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Coordination of Software Development Workgroups

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1. Introduction

Coordination is the integration of or linking together of different work units within an organization to accomplish a collective set of tasks (Van de Ven, Delbecq & Koenig, 1976). Selection and use of coordination strategies is a critical managerial problem because the choice of strategy has been shown to affect organizational performance (Lawrence & Lorsch, 1967; Rahim, 1986). Past research on coordination strategy selection has focused mainly on structural characteristics of the relations between work units: 1) degree of task interdependence (Victor & Blackburn, 1987; Victor, 1990); 2) degree of differentiation (Lawrence & Lorsch, 1967); and 3) degree of interest or goal conflict (Rubin, 1980). This paper develops a theoretical framework that facilitates the investigation of the structural characteristic, differentiation, and two psychosocial characteristics, organizational climate and culture, as determinants of the appropriate mix of and extent of use of specific coordination modes in a software development context.

2. Alternative Modes of Coordination

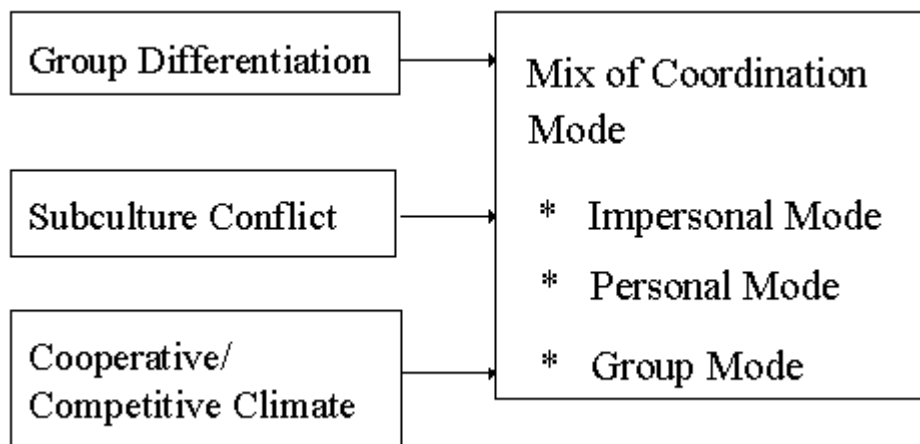
Van de Ven et. al., (1976) classified coordination as either impersonal, personal, or group mode. Impersonal coordination mode was characterized by integrating mechanisms such as preestablished plans, schedules, formalized rules, policies and procedures, and standardized information and communication systems. The operational modes, personal and group, define coordination by feedback which entails the mutual adjustment between task performers based upon the presentation of new information. In personal mode, the individual is the mechanism for making mutual task adjustments through either vertical or horizontal channels of communication (Thompson, 1967). In group mode, the group is the mechanism for making mutual task adjustments through scheduled or unscheduled staff or committee meetings. Variation in the use of coordination mechanisms depend upon both task structural criteria and psychosocial criteria (Victor, 1990). In the following sections, a theoretical framework, depicted in Figure 1 below,) including a structural determinant (differentiation) and two psychosocial determinants (organizational climate and culture) of the appropriate mix of coordination strategies are discussed.

2.1 Differentiation and Coordination in Software Development

The basic hypothesis of Social Identity Theory (SIT) is that pressures to evaluate one's own group positively through ingroup/outgroup comparisons lead identified groups to attempt to differentiate themselves from each other (Tajfel, 1982). Relevant relational attributes (e.g. language, cultures, goals, specific skills) are utilized to make evaluations of between-group differences. Software development work groups differ considerably in

formal structure, training, cognitive orientation of members, career paths, and departmental missions (Robey, Farrow & Franz, 1989). SIT suggests that these differences can give rise to differentiation between the software development work groups (e.g. multiple teams or designer and user groups) resulting in their conducting problem solving and other software development tasks from different frames of reference which would consequently result in ineffective collaboration. At high levels of intergroup conflict attributed to differentiation (i.e. job task, cognitive, or motivational), scheduled and unscheduled staff or committee meetings offer a medium where multiple software teams or designers and user groups could engage in problem solving and mediated confrontation in order to resolve differences in frames of reference (Lawrence & Lorsch, 1967). Thus, the following proposition regarding differentiation and coordination in the software development context is proposed:

P1: Increases in the degree of differentiation among software development work groups will be associated with: 1) a lower use of impersonal coordination mode; 2) moderate use of personal coordination mode; and 3) a significantly greater use of group coordination mode.



