

Investigating Cultural Differences in Virtual Software Teams

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Abstract

Software development projects increasingly extend over the boundaries set by a single company, or country. As the available communication media becomes more sophisticated, and more advanced technology costs less, the trends in software development move towards a more “virtual” nature. This evolutionary process allows individuals or even teams from different locations and cultures, with different expectations and goals, to blend in a virtual team of effectively collaborating and coordinating members.

This paper focuses on virtual software development teams and how cultural differences between them or their members may affect activities in different stages of the development cycle. It briefly reviews the existing perspectives on virtual teams and their organisation and management. It also discusses the main characteristics that such teams have and clarifies the differences between various definitions available for the “virtual team”. After outlining some of the main benefits and barriers of such teams, it concentrates on justifying that cultural differences are one of the most important issues that should be addressed for these teams to work effectively. Next, existing theories on cultural differences are reviewed. Also, the requirements for modelling cultural difference issues are identified. Finally, it provides evidence for the need of computational support for effectively resolving conflicts, forming teams, dynamically allocating roles, and managing software engineering projects in culturally diverse environments.

Keywords

Cultural differences, software engineering, virtual teams.

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Introduction

Several demanding needs in the software development industry lead to a metamorphosis from the traditional form of building applications to its modern virtual nature. Shortage of skills, development costs in high wage nations, increased software development time, and specialised requirements for local markets are some of the obstacles that multinational organisations are usually trying to overcome by using virtual teams. However, there are barriers in implementing and sustaining virtual teams, most of which are related to the characteristics of their members (Dafoulas and Macaulay, 2000d). A major and quite

common factor affecting the effectiveness of virtual teams is the differences in national culture of its members. Individuals from different cultural backgrounds may have different beliefs, values, attitudes, competencies, and perceptions of priority. Various models of national culture exist, trying to provide the means for practitioners to understand and react on cultural differences between collaborating teams or within the same team. Most of these models are quite general, failing to investigate the more specialised requirements of virtual teams or focusing on teams from disciplines other than software engineering. Additionally, there are no available computational models providing numerical values on these differences and measuring how such differences affect software activities (Dafoulas and Macaulay, 2000c). Therefore a framework is required to model cultural differences and their effects on virtual software teams.

The following sections of this paper correspond to the structure of the current research in cultural differences with respect to virtual software teams. Initially the special characteristics of virtual teams are discussed and the main differences with traditional teams are underlined. Also, similar perspectives, such as global, distributed, and virtual teams are discussed. Next, the importance of cultural differences in virtual software teams is considered. Additionally, an overview and critique of existing cultural models underlines their main strengths and weaknesses, and also suggests possible improvements with respect to software engineering teams. Finally a framework that provides support for decision-making and knowledge management while forming virtual teams and allocating roles between their members is described.

Virtual Teams in Software Development Industry

This section discusses the main benefits to the software engineering industry from exploiting virtual teams. In the available literature there is a quite impressive list of gains from turning traditional disadvantages such as time zone differences and geographical dispersion into competitive advantages. However, different perspectives of researchers and practitioners introduced several similar terms used, such as distributed, virtual and global teams. This section explains the main differences between the various terms, discusses the criteria used for their distinction and underlines how vague their boundaries are.

The term that is used throughout this research is the one of virtual teams. Usually the definition provided for such teams is drawn from the main differences that these teams have compared to traditional teams on certain criteria such as team organization and structure, project operations, team processes, project and team management, and communications. Hence, in most virtual teams the members are usually distributed and quite frequently various resources are geographically dispersed over different time zones. Virtual teams may involve more than one organisation, meaning that different team members may belong to different companies but still work in the same project. Also virtual teams have networked structure. Additionally, virtual teams need frequent and structured communication and use primarily electronic means for their interactions. A high level of trust is required in order for virtual teams to perform effectively and avoid any delays and conflicts, much higher than in traditional collocated teams. Finally, most processes are flexible and agreed by the participating team with respect to the requirements of the specific project. There are no predefined processes that are part of specific job titles (Mayer, 1998) (Norton and Smith, 1997).

