-related stressors** (Eigenvalue 4.75, Percent of variance 29.7%), consisting of personality conflicts with supervisor/team leader, other team members, disagreements about task-oriented issues with other team members, supervisor/team leader, and failure of others to complete tasks/accept accountability; ② **workload-related stressors** (Eigenvalue 2.21, Percent of variance 13.8%), consisting of participating on multiple projects, work overload, changes during a project, lack of clear objectives, and lack of adequate time (or unrealistic deadlines); ③ **information-related stressors** (Eigenvalue 1.98, Percent of variance 12.4%), consisting of lack of information to carry out

my responsibilities, poor internal communication among team or departmental members, and poor cooperation between departments; and ④ **support-related stressors** (Eigenvalue 1.37, Percent of variance 8.5%), consisting of lack of senior management support, lack of necessary resources, and challenging task assignments where solutions are not known. In order to find what factors are more influential on the stress level, multiple regression was used. The regression equation explained 35.4% of the variance in the degree of stress level (F-Value=5.473, $P < 0.01$). The regression result showed that teamwork-related stressors (Beta=.433, $P < 0.01$), workload-related stressors (Beta=.308, $P < 0.05$), support-related stressors (Beta=.252, $P < 0.05$) significantly affect stress levels.

In addition to the stressors examined by our questionnaire, respondents provided interesting insights (via open-ended questions) into the factors that promoted stress in product development projects. These are *excessive paperwork, meeting schedules, unrealistic goals, pressures from customers, and working with others who's ability did not meet project requirements*. These supplementary stressors provide valuable additional insight into stress in product development projects.

C. *Is Work Performance Affected by Stress?*

One reason to manage project member stress is the potential relationship between stress and work performance. For this verification, it is necessary to measure the impact of stress on work performance. Some stress impacts occur instantly and are thus easily observed. Others occur later, which can even affect performance in subsequent projects. Moreover, work performance can, of course, be determined by factors other than stress.

When asked to what extent stress adversely affects work performance, sixty-nine percent (69%) of the respondents said “stress affects performance to some or great extent” (the shaded area in Table 4). The significant correlation with ‘stress level’ implies that the more stress one faces, the more it impacts perceived work performance.

Table 4. Stress and Performance

Impact of Stress on Performance	Percentage	Correlation with Stress Level
Very great extent	5 (8.6%)	.641 ^a
Great extent	11 (19.0%)	
Some extent	24 (41.4%)	
Small extent	16 (27.6%)	
Not at all	2 (3.4%)	
	100%	

^a $P < 0.01$.

To determine how work performance is impacted by stress, respondents were asked how stress affects their works. Responses are grouped under several categories:

Time Impacts

- “Causes me to hurry – thus mistakes happen”
- “Creates lost time”
- “Slows productivity”

Performance Impacts

- “Distracts from assigned tasks and affects concentration e.g., limits my creativity”
- “Affects decision-making”
- “Results in unfinished tasks”

Interpersonal Relationships

Several respondents noted that stress makes them irritable and less cooperative.

Other Impacts

There are other impacts on project participants such as “burn-out”, negative attitudes toward work, nervousness, depression, and anxiety.

These findings illustrate that stress impacts project member’s energy and concentration, which in turn affects their willingness to cooperate with project team members. Thus, individual stress can impact not only on a team member’s work performance by delaying time and degrading the quality of work, but also relations with co-workers, both can affect the team’s overall performance.

D. Are There Individual Differences in the Relationships between Stress Level and Its Impact?

An important and fairly recent development in occupational stress, resulting from more sophisticated research designs, is the explicit introduction of moderating variables. Holt (1993) categorized moderator variables into physiological, characteristics of individuals, situational, organizational, and sociological variables. As to characteristics of individuals, such variables as age, sex, ethnicity, attachment to the organization, stage of life, work values, self-esteem, flexibility-rigidity, and Type A (versus Type B) behavior pattern have been studied.

Beehr and Newman (1978) emphasized the role of personal characteristics in influencing both the focal person’s perceptions of stressors as well as reactions to them. The study of individual differences is a rapidly growing branch of stress research (Breznitz and Goldberger, 1993). It is recognized that specific situations are not in themselves “stressful,” but they may be so, depending on how individuals “receive” the demand and the meaning that they attribute to the situation (Parasuraman and Alutto, 1984). Thus, the existence of the same stressor may have different impacts according to age, sex, organizational level, and organizational commitment since there are individual differences in receiving, perceiving and responding to stress.

