FOSTERING CREATIVE PROBLEM SOLVING AMONG SOFTWARE DEVELOPMENT TEAMS

Dr. P.S. Manjula
Director in the Department of Management Studies,
Veltech Multitech
Chennai.
and
Dr. Rangarajan
Dr. Sakunthala Engineering College,
Chennai.

Introduction

In most organizations today, Information Technology (IT) is a critical component in their strategic and operating plans. There is a growing reliance on IT to support all aspects of organizational work. The new era of digital economy is being shaped not only by the development and diffusion of computerization, but also by much cheaper and rapidly increasing electronic connectivity. The advent of the internet and e-commerce in particular is helping business enterprises to expand across national and geographic boundaries with more ease and speed. The surge in IT and its application has led to an unprecedented increase in the demand for an IT workforce in IT development companies as well as in IT occupations in other industries. The spread of networked computers, the internet and the associated growing demand for high-quality digitized products and services have all resulted in an increase in demand for Information Systems (IS) professionals. Jobs in the IT industry, witnessed a steady rise from 1995 onwards. Software development cycle of projects facilitate team based work in the IT industry.

Software Development Teams

Teams are unquestionably an important factor in the success of most software projects. Today, the software development team composition is more cross functional and multidisciplinary.

Carmel and Bird (1997) define a team as an organizational work unit with a clearly defined task and a high degree of interdependence and intra communication among its members. It has been very aptly pointed out by Chesebrough and Davis (1983) that Information Systems work is changing to more complex group-oriented tasks. Today, because of increasing scale, software development activity invariably exceeds the capacity of an individual, and is hence carried out in project teams (Carmel, 1999; Curtis *et al.,* 1988). Thus a typical software developer today spends 70% of his or her time working with others in teams (DeMarco and Lister, 1999).

Weinberg (1971) observes that a software project is a group of programmers and their supporting activities, which have been brought together for the purpose of producing a single integrated system that usually, comprise a closely knit collection of programs. Members of such a software project are collectively known as project team. In large projects, several teams must integrate their work on different parts of the system, and inter team group dynamics are added on top of intra team group dynamics. Projects must be aligned with company goals and are affected by corporate politics, culture, and procedures (Curtis *et al.,* 1988).

It is well accepted that software development is a knowledge intensive activity requiring the collective and collaborative efforts of team members. Team members who have diverse skills, experience and expertise have to share knowledge among them, to enable to meet delivery schedules. There is a need for the IS personnel to co-operate, coordinate, communicate effectively and have clarity of goal in order to optimize the gains.

Creative Problem Solving in Software Development Teams

Problem solving demands represents the amount of active cognitive processing required to carry out a job (Beehr *et al.,* 2001).This corresponds quite well with Karasek and Theorell's (1990) conceptualization of demands as a task's mental workload, or mental alertness needed to carry out the task. Deep thinking and searching for solutions is often required in the software development process. Software development process requires problem-solving (Beirne, Ramsay and Panteli, 1998) and is therefore often described as a problem-solving activity (Curtis *et al.,* 1988).

A software solution is embedded in a cultural matrix of applications, users, laws, market dynamics and hardware technology and in order to solve business problems, the software solution needs to conform to myriad technical and human interfaces. All these change continuously, resulting in a state of flux both in software technology and in the solution being developed (Brooks, 1987). Thus the development process requires not only pooling of information from various sources, but also constant problem solving efforts.

Understanding the requirement of a software development is often an iterative process that the entire team needs to be engaged in; even long after the development process has already begun. All these imply that a software problem can neither be fully defined, nor can the cognitive approach required to solve the same be clearly specified (Visser and Hoc, 1990). IS personnel are often confronted with project requirements which are totally new to them and have not worked on before. Such a new project may need the IS personnel to not only rely on constant learning and relearning, but also increased efforts for its accomplishment. In order to meet these challenges at work the IS personnel may require to use Creative Problem Solving (CPS).

CPS is a methodological framework to assist problem solvers with using creativity to achieve goals, overcome obstacles, and increase the likelihood of enhancing creative performance (Isaksen and Lauer, 1999). Therefore, its main characteristics includes a general framework consisting of a model of the overall process, its three main components (Understanding the problem, Generating Ideas, and Planning for Action) and its six specific stages (Mess finding, Data finding, Problem finding, Idea finding, Solution finding and Acceptance finding). A plethora of research studies have linked climate to creativity (Talbot, Cooper and Barrow, 1992; Turnipseed, 1994). Organizational climate conducive to innovation and growth is of prime interest to any organization looking for inclusive growth and sustainability. Ekvall (1991) has differentiated the concepts of climate and culture. Ekvall (1991) defined climate as the observed and recurring patterns of behaviour, attitudes, and feelings that characterize life in the organization. Culture reflects the deeper foundations of the organization. Culture includes values, beliefs, history and traditions. According to this distinction, culture provides the foundation for patterns of behaviour that are more readily observed, described, and changed.

These patterns of observed behaviour along with many other variables (e.g., management, leadership, organizational size and structure) help to establish the climate within the organization.