Introducing virtual software teams brings several benefits into the software development industry. Most of these benefits are achieved by exploiting the main differences between the characteristics of virtual teams and collocated teams. Mainly organisations have access to a larger pool of computer skills, reduce software development time by running 24-hour shifts with disperse teams, and decrease labour costs by outsourcing software development to low wage countries. Apart from these catalyst benefits there are sustaining benefits that support the move from traditional to virtual teams. Such benefits are internationalising software, creating localisation centres, building an experience and knowledge base for each team, manage smaller size sites and teams, and avoiding constant distractions from the headquarters (Duarte and Snyder, 1999), (Grenier and Metes, 1995). Nevertheless, there are a number of problems that are caused by time, location and cultural differences. In later sections of this paper the effects of cultural differences on virtual teams and software development processes are discussed in detail. First, an attempt is made to clarify the differences between various terms such as distributed, virtual and global teams.

Carmel discusses the main centrifugal and centripetal forces for successful global software teams, but constantly considers differences in issues such as organisation, management, and coordination between traditional and virtual teams (Carmel, 1999). Martha Haywood in her book "Managing Virtual Teams: Practical Techniques for High-Technology Project Managers", constantly refers to distributed teams and how they are organised (Haywood, 1998). Even Lipnack, seems to use interchangeably the notions of virtual and distributed teams (Lipnack and Stamps, 1997). Moreover, Karolak in his book "Global Software Development" seems to confuse virtual and global software developing teams (Karolak, 1998). Kimbell also seems to put very close the terms virtual and distributed, especially when it comes to team membership, location, and management (Kimbrell, 1997). Finally, Jarvenpaa introduces the term global virtual team (Jarvenpaa and Leidner, 1998). More similar examples could be mentioned leading to the conclusion that there is the need of some kind of distinction between these terms. A set of distinguishing differences is provided in table 1, where ten criteria are used to compare and contrast the terms. It should be noted that identifying such criteria is based solely on the purposes of the current research, and therefore the list is by no means regarded as complete and defining.

The ten identified criteria are: (a) cultural differences between team members/teams, (b) distance between collaborating teams, (c) duration/lifetime of the team, (d) frequency of communication between members/teams, (e) meetings taking place between members/teams, (f) role allocation framework followed for each team, (g) dependencies between team tasks, (h) location of team members and team formation practices, (i) technology requirements, and (j) time differences between teams. These criteria are identified as the most representative categories of factors that affect the performance and viability of teams. Cultural differences between team members may either targeted in order to exploit the benefits of diversity within teams, or avoided as a source of instability and conflicts. Distance between collaborating parties can be a critical factor, as interactions tend to require more effort when the participants work in physically distant locations. Another important criterion is the lifecycle of the team, meaning the duration that the specific team is formed and acts for, because members in teams with a temporal nature usually appear less loyal to the team and its goals. In collocated teams there is constant communication and meetings occur daily in a formal or informal basis. However, this is not possible for all teams due to several constraints and can affect both team performance and team spirit. Furthermore, the complex processes of role allocation and team formation can be used as criteria to identify differences between teams. Such processes depend on the location and characteristics of the human resources and follow

formal frameworks imposed according to the characteristics of the team and the nature of the specific project. Task dependencies between team members are closely related to the type of the team and the opportunities for interaction that collaborating parties have. When face-to-face meetings and direct interactions are constrained, technology is used to bridge communications between participants. This technology could be optionally used or become an essential part of team tasks. Finally, dispersed teams can be located in different floors of the same building or residing over several time zones and in different hemispheres of the globe, an essential criterion for exploiting benefits and avoiding conflicts in virtual teams.

Table 1: Distinguishing criteria for Collocated, Distributed, Virtual, and Global teams

	Collocated	Distributed	Virtual	Global
Culture	Same culture		Homogeneous - - - Heterogeneous - - - Heterogeneous Sites	Teams
Distance	None		Travelling - - - Non travelling	
Duration	Permanent		Permanent - - - Temporal - - - Project dependent	
Frequency of communication	Continuous		Periodically - - - Daily - - - When exchanging information	
Face to face Meetings	Daily		Frequent - - - Rare (teams' level) - - - Rare (leaders' level)	
Role Allocation framework provided by:	Organisation		Organisation - - - Project manager - - - Team leader	
Task characteristics	Interdependent		High dependent - - - Low dependent - - - Independent	
Team formation	Same place		Few dispersed - - - Dispersed - - - Dispersed members sub-teams teams	
Technology	Preferably		Occasionally - - - Essential	
Time differences	None		Rare - - - Preferably - - - Always	