In this paper we investigate the differences by individual characteristics – ‘years of organization experiences’. To find moderating effects of the organization experience, a correlation difference test was performed. As seen in Table 5, due to small samples (n=58), the correlation between stress level and the impact of stress is not significantly different according to respondent’s years of organizational

experiences. However, the relationship between stress level and stress impact is found to be higher in ‘more than 10 year organization experience group’ than in ‘10 or less year group.’ This finding implies that ‘years of organizational experiences’ may moderate the relationship between stress level and stress impacts.

Table 5. Correlation Differences by Organizational Experience

Years of organization experiences	Less than or equal to 10 years	More than 10 years
Frequency (Percentage)	19 (32.8%)	39 (67.2%)
Stress Levels Experienced	3.42	3.41
Impact of Stress on Performance	2.95	3.05
Correlation of stress level and stress impacts	.503	.727
Z-value (Significance)	1.228 ^a (n.s.)	

$${}^a Z = \frac{Z_{r1} - Z_{r2}}{\sqrt{\frac{1}{N_1 - 3} + \frac{1}{N_2 - 3}}} \quad \text{where } Z_{r1} = \left(\frac{1}{2}\right) \ln \left(\frac{1+r_1}{1-r_1}\right)$$

$$Z_{r2} = \left(\frac{1}{2}\right) \ln \left(\frac{1+r_2}{1-r_2}\right)$$

E. Does Stress at Each Development Phase Differ?

Most-difficult-to-accomplish NPD activities are as follows (Gupta and Wilemon, 1990); assessing market potential, market testing, finalizing the product design, making the transition from R&D to manufacturing, managing manufacturing/marketing/R&D interface, and developing the business plan. Thus, stress encountered at each development phase may differ as activities in each development phase may be different, for example, quantity and quality of problems to solve, decision-making processes, information to process, and relationships to maintain can also vary with specific NPD phases.

To find the differences, we divide the NPD process into four phases: **Formation** - the project is just getting started, **Build-Up** - actual work on the project is being performed, e.g., building prototypes, **Main** - most of the actual project work occurs here, and **Phase Out** - the project comes to closure. The knowledge about stress in the NPD process is meaningful in that the findings will be useful in determining answers regarding: 1) what processes are most difficult and stressful and thus need management attention? 2) What makes each phase stressful? Stress level at each development phase and its stressors are shown in Table 6 & 7.

Table 6. Stress Level at Each Development Phase

Stress Level	NPD Phases			
	Formation →	Build-Up →	Main →	Phase Out
⑤ Very great extent	12.1%	6.9%	22.4%	10.3%

④ Great extent	15.5%	25.9%	34.5%	19.0%
③ Some extent	27.6%	36.2%	22.4%	24.1%
② Small extent	22.4%	24.1%	15.5%	17.2%
① Not at all	22.4%	6.9%	5.2%	29.3%

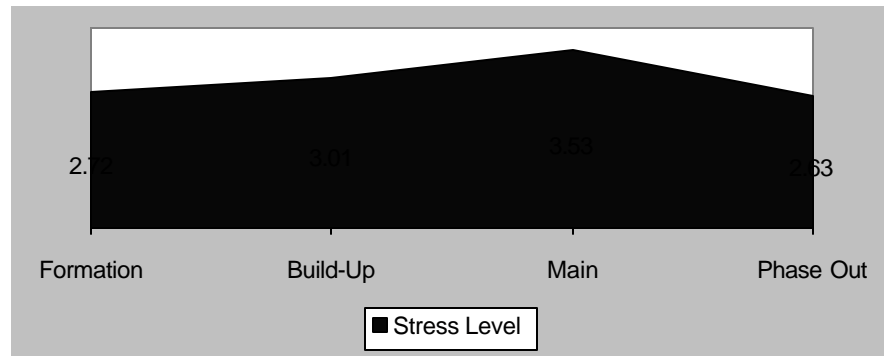


Table 7. Examples of Stressors in Each Development Phase

Formation Stressors	Build-Up Stressors	Main Stressors	Phase Out Stressors
<ul style="list-style-type: none"> Creating a plan Gaining committed team members Defining roles and responsibilities Lack of clear goals Scheduling Dealing with a lack of information Lack of resources 	<ul style="list-style-type: none"> Gaining cooperation between members and getting the team on track Communicating with other departments and getting agreement from the entire group Unforeseen problems Lack of authority/resources Completing tasks on time 	<ul style="list-style-type: none"> Lack of authority/resources/support Making sure all team members have done their job and maintaining the energy of the team Fire-fighting Documenting Focus on <u>all</u> issues Keeping team on track and maintaining the schedule Getting agreement from the entire group 	<ul style="list-style-type: none"> Lingering doubts (e.g., “will the project be successful?”) Making sure everything is complete Keeping key people involved Meeting deadlines Making sure the project meets objectives Documentation Evaluation of the project, lack of recognition What will be next?