Software Development Team Characteristics Fostering Creative Problem Solving

Similar to how a good leadership approach, a conducive organizational climate and positive culture play a vital role in fostering creativity in teams, certain team characteristics also have a major influence in the creative problem solving ability of teams. The following team characteristics are found to encourage creative problem solving in software development team.

Challenge and Involvement: The extent to which teams are given opportunities to get involved in the daily operations, long-term goals, and visions of the organization is termed as challenge and involvement. When there is a high degree of challenge and involvement team members feel motivated, energized, and committed to making contributions. The climate is dynamic, electric, and inspiring. Team members find their work to be personally fulfilling and meaningful to their team and organization. In the opposite situation, team members are not engaged and feelings of alienation and apathy are present. The team lacks direction, members lack interest in their work and interpersonal and intra team interactions are dull or poor.

Freedom: It refers to the degree that teams can take initiatives or are at liberty to act without constantly referring to higher authorities or 'rule books' for decisions. The team members exhibit independence in behaviour and the team is given the autonomy and resources to define much of their work. Team members are provided the opportunities and take initiatives to acquire and share information about their work. In the opposite climate teams work within strict guidelines and are not allowed taking initiative. Team members carry out their work in prescribed ways with little room to redefine their tasks.

Trust and openness: It refers to the degree of emotional safety in relationships. When there is a high degree of trust, team members trust one another and feel 'safe' enough to be open and honest with their colleagues, in the spirit of constructive relationships. Team members are genuinely open and frank with one another. They count on each other for professional and personal support. Team members have a sincere respect for one another and give credit where credit is due. Where trust is missing, team members are suspicious of each other, and therefore, they closely guard themselves, their plans, and their ideas. In these situations team members find it extremely difficult to openly communicate with each other and function as a team.

Idea time: Idea time refers to the time the team takes off to generate new ideas or consider the merits of existing ideas and opportunities. In the high idea-time situation, possibilities exist to discuss and test suggestions not included in the task assignment. There also are opportunities to take the time to explore and develop new ideas. Flexible timelines permit team members to explore new avenues and alternatives. In the reverse case, every minute is booked and specified. The time pressure makes thinking outside the instructions and planned routines impossible.

Playfulness and humour: It refers to the amount of spontaneity and levity displayed within the team. A professional, yet relaxed atmosphere where good-natured jokes and laughter occur often is indicative of this dimension. Team members can be seen having fun within the team and at work. The climate is seen as easy-going and light-hearted. The opposite climate is characterized by gravity and seriousness within the team. The atmosphere is stiff, gloomy and cumbrous. Jokes and laughter are regarded as improper and intolerable.

Minimal Conflicts: Organizational units with high levels of diversity are suited to complex tasks (Pelled, 1996), such as IS development (Borovits, Ellis and Yeheskel, 1990; Parker, 1994). One characteristic of such IS development teams is the existence of conflict because they frequently contain sets of members with different organizational perspectives. The climate in these teams is therefore ripe for the development of conflict (Parker, 1994; Pelled, 1996). Conflict has been identified as a risk factor in software development.

IS development is negatively impacted by conflict and positively influenced by conflict resolution (Robey, Smith and Vijayasarathy, 1993). Conflict leads to the presence of personal and emotional tensions within the team and between team members. When the level of conflict is high, team members dislike and may even hate each other. The climate can be characterized by "interpersonal warfare." Plots, traps, power and territory struggles are usual elements of team functioning. Personal differences yield gossip and slander. In the opposite case, team members behave in a more mature manner; they have psychological insight and control of impulses. The team welcomes, accepts and deals effectively with diversity. Low levels of conflicts are therefore essential to foster creative problem solving environment within team.

Idea Support: It refers to the ways new ideas are considered, taken up or advocated by the team. In the supportive climate, ideas and suggestions are received in an attentive and professional way by team-mates. They listen to each other and encourage initiatives. Possibilities for trying out new ideas are created within the team. The team atmosphere is constructive and positive when considering new ideas. When idea support is low, the automatic "no" is prevailing within the team. Fault-finding and obstacle-raising are the usual styles of responding to ideas.

Constructive Debate: This is the occurrence of encounters and disagreements between viewpoints, ideas, and differing experiences and knowledge within the team. While conflict relates to personal tension debate is related to idea-tension. In the debating team all the voices of team members are heard and they are keen on putting forward their ideas for consideration, and their merits are openly debated and resolutions reached. Where debate is missing, team members follow authoritarian patterns and procedures without questioning them or exploring alternatives.

Risk-Taking: This refers to the degree to which the team can tolerate ambiguity and make decisions with some uncertainty. Team members are prepared to live with the potential negative consequences. In the high risk-taking case, teams take bold initiatives even when the outcomes are unknown. Teams and team members feel as though they can "take a gamble" on ideas.

They will often "go out on a limb" to put an idea forward. In a risk-avoiding climate there is a cautious, hesitant mentality within the team. Team members will lack decisiveness, try to be on the "safe side" and often "sleep on the matter." They may set up committees, defer decisions to other teams, and cover themselves in many ways.

