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**INTERNAL AND EXTERNAL MOTIVATION FACTORS IN VIRTUAL AND
COLLOCATED PROJECT ENVIRONMENTS: A PRINCIPAL COMPONENT
INVESTIGATION**

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ABSTRACT

In this study, we explore motivation in collocated and virtual project teams. The literature on motivation in a project setting reveals that motivation is closely linked to team performance. Based on this literature, we propose a set of variables related to the three dimensions of 'Nature of work', 'Rewards', and 'Communication'. Thirteen original variables in a sample size of 66 collocated and 66 virtual respondents are investigated using one tail t test and principal component analysis. We find that there are minimal differences between the two groups with respect to the above mentioned three dimensions. ($p = .06$; $t = 1.71$). Further, a principal component analysis of the combined sample of collocated and virtual project environments reveals two factors- 'Internal Motivating Factor' related to work and work environment, and 'External Motivating Factor' related to the financial and non-financial rewards that explain 59.8% of the variance and comprehensively characterize motivation in collocated and virtual project environments. A 'sense check' of our interpretation of the results shows conformity with the theory and existing practice of project organization

Key Words: Motivation, Team Performance, Collocated Project Environment, Virtual Project Environment, Principal Component Analysis

Motivation in a project set., up is intricately related to performance. This view is supported by the various theories of motivation which present motivation as a function of individual effort and performance orientation. This observation is further seen in the various theories of motivation which present motivation as a function of individual effort and performance orientation (McClelland, 1961; Locke, 1968; Vroom, 1964; Adams, 1963; Klein, 1989). Further, motivation is also defined as a force that energizes behaviour and which is goal directed (Armstrong, 2003). This behaviour stems from unsatisfied wants and needs of the individuals which leads to the establishment of goals by the individuals (Hull, 1951). These views of motivation are further supported by Arnold et al., (1991) who states that motivation is a function of individual effort and direction. These facets to motivation (individual effort and direction) assume significance in the context of a project environment because projects are bound by goals such as time, space, money, and people constraints (Lock, 1994). Therefore a strict adherence to behavioural school of motivation, which advocates openness, consideration and participation as the only way to motivate the employees, may not elicit the required level of performance as the emphasis would only be on satisfaction of the personnel needs and not on achieving the project goals (Harrison, 1994).

In project management, research is substantiated by experience and scrutiny. However, in case of the study of human variables in projects, there seems to be a lack of rigorous definition and analysis (Hoffman et al., 2002). We also observe that the discussion of people issues is either from a team dynamics perspective (Maznevski and Chudoba, 2000) or from a performance stand-point (Straus, 1996). This seems to suggest that the complementary issues of motivation and performance have not been addressed together. Another shortcoming in project management research which warrants investigation pertains to virtual teams. With the increasing globalization of project management, issues such as cost and skill distribution have gained importance. Virtual teams which overcome the spatial, geographical and time differences, where the members do not interact with each other are becoming a commonplace (Slevin and Pinto, 2004). However, limited research is reported in case of virtual teams, with their key issues not being adequately investigated (Fiol and O'Connor, 2005). Therefore, in this study, we aim to address these shortcomings in the project management research. We first revisit the literature on motivation (Thorns, 1998) and team performance (Thamhain, 1998) in projects to show the link between these two concepts theoretically. Next, building on this literature review, we argue that the key issues which are common to motivation and team performance are related to 'Nature of Work', 'Rewards', and 'Communication'. We then

suggest variables which are related to these 3 issues and which are used as measures to explore motivation of collocated and virtual project team members in our study. Surprisingly, we find the collocated and the virtual project environments show a close affinity in their characteristics in terms of their support to the team member's motivation. While this is briefly touched upon, the emphasis of this paper is on the results of the Principal Component Analysis (PCA) which we use to explain the underlying factors which profile motivation in these two environments. We observe that the characteristics of the project environments show a two factor structure related to intrinsic and extrinsic motivation

THEORY

Motivation in a project context has been presented earlier by Harrison (1994) when he emphasised the role of 'people system' to achieve project performance. Underscoring the importance of motivation, he suggests that performance is dependent on how the ability of the people and motivation impacts people's ability and performance, either positively or negatively. Exploring further the relationship between the characteristics of the people involved and motivation, Miner (1980) states that individuals vary in their response to autonomy, extrinsic rewards (pay and promotion), consideration, and achievement opportunities. These observations are seconded by Harrison (1994) who suggests that goal setting, extrinsic rewards, and job enrichment are motivating to the people. These aspects are reflected in various theories of motivation and team performance in a project context and are discussed next.

Motivation in a Project Environment

McClelland through his theory of needs (1961) posits that individual's motivation is expressed as their drive to excel in relation to a set. of standards. Translating this to a project setting and supporting this argument, Garies (2005) presents the concept of 'performance motives' where the individuals are motivated to achieve the performance objectives they set., for themselves. This contention is also supported by Harrison (1994) who observes that individuals working in a project setting are ambitious and are driven by their goals. Emphasising on the influence of goals in fostering motivation, Locke (1968) in his Goal-Setting theory, shows that individuals having specific goals produces a higher level of output. This, when coupled with feedback on performance, motivates the person as this would help a person know how well he has achieved his targets.

