The impact of change in Software Development Organizations

1 Introduction

This paper emphasizes the problems that arise from changes in software development organizations. A description of the reasons behind change along with processes of how to achieve those changes will be presented. In order to adapt to frequent (or any type) changes, companies need a flexible approach. Agile development methods view the change as a positive thing which can and should evolve over time. Changes occur often in today's software development organizations and because of that companies need to set some standards which will develop their action scope and develop better strategies to handle change properly.

2 Processes of Change

We can see daily how companies within the industry accommodate their development strategies to fit the requirements and changes, which can be unpredictable – clearly observing Lifecycle theory approach to changes within the organizations (Van De Ven and Poole, 1995). They talk about change in organizations and try to explain why and how these changes apply to in companies by attempting to develop a theoretical framework.

Lifecycle theory is defined as cumulative, which means that the characteristics that exist in early stages are possessed in later stages as well. According to this theory, change is imminent and progressive. The first step in following the *Lifecycle theory* is to take the requirements with the top priority which can be implemented in the next iteration. Each requirement that is going to be implemented is discussed by the team. The next step is to develop working software that meets the initial requirements. The development goes closely with the stakeholders. The final third step is optional and it is to provide a demo of the software. Even though this step is optional it is good to have a working demo that is used as a measurement of progress. Each new requirement or change is then proceeded to the next iteration. This type of change is defined as *Continuous*. *Continuous change* is part of the theory developed by Weick and Quin (1999). The authors analyze organizational change contrasting it as episodic or continuous where the first is discontinuous and unpredictable whereas the second is evolving and more incremental. The difference between the two changes depends on the point of view of the observer. From a distance, also called "macro level", the event seems like a repetitive routine with occasional dramatic change. From a closer point of view, also called "micro level", the event proposes continuous adaptation or adjustment. *Continuous change* is used as a phrase to indicate evolving, cumulative and growing change. This change has more of a micro level perspective which suggests that things change constantly and requires adaptation and adjustment because of the small periods of stability. Each continuous change in practice creates conditions for further problematic outcomes and innovations which indicate no beginning or end point. There are three stages – freeze, rebalance and unfreeze. The initial state causes the change making the patterns visible, after that the rebalance is rearranging the patterns and the final state resumes the event with possibility for further changes. The role of the change agent is to redirect change (Weick & Quinn, 1999).

Similarly, Lewin (Burnes, 2004) defines the so called *3-Step Model* which performs a change in the current status quo, which is being maintained by certain conditions or forces within a field (Burnes, 2004), as seen in the *Episodic change* (Weick & Quinn, 1999). The *3-Step Model* is the key change management model in theory by Lewin (Burnes, 2004). As the name suggests, the model has 3 steps – unfreeze, moving and freeze. The first step of *unfreeze* is to destabilize the status quo by reducing the restraining forces in order for the new behavior to take the place of the old one. The second step is necessary in order to bring control and give direction of the change. During that phase new behaviors and values are developed. The third step, *refreeze*, stabilizes the group that has accepted the change. It

ensures that people involved in the project know why the performed change is important so it lowers the resistance to innovation if any.

2.1 Infrastructure of Change in Requirements

Orlikowski and Hofman (1997) discuss organizations that face problematic situations which require change. The authors try to create a model that would facilitate the change process. They see change in requirements as fast and unpredictable, so they base their model on improvisation. To implement the new requirements, two factors are considered – change as a continuing process and unpredictability of related changes.

Most frequently, the *European navigation* method is how change is managed in companies where they believe in the control of change as a rational view of the world (Tjørnehøj & Mathiassen, 2008). In other words, they believe is crucial to begin with a change plan that is mapped out in accordance with certain general organizational principles or with the idea of formative context, which Tjørnehøj and Mathiassen (2008) define as the collection of institutional arrangements and cognitive imageries that shape the actors' practical and reasoning routines in organizations; then link actions to that plan to make sure change stays on track. Another term for it is anticipated changes (Orlikowski & Hofman, 1997), which refers to changes that have been planned in advance and that we anticipate will take place as intended.

