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Gender Perspective of Software Engineering Working Climate

A Case Study

Bachelor of Science Thesis in Software Engineering and Management

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Abstract— **It is known that females are underrepresented in the field of software engineering, and the importance of efforts to involve more women in the area has been acknowledged. This paper reports from a case study in a large software company about gender perspective on working climate in the field of software engineering. This paper focuses on comparing and contrasting women and men's perceptions of the working climate. Our study confirms that diversity, including gender, is a highly appreciated and desired aspect in the study. Issues reported in the literature such as unfair treatment of women are not reported on in the study. Our findings show that the employee's perceptions of the working climate are mostly affected by individual personalities. However, this topic is complex and sensitive; receiving open and genuine answers can prove difficult.**

I. INTRODUCTION

The literature of gender and working climate research describe issues faced by women in faculty engineering, such as unfair prejudgment that results in unfair treatment. Women are often feeling insecure due to isolation, which can result in women not being taken seriously by their colleagues [1]. Similarly, women in higher education often experience lack of confidence [1]. It is recognized that women are affected by the working climate, and being a minority group within an organization influences the behavior of women [2].

Women in engineering and computer science have always played a vital part throughout the history [3]. In the 1970s until the 1990s women's participation and contribution increased in science and engineering fields [4]. However, there are still trends inside and outside of working climate that could affect how women become influential in the field of engineering [2]. An example of an inside trend is insecurity and self-consciousness. The outside trend can be prejudgment, isolation or social perception towards women. For instance, the majority of women in the field of science and technology are perceived as part of the private sphere and men are perceived as a part of the public sphere. This is due to the perception that women take more responsibility in the home, whilst men focus more on work [4]. Women are underrepresented in engineering and science, this is an issue since women are not equally employed and retained in the field of engineering and science [1].

The working climate in organizations is substantially connected with individuals and group dynamics. A group consists of individuals; therefore the single unit of the organization comes down to individuals. It is also important to understand that individuals and group behavior and feelings, are important aspects in organizational climate [5]. The individuals' cultural perception and behavior can impact group dynamics; this impact can assist organizations in achieving the best possible outcome. When the employee feel secure, motivated and treated equally in working climate, conflicts between employees decreases and productivity of the work increases [6]. By understanding today's climate and learning from the past, there are many ways to strive towards a more equal working climate. For instance, when individuals prejudge others, who are different from them, this can impact people's attitudes and behaviors in the organization. Also the organizational management policies may affect minority groups, such as women that can feel discriminated and isolated. This can lead to different behavioral and attitude changes in individuals, as well as in organizations [6].

The purpose of the study is to gain understanding of gender differences within the IT industry by comparing and contrasting male and females' perceptions, and how it affects the employee's satisfaction of the working climate. The study will be conducted as a case study at a large IT company in Gothenburg. Data was collected through interviews and compared with existing literature. The study is focused on gender differences between female and male employees' perception about the working climate in the organization. Furthermore, the study is based on comparing and contrasting, therefore both female and male employees are targeted.

II. RELATED WORK

Several studies have been conducted to investigate software engineering, working climate and gender aspect in IT field. Many researchers emphasize either the gender aspect or working climate in their studies. Not many studies conduct research about both working climate together with the gender aspect, in the field of software engineering. However, combining these aspects allow us to investigate an area that is not extensively covered by researchers.

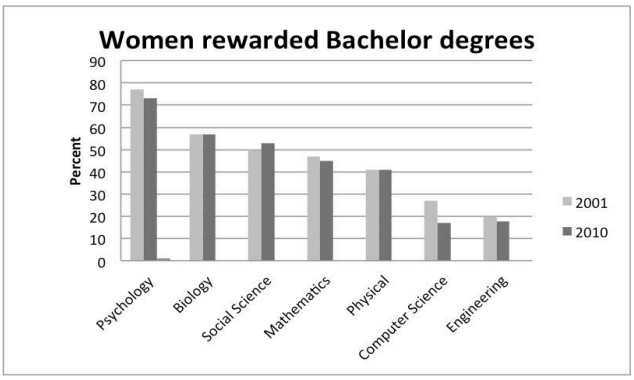
A. Gender studies

Several academic and practical approaches such as research studies and programs have been conducted to involve more women in the software engineering area. Over two decades, a considerable amount of research on gender has been conducted in order to motivate and engage women in the IT and Software engineering field [7].

The society's overall preconceived ideas of professions related to gender, affects people's choice in the professional career such as working in the science or engineering area [4]. In fact, some statistics shows that the number of women attending software engineering education is decreasing [1]. Some studies show that even if women have higher education they prioritize their partner's career more than their own [8] [9], for example when women get married and have a family, they tend to lower their career expectations [9] [10]. Kerr [7] also shows that men are more interested in an engineering career and rank their career higher in their priority list than women do in the engineering field.