As shown in table 1, the boundaries between the various terms used for teams other than collocated ones, are quite vague. It is not possible to define specific points or states for any of the criteria used that could be used to clearly distinguish the various terms. The main reason for this is the fuzzy nature of the identified variables. For example, it is not possible to suggest that virtual teams communicate once a day while global teams once a week. Moreover, it cannot be said that distributed teams have several face-to-face meeting while virtual teams meet only a couple of times and global teams have only one start-up meeting. It is impossible to logically justify statements as the above. It is therefore unnecessary to attempt defining different terms such as virtual, distributed and global teams and explicitly clarifying their differences. Instead, it is feasible to select a term and customise its definition according to the characteristics of the specific project. Hence, the main focus for the rest of this paper will be on virtual teams meaning culturally heterogeneous geographically dispersed teams that are usually created for a specific project. They usually communicate once daily since the time difference is targeted for 8-hours (to exploit the overnight gain effect), and meet rarely, if not at all. The project manager decides on role allocation issues concerning each team and partly each member. Tasks undertaken by different teams are loosely dependent, and even the members of the same team may reside in different time zones. Finally use of technology is essential for their smooth communication and operation. The following sections of this paper are concerned with the cultural differences that exist in such heterogeneous virtual teams, why these are important for software teams in particular and how they affect software processes.

Importance of Cultural Differences in Software Teams

Software professionals have varying views on the importance of cultural differences. Some regard the world, as global village with universal management and technology, while others explain all problems as culturally induced. Culture is a very sensitive topic to discuss, mainly because it deals with archetypes. The most effective way to deal with cultural differences is to use any archetypes as starting points and continuously update them with new information, opposing to either deny existence of these archetypes or strictly rely on them (Schneider and Barsoux, 1997). However, it should be noted that at all times individual differences dominate cultural differences.

There are several types of culture that exist and are responsible for behavioural patterns of team members. Some culture types are stronger than others dominating the results of teamwork and communication between individuals. These culture types are:

- National culture that is defined as a “collective mental programming” of the people of any particular nationality (Hofstede, 1980), (Hofstede, 1991), or as “inherited ethical habit” that can consist of an idea or value, or of a relationship (Fukuyama, 1995).
- Organisational or corporate culture that covers many facets of organisational life, areas such as management styles, appraisals, rewards, and communication styles used by employees. Corporate culture may be strong for the group but weak for individuals.
- Professional culture that is ingrained through highly structured formal education during formative years and continued through training programs. This culture is reinforced through ongoing professional activities such as affiliation with associations. It is a strong culture related to organisation culture since a person usually chooses one profession for life. Moreover, professional cultures cross over national cultures.
- Functional culture that is made up of those norms and habits associated with functional roles within the organisation, such as marketing, R&D, and manufacturing.
- Team culture that emerges from bonding through common work experiences.

Each individual is a member of multiple cultures: one or more national/ethnic cultures, one or more professional cultures, a functional culture, a corporate culture, and a team culture (Carmel, 1999).

The previously discussed cultural differences affect the way that teams work and their members interact. The ongoing research that supports this paper focuses on virtual software teams and therefore on software professional culture. There are several issues rising during collaboration of software professionals with individuals from other disciplines, which couldn't be practically covered in this paper. Additionally, the human resources available for virtual projects frequently change organisations as well as teams. The corporate culture is quite weak in itself. Additionally, there is not usually enough time or close bonding between members in a project involving virtual teams, for building and maintaining a team culture. It is therefore the national and functional culture of software team members that differ in such teams and should be considered in detail. While national culture differences are covered in later sections in detail, the following list includes the various types of virtual software teams that exist, hence a useful classification for functional cultures within virtual software teams (Mittleman and Briggs, 1998):

- Networked teams: team membership is diffuse and fluid (members come and go as needed). Team lacks clear boundaries with the organisation.

- Parallel teams: team has clear boundaries and distinct membership. Team works in short term to develop recommendations for an improvement in a process or system.
- Project/Product-development teams: team has fluid membership, clear boundaries, and a defined customer, technical requirement, and output. Longer-term team task is non-routine, and team has decision-making authority.
- Work/Production teams: team has distinct membership and clear boundaries. Members perform regular and ongoing work, usually in one functional area.
- Service teams: team has distinct membership and supports ongoing customer, network activity.
- Management teams: team has distinct membership and works on a regular basis to lead corporate activities.
- Action teams: team deals with immediate action, usually in an emergency situation. Membership may be fluid or distinct.

