

Human Coordination Factors in Software Development

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Abstract

The goal of any software development project is to deliver the software product on time, within the agreed budget, and with the capabilities expected by the customer. Unfortunately, this goal is rarely achieved. However, an understanding of human factors in software development can greatly contribute to achieving this goal. In this paper I provide an introduction to human coordination issues that are of influence in software development. Human factors are key elements that contribute to the quality of the final software system. The time to be spent in the development process is also affected by internal issues in the development team. In this work, I particularly focus on organizational perspective.

Software developments being a broad and wide subject, various references are cited for others willing to delve in other human factor issues in software development.

Keywords: team work, software product, software client, software developer

1.0 Introduction

Software development is basically a human and collaborative endeavour since software is a product of an individual or group work in an organization. A variety of human factors come into play in determining the success of such a collaborative work. In a group activity, several issues such as the group leader, who does what, among others, will always arise. Software development is not an exception. There are therefore factors that contribute either positively or negatively in a software development process. Various factors have varying impact on the process. Issues such as developer's motivation and organizational structure will determine the path a project will take. However, it is important to note that different software development methodologies may have varying impacts. In this paper, I have taken a general approach without a particular methodology. You may therefore find other factors that are specific to certain development methodologies.

For example, (Pressman, 2010) customer collaboration and communication is important in an Agile development context, while developer coordination and communication is critical in a globally distributed software development environment. Of particular interest, are human factors related to software development in different environments, settings, and cases.

Most software development projects are team-based. As a result, conflicts among team members are inevitable. Conflicts, generally put, are differences on interpretation of a piece of

information such as a customer requirement or need, meaning of a statement, among others (Sawyer, 2001). Effective handling of conflicts is a key role we cannot assume. Either positive or negative effect of a conflict, will affect the overall outcome of the software development process. It is therefore critical to have in place measures to address conflicts amicably such as having a conflict management desk/expert in the development team, someone who is impartial. Managing conflict is central to the success of a team project (Sawyer, 2001).

In (Kwak and Stoddard, 2004), software project success or failure is a result of multiplicity of several factors among them being risks and interaction among team members. Many software projects involve several multiple companies with varying interests. Usually, there is a feeling of disconnection between software developers and the management team. Consequently, some of the developers may establish close ties with the software product client in search of a companion. This in turn may influence the role of the developer – interfacing the client and the software development company. As such, organizational issues play a major role in software product delivery (van Genuchten, 1991).

Ideally, a software development team composition should have balanced skill sets. Some of the developers are best in analysing software requirements and relating with the software client, others are best in programming the code for the software while others are best in testing the software both under development, integration of various components, and user acceptance testing. All these specialties are important for the success of a development team. To achieve optimal success in software development teams, the team members should therefore view the team/group as themselves giving team activities maximum effort for their success.

Human factors in software development team coordination will depend on the type of development. We have distributed software development where developers are sparsely located, in-house software development where team members are housed in the same location or much close in the same building. These two developments will have different human resource coordination issues. In this paper I have considered a general approach in software development focusing on organizational perspective issues: team composition, communication, and the role of management team.

2.0 Team composition

Software development being a team activity demands that a software project should be subdivided into several sub-projects that are then assigned to each development team. The choice of members to compose a development team plays a big role in the success of a software development project. Members in the group need to feel comfortable when discussing issues with their fellows. The location of team members greatly affects the productive level of a team. If members are sparsely located, there may be language barrier and cultural differences that impair effective communication. (Lasser and Heiss, 2005) state that “Geographic dispersion makes teambuilding (e.g. establishing trust) more difficult and may induce language and cultural barriers that hamper effective communication.”

Proper team composition enhances fast decision making and good quality solutions in the development. In every team, other than the complexity of the task assigned, there are other several factors that will influence the success of the team in achieving its objectives:

2.1 *The skill level of the members of a team:*

Although software projects are ever diverse a software developer's skill set play a big role in problem solving. Experience gained in other projects cannot be ignored since it helps a developer to think critically for the appropriate solution.

2.2 *Motivational level:*

Members of a development team need to be motivated in carrying out development tasks. (Summerville, 2011) explains that human needs hierarchy call for different levels of motivation.