To further understand the importance of goals in fostering motivation in project teams, we need to understand the definition of goals in a project context. At the team level, goals in a project set up are defined in terms of team performance, which includes adherence to deadlines, quality of products or solutions and innovation (Cohen and Bailey, 1997; Wang et., al., 2004). Additional measures of team performance such as strategic positioning of the project for future business, organizational learning benefiting future projects, overall satisfaction of stakeholders, effective communication, team spirit, and work interest have been given by Thamhain (1998) and, Thamhain and Wilemon (1999). Turner (1993) suggests that these team performance measures are defined in terms of the customers' requirements. From the motivation perspective, the quality objectives of the team are achieved by constantly monitoring the team members and evaluating them against the customers' performance expectations (Cullen and Hollingum, 1989). This constant evaluation and feedback given to the team members leads to goal adherence (Locke, 1968) in terms of customer's expectations, a feeling of task significance (Hackman and Oldham, 1976) and finally to motivation (Mahaney and Lederer, 2006). In case of organizational learning benefiting future projects, individuals learn (Bredillet., 2004) and gain competences from the information which is stored in the data banks (Hayes-Roth et., al., 1983), through the informal communication networks (Duncan and Weiss, 1979), and through training (Kerzner, 2004). Such a learning, which is facilitated by access to task related and informal communication, is motivating to the employees (McShane and Van Glinow, 2003). Further extending these views on competency at the team and the organizational learning, Jamieson and Morris (2004) state that organizations improve their competency and implement their strategy through projects. At the level of the projects, this is done by achieving the team performance measures (Thamhain, 1998). This process is further facilitated when the team members receive mentoring and coaching (Mikkelsen et., al., 1991). This is motivating to the project teams (Chaffee, 1985).

Departing from the above theories of motivation, which have focussed predominantly on goals and to an extent on the extrinsic rewards such as opportunities for growth and financial benefits, is the Job Characteristic Model (Hackman and Oldham, 1976). This model focuses on the different facets of work, which are argued to be motivating to the employees. The Job characteristic model (Hackman and Oldham, 1976) has been presented by Thorns (1998) and later by Katz (2005) in their studies on motivation in project team environment. This model states that a job may be defined in terms of the following dimensions: Skill Variety, Task Identity, Task Significance, Autonomy, and Feedback. Further, this model

posits that the presence of skill variety, task identity and task significance would translate to the job being perceived as important by the incumbent. This view of the job by the employee would lead to motivation. Also, autonomy at work gives the employee a feeling of personal responsibility for the results and when the employees have knowledge of their performance through feedback, it would lend the jobs to be perceived as being meaningful by the employees. This leads to motivation and increased performance (Hackman, 1977). Supporting this contention are Piccollo and Colquitt (2006) who argue that when the job provides the right degree of autonomy, it is motivating to the employees. Supporting the role of nature of work in fostering motivation, Campion et al., (1996), Hyatt and Ruddy (1997), Cohen and Bailey (1997), Neuman and Wright (1999), and Thompson (2000) observe that work which is professionally stimulating and interesting is intrinsically motivating to the employees (Deci, 1975). also work is motivating when the individuals are given the freedom to apply their skill sets and use their choice of approach to work. Other motivating facets to work are empowering the team members with technical and problem-solving skills through training which lead to self efficacy and therefore motivation. Also important and embedded in motivating work is goal clarity, which we have discussed earlier.

The key issues with respect to individual's motivation which emerged from this discussion of motivation in a project context from a team member's perspective are that motivation stems from nature of work, financial and non-financial rewards, and goal clarity. While the role of nature of work and the rewards (financial and non-financial) goal clarity and clarity of rewards, has been discussed, goal clarity merits further discussion as it was emphasised in all the theories of motivation which we have seen so far. This leads our discussion towards the definition of goals in project teams and we briefly touch upon team performance.

Definition and Behavioural Implications: Team Performance

Performance has been defined as accomplishing units of mission-related outcomes or outputs (Weinberger, 1998) and as demonstration of specific behaviours designed to accomplish specific tasks and outcomes (Swanson and Gradulous, 1986; Brumbach, 1998). In the case of projects, performance has been defined in terms of adherence to deadlines, quality of products or solutions, and innovation (Cohen and Bailey, 1997). This definition of performance in projects seems to encompass the definition of team performance in projects as well, when Hoegl and Weinkauff (2005) define team performance as the extent to which the team is able to meet. the expected objectives in terms of pre-defined product quality, cost, and adherence

to time. This seems to suggest that the definition of team performance includes the underlying theme as goal orientation and thus motivation and team performance may be related. Further, Brumbach (1988) argues that Performance includes both behaviour and results; behaviours lead to task accomplishment and should be judged independently. This view of performance subscribes to the definition of motivation given earlier as it emphasises on the individual effort towards achieving a task and therefore, again, connoting to the relationship between performance and behaviour.

The relation between performance and motivation is better understood when the team performance measures are discussed. Thamhain (1998) cites that it is important that the project has the ability to contribute to the overall learning of the organization. To achieve this, it is important to impart the relevant training to the team members. It should be recalled here that training is one of the aspects which make the work motivating to the employees (Hackman and Oldham, 1976). Apart from *training*, it is also important that the project team has *easy access to documented information* pertaining to the projects and also *communicates effectively*, thus supplementing the formal learning interventions. Free exchange of information and communication (Kaliprasad, 2006) and having access to project related information make the team members aware of the overall project organization, responsibilities, procedures, and reporting relationships (Kerzner, 1989) which is motivating and also enhances performance (Kerkfoot and Knight, 1992).

Continuing our discussion on communication, Thamhain (1998) and Turner (2003) underscore the importance of understanding the user requirements in terms of project goals such as expected level of quality. This is stipulated by the end users. Hence, it is imperative that the project team fully *understands the end user requirements*. This is often done by giving the project team a feedback on their performance. Such a *feedback on performance* is motivating (Hackman, 1987) and also contributes to team performance (Rasker et. al., 2000).

Finally, Thamhain (1998) argues that the project should contribute to the strategic objectives of the organization. A critical factor which strategically places the organization for future business challenges is people management. In projects such as product development, and internal development projects, which may serve as vehicles to achieve the strategic objectives of the organization, issues such as the *mentoring and coaching* available to the team from the project manager, and support of the top management are extremely important and need be addressed (Brown and Eisenhardt, 1995; Mikkelsen et al., 1991). Another key issue, which is important for the successful implementation of the strategy through projects is

learning, which is essential for the long term survival of the organization (De Geus, 1988). This learning again, stems from the individual's intrinsic motivation (motivation embedded in the *nature of work* performed by the individual), *feedback* (Senge, 1990), *communication* (Eisenhardt and Tabrizi, 1995), and coaching (Schoonhoven and Jelinek, 1996).