According to Constantine, software professionals worldwide belong the computer subculture, which is stronger than any other culture (Constantine, 1995). For example, a Russian programmer would be more similar to an American peer than to a Russian marketing manager. This argument provides the opportunity for an endless debate about if cultural differences manage to surface in virtual software teams despite the strong software professional culture. Next in this paper several studies are discussed and existing models are presented in an effort to prove that cultural differences are significant and that there is the need to further support people understanding and managing them.

Managers in virtual software teams should initially understand national culture differences and then investigate how culture influences the internal arrangements of these teams. Such arrangements influence strategic planning and human resources management issues (Dafoulas and Macaulay, 2000a, b). The main arrangements that are directly influenced from the presence of national culture differences within the software team are (a) team structure, (b) team management, (c) communication between team members and (d) conflict resolution. These are briefly discussed before existing cultural differences models are reviewed in the next session.

Structure serves general functions of regulating responsibilities assigned to each member for performing specific tasks and relationships between members. An individual is motivated by a structure that reflects own values with regards to work relationships. For example, when members have a high need to avoid uncertainty they are uncomfortable in dual reporting situations. Also, in high power distance cultures, members prefer hierarchical lines of control and communication. Cultural variables (i.e. shared beliefs, values and attitudes) can greatly affect organisational processes. The effects of culture on specific management functions are particularly noticeable when we attempt to impose our own values and systems on another society. One approach is to develop a cultural profile for each country or region with which one does or is considering doing business. To develop a cultural profile, there is the need for familiarity with the cultural variables universal to most cultures. From these universal variables, specific cultural differences can be identified and implications in the workplace can be anticipated (Deresky, 1998). When a member of one cultural profile sends a message to a member of another cultural profile intercultural communication takes place. The message contains the meaning intended by the encoder. However, when it reaches the receiver it undergoes a transformation in which the influence of the decoder's culture becomes part of the meaning (Deresky, 1998). There is the need to identify the cultural variables that cause noise in the communication process. The following cultural variables that can affect the

communication process by influencing a person's perceptions have been identified (Samovar and Porter, 1988), (Harris and Moran, 1991): attitudes, social organisation, thought patterns, roles, spoken and written language, nonverbal communication, and time. Finally, cultures develop strategies to prevent or minimise those types of behaviour perceived as likely to provoke the conflicts that cause most discomfort. For example, collectivist cultures have a low tolerance of open dispute within a team or between teams. Culture affects tolerances of conflict, therefore culture affects the willingness to confront, or withdraw. In cultures where withdrawal is acceptable, an apparent withdrawal may imply that the "loser" is making a tactical retreat in order to retaliate at a future time when conditions have changed in favour (Mead, 1994).

Comparing Cultures: Existing Models for Cultural Differences

There are several different theories and models of cultural differences. In all cases a recommended approach would be to detect key dimensions that characterise different cultures and can be used by managers during various process of virtual software teams. The following models are classified as either single dimension models that are based upon a single dimension or variable, or multiple dimension models that are based on multiple dimensions or variables (Morden, 1999). These models are included in table 2.

Fukuyama identifies and compares low trust societies that can organise workplace on a more flexible and group-oriented basis, with more responsibility delegated to lower levels of the organisation, and high trust societies, that by contrast must fence in and isolate their workers with a series of bureaucratic rules (Fukuyama, 1995).

Hall also introduces five dimensions as follows (Hall, 1990):

- Space: Different cultures have different attitudes towards space. Social distance or bubbles vary by culture.
- Material Goods: Such goods are used for power and status.
- Friendship: Interpersonal relationships vary considerably across cultures.
- Time: Linear time cultures take time and deadlines very seriously, in a very rationalist sense. Time is structured, sequential and linear.
- Agreement: Expressing agreement and disagreement varies by culture. In some cultures the detailed written contract is essential to agreement, while in others a handshake is sufficient.

Table 2: Overview of Cultural Models

No	Model	Year	Dimensions
1	Fukuyama	1995	[1] Trust
2	Hall	1990	[5] / Space, Material Goods, Friendship, Time, Agreement
3	Hofstede	1991	[5] / Power Distance, Individualism, Masculinity, Uncertainty Avoidance, Long-Term Orientation
4	Lessem	1994	[4] / Pragmatism, Rationalism, Idealism, Humanism
5	Lewis	1992	[1] / Time
6	Trompenaars	1993	[7] / Universalism, Collectivism, emotional, Specific, Status, Sequential, Inner-Directed

Hofstede identifies five national culture dimensions as follows (Hofstede, 1980), (Hofstede, 1991):

- Power Distance that is the extent to which the less powerful members of institutions and organisations within a country expect and accept that power is distributed unequally.
- Individualism-Collectivism that indicates the relative closeness of the relationship between team members.
- Masculinity-Femininity that identifies the sexuality of roles in society and the degree to which a society allows overlap between the roles of men and women.
- Uncertainty Avoidance that is the extent to which the members of a culture feel threatened by uncertain or unknown situations.
- Long-term Orientation that is based on values of Confucianism showing to what degree do people value the future versus the past or present.

