



Research Article

## Psychology of Change Management in Development Process within Software Industry

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### Keywords

Change management,  
Software development,  
Software process.

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### Abstract

The scope of this paper is to consider the physiology of change deeply and studies the stages of change and its bold factors that involvers in software projects (e.g. developers or managers) in companies which require attention for bringing success along with change process in software development organizations.

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### 1. Introduction

The scope of this paper is to consider the physiology of change deeply and studies the stages of change and its bold factors that involvers in software projects (e.g. developers or managers) in companies should pay attention to them for bringing success along with change process in software development organizations.

This paper used identified case papers and researches to consider importance of need for change, How to identify the scope of change in organization, how the change can apply to the projects, how the change process can be selected and proceed and also which challenges involves along with change in projects and how we can overcome these challenges to achieve desired goal as result.

The change needs to be applied at all levels inside a company and for leading change we need to consider all its aspects on individual, group and organizational perspectives. For managing change internally, the environment (e.g. economic tides, actions of competitors, legislation and etc.) should be considered as external factors [1].

In the task of managing change and designing a road map for addressing change and applying it, we need using skills (e.g. Analytical skills, People skills, Business Skills or even System skills) which using them in right direction in my opinion “ is more a matter of leadership ability than management skill” Successfulness in change management depends on deep understanding of the definition and characteristic of the current organization itself (e.g. its business viewpoint, activities, types) and focusing on

problems as opportunities in change process and choosing the right model for leading change (e.g. Unfreezing, Changing and Refreezing or Problem Solving like “why-how-what”)

- Paper which named: The business goal viewpoint [1], illustrated the importance of business goals (goal categories such as meeting financial aspects, meeting the responsibilities for society and stakeholders) in organizations and expressing how recognizing business goals can help to validate requirements, how to deal with change during the development for acquiring more market share from competitors and how the architecture requirements can affect (directly or indirectly) by business goals. This paper focuses on analyzing and dealing with business goal view point and leading solutions for overcoming challenges (Satisfying the customers, stakeholders, society and being productive) related to business goals.

- Paper which named: How the pair programming really works [2], express experimental understanding of pair-programming both in agile and non-agile development. The paper discussed four mechanisms shared by all instances of successful pair programming which named as “pair programming chat”, “pair programming notice more details”, “fighting for practice”, “sharing and judging expertise”. The main intention in this paper for considering those mechanisms in real projects and their impact on the development result and productivity can be identified as communication and collaboration and commitment of developers.

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Another empirical supplementary paper (around this topic) which named “Investigating pair programming...” [3] measured the effectiveness of pair programming in educational environment and also analyzed usefulness of such collaboration between students in software design and its learning outcome.

- Paper which named: Two stage offshoring: An investigation of Irish Bridge [4] is a research to investigate and develop an initial theoretical model for implementation of the two-stage offshoring bridge model based on its case studies. This study shows that while companies that used in this research act as bridges in two-stage offshoring arrangements, their approaches differ in relation to (1) team integration, (2) organizational level implementation, and (3) site hierarchy. The main focus of this paper is learning from offshoring in software development and states challenges in organizations in offshoring projects (e.g. legal issues in different countries, team management barriers in long distance projects, cultural differences which affect project management). The paper states attribute and processes which the attributes can be developed (e.g. commitment, collaboration, communication and etc.) in their presented model for considering usefulness of offshoring. Another case paper named “Offshoring, what can goes wrong?” [5] also considered the factors (e.g. inexperienced developers, cultural issues and distance) that can affect the offshoring to the failure or with no significant benefit. In the paper “the author offers his views on why companies should carefully consider the choices they make in offshoring” [5] According to case studies in some software development researches and comparing them with personal experiences in real projects, there are some bold key aspects (common grounds) for more emphasize with elaboration on each level of applying change in different perspectives.

First aspect can be *leadership of challenges*:

Existence of some challenges in development process are always cause of planning for applying change. Leading a pioneer strategy of change for enhancing the process is depends on features and differences between different companies with different capabilities and goals. For instance to meet some specified goals in Clement & Bass paper [1] like meeting the financial objective or growth, some strategies like changing the work place into a cheaper city for being onshore and reduce operating costs would be better than offshoring the project. Leading such strategy can avoid some challenges on offshoring like quality gap in product [5].