There are other factors that influence women's confidence and leadership opportunities positively, and negatively, during their college attendance [11]. For instance, it is more common for women to feel isolated and less intelligent in the beginning of academic years [1] [9]. In view of the fact that software engineering and computer science faculties have more male students, and consequently women feel under-represented, which can lead to their confidence starting to slide downwards [11]. To enter university, or college, students should have higher grades on certain subjects, such as mathematics, physics and geometric, which may hinder students from a chance to explore and gain knowledge about computer science, software and IT engineering [11]. Statistics show that

the percentage of female employees holding a bachelor degree in computer science, or engineering, is decreasing. This indicates that these areas are becoming less attractive to women [9] [10]. As shown in Fig.1, women that hold a bachelor degree in STEM (Science, technology, Engineering, Mathematics), are decreasing if we look over a longer period of time.



a. *Source modified from [12] [13]*

FIGURE 1. WOMEN AWARDED BACHELOR DEGREES, FROM 2001-2010

The data is extracted from two studies [12] [13] and shows a comparison between a study that was conducted 2001 and a study that was conducted 2010. These studies used an identical approach and the negative trend becomes evident when compared to other fields.

Berenson's et al. [12] research study presents a collaborative pedagogical approach that has four themes; collaboration, productivity, confidence and interest in an IT career by creating a pair-programming environment in agile software development. The purpose of the study was to investigate appropriate way of working to maintain current female employees and to attract more women in IT careers. The participants were female students and the investigation was conducted in an upper-level undergraduate computer science course in a software engineering program. Based on Berenson's et al. [12] findings, women are more comfortable working in a collaborative environment, rather than working individually. It is important to study what barriers and factors are influencing women's choice of engineering, technology education and to investigate future impact on the society [14]. If there are not enough educated and knowledgeable people, it is unlikely to be able to create a diverse and gender equal working climate [14].

Throughout history, before the electronic computing era took place in the 1950s, women were more extensively requested to work in computer engineering fields [4] [15]. During that time, female and male employee's numbers were roughly equal in the organizations. Some researchers think that the reason for the active solicitation of female employment in the IT area, during that time, was that women revealed great impact on the computer science field [15]. This could be related to numerous incidents that happened during World War II, when availability of men was insufficient in many labor communities [15]. Another researcher suggests that women's interest was higher in the mathematical field at that time; therefore it was easier for them to explore computer and software engineering areas. [15]. Ada Lovelace was the world's first computer programmer in 1850s, Jean Batrik, Grace Murray Hopper, Milli Koss and Thelma Estrin, are all role models and representatives who show that computer and software engineering is not for only men, there is always a chance for women to battle in this field [15]. It is central to look at the history of women's contribution to software engineering in order to understand the complete picture that has led up to today's software engineering climate.

B. Working climate

When working in the fields of science or engineering, academic majors are often required. The result of inadequate number of women participants, and graduates, from university and colleges, automatically affects organization's working climate. It is difficult to recruit more female employees and create or maintain diversity, if there is a difference in the availability between male and female personnel. Therefore, the strong evidence that women are underrepresented, and is a minority in computer science, software engineering and IT field [9] is a critical issue.

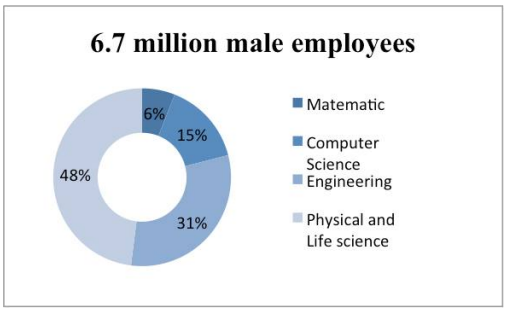
Working climate is just as weather at a workplace, it affects people's daily activity and performance. Furthermore, an individuals' behavior tends to depend strongly on the working climate [16]. The term *working climate* is often used by organizations and describes the overall view of the social and professional environment, however the working climate itself consists of individuals. Therefore, individuals as well as groups, perceptions, behaviors and skills are important aspects in the organization. Thus, an organization's productivity and achievement is directly related to individual- and group activity. A positive working climate strengthens employee's satisfaction, motivation and cooperative performance [9] [16]. The individuals' high motivation and positive perception of working climate, is a vital condition that helps organizations to support the striving towards goals and the capacity to constructively and constantly innovate. Even though, software engineering, technology and programming do not sound human related, these areas could not have reached today's level of high tech era without people's innovation and collaboration. What key factors create a good working climate? The organization's history, culture, structure, strategy and leaders' skill and competence are key aspects to create good working climate [16]. All those aspects involve efforts from each level of the organization's employees. Therefore, it is necessary for everyone to realize how to positively affect the working climate in the organization. Management and leading position have stronger influence than employees. Managers and leaders should motivate, inspire, assess and align employees, regardless of gender, culture and ethnicity difference [16]. To create strong relationships between employees, everyone should feel equally treated and respected, regardless of whom they are [16]. Personal experiences of isolation, insecurity, lack of confidence and feeling of not being included, can affect working climate