It is found that stress levels are significantly different between phases (F-Value=6.362, $P < 0.01$) and, among four phases, ‘main phase’ is found to be the most stressful phase in NPD. We also found that stressors in each phase differ.

F. What Methods Are Used to Manage Stress?

One who faces stress often attempts to find ways to lessen his/her stress. Those team members possessing more effective methods to cope would face less stress, and his/her work performance would be less affected by the impact of stress. Thus, developing effective methods to cope with stress and evaluating their effectiveness is an important area to research. As seen in Table 3, stress of project members comes from various sources, which implies that all the stressors may not be handled by one general method. When asked what they have found helpful in managing their stress, the following were noted (cf. no-response rates=24%):

First, 'time away from the project/work'

- "Move to different projects (tasks) and then return to the stressful project"
- "Leave the stressful environment temporarily" e.g., vacation
- "Off-site activities" e.g., recreational activities
- "Exercise and computer games"
-

Second, 'confront the stress'

- "Complete the stressful project"
- "Focus on one project at a time"
- "Perform my responsibilities to the best of my capabilities"
- "Solve the problems that create stress"
- "Complain to management"
- "Group meetings – expressing concerns and problems, getting help from co-workers"
-

Third, other methods:

- "Take each day as it comes"
- "Sit back and let people fall on their own sword"
- "Let responsibility for problems stay with the originator"
- "Try not to take things too seriously - bring humor to the task"
- "Time to alternate between projects when 'at the end of my rope'"
- "Rely on my own experiences – most things that come up are not new"
- "Control yourself and your perspectives"
- "Family"

Implications

Our research has several practical implications for organizations and senior management who want to improve the performance of their NPD teams.

A. Check stress levels and stress causes regularly

It can be helpful to measure project team member stress regularly, as well as to identify the causes of stress and monitor changes in stress levels. The information is helpful in preventing further stress and in developing action plans for improving work performance. Thus, companies need to develop suitable research programs (e.g. ‘Workplace Stress Audit’ - DeFrank and Ivancevich, 1999) and accumulate data on stress over a period of time. These cumulative efforts can help prevent project participants from facing similar stressors in the future.

B. Senior management needs to consider the impact of project member stress

Project member stress deserves organizational attention. Moreover, when stress cannot be solved by individual effort it will need company-level considerations. Based on our findings about stressors, some stressors are (partly) related to senior management, for example ‘lack of senior management support’ and ‘lack of resources’. Thus, senior management can be a major source of stress as well as a major actor in alleviating some of the pressure from the projects. Senior management also can help minimize stress in several positive ways, for example, realistic time schedules, prioritization, clarification/vision, and fairness in treatment and reward. Even when senior management’s efforts cannot solve the problems of stress, their visible involvement may increase the level of motivation of project team members.

C. Find suitable methods to manage stress

People cannot eliminate stress in their work as it is part of one’s work life. Thus, what distinguish successful projects is not the absence or presence of stress, but rather how it is managed. When preparing suitable methods to manage stress, the following factors need to be considered:

- Though similar symptoms can be observed, stress “management” may require different methods. For example, stress from one’s workload can be different from “people stress” as these workload stressors often disappear with the end of a project, but interpersonal-related stressors can remain after the end of a project. Thus, one should not overlook its causes while developing methods to manage stress.
- If stressors are likely to disappear as time passes, then ‘time away from my project/work’ can be an effective and efficient way. However, if stressors are not likely to disappear until its sources are handled, then ‘confronting the stress’ may be the only effective method. Thus, when choosing methods to cope with stress, each method’s strengths and limitations need to be considered.
-

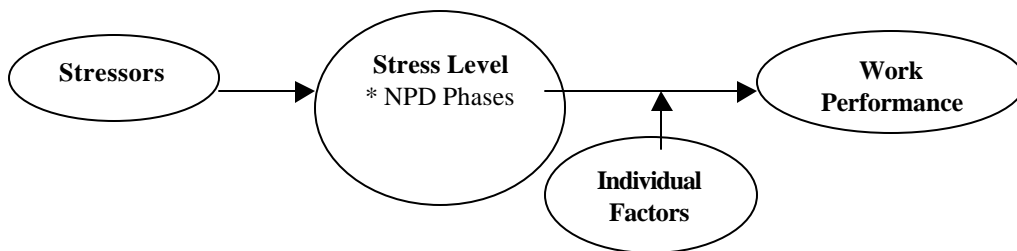
D. Each NPD phase can present different challenges.