In another example, the Clement & Bass paper [1] mentioned that business goal and vision of an organization have their direct or indirect affects to the requirements such as functional and non-functional requirements and shapes the development process and design of architecture. Leading the project in a way to meet those objectives with fewer problems in development needs its own strategy. Another case study mentioned advantages of managing pair programming (rather than solo programming) for having successful implementation and increasing productivity and learn ability (e.g. Wray’s paper)[2]. The role of leadership is to find and apply strategies for solving such challenges. Organizations with the ability to solve challenges create a

nimble environment that for instance can improve contributions among teams, increase motivation and give this confidence feeling to the members that the organizations is capable of overcoming barriers and it can cause self-actuaism and self management among contributors in individuals and even enhance communications for sharing knowledge and learn ability in team [6].

Second aspect is *communication*:

Communication is a main factor in development which is related to social interaction. As it defined in one of the papers it is “formal and informal sharing or exchange of information” (Holmström Olsson et al., 2008). Based on my experiences in projects and case papers, as the communication between teams in an organization improved, the challenges could be solve more easily and less confliction happens during the development among team members.

According to Wray paper [2], one of the main aspects under the pair programming’s umbrella is communication. Enhancement of this factor has critical advantages for overcoming coding difficulties, sharing their views and discussion among pairs for problem solving faster and more efficiently.

Also in Holmström Olsson et al paper [4] the authors mentioned that they adopt the social perspective to explore the dual role experienced by two Irish software development companies.

These case studies and experiences all illustrate the importance of the role of communications in developing projects, solving challenges in team and enhance organizational outcome.

Third aspect is *commitment*:

Commitment consider as a important factor on developing software that can involve in individuals and teams which participate in development in the organization and exploring the constructs of an inter-organizational relationship [4]. Commitment individuals in team level in an organization also are an important factor for solving problems and adopting to change in best possible way.

As one of the papers mentioned in their research, tasks could be delegated to other parties, the willingness of the parties to exert effort and devote resources in order to sustain an ongoing relationship which can consider in this aspect as well [4].

The last aspect can be mentioned as *collaboration*:

According to the case studies from papers and industrial experiences, collaboration has been identified as an important factor (e.g. core categories which mentioned in Holmström Olsson’s research [4] ) among other aspects. This aspect can be an important factor in developing projects, for instance the aim for Pair programming or XP is to have more collaboration among pairs for creating better codes and solving deep questions during implementation faster [2]. This aspect can refer to the undertaking of complementary activities to achieve mutual benefits. In other hand for instance lack of on-site collaboration among contributors in a project can negatively affect final product which consider as main problem in offshoring [5].

The intention of all of these aspects which brought from case papers are to bold the need for change in software development organizations and also propose an approach for manage change that can assure better market place, better products and ensure understanding organizational needs to fulfill them.

For describing the importance of these aspects in change process we should consider each of aspects for focusing more in the different perspectives by supporting with literature reviews and experiences in real cases.

## 2. Individual Perspective

Organizational change is going to be happening through the influence of individual changeability [7]. While each of us have our own ways of dealing with change based on different factors, motivating individuals for adopting to change and their social interaction factors should be considered in this perspective for increasing positive responding to achieve desired goal among individuals [6].

The first focus in the individual perspective would be communication which brought for focusing more from different case studies and personal experiences which are brought by different projects.

One of the change strategies which called Empirical-Rational is based on people self interests for being motivated to adapt to a new approach or in Normative-Reeducative strategy the people have willingness to adapt themselves to norms and values. Creating such a situation for individuals for applying these two mixed strategy can be beneficial for addressing them to the desired approach.

Communications is the first step of this strategy. Negotiations, or gathering data (level 1: Ladder of inference) for further analysis and actions in an individual person whom need to change has big role [8].

According to Wray paper [2] experiments which mentioned in their research as mechanisms of pair programming such as pair programming chat, sharing and judging expertise and also notifying more details by programmers and increasing learning outcome between students whom works in pairs, the main factor which can be consider is collaboration between developers and the other one is communication as an important factor.