Thus, we present an integrated view of projects where *motivation* and *team performance* are inextricable. We infer that the key issues which are common to motivation and team performance are related to *nature of work*, *rewards*, and *communication*. These three dimensions are further discussed below.

An Integrated View of Motivation in Projects

Having established the relation between motivation, and team performance theoretically, we summarize that *nature of work* is contributing to motivation (McClelland, 1961) and team performance (Thamhain, 1998; Thamhain and Wilemon, 1999). The financial and the non financial *rewards* are also important to foster motivation and team performance (Kerzner, 2004). Finally, *Communication* among the project team members especially that related to the end-users and the project goals are contributing to motivation and team performance (Turner, 1993). Thus we contend that in projects, there is a similarity between the variables contributing to motivation and team performance. Further, motivation and team performance have to be studied together by incorporating issues related to 'Nature of Work', 'Rewards', and 'Communication' to fully understand the people issues. This argument is supported by Guest et., al.. (1996) and Kerzner (2003) who state that employees value interesting work, potential for growth, career expectations, and fairness for rewards. We discuss this further below.

Nature of Work. The importance of meaningful work as being motivating has been posited as early as Maslow (1943, 1971) who stated that "individuals who do not perceive their work place as meaningful and purposeful, will not work up to their professional capacity". The need to consider the various facets to nature of work, which make it meaningful, may be attributed to the emergence of the empowered employee. Hitherto, when the focus was on efficiency, the nodes of decision making were the managers, and the jobs were broken down to tasks, mapped to the competencies of the personnel, and were measured by quantifiable outcomes. However, of late, there is greater dependence of the organizations on their workers to make the decisions. This necessitates giving the employees greater challenging work which is professionally stimulating (Fried and Ferris, 1987) autonomy at work (Hyatt and Ruddy, 1997; Cohen and Bailey, 1997) and more opportunities to learn (Thomas, 2000). Interesting

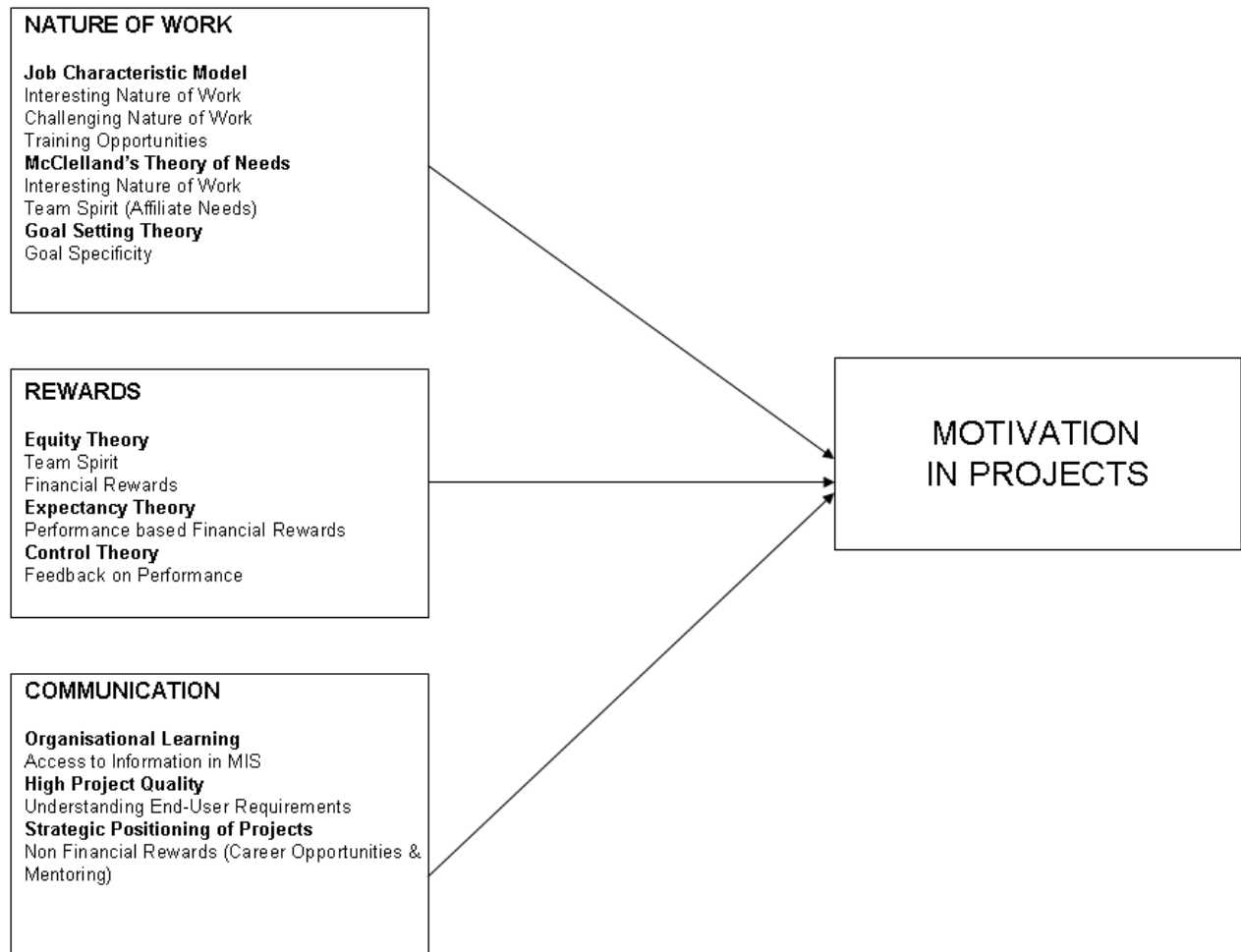
nature of work leads to motivation and enhances team performance (Kovach, 1987). In the context of the projects, these observations are held by Kerzner (2003), when he states that interesting work and a stimulating environment are motivating and lead to team performance (Thamhain, 1998).