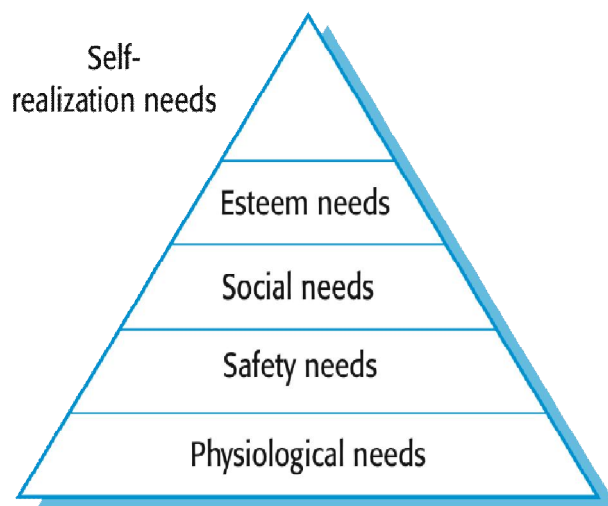


Figure 1.1 Human needs hierarchy

[Adapted from Ian Summerville (2011)]

Some of the developers will feel motivated when the development environment provides a way for their needs to be met.

3.0 **Communication**

The way team members exchange information and interact directly impacts on the software product under development. Communication can be a broad aspect in software development ranging from managers and individual developers, clients and management team, and among developers. In this particular task, I focus on the latter. Software development Models have been primarily used for communication (Basha et al., 2011).The use of models faces challenges because of lack of

standardized models. Unified Modelling Language has developed a good standard but different development teams use the models differently thus making it hard for a large team of developers especially those sparsely distributed. Again most models are not complete, they either cover a general view open to various interpretations or are too specific allowing only a narrow application (Kleppe et al., 2003).

It is important to note that developers need to communicate over various issues: meetings, the way of writing code, sharing ideas, brain storming among others. All these aspects directly impact on the quality of the final software product. Poor communication will most likely lead to late projects and worse still poor quality software products and software documentations. In a team work set up, group members feel valued especially when their views are considered in decision making this in turn enhances group cohesiveness and knowledge sharing thus impact of exit of a group member is not severe.

4.0 Role of management team

The goal of any software development project is to produce a product that is delivered on time, within the allocated budget, and with the capabilities expected by the customer. Unfortunately, this goal is rarely achieved (Summerville, 2011). However, Edward Yourdon argues that “a properly managed project, in a mature software engineering environment, managed by a competent manager, can repeatedly deliver a software system on time, within cost, and satisfactory to the user” (Yourdon, 1997). In this case, success for a software project is determined by three variables, a properly managed project, a competent manager, and a mature software engineering environment. The three variables are determined on how the management conducts the management roles. Software being a growing industry means that managers (software project managers and team leaders) need to constantly be informed on the best practices for handling such a dynamic industry. One big challenge for the management team is keeping software cost, budget, schedule, and human resources (developers) in check.

The management team need be inclusive and cohesive in decision making. Individual developers would be motivated if their views aired to management are considered in vital decisions. A motivated developer is definitely more productive as opposed to a complaining developer. It is the role of the management to ensure that all developers feel important in the development. Though indirectly, this would improve self-esteem of the developers.

In order to complete a software product in time, there is need for a proper co-ordination among the team members of a development team (Nagarajan et al., 2011). This is entirely the role of the project manager in collaboration with the team leader. The management team also need to handle issues like “feature creep” that inherently surface during implementation and testing phases. The fear of individual developer accountability – if things go wrong, I am to blame; need be properly handled by the management team to improve developers’ contribution. Measures like

collective responsibility and knowledge sharing can be applied so that no individual developer feels targeted for example when assigned a highly challenging task.

Since many software projects may involve multiple entities such as companies, divisions, etc., that may have certain interests, there is often a feeling of disconnection between software developers and their management, each believing that the others are out of touch with reality resulting in misunderstanding and lack of trust. Research shows that 45% of all the causes of delayed software deliverables are related to organizational issues (van Genuchten, 1991).