In such case for instance, according to Billikoft [7], I believe effective negotiations has big role for achieving the desired improvement in pairs rather than solo programming. Some strategies here like valuing others, or conversational skills between members and problem focusing can solve complex coding problem faster, negotiation skills can improve sharing knowledge among programmers. For example confliction reduces when each pairs valued each other's interaction. In other example interpersonal skills serves a big role in development and maintains of trust and positive feeling when we deal with each other [7]. All these skills increase level of interaction between pairs which can cause reduce mistakes and improve quality, learn ability and better collaboration in programming at last.

Applying these factors can improve communication among individuals. This can increase the level of self confidence of individuals for showing their potentials and real competence during development in pair programming.

For instance in programming it is quite common that each pair has their own experiences in coding and each of them has their own qualifications, therefore the need for communication is obvious here for sharing competence and efficient use of their experiences in different coding parts (e.g. testing, debugging, implementing [2] and do the task which can give the confidence to both contributors.

Furthermore according to another case study, in the customer-vendor relationship, increasing communication skills is seen as increasingly important for the outcome of the offshore arrangement [4].

Motivation of individuals is directly affected by the improvement of the communication among individuals. Lack of motivation for adopting to change or even responding to change challenges in constructive way is the main issue that can solve by creating positive emotions and improving the feeling of self confidence of individuals in their workplace. As example from cases considering different business goals for the whole company which affects each projects directly in Clement & Bass paper [1] or when we have to use offshoring rather than onsite development the factor of motivating which participants via distance love the project could affect the project development to avoid quality gap which is common in offshoring [5].

For expected improvement in communication among individuals, the role of mediators is now clear as a third party that can improve the level of motivations and resolving the issues (e.g. confliction among individuals or for fearing to change or motivating individuals). Mediators involve as third party and they have excellent negotiation and communication skills. Mediators can increase interests of individuals in terms of participating in challenges of implementations (e.g. notifying more details in contributing to pair programming or conversations between pair programmers for finding more innovative solutions to coding problems and tasks which mentioned in Wray's paper [2][7].

As the level of motivation increased and based on Maslow's [6] paper that illustrated the basic needs in hierarchy of needs from a theory of human motivation, the need for change in individual appears and they commit to change.

Another aspect that could be improved is level of commitment of Individuals in processes. For increasing commitment of individuals during the change process, mediators and managers should know that how to deal with each type of issue or problems (either positive as opportunities or negative meaning). By sorting the issues in type of questioning we are able to separate it to the individuals in different positions with different knowledge to help change the current approach to enhanced one by giving right task to them which fits their skills (Power-coercive) or fits motivation for participation along their specialization (Empirical-Rational) [7].

This can apply to some common issues:

*-Lack of Individual commitment: due to lack of motivation*

When the individual doesn't have motivation and desire for participating to change to a new SW development processes methodology which applied to current one they don't positively committed to change process [4].

*-Lack of commitment due to learn ability issue*

The failure to learn the usage of change and its importance for adoption in new approach for enhances the organization happens among individuals whom contribute in a project in different section (developing, testing, and designing the architecture) which causes often by lack of business sense in them or even in management team [1][2].

In my reflection based on previous experiences these lack of commitment which either caused by miscommunication issues among individuals or motivation issues can get the projects far away from the main point. Mediators are players of the change management team. They should learn how to cooperate and communicate with other members in a way to have deep understanding of the members for finding the key persons whom are more interested for bringing change into the process and have significant impact on others. Then they can expand the change to other members. For example a respected software engineer inside the team can have better impact on other members if he became key person. Therefore for adoption to a new approach, design or need to convincing individuals, as Clements and Bass [1] slightly mentioned in their paper, the mediators need to find the key person first to convince him and then to use him as key role for increase the level of satisfaction of other individuals to adopt to new way or learn how to deal with issues [8].