Lessem and Neubauer analyse European management systems and categorise the impact of national culture under the following four inter-related criteria (Lessem and Neubauer, 1995):

- Pragmatism that is a dominant influence in the conceptualising of management principles and practice.
- Rationalism that is defined as a theory, which regards reason than sense as the foundation of certainty in knowledge.
- Idealism/Wholism that is something made up of parts in combination, a complex unity or system.
- Humanism that defined as pertaining to the social life or collective relations of mankind.

Lewis differentiates monochronic cultures that act in a focused manner, concentrating on one thing at a time within a set time scale, and polychronic cultures that are flexible and unconstrained by concerns with time (Lewis, 1992).

Trompenaars develops his parameters in chapters four to ten as follows (Trompenaars, 1993):

Chapter No4 Universalism vs. Particularism: The universalist approach is to say that what is good and right applies everywhere, while the particularist emphasises the obligations of relationships.

Chapter No 5 Collectivism vs. Individualism: similar to Hofstede's model.

Chapter No 6 Neutral vs. Emotional: Some cultures are affective in that they show emotions while others are neutral, control and subdue their emotions

Chapter No 7 Specific vs. Diffuse: In specific oriented cultures the manager separates the work relationships with subordinates from other dealings with them.

Chapter No 8 Status: While some cultures give status on the basis of achievement, others ascribe it on the basis of age, class, gender, education, etc.

Chapter No 9 Sequential vs. Synchronic: In the former cultures time is treated as a sequence of events while on later cultures a number of events are juggled at the same time.

Chapter No 10 Inner-Directed vs. Outer-Directed: The former cultures believe that they can and should control nature while the later go along with nature.

Apart from these models, there are numerous theories, surveys, and investigations that focus on specific countries, regions, and organisations that are not covered in this paper due to

space limitations. In addition historical and social dimension identified for specific cultures are not as helpful and descriptive when it comes to culturally diverse environments as the previously discussed general models.

Suggesting a Framework for Using Cultural Models Dimensions in Virtual Software Teams

In the previous section a number of national culture models have been described. What these models have in common is that they attempt to provide the means for understanding and categorising all the different characteristics of individuals that belong to different cultural backgrounds. By now it should be clear that national culture affects behaviour of virtual software teams. A number of variables that have been identified in these models can be used to underline how national culture may affect team performance and the results of software activities.

Cultural differences between software team members may cause conflicts and affect performance. The main conflicts between team members are implications of the cultural dimensions described in the various models above. This can be better displayed with some examples (Carmel, 1999). A minor meeting conflict between members of individualist and collectivist cultures could result in mutual insults through their styles of communication. Time perceptions also lead to misunderstandings. For example, while a linear time person treats any deadline seriously, the expandable time person regards time as just another variable that should be weighed. In software development, quality could be another variable worth delaying completion. Finally, problems may also arise because of different attitudes towards hierarchy. Although there is a spectrum of potential cultural implications, cultural diversity may be beneficiary for a team. When a culturally diverse team first forms, its members will need time to be able to adjust to the cultural differences among them. However, as team members learn to interact with each other despite their different backgrounds, performance differences should disappear (Watson, et. al., 1993). The initial advantage of homogeneous teams is temporary only in newly created teams. As team members have more experiences working with each other, the differences between them become less of a source of interference (Greenberg and Baron, 1995). There is the need to further research the effects of cultural diversity in software teams and more specifically on the outcomes of software tasks. Also to investigate if diverse teams eventually perform even better than homogeneous ones. It is obvious that on tasks which differing perspectives might increase team performance, diverse teams are expected to have an edge over homogeneous ones.