negatively. Support and good management system retain the positive climate in the organization and encourages the employee's enthusiasm for the work [14].

Individual behavior is a crucial aspect for a successive and structured collaboration [7]. For instance gender, background, language and other cultural differences can have various impacts in organizations and project groups. Embracing, respecting and supporting the differences make the organizations' working climate better and more comfortable for the employees and increasing their potential contribution in the organization [6]. Many researchers studied technical related topics such as, process improvement and software development. However only 7% of the researchers studied human interaction and individual behavioral related topics from the total amount of software engineering related studies in 2013 [17]. This indicates that technology and process related topics were investigated ten times more than individual and team's perception of organizational climate and personality related studies [17] [18]. This statistic shows that many are trying to identify the result of different processes, change and improvement methods that determines success or failure without inquiring into the different aspects, such as individual's behavior and human interaction in working climate [17] [19]. To succeed in process change, and to improve the productivity and performance, people's collaboration and motivation in the working climate should be taken into account to a larger extent [7]. Since the 1920s individual wellbeing and employment satisfaction research studies significantly increased in the organizational psychology area [19] [20]. The organizational psychology research area investigates the individual's behavior, emotions and thinking [19]. These studies are also applicable in the software engineering field to manage people more effectively and to make a better and positive working climate, that drive people to perform better [21]. In the 1970s, research to investigate organizational culture increased, particularly in the organizations working climate, which drew the attention of researchers and organizations [20]. In general, the studies had identified several dimensions and aspects that impact the working climate, such as individuals' feeling and perception, organization diversity in different aspects and communication. Those combined aspects together with the organization's goals, can contribute in creating a good working climate [21].

In the software engineering field there is a tendency to disregard some vital aspects when it comes to working climate, for instance, diversity in terms of gender [16]. Although, many researches have emphasized that if the organization has more diversity and mixed groups, it tend to show higher performance and produce a higher quality product [16] [19] [21]. Recently, research within software engineering illuminated how gender imbalance with more men may lead to certain attitudes in the working climate, like a more harsh jargon and a higher risk to become unambitious and unfriendly. This can then inhibit innovation and creativity [16] [19] [21]. Many researchers agree that software engineering and IT organizations' working climate are struggling to keep the balance of diversity regarding gender equality [6]. Working climate should benefit both organization's and employee's' advancement and contentment [20].

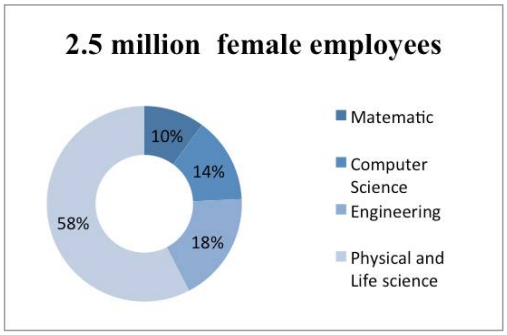
Engineering working climate is still recognized as hostile to women [1] [2] [4] [22]. The distribution of male employees holding bachelor in 2009 is shown in figure 2. This shows that engineering degrees represented almost a third of the degrees [23].



a. *[23]*

FIGURE 2. MALE EMPLOYEES AWARDED BACHELOR DEGREES, USA 2009

In contrast to the male employees the female employees graph looks very different. As shown in figure 3, female employees that hold a bachelor degree are much fewer than the males. Furthermore, when looking at the distribution of the degrees and in particular the engineering field, it becomes evident that few women choose this field [23].



a. *[23]*

FIGURE 3. FEMALE EMPLOYEES AWARDED BACHELOR DEGREES, USA 2009

Ideologically, engineering and science working climates are systematized "masculine", and most of the engineering fields are disciplined hard, objective, rational, and logical. On the contrary, "femininity" is more soft, subjective, emotional and tumultuous [24]. Therefore, it is hard for women to adapt to a strong masculine working climate [24]. Even though a lot of research has been done in the field of gender aspects, it has not been combined with the working climate in the field of software engineering. Therefore we believe that the combination of gender and working climate, by comparing and contrasting men and women's perception about working climate, would be helpful for the software engineering community to obtain further evidence and support. The more knowledge and understanding we gain about gender difference and perception about the working climate in software

engineering and the IT area, the more can be done to involve more women into the field. In addition, by investigating and understanding the gender difference and perception of the working climate, our study may inspire and motivate more women into the software engineering field.