Also in my reflection since resistance for change in process can be appear in different phases of the project, therefore the Mediators (or change agents) should have the skills for coping with it depending on that in which level resistance exists for example if the individuals ( whom are holds the project or organization like managers) or stakeholder (whom are much harder to convince ) the good way is convincing them by using mediators (Involving a third party) which has the role for solving the fears, concerns about the change which are going to apply or convincing them by improving the communication and using negotiating skills (like creative negotiation) for make them being flexible to creativity of other employees for example in applying new ideas to a project or designing a new model for requirements and looking them as an hidden opportunities rather than issue itself [7].

According to case studies and my reflection, the theory-in-use model which mentioned in Argyris [8] paper is also beneficial when it comes to discuss the issue cases to responsible persons directly. For instance in offshoring projects, managers can follow their released tasks to individuals more efficiently and discuss the problems with individuals involved in much less time The approach mentioned in "Model II, Theory-in-use" also help to increase understandability of the core issue and apply best action to solve it with less negative consequences such as misunderstanding [1][6].

### 3. Team (Group) Perspective

Depending on what different types of individual exists in each group change process is going to confront team level barriers. Balancing individuals and groups (teams) is a leading factor for approaching change in whole organization. According to my experiences (e.g. Embedded system project), communication and commitment between members in a group or related groups is a core for critical task of coping with inter-group situations and analyzing the

interactions among the teams and their members that should be managed to respond to issues, and also applying change [9].

Since we are facing different type of individuals in teams we need mix of strategies for approaching issues (art of managing change) in groups. Sometimes the change target and goal for each department or groups are different and we need manage each separately for addressing improvement at the whole organization.

For instance in offshoring, the projects is going to outsource in another workplace so the problems is related to globally distributed work management, cultural barriers and team management in long distance.. The structure of the teams involved in offshore sourcing projects affects the bridge model being adopted [5] .Large offshore sourcing project teams undoubtedly consist of team members located in several countries, possibly across several continents. According to this paper therefore the relationships between parties at different locations are close to minimum and that could be a challenge. Differences between teams (e.g. cultural differences, expertise differences) could be a challenge that can affect and threatens your product and your goal for offshoring (mainly for reducing costs) which observed and warns managers to be careful about choosing offshoring.

For such group challenges and to reduce the inter-group conflicts (Conflict management process) and increase level of positive collaboration between teams, the illustration of media synchronicity theory which mentioned in the Maruping and Agarwal [10] paper has also a vital role. Information and communication technologies can facilitate the coordination in teams and the performance. For instance in virtual teams (e.g. teams in off shored places) that "use ICTs which is fast in feedback, symbol variety, and parallelism (e.g. video- or audio conferencing) for managing task conflict during early team developmental stages will be more effective than virtual teams that use ICTs with other functionalities" in other hand for low feedback ICTs and symbol variety and high in parallelism, rehears ability, and reprocess ability (e.g., e-mail) for managing task conflict is more beneficial. In This case, using right process for direct and immediate feedback can help the manager to apply further actions to make balance between teams to make the behavior adjusted if needed in right time [9].

In Another case, specifies two people programming together won't have the same prior knowledge or categorization: one will presumably spot some things faster and the other different things faster. Where their rate of working is limited by the rate they can find things by just looking, two heads must be better than one.

In such cases, the need for creating positive behavior during the interaction between inter-group members (e.g. pairs) for getting better result is clearer. For example focus on strengths (i.e. positive traits area) is a key to increase productivity among members. This can be leveraging rather than criticizing, Identify strengths between participants in project, or starting from what works for solving problems with initial hope to change [9][10].

This positive Inter group relation which Foster & Lloyd [9] emphasizes in their paper in details, can increase

collaboration in a way to find the best possible solution for the issues (e.g. managing dissimilar individuals in teams for enhancing the discussion outcome) as a inter group behavior for overcoming the challenges.

In other hand, Baaz, et al., [11] specifies 4ALL as “a new lessons-learned method that facilitates learning through attentive moderating and careful timing, radically increasing the identification of excellence and learning from what went right”.

This approach is beneficial (which starts with a set of workshops to share knowledge, identify issues, analyze it between managers and involvers and get feedback and conclusions for solving them) when it comes to apply for understanding the barriers that identified in previous projects for managing them. For instance, it can apply to virtual team's issues in offshoring such as bad planning, lack of commitments, time lag between decisions and outcomes in projects. So that learned lessons from those experiences can apply to future projects for improving the development processes [11] which can be avoid offshoring as much as possible and using alternative solutions like finding cheaper locations at the same country as the headquarter of the organization located [5].