Fertile Ground for Knowledge Sharing: Knowledge sharing is a set of behaviour that involves the exchange of information or assistance to others. It is separate from information sharing, which typically involves management making information about the organization (eg. Financial statements) available to employees at every level (Connelley and Kelloway, 2003). Knowledge sharing is defined as the process where individuals mutually exchange their knowledge and jointly create new knowledge (Hoof and Ridder, 2004). Bartol and Srivastava (2002) defined knowledge sharing as individuals sharing organizationally relevant information, ideas, suggestions, and expertise with one another. Connelly and Kelloway (2003) further indicated that knowledge sharing is a set of behaviours that involve the exchange of information or assistance to others. A fertile ground that encourages knowledge sharing among the team members also fosters creative problem solving in team as team members try to find out apt solutions by pooling their knowledge and creating new knowledge that can help solve the problem in hand.

Conclusion

The potential benefits of teams have perhaps forced software companies to address the issue of how best to create and develop a well knitted team that integrates and supports its people, systems and technology. Creative Problem Solving ability is about survival in a new business world- a world of competition that increases in complexity and uncertainty each day. For a software company creative problem solving can ensure better solutions to problems. IT companies should align its human resource strategies, practices and processes in such a way that creative problem solving becomes a part of the team culture. Efforts should be made to overcome the potential barriers to creative problem solving within teams in IT companies. The team characteristics that foster creative problem solving within team should be encouraged among team so as to reap its benefits. The dimensions presented in this conceptual paper also pave way for future empirical study and testing.

References

Bartol, K. & Srivastava, A. (2002). Encouraging knowledge sharing: the role of organizational reward systems, *Journal of Leadership and Organizational Studies*, 9(1),64-76.

Beehr, T. A., Glaser, K. M., Canali, K. G., & Wallwey, D. A. (2001). Back to basics: Re-examination
of Demand-Control Theory of occupational stress. *Work & Stress*, 15(2), 115-130.

Beirne, M., Ramsay, H., & Panteli, A. (1998). Developments in computing work:control and contradiction in the software labour process. In P. Thompson & C. Warhurst (Eds.), *Workplaces of the Future*. London: MacMillan.

Borovits, I., Ellis, S., & Yeheskel, O. (1990). Group processes and development of information systems: A social psychological perspective. *Information and Management*, 19(2), 65-72.

Brooks, F. P. (1987). No Silver Bullet: Essence and Accidents of Software Engineering, *Computer*: April, 10-19.

Carmel, E. (1999). *Global software teams: Collaborating across borders and time zones*. NJ: Prentice Hall.

Carmel, E. & Bird, B. J. (1997). Small is beautiful: a study of packaged software development teams. *The Journal of High Technology Management Research*, 8(1), 129-148.

Chesebrough, H. & Davis, G. (1983). Planning a Career in Information Systems. *Journal of Systems Management*, 12(2), 6-12.

Connelly, C.E. & Kelloway, E.K. (2003). Predictors of employees' perceptions of knowledge sharing cultures, *Leadership & Organization Development Journal*, 24(3), 294-301.

Curtis, B., Krasner, H., & Iscoe, N. (1988). *A Field Study of the Software Design Process for Large Systems*. Paper presented at the ACM.

DeMarco, T. & Lister, T. (1999). *Peopleware: Productive projects and teams*. New York: Dorsett House.

Ekvall, G. (1991). The organizational culture of idea-management: A creative climate for the management of ideas. In J. Henry and D. Walker (Eds.), *Managing innovation*, (pp. 73-79). London: SAGE Publications Ltd.

Hoof, B.V. D. & Ridder, J.A.D. (2004). Knowledge sharing in context: the influence of organizational commitment, communication climate and CMC use on knowledge sharing, *Journal of Knowledge Management*, 8(6), 177-130.

Isaksen, S. G., & Lauer, K. J. (1999). Relationship between cognitive styles and individual psychological climate: Reflections on a previous study. *Studia Psychologica*, 41 (3), 177-190.

Karasek, R. A. & Theorell, T. (1990). *Healthy Work: Stress, Productivity, and the Reconstruction of Working Life*. New York: Basic Books.

Parker, G. M. (1994). *Cross functional teams: Working with allies, enemies and other strangers*. San Francisco: Jossey-Bass.

Pelled, L. (1996). Demographic diversity, conflict and work group outcomes: An intervening process theory. *Organization Science*, 7, 615-631.

Pfleeger, S. L. (1998). *Software Engineering Theory and Practice*. New Jersey: Prentice Hall Inc.Upper Saddle River.

Robey, D., Smith, L. A., & Vijayasarathy, L. R. (1993). Perceptions of conflict and success in information systems development projects. *Journal of Management Information Systems*, 10(1), 123-139.

Talbot, R., Cooper, C., & Barrow, S. (1992). Creativity and stress. *Creativity and Innovation Management*, 1, 183 - 193.

Turnipseed, D. (1994). The relationship between the social environment of organizations and the climate for innovation and creativity. *Creativity and Innovation Management*, 3, 184 - 195.

Visser, W. & Hoc, J. (1990). *Expert Software Design Strategies*. California: Academy Press,San Diego.

Weinberg, G. (1971). *The psychology of computer programming*: Van Nostrand Reinholdt.