III. CASE COMPANY DESCRIPTION

The research study is based on large sized IT Company, which is located in Gothenburg, Sweden. The company mainly builds software products developed in-house. The company is located in Sweden, with subsidiaries that are located abroad. The company has a total of 17000 employees of which 25% are women. In the Gothenburg office there are currently 2500 employees, which will be our main area of investigation. The company has a team-based working climate and the teams consist of both male and female employees.

IV. RESEARCH STRATEGY

The main objective of the study is to investigate how employees in software engineering perceive their working climate and to explore similarities and differences between genders. The following research questions are defined:

A. *Main question*

- How do employees perceive working climate?

B. *Sub-questions:*

a) What are the similarities and differences between genders regarding the positive aspects that affect the working climate in the organization?

b) What are the similarities and differences between genders regarding the negative aspects that affects to working climate?

For these research questions, a qualitative case study is found to be the most suitable approach, in order to gather the most appropriate data for the research questions, such as in-depth and detailed data. Other methods, such as a survey, which is usually a quantitative method, will not cover the depth and detail since it does not give the opportunity to evolve questions depending on the answer. This is very important to our study since the objective was to capture all possible aspects. Also, using an experimental study would require thorough previous knowledge, since the setting should be known before conducting the study; therefore this would not be applicable to this setting. Quantitative methods also require background knowledge where you prove if the hypothesis if false or not, which is the opposite of a qualitative method where you want to discover the unknown.

Case studies are known for their qualitative strategy and the data collected usually consists of detailed descriptions [25]. By definition, a case study is conducted in a real environment. This is to ensure realism in the study and means that the study is within a less controlled setting [26]. Furthermore, the research methodology characteristics of a case study is directed towards an exploratory setting and the primary data that is collected consists of qualitative data that most often goes into depths in detail [26]. The design of a case study is flexible and allows the key parameters of the study to be changed during the study. One of the most important parts of the case study is the interviews' [26].

C. *Data collection*

We used a semi-structured interview in order to collect data, this is because the aim was to gather detailed data and get an in-depth understanding as well as discover parts that we may have overlooked. A semi-structured interview has open-ended questions and allows the interviewee to some extent lead the conversation. The purpose of a semi-structured interview is to let information or questions to arise, which may not have been considered in the first place [25]. By using this method it is more likely to receive more detailed data that goes into depth of the topic. Furthermore, when conducting the interviews the first step is to introduce the topic to the interviewee and explain how the data will be collected and how it will be used in the research [26]. This is to build trust and create a good atmosphere for the interview. It is also essential for the interviewee to know that they are anonymously reported in the paper, even though the interview is conducted face-to-face. This is to ensure that answers are more likely to be trustworthy rather than the interviewees feeling reluctant to say anything that could potentially harm their current position. All interviews, based on consent of the interviewee, were recorded to ensure that no data was lost. This is the created structure for the interviews; the questions are divided into the following categories:

- Knowledge
- Group dynamics
- Assessment
- Other

For the interviews, different people within the company were targeted, representing male and females and different areas within the organization, both within management and technical development. We interviewed three females and three males, six people in total that had various positions in the organization. The interviewees were selected by the organization through a contact person, and we do not know under what circumstances they were selected. Therefore we must also consider a potential bias of the participants being colored by the organization. The total number of participants was based on the number of females that the company assigned to us and where willing to participate in this study. Table I, summarizes the interviewees and their roles.

We conducted face-to face interviews and each interview lasted approximately 50-60 minutes. The first step in the interview was to gain trust of the interviewee and introduce the purpose of the topic to the interviewee. After the first interview the data was analyzed, and served as a learning opportunity to improve the study. Depending on the responses, the questions were changed, or modified, to fit the purpose of the study and the improved questions were used in the next interview.