Developing new products is a multi-stage process and its difficulties and challenges vary along each NPD phase. We find that each phase has a different stress level and a different mix of stressors. Thus, it is important to be aware of the type of stressors likely to occur in each development phase. Effective handling of stress in each phase has the potential to help accelerate the NPD process as well as produce higher performance.

Further Research Directions

A tentative conceptual framework derived from our findings is depicted in Figure 1. Stress is caused by various factors which are grouped into teamwork-related, workload-related, information-related, and support-related stressors. Half the respondents' stress level is found to be more than moderate. Respondents with different stress levels perceive different impacts of stressors. Stress level and stressors also are different in each NPD phase. As noted, stress level impacts work performance, its impacts on project participants are varied. Moreover, the relationships between stress level and stress impacts can be moderated by individual factors.

Figure 1. Stress Relationships Examined in This Study



An exploratory study of this nature often raises additional questions. We develop several issues needing further exploration, based on Figure 1:

- What are the best ways to measure stress?

Finding suitable methods for measuring stress is important, since reliable empirical data on stress in NPD is the first step toward its systematic management. Relatedly, the following question also should be considered. When is the best time to measure stress – in the middle of the project, at the end of the project, or periodically as the project progresses? One of the problems of post hoc research is that respondents might tend to underestimate their stress level in the case of a successful project, but overestimate it in the case of a failure project.

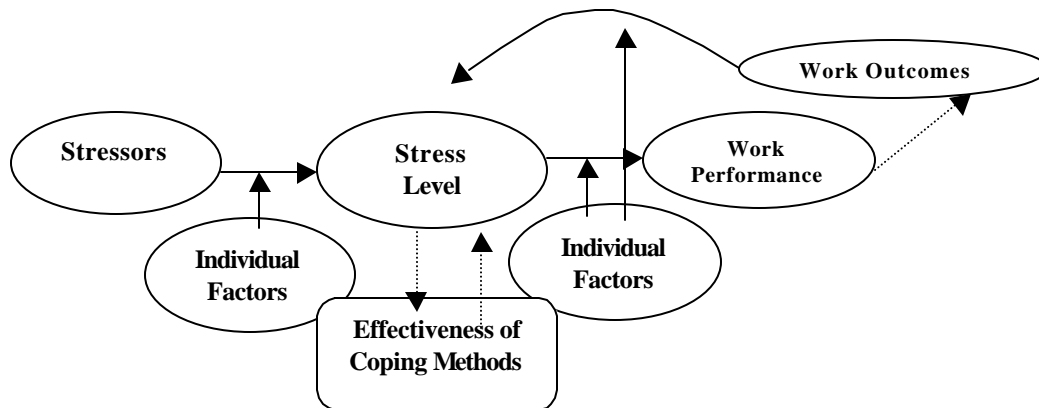
- What sources of stress exist in NPD?

The description of stressors and their impact on behavior is an open-ended task and current research considers an increasing number of events and conditions to be stressors. Most of this effort is still in the qualitative domain (Breznitz and Goldberger, 1993). Stressors are different according to the specific situation and time. For example, differences exist across firms, industries, and nations and they can vary with time. Moreover, in an accelerated world, the pressure to speed-up development projects will lead to higher stress (Millson, Raj and Wilemon, 1992). Knowledge of these differences can help develop suitable methods for different situations as well as determine what problems may occur in the NPD process. Thus, various comparative investigations of stressors in NPD are needed. Thus, sources of stress relevant to NPD contexts should be considered and developed.

- What relationships exist between stressors, stress, and work performance?

The knowledge of these relationships would be helpful in finding methods to effectively manage stress. There also are many other possible relationships, which are not depicted in Figure 1. There can be, for example, potential feedback impacts of work performance on stress level. Moreover, interactions between stressors and the time lag in stress outcomes can be an important issue. More accurate measurements and diverse relations (e.g., Figure 2) need to be considered in future research.

Figure 2. Extended Relationships on Stress



- What factors (e.g., personal characteristics) moderate those relationships?
To develop suitable methods for different participants, it is necessary to identify meaningful moderating variables and to find moderating effects. As seen in Figure 1, moderating variables influence the relationship between stress and work performance. They also can moderate other relationships such as between stressors and stress (Figure 2).
- What coping methods are most suitable?
Stress level is related to stressors, but it is also correlated to the efficiency of one's coping methods. It is thus important to note that some coping methods that are effective on certain situations will not work in other situations.
- What differences exist in the stress sources and levels between the project team members, leader, and senior management?
- What differences exist in the stress sources and levels according project characteristics e.g., an advanced high technology project versus a derivative project?