2.2 Climate and Coordination in Software Development

Pritchard and Karasick (1973) synthesized a definition of organizational climate as a relatively enduring quality of an organization's internal environment which: 1) results from the behavior and policies of members; 2) is perceived by members; 3) serves as a basis for interpreting a situation; and 4) acts as a source of pressure for directing activity. In addition, climate is considered to be a multidimensional construct with dimensions that include concepts of autonomy, cooperation versus competition, structure, supportiveness, flexibility and innovation, and reward levels. As an organizational climate moves from cooperative to competitive, exchanges in resources and information ceases and members strive to outdo each other to win contests and appear more competent (Tjosvold, 1984).

System designers and user groups can possess distinct models of a software systems' structure and functionality (Curtis et. al., 1988). Subgoals of these designers and user groups then result in competitive behaviors devised to influence the design according to their cognitive representation. Tjosvold (1988) noted that consulting with others and considering their ideas and perspectives, discussing conflicts and problems directly with others to make mutually beneficial agreements, and integrating opposing or competitive views to create new solutions all contributed to successful collaboration. This implies that at high levels of intergroup conflict attributed to a competitive climate in a software development setting, scheduled and unscheduled staff or committee meetings offer a medium where the workgroup(s) could engage in problem solving and negotiation in order to align competitive perspectives. Thus, the following proposition regarding cooperative and competitive climates and coordination in the software development context is proposed:

P2: Increases in the degree of competitive behavior among software development work groups will be associated with: 1) a lower use of impersonal coordination mode; 2) moderate use of personal coordination mode; and 3) a significantly greater use of group coordination mode.

2.3 Subcultures and Coordination in Software Development

Barley (1984) investigated two radiology departments and identified subcultures associated with the various technologists working in the departments, for example, the CT techs, special techs, and sonographers. Davis (1984) noted that subcultures are a natural consequence of the division of labor. Differences in values and frames of reference associated with subcultures can lead to conflict and misunderstandings (Elmes & Wilemon, 1988). Variations in subculture could result in the perception of differing "organizational realities" that would negatively impact intergroup interactions.

Software engineers, systems analysts, programmers, and user groups represent specialist groups that can be viewed as occupational communities. These occupational communities do not often share the same set of values, norms, and perspectives that apply to work related matters thereby giving rise to intergroup conflict attributed to subcultural differences (Curtis et. al., 1988; Robey et. al., 1989). At high levels of intergroup conflict attributed to subculture variation, scheduled and unscheduled staff or committee meetings offer a medium where the intergroup could engage in problem solving and negotiation in order to align conflicting perceptions of "organizational reality". Thus, the following proposition regarding variations in subcultures and coordination in the software development context is proposed:

P3: Increases in the degree of subculture variation among software development work groups will be associated with: 1) a lower use of impersonal coordination mode; 2) moderate use of personal coordination mode; and 3) a significantly greater use of group coordination mode.

3. Discussion

SIT suggests that there are social psychological causes of intergroup or interdepartment discrimination that leads to dysfunctional behaviors (Brown & Williams, 1984). Secondly, a climate of cooperativeness is essential in a software development context where both administrative and problem solving information must be openly and freely exchanged (Tjosvold, 1988). Finally, this paper argues that there are subcultures or "software development occupational communities" involved in highly interdependent activities during the phases of software development (Curtis et. al., 1988; Robey et. al., 1989). These occupational communities must all develop appropriate subcultures that will result in synergistic interactions between them. These issues are a part of the social bases through which software development takes place and they must be addressed in selecting appropriate coordination strategies if increases in productivity beyond that afforded by innovative development methodologies (e.g. objected oriented design) and ComputerAided Software Engineering tools are to be realized.

3.1 Implications for Software Development Research

Research in software engineering and management information systems should consider the social bases through which software is developed (Robey et. al. 1989). The propositions stated in this paper suggests relationships between aspects of the organizational context of software development and the choice of appropriate coordination strategies. Future research should make attempts to empirically study attributional processes in software development intergroup contexts. Such investigation should yield insights into the antecedents of dysfunctional intergroup conflict reported to constrain software development efforts (Curtis et. al., 1988; Robey et. al., 1989). Secondly, appropriate dimensions of and a facet of organizational climate (i.e. climate of creativity, innovative climate, etc.) specific to the software development context should be investigated. Future research might also examine the means by which organizational culture can shape patterns of organizational behavior (Bate, 1984). For example, how does certain cultural orientations constrain or induce desired behavior?

4. Conclusion

Past research on coordination strategy selection and use have either neglected to or minimally addressed the impact of social factors that may impact coordination strategy selection and use (Van de Ven et. al, 1976; Victor, 1990; Kim & Umanath, 1993; Kraut & Streeter, 1995). Consideration of these issues may offer greater insights into the dynamics of software development and potentially afford increased productivity leverage beyond that now realized by current software development management practices.