TABLE I. INTERVIEWEES AND THEIR ROLES

F = female M = male	Roles in the company
F1	Scrum Master
F2	Human Resources
F3	Program Manager
M1	Developer
M2	Change Agent
M3	Line Manager

D. Data analysis

When analyzing the result of the interviews, well-known techniques were used, such as coding and creating a chain of evidence from the original data and the findings. Coding consists of blocks of text that are given a code, several pieces of text can have the same code and are patterned together if they regard the same topic. By using this pattern matching and coding the researcher will be able to analyze the result and also create a chain of evidence to provide the reader with an understanding of the final conclusions [25]. The categories that we created for our interviews were used in order to sort the different types of data. This was done deductively [27] where we used the categories to code the individual interviews and adding codes for additional aspects. By using this technique we can more easily compare, and contrast, the results of the interviews. We used color-coding to get a more clear view of the data we collected; each category was assigned a color and based on the content of the data, the data was then sorted in the matching category. This was done independently to avoid any bias, after this step was concluded we proceeded with comparing our independently colored data to discuss and resolve any disagreements. In addition to the coding, we compared and contrasted the data dependent on gender; this was done to investigate any significant difference between female and males perceptions within the categories. When this step was done we proceeded with data analysis by creating a table where we could match the data to the different categories to get a complete view of the data collection. When extracting the data from the interviews we used thematic analysis. Thematic analysis helps extract the core points of an intelligible and meaningful pattern in the data [28]. Additionally, one interview was held in Swedish due to the participant's request, which led us to a careful translation of the transcript, in order to not misinterpret the data.

V. VALIDITY THREATS

There is no explicit definition for the quality of a research study; however researchers have investigated how to conduct more truthful study in terms of less bias. The type of threats that affect the quality of the study is depending on the research study design. For instance, in a qualitative research study, the validity threat can be misinterpretation, observation or experiment description, and manipulated data [25]. Maxwell [29] identified five threats that affect to the validity of quality research and introduced the techniques that can reinforce the validity of the qualitative study; they were described in Lewis' work [30].

Regarding our research design, we as researchers must be aware of the validity threats that can affect the quality of the study. When using interviews one must consider the possibility that the answers can be colored by the view of the interviewee. Furthermore, the presence of the interviewer can also affect the respondent's bias and not all people feel comfortable sharing and describing their own perspectives. The answers to the questions were not collected in a natural setting, but in a designated manner, this could affect the bias [25]. It is important that the researcher is aware of all these aspects when analyzing the result so that this is taken under consideration when drawing the conclusions. In addition, the topic of our case study might be sensitive to the company; both from the perspective that the company does not want to have any negative publicity regarding the area and that the responses of the interviewees might show answers that are politically correct, that would not harm their role at the company. In order to avoid this kind of bias we conducted the questions certain order, so that general question that were not obviously linked to gender were presented first and then in the end there were more questions regarding gender. This was done in order sum up the result of the interview. Our research follows the five threats identification by Maxwell [29].

Descriptive validity: We had six interviewees, who participated in our study. With the agreement of the participants we recorded the interviews and we ensured them that the data that we gather would be presented anonymously. By doing this, we gained trust with our interviewers, so we could receive more truthful answers. Most importantly, the recording helped us to collect more descriptive data and to make sure that the answers are documented correctly. Moreover, the recording helped us avoid omitting relevant data and to remember the process clearly, which was beneficial when analyzing the data.

Interpretation validity: To effectively interpret the real concept that is given from interviews, we interviewed the participants separately. The primary threat to quality of the study is misunderstanding and misinterpreting, to avoid those threats, our questions were formulated as open-ended questions. This allowed the participants to elaborate on responds and we maintained a neutral position, not making any misleading attempts, such as filling in the sentence and encouraging the response. However, there is also a risk of the interviewer misunderstanding and misinterpreting the response of the interviewee. We tried to obtain the responses as neutral as possible and eliminate leading and directional questions that could affect to data.

Researcher bias: To avoid bias that could relate from investigators side, such as asking different questions to different individuals and mixing own point of view by asking leading questions and rephrasing the responses, which could influence our findings and result. Therefore, both researchers participated during the interview to ensure the interview process; also each researcher double-checked the record with transcripts to confirm the data.

Theory validity: We as researchers tried to restrain our personal perceptions, expectations and judgments from the study and tried to be more impartial and observant to the data, regardless of the data being contradictive to our personal expectations. For that reason, we eliminate our bias so that we are able to answer our research questions as truthfully as possible.

Reactivity validity: The reactivity is the impact of the researcher presence that can affect the interviewee's responses. We tried to avoid too much communication with interviewee, because we avoid influencing the interview environment or unintentionally misleading the interviewee, which could impact our research outcomes. To avoid reactivity threat, we categorized our questions in six different sections and prepared three to four main interview questions in each category. It was helpful to keep the interview focused and control the interview in in right track.

In addition, one validity threat could be the language. All the participants have been interviewed in English except one person who felt uncomfortable to talk and expressing his/her opinion in English; therefore we changed the language to Swedish. However, for the rest interviewees English were not their native language, therefore interviewees might not express themselves fully. We tried to eliminate as much bias and threats possible to improve our quality of the study and provide more accurate and honest result. However, we cannot guarantee that those approaches covered all of the threats to validity of our study.