For effective developers' co-ordination, the management team should look at the following issues:

4.1 Developer's Motivation

(Summerville, 2011) an important role of management team is motivating developers working on a project. Motivation involves organizing the work and the working conditions/environment so as to encourage people to work effectively. Motivation is a factor that directly impacts on the success of a project. If people are not motivated, they would definitely lose interest in the work they are doing and this will lead to adverse effects on the project such as developer's withdrawal from the project, project schedule slippage, or worse still project failure.

Individual developers have goals they intend to meet in life. For some, by working for a well doing Software Company is already a fulfilling thing. However, for others, actually the majority will want to be appreciated for their good performance. According to (Kwak and Stoddard, 2004) software developers have a natural tendency of withholding technical information since information is a source of power. This would make imminent problems to definitely haunt the project. If the developers are rewarded and encouraged to share knowledge, then they would feel motivated to deliver the best for the company.

4.2 Managing developer's skill sets

Software development relies heavily on skills of the development team. The users of the system being developed also play a pivotal role in the entire system development process.

5.0 Software project success and human coordination factors

The success or failure in software development directly depends on the above three factors.

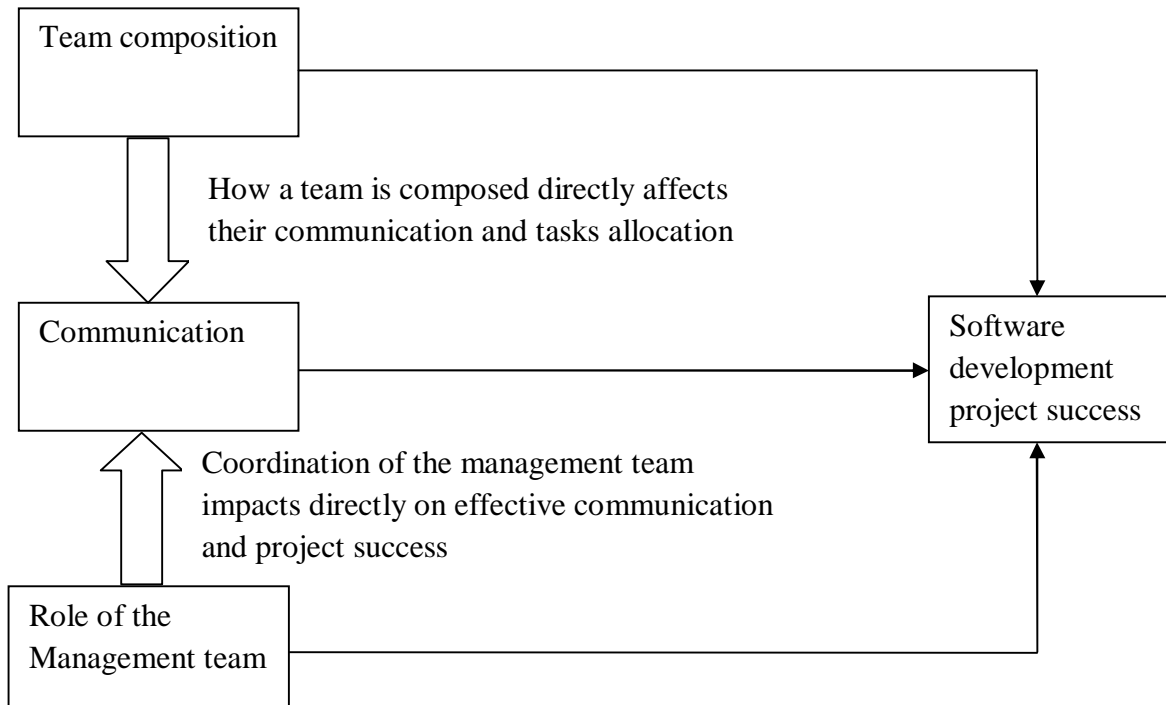


Figure 1.0: Team work, communication and management on project success.

6.0 Conclusion

The goal of this study was to conduct a review on the human factors that affect software development. Team composition is a critical aspect of group work that influences communication among software developers. Constituting a skill wise balanced team can guarantee success given good coordination from the management team. The ultimate goal of software development is to develop software within the allocated budget and deliver a good quality software product to the client. As future work, one can delve into a specific factor such as communication, team composition or management role and how it contributes to software development in different set ups such as open source and commercial development software projects.

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