LITERATURE SURVEY: GENDER DIVERSITY AND WOMEN IN SOFTWARE TEAMS

SOFTWARE DEPENDABILITY

Project Supervisor: Professor Fabio Palomba

Submitted By: Hina Shahid

Contents

GENDER DIVERSITY AND WOMEN IN SOFTWARE TEAMS

ABSTRACT:

Gender diversity has the power to drive scientific discovery and innovation. Human aspect is considered as one of the success factors for software development. Besides gender diversity in Software Development is labelled as important to understand the incongruity that has been occurring presently at information technology workplaces such as Software organizations etc. due to community smells. This piece of graft investigates the characteristics of gender diversity in Software Development and how to familiarize Software Development practices when we have teams with diverse characteristics. This study also shed light on how gender difference plays role in the evolution of self-efficacy. This study has aimed to investigate the nuances of gender diversity on that brings out creativity, innovation, team performance and organizational quality. We gathered data by conducting a Systematic Literature Review (SLR) to identify what impacts of gender diversity can be observed in software development teams in the presence of women.

KEYWORDS: Gender Diversity, Software Dependability

INTRODUCTION:

The entire world is becoming a global village and the cross-border distances have been reduced with a high stride and enhanced global interconnectedness of business operations and people. As a value of such liberalized and globalized shift, workforce diversity and wide-ranging work practices have become substantial for the survival of organization, growth and success. Some studies proclaimed that diversity refers to the co-existence of employees with a wide variety of socio-economic, sociocultural demographic attributes. It can be demarcated as different variations such as gender, age, race, ethnicity and non-observables including cultural and technical characteristics of employees.

Diversity in the Software Teams shows compound dimensions regarding ethnicity, age and more specifically gender, such as perspectives on how people understand themselves and how they perceive others, and that these perceptions affect their interactions in the work environment. As we know culturally diverse Software teams in the work environment are needed, because their effects could impact project performance, processes, project quality and even technological advances. Increasing diversity in computing is important to design more robust end products and because issue of inclusion to be more representative of society is the main need in order to create successful projects. Some Studies also indicates that diversity is imperative for Software engineering because creates better software teams, with improved teamwork and efficiency.

The responsibilities of software engineering project is mostly a joint venture between different software teams with different genders to lessen their burden and concurrently increase the software

quality. Inclusively, the human features like opinions, perceptions, experiences and personalities in software development play main roles to make a project successful. The interaction of the human aspects in software development comes up from problem solving to communication, and from analytical thinking to cognitive reasoning. In the same manner, Capretz & Ahmed underlined that an ideal software staff holds qualities of both types of skills- soft skills and hard skills. Also, the isolation of social component i.e. personality will never ensure the best and desired results of development. The lack of this trait component does not ensure the effectiveness of a software team as well.

METHOD:

We used the following search keywords, derived from the major terms in our main research question: (GenderDiversity OR "Gender Diversity" OR "Gender Diversity in software Teams") AND (Gender Diversity in software dependability OR "Gender Diversity and Women" OR "Gender Diversity and its impact on software Dependability"). We used three electronic database resources to find research articles: 4 IEEE, ScienceDirect, and Springer Link. Research papers are searched on the basis of Title, abstract and keywords used.
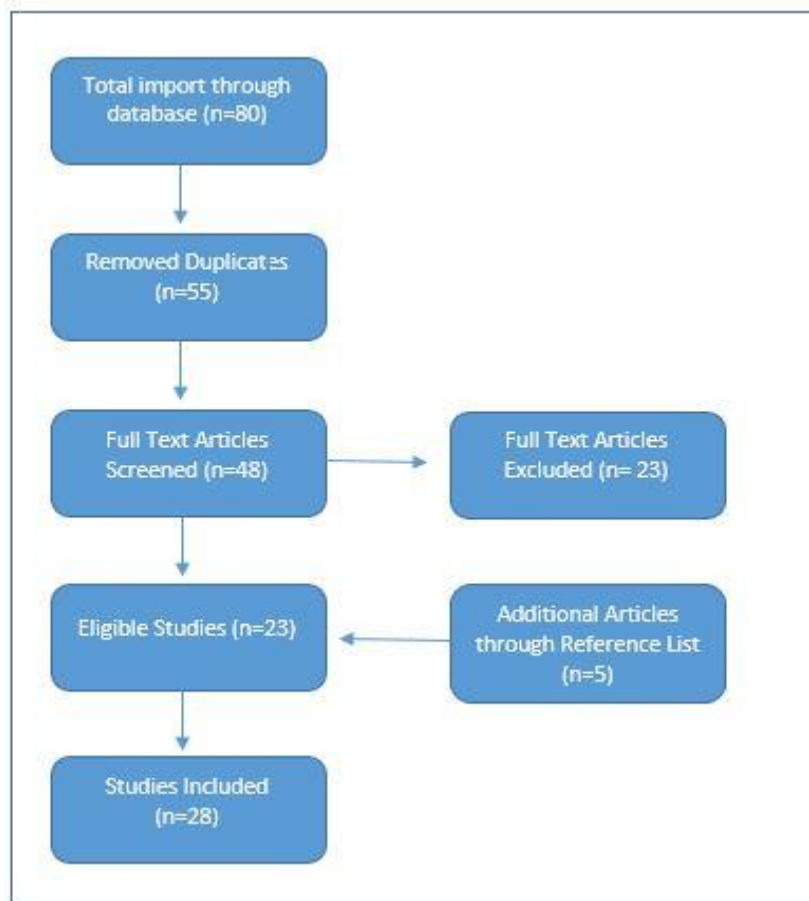
A number of additional standards were kept in mind to select studies for inclusion in the review. The articles included in the review should be: (a) be published in a peer-reviewed journal or conference, (b) present research about the use of Gender Diversity, (c) be presented in English, (d) be easily accessible in full-text, (e) not duplicate with articles from other databases.