Rewards. In the project context, rewards have been studied by Huws (1999) and Armstrong (1999). The link between motivation, performance and rewards was explained in the expectancy theory on motivation (Vroom, 1964). In this case, this translates to understanding the relation between effort, the expected performance outcome and the proportionate rewards which the team member gets. Apart from the tangible rewards such as the financial benefits, intangible rewards such as nature of work in terms of the employees obtaining feedback on performance and the task being meaningful (Beech and Brochbank, 1999), security of advancement (Herzberg et., al, 959; Armstrong and Brown, 2001), good work-life balance (Huws, 1999), and mentoring (Armstrong, 2003) have been found to enhance motivation and team performance. Armstrong and Brown (2001) put forth that rewards may be financial (transactional) and non-financial (relational) and that the non-financial rewards are complementary to the financial rewards.

Communication. A project is tied together by its system of communications (Cleland and Ireland, 2002). From the behavioural standpoint, communication leads to increased job satisfaction and productivity (Verma, 1997). Examples of different communiqués are formal proposals, reports, procedures, project meetings, and even informal communication among the team members. The team members' need to communicate can be seen McClelland's theory of needs (1961) where he put forth 'need for affiliation', where the team members are motivated when they socialize. Further, the team members exchanging task specific information (scope definitions, quality standards, schedules, feedback on their performance) leads to fostering of team spirit among the team members (Verma, 1997) and enhances performance (Kerkfoot and Knight, 1992). A key issue in the discussion of team performance seen earlier, is the emphasis on the understanding of the end-users' requirements in terms of quality, schedule, and time constraints. This again is task specific information. Drawing a relation between these two forms of communication, Chia-Chen Kuo (2004) states that the frequency of information exchange and interaction within the teams has a positive impact on the exchange of resources and information among the project team members.

The above discussion bringing out the key issues which bridge *motivation* and *team performance*, related to *nature of work*, *rewards*, and *communication* is summarized in figure 1 below. This presents an integrated view of motivation in projects.

Figure 1. Integrated View of Motivation in Projects



After this discussion on motivation in project teams where we highlight the key issues and the three dimensions which we explore using the variables called ‘Project Team Member Motivators’ to compare collocated and virtual project teams (described in the section ‘Method’), we introduce the definitions and characteristics of virtual teams.

Virtual Teams: Definition and Characteristics in the context of this research

Virtual teams can be defined as internationally distributed groups of people (Maznevski and Chudoba, 2000) or teams (Hertel, Konrad and Orlikowski, 2004) directed to achieve common goals (Delisle et al., 2001; Mayer, 1998). The team members are culturally diverse, geographically dispersed (Geber, 1995; Melymuka, 1997), and are engaged extensively in technology mediated communication (Cleland and Ireland, 2002). The virtual team members

have no or minimal face-to-face contact and behave as a temporary group akin to project oriented groups.

Coming to the characteristics of the virtual teams, Maznevski and Chudoba (2000) have suggested the following characteristics of virtual teams:

- Groups and members are identified by the organization as a team
- Are responsible for making and/or implementing decisions important to organization's global strategy as 'knowledge based teams'
- Use technology supported communication substantially more than the face-to-face teams
- Work and live in different countries
- Members may be collocated at the customer's site or in proximity. Thus they have better access to the customer's markets and resources. This while making the virtual teams highly responsive to the customer's needs, also contributed to their exponential growth (Kirkman et al., 2002).

Thus, based on these definitions and characteristics of the virtual teams, we explain our standpoint on the definition and metrics of virtual teams which we use to distinguish between these two groups in our study.

Hinds and Bailey (2003) in their study of conflict engendering in virtual teams, connote to the concepts of collocation and virtual-ness by bringing out the differences between the collocated and the virtual teams. They hold the view that physical distance among the team members is a characteristic which distinguishes the traditional collocated teams with the virtual teams. The geographical distance among the team members in case of virtual teams lead to a lack of shared context among the team members (Schober, 1998). Shared context relates to the perception of the team members towards their work (Tyre and Von Hippel, 1997), and sharing the task related information with each other in the team (Hinds and Bailey, 2003). Collocated teams have reported a higher degree of shared context among them as collocation fosters familiarity in the team (Hinds and Bailey, 2003), unplanned conversations (Kraut et., al., 2002) vis-à-vis the virtual teams (Hinds and Bailey, 2003). Hence, distance may be understood as a metric for collocation and virtualness.

Another dimension which may define the degree of collocation and virtualness in teams is the extent of technology mediated communication, which is prevalent more in the virtual teams than in the traditional face-to-face collocated teams (Attaran and Attaran, 2003).

The extensive use of technology in the virtual teams undermines the exchange of social cues such as attitudes, identity, and cohesiveness (Short et., al., 1976). This seems to suggest that though technology plays a major role in influencing the communication and thence the behaviour of the virtual team members, it may be traced back to the physical dispersion among the team members. Other studies which undermine the extent of technology used as a direct measure of degree of virtualness and collocation have been given by Griffith and Neale (2001) and later supported by Fiol and O'Connor (2005). They posit that virtual teams may not necessarily use technology while face-to-face teams may extensively use technology. Hence, it may not be a dimension which differentiates collocated and virtual teams directly.

There are other dimensions such as culture (Duarte and Snyder, 1999), standard work practices (Wenger, 1998) and inter-organizational teaming (Espinosa et., al., 2003) which distinguish collocation and virtualness. However, Hinds and Bailey (2003) contend that all these other traits are associated with the extent of physical dispersion of the team members.

A key perspective in defining the *metrics* of virtualness is presented by Cohen and Gibson (2003), Griffith and Neale (2001), and Griffith et., al.. (2003). They state that the distinction between teams as being absolutely collocated or absolutely virtual is unrealistic as virtuality lies on a continuum ranging from highly virtual to minimal virtual; Further, drawing from the definitions of virtual team given by Maznevski and Chudoba (2000) and the above discussion on the metrics for collocation and virtualness, the terms 'virtual teams' and 'distributed teams' have been used synonymously in the current research study.