VI. Findings

The findings are presented dependent on the category and are divided into two subcategories of the gender.

A. Knowledge

This category is based on how employees perceive support of their knowledge advancement in the company.

1) Females

The general perception amongst the female interviewees in the company is that there is good support like courses and training for developers. There is also a high positive emphasis on the individual choice of development and managers' as well as colleague's support in the organization. One of the interviewees stated, "*I have a good manager that support me very well and the colleagues supports me, we support each other*" (TABLE 1. F3). One of the interviewees said that she perhaps works faster if she has a more direct manager, since she perceives a direct attitude as more serious. In addition regarding the gender distribution and knowledge, one described programming as a male hobby and that it is a very technical climate in the organization. She did not think that the technical things were too hard to learn and therefore she did not understand why not more females choose this path.

The females did not state any negative aspect regarding support of their knowledge; however there was negativity towards redundancy processes and that it affected the newest employees the most in the form of stress and uncertainty.

2) Males

The male interviewees tended to talk more about their performance and that it depended on taking the opportunity, being eager to learn and learning by doing. They did also mention the positive support from the organization in form of education for developers. One male also felt that there was a general perception that guys are more technical and females are more organized and that females tend to ask more whilst males are supposed to know more. He did also state "*I think it is a built in reflex that you are for example nicer to a female and this can be because I am a male, but I don't know. Some females get more help than some males*" (TABLE 1. M1)

For the negative aspect regarding support of their knowledge most of the males did not mention any particular event. However one interviewee stated that "*lacking organizational support, for example trying to pursue a task that is not really in the highest of interest in your current organization, that tends to fall a bit between the chairs in the different parts of the organization*" (TABLE 1. M2) the interviewee felt that it was hard to bridge and get the right attention regarding this matter. Another said "In the broader area I can also do changes but it is hard to do something outside the responsible area since I do not have the knowledge, experience and influence.

B. Group dynamics

This category is based on how employees perceive the working climate with regards to how people collaborate with each other.

1) Females

All the females that we interviewed mentioned the term "*high performing team*" (TABLE 1. F1. F2. F3) with regards to good group dynamics, this was both with regards to managers and to developers within the company. The interviewees touched upon several different factors that they thought contributed to a high performing team, such as foreign experiences that enhanced the working climate, having an open atmosphere, getting clear goals from start and being pragmatic. When it comes to the diversity of the group, one stated that she thought it was easier to work when the group is mixed, preferably with the same amount of people from each gender. When asked in what way it makes it is easier the reply was "*I am a woman myself but at least they try to understand what you are trying to say and it is probably easier to communicate because we have the same type of language. My feeling is that guys… it feels like they do not want to understand especially those who do not want to work in a team, they don't want to listen to what you say, they don't want to try to understand. My feeling that women are more into trying.*" (TABLE 1. F1). However, she also highlights the fact that it is also dependent on the individual and that this is not generic for all men. Furthermore, one interviewee talked about the difference in having both males and females in a group and how the management team set norms for the employees and how they are good examples for the groups. The following was stated "*We see that they share values and focus on what it is important and my impression is that, teams that are mixed are often better working teams*" (TABLE 1. F2). She did also describe in what way a mixed team would

work better, "*For instance when we are challenged in the group, female employees bring a broader perspective and a more tolerant perspective and inclusive perspective, not in general but often"* (TABLE 1. F2). However one female did not feel that it was any difference in the group dynamics when it comes to mixed groups. Her perception was that; since she is a woman herself and that the males probably influence her she would not be able to tell if it made a difference in the group.

The negative aspects that were mentioned were; not receiving clear instructions or goals and that the task was not broken down into smaller parts before it was handed out, therefore parts are forgotten and no one is taking the responsibility for them. One interviewee that was a manger stated, "*you are not allowed to select the team in anyway, you are not even allowed to select roles so you just get a bunch of people and they say okay, make a team out of these people*" (TABLE 1. F1), the interviewee explained that this was sometimes frustrating due to the personality of certain individuals that do not want to cooperate in a team. One of the interviewees stated, "*I think women are perhaps a little bit more positive. At least they try to find the good things even in the bad parts they try to find the little light that is somewhere in there. But guys tend to get more positive when it is positive and more negative when is negative*" (TABLE 1. F1).