Summary

Our small sample of 58 individuals from two industries reduces our ability to generalize findings. However, our findings can be used to benchmark future empirical researches. We suggest that the competency in managing stress in product development projects can result in an important competitive advantage for most any company relying on a continuous flow development projects. Understanding project member stress is sure to be an important element for managing NPD process successfully. We plan to pursue additional empirical research into this area and hope others will join us.

References

- Beehr, T. A. and Newman, J. E. (1978), "Job Stress, Employee Health, and Organizational Effectiveness: A Facet Analysis, Model, and Literature Review", *Personnel Psychology*, 31, 665-699.
- Boehr, T. A., Walsh, J. T. and Tabor, T. D. (1976), "Relationships of Stress to Individually and Organizationally Valued States: Higher Order Needs as a Moderator", *Journal of Applied Psychology*, 61, 41-47.
- Breznitz, S. and Goldberger, L. (1993), "Stress Research at a Crossroads", In L. Goldberger and S. Breznitz (2nd ed.), *Handbook of Stress: Theoretical and Clinical Aspects*, The Free Press, 3-6.
- Brown, S. L. and Eisenhardt, K. M. (1995), "Produce Development: Past Research, Present Findings, and Future Directions", *Academy of Management Review*, 20(2), 343-378.
- DeFrank, R. and Ivancevich, J. M. (1999), "Stress on the Job: An Executive Update", *IEEE Engineering Management Review*, 27(3), 31-41.
- Grover, Mary Beth (1999), "Daddy Stress", *Forbes*, 202-208 (September 6).
- Gupta, A. K. and Wilemon, D. (1990), "Accelerating the Development of Technology-Based New Products", *California Management Review*, 32(2), 24-44.
- Haan, N. (1993), "The Assessment of Coping, Defense, and Stress," In L. Goldberger and S. Breznitz (2nd ed.), *Handbook of Stress: Theoretical and Clinical Aspects* (1993), The Free Press, 258-273.
- Holt, R. R. (1993), "Occupational Stress," In L. Goldberger and S. Breznitz (2nd ed.), *Handbook of Stress: Theoretical and Clinical Aspects* (1993), The Free Press, 342-367.
- Ivancevich, J. M. and Matteson, M. T. (1996), *Organizational Behavior and Management* (4th Ed.), Chicago: Irwin.
- Jamal, M. (1984), "Job Stress and Job Performance Controversy: An Empirical Assessment", *Organizational Behavior and Human Performance*, 33, 1-21.
- Jex, S. M. and Boehr, T. A. (1991), "Emerging Theoretical and Methodological Issues in the Study of Work-Related Stress," in *Research in Personnel and Human Resources Management*, Vol. 9, Kendrith M. Rowland and Gerald R. Ferris, eds., JAI Press Inc., Greenwich, CT, 311-365.
- Lapidus, R. S., Roberts, J. A. and Chonko, L. B. (1997), "Stressors, Leadership Substitutes, and Relations with Supervisions among Industrial Salespeople", *Industrial Marketing Management*, 26, 255-269.

Lysonski, S. (1985), "A Boundary Theory Investigation of the Product Manager's Role", *Journal of Marketing*, 49(1), 26-40.

Millson, M. R., Raj, S. P. and Wilemon, D. (1992), "A Survey of Major Approaches for Accelerating New Product Development", *Journal of Product Innovation Management*, 9(1), 53-69.

Parasuraman, S. and Alutto, J. A. (1984), "Sources and Outcomes of Stress in Organizational Settings: Toward the Development of a Structural Model", *Academy of Management Journal*, 27(2), 330-350.

Selye, H. (1993), "History of the Stress Concept," In L. Goldberger and S. Breznitz (2nd ed.), *Handbook of Stress: Theoretical and Clinical Aspects* (1993), The Free Press, 7-17.

Spector, P. E., Dwyer, D. J. and Jex, S. M. (1988), "Relations of Job Stressors to Affective, Health, and Performance Outcomes: A Comparison of Multiple Data Sources", *Journal of Applied Psychology*, 73, 11-19.

Zirger, B. J. and Maidique, M. (1990), "A Model of New Product Development: An Empirical Test", *Management Science*, 36, 867-883.

Title: Managing Stress In Product Development Projects

Jongbae Kim

David Wilemon

Bob Schultz, USA