Thus, for the purpose of this research study, a team is argued to be a virtual team if the members are geographically dispersed. The extent of face-to-face contact among the team members seems to influence issues such as exchange of social cues, extent of technology mediated communication in teams, and cultural diversity. Apart from the physical dispersion as being an important criteria for virtualness (Rad and Levin, 2003), we also concur with the perspective that collocation and virtualness lie on a continuum, ranging from being highly collocated to being highly virtual (Cohen and Gibson, 2003; Griffith and Neale, 2001; Griffith et al., 2003). We consider these aspects to distinguish collocated and virtual environments (explained in the 'Method' section).

METHOD

Sample

As our objective was to compare motivation in collocated and virtual project environments in general, we chose a random sample. Overall, the group consisted of 63% men and 37 % women. The average age of the participants ranged between 31 and 36 years and the mean work experience between 11 and 16 years. The participant pool came from 17 countries spread across 6 continents and from diverse set of industries (see table 1 below).

Table 1. Respondent Profile

<i>Respondent Profile</i>			
Location	Number of Respondents	Industry	Number of Respondents
		General Construction	4
North America	13	Oil & Energy	9
Central & South America	1	Telecommunications	3
		IS/IT	22
Europe	72	Pharmaceutical	3
Middle East	4	Management Services	7
Africa	3	Banking	4
Asia	17	Consultancy	22
Indian Sub Continent	22	Others	58

Procedure

The respondents were either contacted by email, from a mailing list available in the authors' university alumni database or in person. Only those who were working in a project-based organization were contacted. A comprehensive explanation of the purpose of the research study, and the expected outcomes were summarized in an explanatory cover letter accompanying the survey instrument. A total of 200 questionnaires were sent by email or handed out to the participants of which 132 responses were returned; a response rate of 56%

Measures

The survey instrument was based on an earlier instrument used by Marwick (1958), who had conducted a similar study on how characteristic of the work environment were variables contributing to motivation. The questions of the survey instrument were based on the variables

which were related to ‘Nature of Work’, ‘Communication’, and ‘Rewards’. These variables are described later in this section (see page 14).

The presence of ‘Nature of Work’, ‘Rewards’, and ‘Communication’ in the collocated and the virtual project environment was asked using the question:

“How important are/were the following factors in your current/latest projects (1- ‘Strongly Disagree’, 7- ‘Strongly Agree’)”

Every question was asked several times but in a slightly different form, to build in reliability. Reliability means consistency of measurement and can be assessed by means of a holistic measure named the Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO). This procedure is further explained when we discuss the validity of the factor structure (see page 17).

Further, we asked questions related to the demographical information about the respondents such as Age, Professional experience, industry, and location of the work. We obtained a measure of collection vs. distribution using a combination of questions such as:

- “What percentage of time do you spend telecommuting (working from home) in a typical working week?”
- “On your current project, what percentage of the workforce is working from a distance?”
- “Would you say that your current project is collocated or distributed?”

‘Nature of Work’ variables

Enjoying Nature of Work Itself. The nature of work has to be professionally interesting and stimulating to be able to enhance team performance (Thamhain, 1998) and motivate the employees (Herzberg et., al., 1959). This may imply that work has to provide the employee with the opportunity to demonstrate his skill variety; should be enriching enough to enhance motivation and team performance (Fried and Ferris, 1987). The same is reflected in the job characteristic model (Hackman and Oldham, 1980) and in the McClelland’s theory of needs (1961).

Autonomy at Work. Autonomy gives the employees discretion and responsibility to carry out their tasks (Chase et., 2001). Autonomy leads to high quality work performance (Anderson, 2003) and higher satisfaction with the work (Hackman and Oldham, 1980).

Being Involved in Critical Project Activities. It is the responsibility of the top management to build the team by engaging the team members in professionally stimulating work – involving the team members in the project and assigning them the responsibility for the whole project, through which the team members perceive their task to be significant (Thorns, 1998). This leads to higher team performance (Thamhain, 1998) and motivation (Hackman and Oldham, 1980).

The mention of team building now brings into focus the trust, interaction and openness present in the team members, which are in turn facets of team spirit. This variable is discussed next.

Strong Team Spirit. Christenson and Walker (2004) posit state that cohesiveness among the team members is important to achieve the project outcomes (in terms of the team performance constraints discussed earlier). From the motivation stand-point, the team members preference for the presence of team spirit in their work environment may be traced back to *Need for Affiliation* (McClelland, 1961). Garies (2005) subscribes to the same as *Relational Motives* in the context of projects.

Feedback on Performance. Silverman et., al.. (2005) observe that at the individual level feedback on performance is important to develop motivation, career planning, performance management and performance. This is seconded by Dessler (2005), who suggested that feedback motivates employees and leads to higher team performance (Rasker, 2000).

Apart from feedback on performance, the other key facet., to nature of works, which lends the work to be perceived as being interesting by the incumbents is the learning opportunities. While on the job learning opportunities such as mentoring would be discussed in the section ‘Project Team Member Motivators to explore Rewards’, more formal learning methods such as Training are discussed next.

Training for Learning. Training is a planned effort to instil job related competencies in the employees. These competencies include knowledge, skills, or behaviour that are critical for successful job performance (Noe et al., 2003). Training also creates an intellectual capital in the organization, helping the employees understand the customer requirements (Quinn and Finkelstein, 1996), to share knowledge with other employees and facilitates continuous learning (Baldwin, Danielson, and Wiggernhorn, 1997); thus enhancing team performance and motivation (Venkatesh, 1999).

‘Communication’ Variables

Comprehension of End-User Requirements. Cleland (1998) states that customers (along with the other primary stakeholders) have the authority to manage and commit resources according to schedule, cost, and technical performance objectives. Such an understanding of the user requirements is important for the team members to have a vision of the project (Thorns, 1998); this ensures goal direction and therefore motivation in project teams (Christenson and Walker, 2004).

Easy Access to Project Information. The individual's propensity for access to task related communication maps back to the individual's motivation to achieve the targets (Anderson, 2003). Further, as was seen in the earlier discussion on communicating the end user requirements to the project team, it is important that the project plans, specific objectives and the results are made known to the team members (Thamhain, 1998) through clearly defined communication channels and methods. Knowledge of such information fosters motivation, and enhances performance (Kerkfoot and Knight, 1992).