Managing conflicts, increasing trust and overcoming to barriers that mentioned in offshoring paper can be happened by role of efficient communications between offshore teams for instance face to face communication, frequent contacts between teams can increase the degree of successfulness between the members relations.

Each teams in an organization should managed to have minimized conflict during development between the members of different groups within a project in the organization or even inter-group conflict like coping with issues like stressful situations (Making inter-group situation works) [10][9].

In my opinion (according to my commitment in several academic projects) the important factor for managing the groups and coping the challenges is related to leadership and leading these challenges and it is all about the skills of managers for finding the best way for approaching change in teams and learning from previous experiences to avoid redoing same mistakes is a best practice. For instance the good leadership needs positive physiology to create a working environment for getting the most outcomes from employees by transferring the feeling of positive responsibility to the project [9].

#### 4. Organizational Perspective

There are some vital factors that should be considered to present a successful organizational change in software organizational such as setting relevant and realistic objectives, stabilizing changed process and unfreezing organization. However, among all success factors that have influence for improvement of software processes and based on researches and case papers among them there are some major factors that have most influence in organization change.

Huy [12] paper proposed four ideal types of planned change processes these types are commanding, engineering, teaching and socializing. Based on the change scale required,

the paper proposed multiple interventions of ideal types and skilled change agents to combine interventions effectively.

As Clements & Bass [1] illustrated in their paper, there are some groups of business goals such as managing market position, improving business processes, meeting personal objectives, meeting financial objectives. All those considered as managing change for improving organization over time. Each of these aspects could be considered according to Hue'[12] ideal change processes. For instance meeting personal objective as a business goal needs socializing which change agent here has the role for applying “workspace redesign around socio-technical principle”. In other hand meeting financial objectives needs commanding and engineering which the change agents here has the role for competitive analysis and work process analysis for redesign and reengineering for meetings those objectives [1]. Each organization has its own business viewpoints which need combinations of these innervations.

According to the issue and the need for change, the change agents should consider the time perspective and pacing (e.g. Gradual, Rapid[12]). For example the need for adopting to new approach of collaborations and increasing social interaction in development in pairs can be more gradual (through type of teaching for exposing tactics) (. However the need for respond to the competitor (which can be the atter of success or failure) the improvement should be rapid [1].

In the cases which improvement needs long term plan for applying, IDEAL model which is a model within SPI can be used for long-ranged development plan. IDEAL includes different phases. For instances during initiating phase general goals will be defined, these goals establish from business needs of the organization which also meeting financial objectives and marketing position [13].

In Holmström research [5] managing the challenges has been considered in Site Hierarchy: Hierarchy of Parties Versus Parties Acting as Peers. The paper mentioned the need to manage different expectations to ensure that a power struggle does not threaten the functioning of this two stage offshoring model and suggests some points like sharing ownership between stakeholders to avoid power struggle. In Such situations that need negotiations skills as well as showing the positive development progress to the stakeholders, time has a role for overcoming to the barriers. For such a time consuming enhancement IDEAL can be used. The IDEAL capability to create an action plan for meeting a goal (in this case it would be convincing stakeholders) is efficient here. For instance management steering group (STG) has the role for confirming actions plans, have regular meeting and monitor the planning and actions. In the mentioned case and other cases regarding engineering issues (coding, debugging and testing), IDEAL model and its stage by stage progress for enhancement is really suits at the organizational level [13] In my reflection it can reduce applying unfeasible actions and reduce conflicts significantly.

Kotter [14] mentioned main reasons for failure in transformations. In such issues, I refer to Kotter paper which said “Management commitment and support is the degree to which management at all organizational Levels sponsor the change” [14]. The reasons mentioned in this paper are vital

for supporting organizational change in improvement process. For instance the change cannot be succeeded without investing time, money and efforts on it and one of the important parts that can lead the progress is management support. Basically When a project manager decides to apply change for example in software development process (decides about offshoring a project) or in business goal (how decides about the requirements if it contradicts with the business goal like omitting the database in architecture) [1]. Most are not well prepared and didn't have feasibility study for the scale and complexity of the organizational change involved (no powerful change agency and no clear vision). "Although they typically know how to deal with large software projects, few managers have sufficient experience with projects that transform organizations". These reasons should be considered in organization.