RESEARCH QUESTIONS:

This piece of research explores how gender diversity is important for this digitalized and modern era, especially for the sake of organizational profit and growth it is becoming the key ingredient. Research indicates that a 1% increase in workforce diversity leads to a 3% to 9% increase in the revenues (Bahl, 2018). After reviewing the literature, it is found that majority of the research work in the field of gender diversity has focused upon its beneficial influences in software teams for better growth. In light of the above, it addresses how gender diversity can bring a positive transformation in the organizations and strengthen work performances.

Consequently, the following research questions are been focused:

RQ1: How do gender diversity influence the overall organizational growth?

RQ2: What are the possible consequences of promoting gender diversity?

RQ3: Is there any collaborative impact of gender diversity in software teams?

RQ4: How Gender differences leads to self-efficacy?

STATE OF THE ART:

Gender Diversity and Women in Software Teams: How Do They Affect Community Smells?

As social as software engineers are, there is a known and established gender imbalance in our community structures, regardless of their open- or closed-source nature. To shed light on the actual benefits of achieving such balance, this empirical study looks into the relations between such balance and the occurrence of community smells, that is, sub-optimal circumstances and patterns across the software organizational structure. Example of community smells are Organizational Silo effects (overly disconnected sub-groups) or Lone Wolves (defiant community members). Results indicate that the presence of women generally reduces the amount of community smells. We conclude that women are instrumental to reducing community smells in software development teams.

LITERATURE REVIEW:

Over the last 30 years Software engineering is one of the most impactful professions besides, it will continue to expand its boundaries into the next decades. For some time Software development has been considered a socio-technical struggle. For software engineers whether male or female the need to communicate effectively with users and team members has been increasingly emphasized. When someone accepts the vision that awareness of psychological dimensions within oneself and human factors within one's work environment increase the software engineer's productivity, we must then wonder which psychological traits would be most worth investigating. It is mentioned that Software production is a result of human struggle obviously, which frequently include problem-solving capabilities, cognitive aspects, and social interaction. Nevertheless, gender problems considered more complicated and less predictable as compare to computer machine. Therefore, the complexity of human personality necessitates sophisticated subtleties that are integral and however regularly overlooked in software development. Therefore, sooner or later, major issues relevant to software engineering boil down the team and their personality traits that give rise to self-efficacy and community smells.

The term Modern software engineering is gradually reliant on the good fortune of distributed communities globally and their social complexes in software development. Getting more knowledge regarding the organizational structures of these communities and their social individualities in addition to the factors that affect their quality is critical to software projects success. Therefore, in order to maintain the project success in software teams these communities should be eliminated and must accept the diverse nature of women.

Latest studies shed light on a set of some socio-technical patterns due to which organizational health of software projects has been affected negatively and devised them as community smells. The term community smells are is a package of such circumstances that is due to meager organizational and social practices that lead to manifest social commitment. Social commitment is linked to negative organized structures that further leads to short and/or long term social matters within a project. These issues could noticeable in several forms for example communication gap, coordination among team members in a software development community. By going deeper we came to know that women plays a significant role at their workplaces more specifically if we consider software teams they shows such a positive behavior in organizational structure that is healthy and avoid any type of issues that leads them to work efficiently and effectively. By getting more specific to software development by excluding gender differences is more healthy and successful for software projects and organizations atmosphere as well.