All of the above models are quite useful and have several strengths that are manifested in the corresponding references. However there are also some points of concern; some weaknesses that should be identified with respect to each model separately. Hall's model is built on qualitative insights rather than quantitative data and does not rank different countries. Hofstede's work has three main problems: (a) assumes that national territory corresponds to culture limits, omitting existing cultural heterogeneity in various countries included in the survey, (b) information is gathered from a single organisation IBM, and (c) some of the dimensions effects overlap such as the small power distance characteristics with the feminine ones. For Trompenaars' model the main problem is that the pool of informants is vaguely defined and lacks homogeneity, therefore the comparisons that are made between cultures are imprecise. Apart from these weaknesses, the identified dimensions are very useful in modelling culture related issues in software development (Carmel, 1999). Japanese and Americans have quite different assessing levels of bug severity. Japanese tend to stop the

entire process in order to fix bug regardless their criticality, while Americans are quite reluctant to stop the development process for minor bugs. The meaning of requirements can be different in varying cultures. For example in USA requirements are expected to have a contract style with every deviation to be subject to additional charges, while in Japan such changes could be part of requirements phase. Finally, in multicultural design sessions western cultures following a traditional top-down stepwise approach usually collide with eastern cultures following bottom-up approaches.

So far in this paper it is established that cultural differences can be a source of conflicts in software tasks, cultural diversity may affect performance in virtual software teams, and that using cultural dimensions may affect the result of software tasks. Figure 1 represents a framework that describes how dimensions of cultural models may be used in virtual software teams. The underlying idea is to create profiles for teams and their members as well as for roles and tasks. These profiles follow a certain set of rules or requirements that are set from the project manager and are either enforced by the organisation involved or defined for the specific project and the teams involved. There are four main phases that take place:

- Developing a team – This is an iterative process that ends only when the project is completed. Initially the project manager decides a diversity level for the team responsible for the project. If the team is newly created then members from certain cultural backgrounds are targeted. Next, defining the preferred characteristics that individuals who would undertake the specific roles should possess creates role profiles. Finally, requirements for each task are identified. The last two stages are repeated each time a new role or task is introduced. The team profile changes whenever existing members leave or others join the team.
- Defining the required skills – The skills that are identified in this phase are related or affected by the cultural background of individuals. They are required for successful completion of the project but do not include technical skills. These skills belong into two different categories. First, there are skills that are required for effective team building including communication skills, participation, conflict resolution and leadership skills. Next are skills useful for successful completion for specific roles and tasks such as problem solving, decision-making, goal setting and motivation.
- Creating cultural profiles for individuals – Each individual has a cultural profile assigned to him/her. This cultural profile includes all different types of culture discussed in previous sections such as professional, corporate, functional, and national culture. This profile is clearly defined by including certain values for a set of national culture dimensions that are selected by the project manager. Each individual is assigned a value for each one of these dimensions.
- Screening – This stage involves selection of the most suitable individuals for the team and the specific roles and tasks. The project manager decides upon which dimensions to be used during the screening process. The main criterion is that certain dimensions are responsible for certain skills of individuals that may be required for a specific role or task. Furthermore, these variables can be used to estimate potential diversity levels if the result team is going to be prone to conflicts.

It should be noted that there are other criteria that project managers may use during the screening process. These could be the technical skills of individuals, the past performance of a certain team or specific individuals, and any provided recommendations. However, the focus of this framework is on using cultural differences as a filter for such a screening process.

According to Higgs, a framework for developing effective international teams needs to address team purpose, objectives, values, member roles, and team working processes. Combining these requirements with cross-cultural considerations may be achieved by a framework that addresses both the “what” in terms of content and focus of the team working and the “how” in terms of style and working processes (Higgs, 1996). The proposed framework follows this practice.