2) Males

The men talked about the importance of diversity, in forms of different professional backgrounds and previous experiences combined with individual personality that contributed in creating good group dynamics. One of the interviewees stated, "*I have been part of skilled teams with diverse skill-sets that I think is bringing that positive experience. I think that is really important so it is probably some of the more important good experiences in set*."(TABLE 1. M2) He also explained how it helped in creating an efficient team, by using the diversity to its advantage and utilizing parts together. Another positive aspect that was mentioned, was when the manager that assembles the group did not only look at the different skills of the individuals but also looked at the different personalities in order to assemble the best team possible in form of behavior. One of the interviewees thought that having a mixed group is preferable to a group with only one gender. His experience was that you have to have at approximately 25% of the gender which you have less of in order to form a balanced group with better dynamics. He also highlighted that this was only generalizing and that personalities and different individuals can have a big influence. Another pointed out actions that he had been taking in order to improve the group dynamics; he thought that it is common that people use the term "hey guys" and that it might contribute to women not feeling included. Therefore he had used the term "hey girls" and asked if the men felt included. He says that this needs to be reevaluated, "*if it did not matter, turn it the other way around and see how you would react and if you don't recognize this problem try for one meeting exchange guys to girls and let's see what happens*" (TABLE 1. M3).

The negative aspects that was mentioned, was involving too many people in a task with different roles; this had led to confusion and misunderstandings between colleagues. One interviewee mentioned that diversity is good; however sometimes this can lead to conflicts and lack of respect due to the different ways of thinking. In addition changing and replacing people too often was perceived as negative since this could cause an unstable group dynamic. One of the interviewees also mentioned that the he had experienced a situation with a large group with both females and males that had various backgrounds. In this group smaller sub groups had emerged that had different sub-cultures. This had caused a lot of conflicts and the interviewee thought that this was due to the difference in values, gender, and perceptions. Another interviewee talked about the change in the climate when a woman is present in a team and that it makes a difference in the attitude. His perception is that teams that consist of only males have a bit harder approach and that they tend to slide into typical guy talk. He did not like this kind of environment since it can get to harsh and male oriented. He did not experience this when the team was mixed.

C. Assessment

This category is based on how employees perceive encouragement and assessment from managers as well as colleagues in the company.

1) Females

When asked about assessment, the females gave different answers in form of their perception of assessment and what it means to them. One mentioned the performance evaluation that is done three to four times a year where the employee meet with the manager and goes though the goals and discuss if they are achieved or not. This was perceived positive since the interviewee felt that they got a chance to motivate their decisions and why things were done/not done and the manager gets to give this view on things. When asked about assessment towards colleagues the interviewee stated, "*It's a goal we have in the team, we try to set up, to state what expectations we have on each other in our different roles. I found that to be quite a good way to get the team to work better together, because it is easier to understand what you expect from me and what I expect from you and then it is easier*" (TABLE 1. F1). The females mentioned support from colleagues as an positive aspect and one of them mentioned healthy competition as everyone is aiming towards the same goals. Regarding assessment from managers, one of the interviewees felt that there was a difference in behavior from the manager depending on the gender, saying that men are more direct and that women are more polite in the way they give feedback. Although when getting used to the male climate this is normal. Another interviewee, who was a manager, said that she could express herself more clearly to female employees since she can relate more to them.

The negative aspects that was mentioned was an event where a manager assisted another manager in giving feedback. The manager that assisted in the feedback felt miss-interpreted

when she heard about it later on. This lead to a reluctance to assist in giving feedback in the future. Regarding feedback another said that she gave feedback dependent on the individual so that it would be received in the best possible way. In addition one said the she did not feel she was assessed enough, she wanted more feedback from her colleagues in order to improve the working climate.

2) Males

The males did also respond differently depending of their interpretation of the question. One interviewee was more focused on the product and talked about receiving feedback depending on how things that he develop are used and that the people who use the system will give him feedback. What was also mentioned was the "all employees meeting"; where people from the unit come together and present, this was perceived as a positive event since the employee felt that he was a part of something important. Furthermore he felt supported by his manager and felt that he had a freedom within his responsibility. Another aspect that was mentioned was encouragement by colleagues, one interviewee stated, "*I feel encouraged by my colleagues in the sense that I am a part of a high performing team and that I know that my colleagues have high expectations on themselves and on me and I know that if I do something that is not good quality work somehow they will let me know and they will say so. But if I do something good they will recognize that. I think that is encouraging, together wanting to have a high standard on how we do things*" (TABLE1. M2). Another aspect that was mentioned regarding positive perceptions of assessment was the yearly process of feedback where you discuss your present and future goals; this was seen as helpful and encouraging. One of the interviewees talked about his perception of different attitudes dependent on gender. He described that he had a male manager previously who was concerned about soft questions and when he got a new female manager he thought that it was going to be more of those questions, but in fact this did not happen at all. When he got a female leader it was more freedom under responsibility and more coaching and cheering. He made the conclusion that it is more dependent on the type of leader rather than the gender. Furthermore, one of the interviewees explained that when he gave feedback he did not make any difference regarding gender but rather based on the individuals personality, however he said that there might be an unintentional difference.