To address this, workshops and supports for middle managers could help them to get accurate picture about how can they deal with change decisions with available resources and abilities without affecting the functional requirements of the actual (SW) project [15].

## 5. Discussion

This paper illustrated common issues related to the aspects that identified from case studies and support the proposed solutions for each of them based on literature reviews and project experiences. This section is my reflection according to all of these perspectives.

As we considered the aspects by focusing in different perspectives, we can say change is layered and for applying a successful change process (Unfreezing, changing, freezing) we should first understand the problem deeply and then apply required change by considering it from individual to group and finally assess it on the whole organization.

According to Maslow [6] satisfying basic needs and giving the feeling of confidence and motivations together, can make strong people. Strong people can swim opposite of the stream .I believe these confidence and strong people can create organizations that can meet their visions, find best solutions for development and change the process if needed and have self-actual employees which can do self management and push the company forward by solving the problems themselves. All these will increase profitability and productivity as result.

What I want to bring here from all the considered aspects in different perspectives is a new model of achieving such ideal organization for processing issues to solutions in short time. This model contains the methodologies in different level of an organization.

For instance the creation of the organization should be in a way to solve the issues in **Individual** level by the participants themselves (self management). Different types of individual enforce us to use different methodology for gaining the most from individuals in terms of their positive reaction to any kind of change process for an organization [6].

In individuals, role of communication has been analyzed in terms of making the willingness to change and increase level of commitment with the role of mediators on leading change as the way that it should addressed based on

challenges that involved as real cases in the case papers. Therefore methodologies for negotiating effectively (mediators) and frameworks to get information directly from the involvers and analyzing the gathered data more comprehensive and find best solution for problem is considered. The cases for the focus in collaboration and communication between individuals like Wray's [2] paper in offshoring experience showed the effectiveness of such methods for individuals to be able to solve issues at this level more efficiently and even by the individuals participants themselves [5].

In **Team** level, the structure should be in a way to minimize inner groups and teams confliction. In group perspective positive emotions considered for motivating individuals and communications tools considered for improvement of team relations even in offshoring projects. This ICTs (depends on how fast we need feedback) and methodologies (e.g. 4ALL) for analyzing the lessons learned from other experiences and avoid redoing pervious mistakes could manage conflictions and creating positive environment at this level. Applying these methods on Offshoring cases and pair programming (papers were good examples that showed importance of these strategies in teams to reduce conflictions and increase successfulness of project progress and development [2].

And at last the **Organizations** should use the required methods to be nimble and fast and adoptable to the change needed.

For adopting the organization to the change we should consider each perspective separately for applying the change into whole organization at last. Although that the change process for each organization has its difficulties based on that organization behaviors and also by paying attention to this fact that we cannot choose one single model for change but a mix of them is necessary to have successful change, we should also know that change is not permanent and the needs for change is continually since we don't have a static and isolated market but a global and competitive one. Therefore for being active in this market and surviving and get high rank in marketplace needs deep understands of business goals, organization needs to achieve goals and recognizing barriers and solutions and applying change based on them (even revision or change business plan [1][15].

During the change progress and according to needed time, change we can adopt to IDEAL model for long term strategies at organizational level For time consuming [13][16].

## 6. Conclusion

In summary, for creating such organizations which is being ready at all time for recognition of needs for change, and considering applies it and put change in focus we need different level of consideration from individual, team and organization level. This kind of organization is based on put innovation, business plan and model and also productivity always under research for comparing the organization to other market for applying change by its strategies. This kind of organizations doesn't have the goal for holding fixed structure but responding to today's high competitive market and innovative management strategies that is ready for

responding to needs and revise itself continuously and at each revision and change we need to be patience for observing the results and getting feedback for next improvement and considering the main reasons on failures to overcome them [14][17].

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