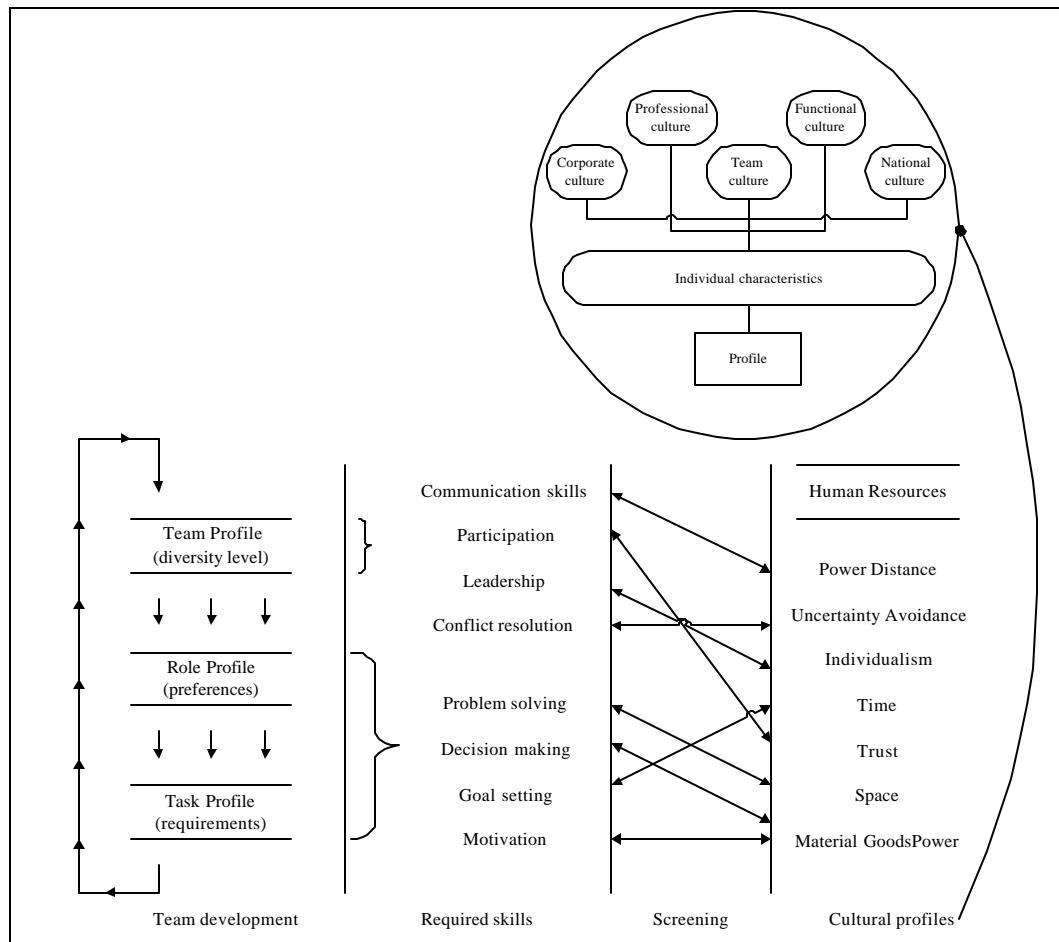


Figure 1: A Framework for Using Cultural Models Dimensions in Virtual Software Teams

Conclusions

Virtual software teams are these days quite common and have several benefits on software development industry. Project managers face a number of serious obstacles in their efforts for effective team building when it comes to such teams, mainly because they are geographically dispersed, they usually are located over different time zones, and their members compose a mosaic of different cultural backgrounds. National culture is extremely difficult to be modelled using accurate computational variables, and trying to do so would be very risky. It is essential to provide the means for understanding the effects of culture on team building and on team working. Based on several existing cultural models a framework to use cultural dimensions in virtual software teams is needed, nevertheless this is a stroll on dangerous ground. There are so many factors to take under consideration and such data are so sensitive

regarding discrimination, ethics, and privacy. Hence providing such a framework should be merely an effort to facilitate and support project managers and other practitioners reducing and effectively using all the available information about cultural backgrounds, national culture dimensions, etc. It would not be wise to provide statements, say, about preferred cultural matches between team members, or the suitability of certain cultures for specific roles. However it is possible to suggest ways of using national culture as another additional filter in the entire screening process.

This paper discussed cultural differences and their effects on virtual software teams. More specifically, it focused on the special characteristics that virtual teams have and how they change the way that software is developed. Several models for national culture differences were discussed and reviewed. The importance of cultural differences on software teams was underlined. Additionally a framework for using national culture dimensions in virtual software teams was described.