However, when we examine how change actually happens in the real world, we discover that it much more closely resembles *Trukese navigation*, which emphasizes how side effects, surprises, and people's usual coping mechanisms with bricolage, hacking, and formative context cause reality to drift away from plans (Tjørnehøj & Mathiassen, 2008). That is, individuals react to circumstances as they develop, frequently in an ad hoc manner, and take whatever actions are required to implement change (Orlikowski & Hofman, 1997). *Teleology* (Van De Ven & Poole, 1995) states that an organizational entity's development moves in the direction of a goal or an envisioned end state. As a result, proponents of this theory see development as a continuous process of goal formulation, implementation, evaluation, and modification of goals based on what the entity has learned or meant. This can be viewed as the frames of reference (Orlikowski & Gash, 1994) held by organizational members, which are unspoken rules used to organize and influence their interpretations of events and organizational phenomena and give these meaning. This is comparable to what Smith (2001) refers to as *Espoused Theory* vs *Theory in use*. The former is the theory that individuals adhere to, and with which they attempt to describe, explain, or forecast their behavior when asked (*European navigation*). The latter is the notion or theory that actually directs their behavior (*Trukese navigation*) in line with the mental maps they have of how to behave in situations, involving the way they plan, carry out, and evaluate their actions.

With the idea of frames (Orlikowski & Gash, 1994), which are used as vehicles for understanding and action, we may see how people act based on their interpretations of the world at the same level of mental maps. Realizing the nature of technology (Orlikowski & Gash, 1994) of the people, that is images of the technology and their understanding of its capabilities and functionality requires an understanding of their presumptions, knowledge, and expectations. This is why the identification of a customer representative in the ABB case (Karlstrom & Runeson, 2005) boosted the quantity and the rate of feedback on the performed job, which is equally important. Prompt feedback eliminated incorrect functionalities at an early development stage. Developers and project managers meet and converse with customers and users to establish the requirements on a regular basis, making sure that the requirements are feasible, and if they aren't – to make sure the customer understands why, reducing the misunderstanding and delusion around implementation and use of any new change (Orlikowski & Gash, 1994). According to Orlikowski and Hofman (1997), the primary goal would be to integrate or align the change model, the organization, and the technology by allocating resources and time to offer continuous support for the change process.

By coexisting with incongruent technological frames (Orlikowski & Gash, 1994) in the Late Status Quo, which is a state of unhealth that invariably comes before the alleged crisis and the first of four

major stages in the Satir Change Model of Weinberg (1997), the Ericsson team (Karlstrom & Runeson, 2005) on the other hand, ran into the issue of initial rejection at the management level. This is partially due to under-communicating the vision (Kotter, 1995), given that transformation is impossible unless everyone is willing to help, even to the point of making short-term sacrifices. Companies must take action to increase understanding and support inside the organization because, as action research from Lewin (Burnes, 2004) emphasizes, for a change to be successful, it must occur at the group level and involve everyone who is affected. They can achieve this by providing pertinent training for every corporate level and function. They might also create discussion boards where people can air their opinions. The dialectical process theory (Van De Ven & Poole, 1995) explains how the power dynamics between a theory and an antithesis, or the divergent viewpoints within or outside of a corporation, can mobilize an organizational entity sufficiently to question the status quo and create a synthesis, also called change. This is comparable to the assertion made by Tjørnehøj and Mathiassen (2008) that control and drift are complementary and intrinsically linked techniques that, when properly negotiated, assist one another and result in favorable adoption outcomes.

Additionally, these businesses fail due to poor management, requiring what Gill (2002) terms *Transformational Leadership*, which entails creating a future vision, and devising strategies to make that vision a reality while inspiring and motivating everyone in the organization to direct their efforts towards shared objectives. This comes after the system goes into Chaos (Weinberg, 1997) as soon as some foreign element cannot longer be evaded. *Effective Leadership* Gill (2002) is vital to do this; leaders who live out their principles, keep the company culture in mind, and empower others to carry out the necessary tasks during the change process, so they can feel good during the Integration and Practice era (Weinberg, 1997), when it is simpler to feel disappointed when things do not go as planned but they still need constant support. Additionally, it is critical to comprehend that reactions to a new foreign element will vary depending on where the system or individual is in the current change cycle, demanding, in Weinberg's (1997) view, the importance of timing.