Ease of Information Exchange/ Communication. Communication may be related to, coordination of expertise of the team members (Faraj and Sproull, 2000), tasks (Cummings, 2004), feedback about a product or procedure (Hansen, 1999), and employees being given background information about their teams, organization, its strategy, and technology (Baron and Kreps, 1999). Facilitating free exchange of information in teams is critical for their performance (Pinto and Slevin, 2003) and fosters motivation (Kaliprasad, 2006) as it permits quicker decision making.

'Rewards' Variables

Performance based Financial Rewards. Performance related pay provides equitable reward to the people who perform well more than who perform badly (Armstrong, 2003). This improves performance and extrinsically motivates the team members (Mahaney and Lederer, 2006). It may be noted here that for the purpose of the present study, no distinction has been made between contingent pay, Skill-based pay, and Performance based pay as they are all dependent on performance. (Armstrong, 2003).

Future Career Opportunities. Performance management concerns employee development. Studies by Thamhain (1998) suggest that poor job security is a barrier to team performance. So much so that The Two-Factor Motivation theory suggested by Herzberg et., al. (1959) shows that growth and advancement lead to extreme satisfaction. The mention of growth and

advancement as motivating factors brings to the fore, Mentoring and coaching, which we would see now.

Mentoring by Top Management. Mentoring and coaching involves protégés acquiring specific knowledge, skills with the help of their mentors (Armstrong, 2003) and being given wide-ranging feedback, which lends the protégés to view his work as being meaningful (Beech and Brochbank, 1999). Mentoring programmes may be used to achieve cost reductions and high quality standards thus ensuring high performance at the work place (Tovey, 1995) and motivated employees (Spencer, 1996; Certo and Peter, 1995).

Project Accommodating Personal Life. A healthy work-life balance has an influence on the attitude of the employees, especially who have specialized knowledge and skill set, and their attitude towards the organization (Davenport, 1999). In the context of projects, these observations on work-life balance having a positive influence on the motivation of the employees is supported by Mahaney, and Lederer (2006) when they found that project team members were motivated when they had flexible work schedule and opportunity to work from home.

Pilot Test

The questionnaire was initially tested on a random sample of 80 respondents, which included members working in both collocated and virtual teams. A quick and dirty factor analysis led to the selection of the appropriate collocation and distribution indicators and to discard those of less interest. The respondents were then sorted on these variables along with this variable along a continuum of collocation vs. distribution and selected two groups: those who were scoring high on the collocation variable and those who were scoring low on this variable or, in other words, high on the distribution side.

Preliminary Data Analysis

A two-pronged approach was used to analyze the results stemming from the instrument. The first objective of the current research study was to know if there existed differences between the collocated and the virtual team members with respect to ‘Nature of Work’, ‘Rewards’, and ‘Communication, explored through the variables described above. We observe close affinities between the characteristics of the collocated and virtual project environments (‘Get.,’) with respect to the presence of variables related to ‘nature of work’ ‘rewards’, and ‘communication’ ($t = 1.71$ significant at $p = .06$).

We then combined the collocated and the distributed responses and proposed the second objective of the study, which was to understand the interrelationship among the various variables and more importantly to understand the common underlying dimensions or factors which would explain the characteristics of the project environments. Thus, we employed a Principal Component Analysis.

Validity of the Factor Structure

For the purpose of the study, a factor was defined as one which loaded at least 3 variables, and each of them having a loading greater than or equal to .5 on that factor (Peterson et., al., 1995). We used a Principal Component Analysis (PCA) and then rotated the components with Varimax, a common orthogonal rotation method used to achieve simple structure. We obtained a Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy .89 which justifies our Factor Structure (Geourge and Mallery, 1999; Field, 2000).

Sampling error was minimized by using a large sample pool in relation to the number of items to be factored (Nunnally, 1978). A high subject-to-variable ratio of 10:1 (132 respondents to 13 variables); well above the accepted ratio of 5:1 (Grimm and Yarnold, 1995) further supports our results.

RESULTS

Table 2 (see page 19) presents the results of the principal component analysis of the characteristics of the project environment in terms of its support to the team members. Two distinct factors which explained 58.8% of the total variance were revealed. The first factor accounting for 49.5% of the total variance loads essentially and in that order, variables 12, 11, 10, 13, 6, 4, 1, and 7. Factor two, accounting for 9.3% of the total variance, loads variables 9, 3, 8, 2, and 5 in that order. The variables, their corresponding serial numbers, the Factors and the Factor loadings are summarized in Table 2.

Table 2. Results of the Rotated Factor Loadings of the Variables¹ (PCA with Varimax Rotation)

Variable Number	Variable:	Factor 1 - Internal Motivation Factor	<i>Factor 2- External Motivation Factor</i>
12	Easy Access to Project Information	.80	.25
11	Ease of Information Exchange/ Communication	.78	.31
10	Being Involved in Critical Project Activities	.75	.26
13	Strong Team Spirit	.70	.26
6	Enjoying Nature of Work Itself	.69	.16
1	Training for Learning	.65	.46
7	Autonomy at Work	.64	.14
9	Comprehension of End-User Requirements	.63	.33
3	Mentoring by Top Management	.16	.83
8	Post Project Evaluation Feedback	.43	.73
8	Performance based Financial Rewards	.35	.65
2	Future Career Opportunities	.36	.65
5	Project Accommodating Personal Life	.008	.59

¹ Text in Bold indicates the factor loadings of the survey item on its corresponding Factor. Rotated Factor loadings which are greater than .50 considered within each factor

DISCUSSION

The results of the one tail t-test and principal component analysis which explored the question – “How important are/were the following factors in your current/latest projects?” revealed high affinities between the collocated and the virtual team samples suggesting that the two project environments may not greatly differ in terms of their support to the aspirations of the team members. A two factor structure which loaded ‘project team member motivators’ External and Internal to the project environment was abstracted and hence were named ‘External Motivating Factor’ and ‘Internal Motivating Factor’ respectively. The variables loaded on the External Motivating Factor subscribed to the Extrinsic Motivators (Herzberg, 1987b; Nelson, 1994; O’Driscoll & Randall, 1999), while the ‘Internal Motivation Factor’ referred to the Intrinsic Motivators which are related to nature of work itself (Herzberg, 1987a) and which constitute jobs which are challenging (Hwang, 2005).