Mostly in software companies people are their most significant asset because they prefer to work on respect for differences besides being expensively recruited they tried best to retain their competent professional attitude. It is necessary to manage people by equally treating them, by appraising them and motivating them in order to maintain the composition of unified and strong group that deals with unexpected problems and situations. Though some studies reveal that teams with a presence of minorities and diversity are beneficial in the work environment. However other

studies demonstrates that the Software Engineering sector is homogeneous with numerous facets, due to the groups comprised of males only and non-minority people. In this milieu, this report proposes to explore the characteristics that involve diversity in Software Engineering to highlight the efforts, impacts, and challenges of a diverse software development team.

BACKGROUND:

All the nations are affected from Defies and prospects of Gender diversity around the world and can be strong enough for those who are directly or indirectly dealing with this theme. Members should show some tolerance, respect and understanding the gender differences, farther being taking moral responsibility of each one. It is shown that by valuing diversity in the work environment one can maximize workforce productivity and can achieve organizational efficiency, as well as promote positive profile-raising of the company.

Over the past years the issue of gender-diversity have gained pretty much attention, when several major technology companies allows workforce-diversity data, showing, no surprise, a significant prominence and underrepresentation of women in technical jobs. Tech and Software companies highlight, of course, to the thin pipeline of women with computing degrees to explain this underrepresentation, but the culture inside these companies also appears a foremost factor. However, the male-dominated tech culture gave rise to the phrase "brogramming," in their workplaces, a slang term used to symbolize to computer code produced by "bros" (slang for male friends). While gender diversity is commonly implicit to discuss only to the gender composition of software teams and copiously realize the potential of diversity for software, technology and innovation, it also requires attention to the methods employed and questions raised in scientific knowledge-making

A study has been done in Germany shown up the gender gap in IT sector-software organizations and proposed that the higher authorities should hire women and prefer them to employ in socially oriented tasks for example, project management or quality. This acuity is so much pigeonholed, which in some scenarios leads to organizational seclusion. Guerrier et al. Similar research has been made in the United Kingdom that focuses on the underrepresentation of women in the IT sector and software development. The consequences shows that a gender identity continues to be done in a pejorative and traditional manner, shows biasness towards gender and consider women on the basis of their soft skill and a less technical profile rather they are as much as competent as man.

Latest findings, also highlight the importance of gender diversity in team science for effectively using the expertise of each team member. Some studies shows that across a variety of disciplines, including software technology women more accurately recognize the expertise of fellow team members than men. It is also found that women are more likely to accentuate educational qualifications when evaluating expertise however men tend to be distracted by extraneous prompts,

such as gender. Therefore by endorsing gender diversity, teams can overcome such biases and reap the full rewards of team expertise.

Community Smells Definitions

Community smells are defined as a set of social-organizational factors that occur within the software development community with a negative effect on organizational terms within the development team which may cause social communication issues over time. A number of community smells definitions have been found from literature but we are referring to some community smell types:

• Organizational Silo Effect (OSE): This smell is established when developers are tightly decoupled, scattering of groups and communication gap and coordination between community developers arises. The significance of this smell leads to project cost as there is a waste of resources due to lack of communication (e.g., time), as well as code replication.

• Black-cloud Effect (BCE): This smell transpires when developers does not share information and close the door of opportunities by not collaborating, discussing the daily stand-ups to receive some resourceful information from expert members in the project that possess such qualities to conceal the experience or knowledge gap of a community. This also leads to the origin a mistrust between members.

• Prima-donnas Effect (PDE): This smell arises when people are reluctant to accept external changes from other team members within the community due to inefficiently structured collaboration. This smell also creates segregation issues, superiority, constant disagreement, contrariness and raise selfish team behavior, which is known as "prima-donnas".

• Sharing Villainy (SV): This smell is caused by not sharing the high-quality and necessary information. The disadvantage of this smell limitation is that members share such indispensable knowledge which is unnecessary, wrong and unconfirmed information.

• Organizational Skirmish (OS): This smell is caused due to disagreements and mismatch of thoughts between different expertise levels and individuals involved in the project as they do not communicate properly. Therefore due to this smell projects productivity gets affected and also the project's deadline are not met properly and most important cost.

• Solution Defiance (SD): The SD smell exists when there is a diversity in cultural levels and experience background in the development community this lead to the division of the community into similar subgroups with completely different opinions showing conflicts in there thoughts about technical decisions. This often leads to project delays and uncooperative behaviors among the team members and developers.

Radio Silence (RS): This smell occurs when unnecessary procedures with strict formality takes place due to the inefficient structural organization. This community smell basically causes changes that are lagging, as well as of no value because this leads to loss of time due to multifaceted and

firm formal procedures. Thus, due to the required formal actions the core upshot of this smell is massive delay in the decision-making process.