According to Smith (2001), each individual inside an entity should participate in organizational learning in order to create his or her own representation of the theory-in-use that guides operations across the company. People would have tended to share assumptions, knowledge, and expectations with others regardless of their hierarchy on the entity if Ericsson had been able to establish shared congruent frames (Orlikowski & Gash, 1994) across the organization. People have unique interpretations, which is undoubtedly true and significant, but they also share a common set of fundamental notions that we may connect to what Lewin (Burnes, 2004) termed as *Field*, which is a collection of coexisting facts that are seen as being dependent on one another to maintain the group behavior. As we have seen in the ABB case, it is crucial that the company ensures that everyone is aware of the technology strategy (Orlikowski & Gash, 1994), which includes their comprehension of the rationale or vision that led to the adoption choice and its likely value to the company. They must use the forces that exist within these groups to help the group shape the behavior of its members; this concept is connected to what Lewin (Burnes, 2004) termed *Group Dynamics*. Similarly to the previous idea of technology strategy, the technology in use notion (Orlikowski & Gash, 1994) is equally essential since it relates to people's awareness of how technology will be utilized on a daily basis and the conditions and consequences that will likely or really be linked with such use.

2.2 Social Behavior in Requirement changes

Klein and Sorra (1996) explain the difficulties and the importance of the commitment to the use of innovation by the organizational members. Innovation implementation begins when a superior member of the organization or a client makes the decision to perform a change. They propose two types of stage models for implementation – *Source-based* and *User-based* model. Organizations, who make a choice to adopt innovation, face the challenge to change their members' behavior (Klein & Sorra, 1996). The advantages depend on the overall usage, and not individual one. An appropriate climate for implementation is needed, meaning that users should be given enough time to experiment with the innovation or be trained by supervisors, assuring their commitment while being congruent with employees' values. Supporting and rewarding users' behavior by removing any kind of obstacles (Kotter, 1995) adds to the good and strong climate for implementation. According to Noventum (M. E.

Quevedo & A. Perry, personal communication, October 4, 2022) a company must first establish agreement amongst its management team over how the service business should be run. People must first understand and embrace change before their behavior can be changed. The efficiency and reliability with which a particular invention is used by the targeted organizational members is referred to as the implementation's effectiveness (Klein & Sorra, 1996). This is a required but insufficient need for innovation effectiveness and it refers to the advantages a company experiences after adopting a particular innovation.

Source-based models are based on the perspective of the innovation developer or source. It follows the development of new goods or services from the genesis of the concept to the marketing of the final product. Within source-based stage models, an innovation is a brand-new product or service that a company, developer, or creator has produced for the market (Klein & Sorra, 1996).

3 Findings concerning changes in the software requirements

While still on the organizational level, dealing with change in the requirements is something companies can hardly predict and it can be very difficult to think of ways to deal with the problems that arise from emergent changes (Orlikowski & Hofman, 1997) that occur unexpectedly and that were not initially intended or anticipated (such as delays in deployment, bugs in software, loss of resources, etc.). That's why some organizations such as Agricultural Data Processing Centre Ltd. (Nikula, Jurvanen, Gotel & Gause, 2010) did not have a set contingency plan to handle those kinds of changes and instead, relied on adapting to the change and the effects that come with it – that's the process of *continuous change*, illustrated by the article presented by Weick and Quinn (1999), while also supporting the type of strategy planning for the future, presented by Mintzberg and Waters (1985) – which is the *emergent* type of planning. The *emergent* strategy of dealing with problems does not focus on a set goal, but instead focuses on tackling problems that pop up over a long period of time. Which is comparable to the idea of moving from control to drift (Tjørnehøj & Mathiassen, 2008) because, while trying to control and plan technology, it drifts away from plans due to side effects and surprises. In response, humans reinvent technology through improvisations and alter the adoption process from what was anticipated.

Single-loop learning (Smith, 2001) is another perspective on this method of resolving unforeseen as well as intentional effects or difficulties that may occur from an action. This approach is the most popular problem-solving style, it involves making plans and following them to keep everything inside a reasonable comfort zone.