In the context of projects, the results of the study confirm the findings of Strickler (2006) and Weitz et., al. (1986) who observe that extrinsic motivation relates to financial benefits, and growth opportunities. These results are further supported by Mahaney and Lederer (2006) when they posit that extrinsic motivation relates to financial benefits, opportunities for career growth. Further, they extend the dimensions of extrinsic motivation to variables such as ‘flexible work schedule’, and ‘opportunity to work at home’ suggesting that apart from the financial and the non-financial rewards, work-life balance (which has been presented as ‘project accommodating personal life’ in the context of the present research study) is extrinsically motivating to project teams. Each of these factors are discussed in detail next.

Factor 1. Internal Motivating Factor

The internal motivating factor, as discussed earlier contains variables which are directly related to the team members’ work. White (1959) suggests that job dimensions such as autonomy, challenging work environment, and responsibility are closely associated and load onto the factor Intrinsic Motivation. In the context of the discussion of the Internal Motivating factor, it is observed that the project team members being involved in critical project activities and having work autonomy load onto this factor; thus supporting the studies of White (1959). Further extending the understanding of intrinsic motivation, Mats et., al... (2005) state that intrinsic motivation relates to interesting, challenging and exciting nature of work, and high degree of autonomy for the employee (Ralph, 2005; Piccollo and Colquitt, 2005). Apart from the nature of work in terms of being interesting, providing autonomy to the team members,

and being challenging, an opportunity for the individuals to enhance their competence is a source of motivation (Deci, 1975). This is best brought to the fore when the individuals are assigned activities which are important (posited as the variable ‘being involved in critical project activities’) and when they are provided training opportunities which enhance their competence and learning of the job (Hackman and Oldham, 1980). O’Neal (1998) in her discussion on what is most motivating to the employees working in a technology intensive environment suggests that apart from the nature of work itself (in terms of it being interesting, autonomous, and challenging) work life balance and relationship with colleagues are complementary to nature of work and the environment and thus are motivating.

Factor 2. External Motivating Factor

Armstrong and Brown (2001) define a reward as an umbrella component which contains monetary and non-monetary rewards as its sub-components This is especially true in case of employees engaged in technology intensive work environments such as project team members working in remote working conditions (Rumpel and Medcof, 2006).

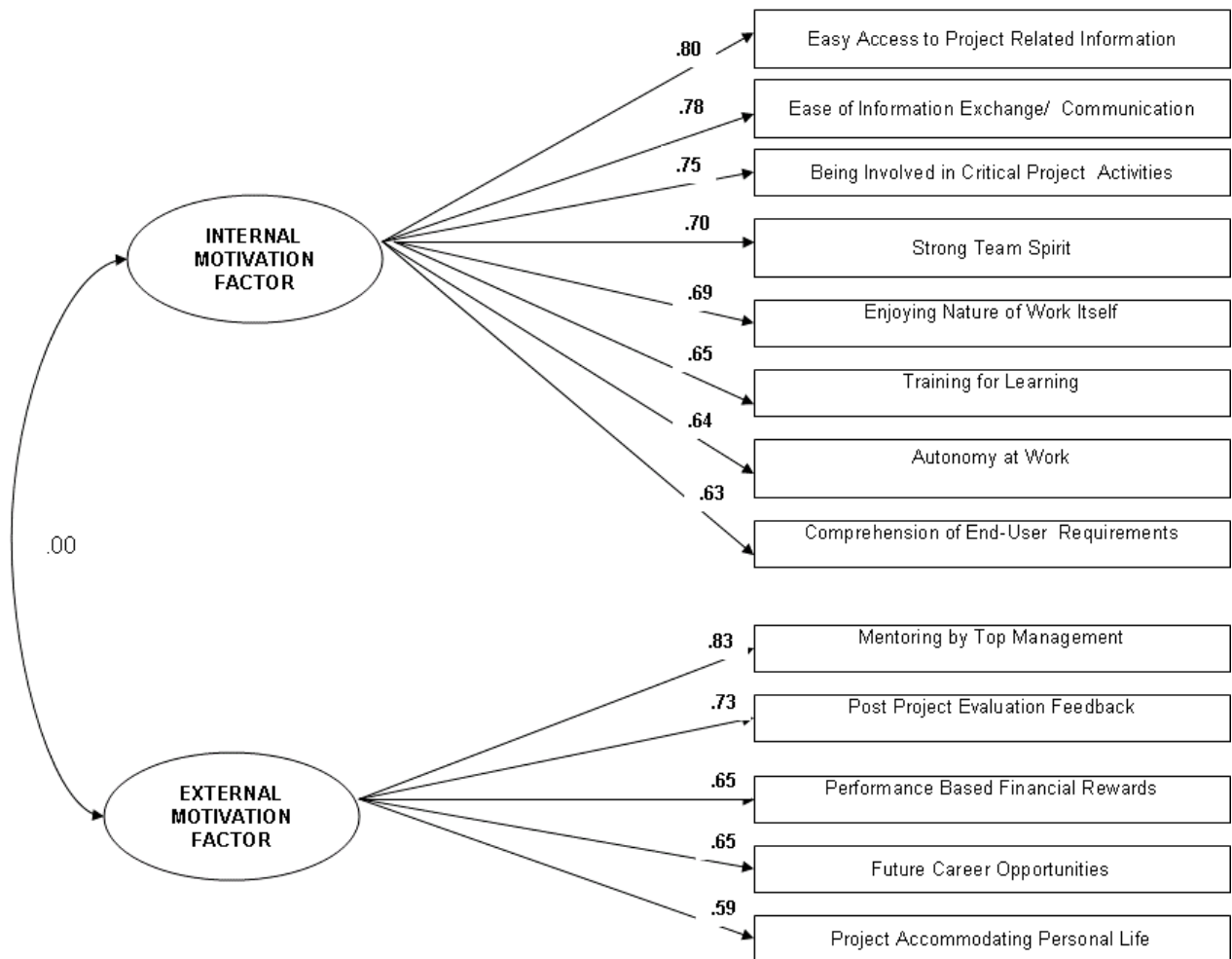
In case of project environments, financial rewards are motivating when tied to specific performance targets (Eisenberger, Rhoades, and Cameron, 1999). This is because it increases the self-efficacy of the employees which in turn leads to motivation. Though the motivating potential of the financial rewards as a ‘stand alone’ may not be abiding, it symbolizes many intangible goals and is directly or indirectly linked to the satisfaction of the basic, security, and self-esteem needs of the employees (Armstrong, 2003). Further, considerations of pay have been observed as a dominant factor binding people to their job (Goldthorpe et., al., 1968).