• Truck Factor Smell (TFS): It transpires when most of the project information and knowledge are limited to just few developers and does not exchange further. The disadvantage due to this smell results of a high quality knowledge between developers.

GENDER DIFFERENCES AND TECHNOLOGY SELF-EFFICACY:

Inclusively, researchers have mentioned that males shows more patience and deals things with positive attitudes in software engineering when compared to females. While dealing with technology males reported to show lower levels of anxiety. It is also demonstrated that they are more comfortable in software teams and using computers and show more diverse skills and are more knowledgeable about all aspects of computers. It should also be demonstrated that studies has shown that this digital division or computer gender gap is an global phenomenon and that the differences between men and women's self-efficacy and attitude toward computers is regular throughout the world. We propose that gender differences continue to exist in relation to technology self-efficacy. Several studies have investigated female choice careers, and self-efficacy has turned out to be a critical predictor. Women's have significantly lower self-efficacy than male regarding technology and traditionally male-dominated workplaces, including software organizations. Other studies have shown strong gender differences in levels of computing self-efficacy expectations as women shows commendable performances by dealing and handling every situation in a optimistic way. Murphy, Coover and Owen found that the difference in self-efficacy between women and men was highest in software and technical related field. Nevertheless, some studies also has been done that reports no gender differences, in fact there are some researches that reported positive outcomes for women's, however these findings are far less communal.

SOFTWARE DEPENDABILITY AND FAULT TOLERANCE:

Avizienis et al. highlighted that, over the years, there are many methods developed to conquer the various dependability attributes. Those means are grouped into four types: (i) Fault prevention: how to preclude the fault occurrence or existence of faults (ii) Fault tolerance: Maintain provision of services in order to prevent failures in the presence of faults (iii) Fault removal: minimizing the quantity and sternness of failures and (iv) Fault forecasting: estimating the quantity, the future attack and the probability of faults occurrence and their consequences. It has been said that while implementation of software fault tolerance, it is mandatory to edifice and detach the several software versions which is basically design diversity that prevents the proliferation of design faults in result then they can cause the system failure. Risk tolerance is an important factor of human

behavior. A literature summarized by Byrne, advises that men and women possess different tolerances for bearing risk.

FINDINGS OF GENDER DIVERSITY IN SOFTWARE TEAMS:

After examining approximately more than 30 sources of literature including research articles, web sources and several reports by different notorious organizations in the respective domain of research the following implications have been drawn:

- One of the key reasons for gender diversity amongst software teams is the performance that is required by the organization from them. Diverse teams also lead towards wellbeing when working as a unit.
- It also makes the organization as well as the team to understand the target customers along with their requirements which could be beneficial for them. The role of women in this context is very evident since it is been analyzed that woman possesses extraordinary decision power. The better the needs of the customers could be understanding the more it will be easy to fulfil them. The masculine thinking of the team can leads towards constructive outcomes.
- The gender diverse software teams are very beneficial for organizations in terms of acaof acquiring and retaining the top female talent. According to a research around 60% of the graduates are women which makes an attractive pool for the organizations.
- Organizations who provide software based services when focus on improving their corporate reputation, they opt for gender diverse software teams. It is very important for them in terms of growing them as a brand.
- Gender diverse teams helps the organizations in reducing their risks. The main risk for organizations is always towards legal enforcements due to increasing demand for gender diverse workplace. The regulatory compliance becomes inevitable for organizations as a very intensive risk factor.
- Gender diversity give rise to self-efficacy.
- Gender diversity have a positive impact upon creativity and innovation, productivity organizational reputation and performance.

CONCLUSION:

This backdrop clears that gender diversity is not just certifying fair representation of men and women in teams. There is a pressing need to include the context in which the diversity performance link is being examined. It has some vital allegations for resolving the mixed results observed in previous studies. Still it is not ample to ask whether gender diversity improves performance. There is a need to find whether firms are fostering the right climate of inclusion to leverage gender diversity towards better firm performance. This study also provides important support for efforts to encourage greater participation of women at different workplaces.

This study pursued to mature a deeper understanding of the gender diversity in software teams. We did a Systematic Literature Review and found out how a software team can work and perform in the presence of women. We found that Women faces several challenges and barriers encountered in their work surroundings, but that includes more diversity in their roles that can affect the software development teams but in a positive way. Those issues are indicated by term "community smells" but they deal with these efficiently and positively in order to increase the team performance and the end product quality as well. This document found some types of community smells and describes the women role to work and behave in a collaborative and cooperative manner which also increases organizational quality.

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