Following what Smith (2001) refers to as *Double-loop learning*, which goes beyond problem resolution, might be a better course of action. It focuses on reassessing and redefining objectives while challenging the parameters that people are attempting to maintain within reasonable bounds. This could result in a change in how methods and consequences are presented. This is a higher level of change, or meta-change (Weinberg, 1997), that entails altering how we change. Involves accounting for various personalities, or temperaments, react to change and how they learn during the changing process such that the introduction of any foreign element causes virtually complete excitement and almost no anxiety. For Smith (2001), *Model I* and *Model II* are related to single-loop and double-loop learning respectively. *Model I* entails drawing conclusions about another person's actions without verifying their accuracy and expressing one's opinions in an abstract manner without providing any justification or examples. *Model II*, on the other hand, seeks to include the opinions and experiences of participants rather than trying to impose a judgement of an issue.

The case study of Credit Suisse IT Switzerland **(**Sagesser, Joseph & Grau 2013) is a great fit for the *Lifecycle* development model that was previously discussed. They conducted such a significant and large-scale change management program that was risky, challenging and demanded a mental shift from the organization to accept this change. The activities to deploy the model across the organization were coordinated in collaboration with actual practitioners towards raising awareness, knowledge management, overcoming obstacles and effecting the required mindset change. They ensured that all

the efforts were directed towards instilling a strong felling of urgency for the change so that people will assist, developing a strong leadership guiding coalition that grows over time, and providing the organization with a vision to believe in and follow (Kotter, 1995), which is the same as what Noventum (M. E. Quevedo & A. Perry, personal communication, October 4, 2022) states in relation to the importance of defining a clear vision and strategy for the future of the business. This is a clear example of a *deliberate* strategy (Mintzberg & Waters, 1985), as the organization had clear intentions that were shared by all of the actors in the business. These intentions were articulated in a relatively concrete level of detail so that there could be no doubt about what was desired before any actions were taken. They made sure that everything happened exactly as they had planned so that no external forces could have hampered them so they would not declare victory too soon and while anchoring the changes in the roots of the corporation's culture (Kotter, 1995). The New Status Quo stage (Weinberg, 1997), where unfamiliar things become familiar and a new set of expectations and forecasts arises, is finally reached after successfully completing those milestones.

3.1 Follow-up and engagement

According to Orlikowski and Hofman (1997), and Weick and Quinn (1999) change is fast and unpredictable. Credit Suisse IT Switzerland believed that most changes cannot be foreseen as they saw that a typical threat and source of resistance was uncertainty and precariousness of many staff members and the non-communicated fear to violate compliance regulations. This threat is hard to discover and to mitigate as different types of changes can occur depending on the people the company is working with. That is because different companies or clients have different styles to which adjust their needs. Face to face meetings proved to be the most valuable means to address the issue in the Credit Suisse IT Switzerland case, this is another way of planning and creating short-term wins (Kotter, 1995) so the people will follow-up and actively join the forces promoting the change. This is also another way of making sure that all the choice points that can undermine or support the change process are covered and protected (Weinberg, 1997).

Even though Klein and Sorra (1996) describe that members of the organization have difficult times committing to a change, that is not the case with ABB. The company recognizes the importance of their customers' input through the customer representative and that is why they perform the change in requirements if they are asked to. Even more, ABB encourages their employees to provide changes that are beneficial to the software. If a developer wants to perform a change, first the client is informed with good arguments. If the client agrees, the new requirement will be done in the next iteration. ABB adapts to the requirements set by their customers, and try to discuss the changes in case the asked change harms the project or increases the cost drastically. This is a clear example of opportunity-based changes (Orlikowski & Hofman, 1997), which may be not anticipated ahead of time but are introduced purposefully and intentionally during the change process in response to an unexpected opportunity, event, feedback, or suggestions received.

This kind of feedback is similar to biological evolution, which involves a constant cycle of variation, selection, and retention to bring about change. Therefore, according to Van De Ven and Poole (1995), evolution describes change as a cyclical, cumulative, and probabilistic sequence of variation, selection, and retention of organizational entities. Klein and Sorra (1996) describe two types of models previously mentioned – *Source-based* and *User-based*. ABB does not follow strictly any of those models, but they can be recognized in the latter. They find the interactions with the customers very important for the software development and to avoid erroneous functionalities at an early development stage, since they are using Agile development. The approval of the requests is done by the project leader and decision maker. This type of approval is *Source-based*. It means that decisions coordinate marketing with technical and program management. The project manager goes through the request and analyzes risks, cost and outcomes related to the end product. Before performing change, ABB makes sure the customer understands the requirement specification ensuring the correct implementation of change.

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