In case of mentoring and coaching, apart from contributing to career enhancement, mentoring programmes can lead to increased financial compensation and career satisfaction among the employees (Ragins and Cotton, 1999; Ragins et., al., 2000) which is beneficial to the organizations as well (Kram and Hall, 1989; Mullen and Noe, 1999; Viator and Scandura, 1991; Wilson and Elman, 1990). Further, the different facets to mentoring such as opportunities for financial rewards (Dreher and Ash, 1990; Fagenson, 1992; Ragins and Cotton, 1999; Ragins et., al., 2000; Turban and Dougherty, 1994) and career functions such as advancement at work (Hunt and Michael, 1983; Kram, 1985; Levinson et., al., 1978) and coaching of the employees which involves providing them with feedback on performance (Kram, 1985) have been shown to be interrelated (Kram, 1985).

In consonance with this view where the financial and the non financial rewards are complementary to each other, this factor loads variables pertaining to financial rewards related to performance and non financial rewards related to career growth and work-life balance. These views are supported by Weitz et., al. (1986) who suggest that extrinsic motivation relates to recognition, money, and growth. These variables have been categorized as ‘second-level outcomes’ of motivation which are derived from the job performance itself (Galbraith and Cummings, 1967; Lawler, 1970; Lawler and Porter, 1967) and also as the ‘hygiene factors’ (related to pay and working conditions) by Herzberg in his two factor model (1959). These variables are external to the job itself and are related to the financial benefits and career opportunities (Nelson, 1994; O’Driscoll and Randall, 1999). These observations are further held by Amabile (1983) and Amabile et., al., (1996) when she states that the constituents of extrinsic motivation include performance evaluation, expectancy of rewards from the organization, thus connoting to the variables related to feedback on performance and the financial and non financial rewards discussed in this study. In the context of projects, these results have been support by Mahaney and Lederer (2006) who identified flexible work schedule , time off, and opportunity to work from home (connoting to the variable ‘project accommodating personal life’), annual performance review (connoting to the variable ‘post project evaluation feedback’), financial bonus (connoting to the variable ‘performance based financial rewards’), and job promotion (connoting to the variables ‘future career opportunities’ and ‘mentoring by top management’).

The results of the ‘principal component analysis’ of the project team environment’s characteristics are summarized in the table 2 (see page 19) and Figure 1 (see page 23)

Figure 1. Model depicting Motivation in Collocated and Virtual Project Environments



‘Sense Check’ with the Industry

The results of the study seem to be reflected in the industry practices as well. Further, we observe that the people factors seem to significantly impact larger project management issues such as maturity and excellence. In this direction, Kerzner (2004) presents the ‘The Success Pyramid’ developed at Texas Instruments to manage their new product development teams comprising of 6-12 team members and spread across North America, Europe, and Asia. The success of these dispersed teams and that of the project is based on establishment of trust and team spirit among the members as the foundation and strong customer orientation as a guiding principal. Building on this feeling of trust and spirit, the project manager communicates the vision and the larger project objectives to the team members, which is important to avoid inter-team conflicts. This is further reinforced by communicating to the team members project related information through daily, weekly, and monthly communications. In case of Texas

Instruments, these variables were termed as ‘Global Team Enablers’. Complementing these observations is a study presented by Stranton and Ashleigh (2000) in their study of the influence of human and technical elements on the changes in system performance in a UK based Energy company have shown that informal communication among the members of dispersed project teams had lead to the team members perceiving their work to be more interesting and consequently increasing the firm performance. These variables draw a close parallel with the variables observed in ‘Internal Motivation Factor’ where having free flow of communication among the team members, access to project related information, understanding of the end-user requirements, and interesting nature of work were found to be characteristic features of both collocated and virtual project environments from the motivation standpoint.

CONCLUSION AND FURTHER RESEARCH

Conclusion

We comprehensively explained motivation in collocated and virtual project environments by simultaneously examining issues related to motivation and team performance in a multivariate fashion. This brought to the fore their inherent complexities and relationships. Thirteen original variables related to the dimensions ‘Nature of work’, ‘Rewards’, and ‘Communication’ were investigated with the Principal Component Analysis in a sample of collocated and virtual project team members. Two factors – e.g., Internal motivating factor and External motivating factor emerged. The internal motivating factor which is directly related to the work of the team member covers work characteristics such as interest, challenge, and autonomy. On the other hand, the external motivating factor shows that the financial and non financial rewards which are related to monetary benefits, work-life balance and career enhancement are complementary to each other. This interpretation of motivation in terms of these two factors finds support in the theory and further reflects the nature of the current project organizations which are not exclusively collocated or virtual in nature. We suggest that future research in this direction consider the influence of dimensions such as organization culture (Hanjun, Roberts and Chang-Hoan, 2006), leadership (Bass, 1985) and project success (Pinto and Slevin, 1998) on motivation in collocated and virtual project environments. Thus, we believe that while the current study adds value to the existing project management literature by addressing the social aspects of virtual and collocated teams, it is also capable of guiding motivation interventions in project organizations at the operational level.

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