References

- Carmel, E. "Global Software Teams: Collaborating Across Borders and Time Zones". Prentice Hall, 1999.
- Constantine, L. "Constantine on Peopleware". Yourdon Press, 1995.
- Dafoulas, G. and Macaulay, L. "Assisting Knowledge Management in Virtual Software Teams: Coping with Location, Time, and Cultural Differences". In proceedings of International Workshop on Cooperative Internet Computing, CIC 2000, Sponsored by IEEE, Hong Kong, 29 November 2000.
- Dafoulas, G. and Macaulay, L. "Decision Making Issues in Software Engineering: Investigating Factors Affecting Team and Role Conflicts in Collaborating Virtual Teams". In proceedings of 5th International Conference: Computer Supported Cooperative Work in Design, CSCWD 2000, Sponsored by IEEE, Hong Kong, 29 November – 2 December 2000.
- Dafoulas, G. and Macaulay, L. "DRASIS: Supporting Dynamic Role Allocation in Software Engineering Teams", In proceedings of the GEMISIS Millennium Conference, Sponsored by IEE, University of Salford, England, 16-18 May 2000.
- Dafoulas, G. and Macaulay, L. (2000), "Virtual Teams and Dynamic Role Allocation: e-future of Decision Support and Knowledge Management through IT", In proceedings of the BIT Conference: Business Information Technology Management, Manchester Metropolitan University, England, 1-2 November 2000.
- Deresky, H. "International Management: Managing Across Borders and Cultures". Addison-Wesley, 2nd edition, 1998.
- Duarte, D. L. and Snyder, N. T. "Mastering Virtual Teams: Strategies, Tools, and Techniques that Succeed". Jossey-Bass Publishers, 1999.
- Fukuyama, F. "Trust: The Social Virtues and the Creation of Prosperity". Hamish Hamilton, 1995.

- Greenberg, J. and Baron, R. A., "Behavior in Organizations: Understanding and Managing the Human Side of Work", 5th edition, Prentice Hall, International Editions, 1995.
- Grenier, R. and Metes, G. "Going Virtual: Moving Your Organisation into the 21st Century". Prentice Hall, 1995.
- Hall E. T. and Hall M. R. "Understanding Cultural Differences". Intercultural Press, 1990.
- Harris, P. R. and Moran R. T. "Managing Cultural Differences". Gulf Publishing, 3rd edition, 1991.
- Haywood, M. "Managing Virtual Teams: Practical Techniques for High-Technology Project Managers". Artech House, 1998.
- Higgs, M. "Overcoming the Problems of Cultural Differences to Establish Success for International Management Teams", Team Performance Management, Vol. 2, No. 1, pp 36-43, 1996.
- Hofstede, G. "Cultures Consequences". Sage, 1980.
- Hofstede, G. "Cultures and Organisations". McGraw-Hill, 1991.
- Jarvenpaa, S. L. and Leidner, D. E. "Communication and Trust in Global Virtual Teams". In JCMC, Vol. 3, No. 4, June, 1998, <http://www.ascusc.org/jcmc/vol3/issue4/jarvenpaa.html> (active on 02/10/2000).
- Karolak, D. W. "Global Software Development: Managing Virtual Teams and Environments". IEEE Computer Society, 1998.
- Kimbell, L. "Managing Virtual Teams". Text of speech for Team Strategies Conference, sponsored by Federated Press, Toronto, Canada, 1997. <http://www.tmn.com/~lisa/vteams-toronto.htm> (active on 02/10/2000).
- Lipnack, J. and Stamps, J. "Virtual Teams: Reaching Across Space, Time, and Organisations with Technology". John Wiley & Sons, Inc, 1997.
- Mayer, M. "The Virtual Edge: Embracing Technology for Distributed Project Team Success". Project Management Institute, 1998.
- Mead, R. "International Management: Cross-Cultural Dimensions". Blackwell Business, 1994.
- Mittleman, D. D. and Briggs, B. O. "Communication Technology for Teams: Electronic Collaboration". In Sunderstrom, E., and Associates, Supporting Work Team Effectiveness: Best Practices for Fostering High-Performance", Jossey-Bass, 1998.
- Morden, T. "Models of National Culture: A Management Review". Cross Cultural Management Journal, Vol. 6, No. 1, p.p. 19-44, 1999.
- Lessem R. and Neubauer F. "European Management Systems". McGraw-Hill, 1994

Lewis R. D. "Finland: Cultural Lone Wolf: Consequences in International Business". Richard Lewis Communications, 1992.

Norton, B. and Smith, C. "Understanding the Virtual Organisation". Barron's, 1997.

Samovar L .A. and Porter R. E. "International Communications: A Reader". Wadsworth, 1988.

Schneider, S.C. and Barsoux, J. "Managing Across Cultures". Prentice Hall, 1997.

Trompenaars, F. "Riding the Waves of Culture". Nicholas Brealey, 1993.

Watson, W. E., Kumar, K. and Michaelsen, K. K. "Cultural Diversity's Impact on Interaction Process and Performance: Comparing Homogeneous and Diverse Task Groups", Academy of Management Journal, Vol. 36, pp 590-602, 1993.