For the negative aspect, one interviewee mentioned expectations being set too high and as an employee being accountable for that, brought a feeling of giving up before even starting the task. Furthermore, one interviewee mentioned that not being listened to when you know that you have something of importance to say is very discouraging. One of the interviewees also talked about giving feedback and how that is received dependent on the gender. He said that improvement suggestions tend to hit harder for females and that males tend to stick to the good part. He stated, "*For example, if I say ten good things and one suggestion, females have tendency to remember that one improvement*" (TABLE 1. M4). However it was never mentioned if this was positive or negative regarding assessment.

D. Other

In this category the interviewees was asked if there were anything else they would like to share. The data presented here is outside our main categories; however we believe that some aspects that they share are still relevant in regards to group dynamics or gender in software organizations. Since the data here is not compared and contrasted it is not presented as female or male.

A. In the organization one of the interviewees wanted to point out that it is the knowledge that you have that earns you your respect in the company and that there is no different treatment because of the gender of the person.

B. One also mentioned the many nationalities of people working in the company and how that contributes to a more diverse working climate in terms of backgrounds and cultures.

C. Another aspect that was mentioned was the organization's support for people with disabilities such as Asperger. According to the interviewee the people with Asperger are treated very well.

D. Regarding gender and salary equality one stated, "*It was quite early when I was manager, quite ahead of looking into salary structure market for females, in order to push them up. Even though they have the same background, same performance, and same amount of years and experience roughly, this was ten years ago. Analysis say it is ongoing, but in team there is no difference. People can have different salary but it is not gender, it is performance, experience and background".*

E. It was also evident that the organization pushed towards hiring more females; however the interviewees that pointed out this, did also mention that knowledge is key and that the expectations on the candidate are still the same. One of them said that they tried to influence people in order to choose a female, since mixed groups have better efficiency.

F. Additionally some of the interviewees talked about reaching out to universities in order to attract more females. One of the interviewees mentioned that the uneven distribution is due to the circumstance that there are more males studying software engineering than females and therefore naturally the industry would not be able to have an equal distribution.

VII. DISCUSSION

In order to conclude the main research question, we present an overview of the findings as seen in Table II. The table will lay the foundation for further reasoning of our analysis. The table shows the similarities and differences of females and males responses to the questions regarding the categories, knowledge, group dynamics and assessment. The "other" category is not included since the interviewees talked about different things that were not in relation to each other. However, they are still a relevant aspects and taken into consideration in our analysis. In the discussion, we connect and compare our findings with the literature. We also reflect on our perceptions of the interviews and how that could have affected the data and the result of the study.

A. Diversity

Our analysis shows that many of the employees mention diversity as a positive aspect of group dynamics. This is shown in table II in group dynamics and similarities. Even though both genders mentioned this as a positive aspect, it was also added that this was only in general. Overall when talking about sensitive questions many of the interviewees stated something and then added that it is only general and it depends on the individual. When getting this response it is hard to determine whether the answer is politically correct or if it is their genuine perception. The perception that the interviewees have is that a mixed group performs better in the company match the theory of many researchers [16] [19] [21]. Even when talking about the negative aspects of group dynamics it also becomes apparent that the underlying implication is to encourage mixed teams. When the negative impact was explained more in detail, a male group was associated with a certain attitude and the perception was that it brings a male oriented climate that can be harsh. This is described in table II, group dynamics and similarities. This can also be put in relation to the females feeling that they can relate more to other females. This is also in line with what Denison [19] and Rigg and Sparrow [24] describe, of course this can only be known from the experience of being a part of a group that consists of only males.

When seeing the different responses in table II group dynamics, knowledge and looking at the differences, one can assume that males are more self-oriented and that females are more concerned about the surroundings. Berenson et al. research study suggests that women are more comfortable working in collaborative environment, rather than working individually [14]. These responses show the different mindsets and can to some extent confirm the theory since the answers reveal the different genders concerns when it comes to what positive aspects affect their advancement in the company.

Since the diversity and the mixed groups were the aspects that were most recognized amongst the employees, we can see that the company is emphasizing and highlighting the importance of diversity. This is shown in table II group dynamics and similarities. In order to keep up with today's rapidly changing software climate it is important to stay up to date. Even if the employees are satisfied today, the work still needs to continue, there is no end date and this will evolve over time together with society's development and perceptions. We encourage the studied organization to continue its work towards a good work climate and for

TABLE II. GENDER SIMILARITIES AND DIFFERENCES

Categories	Similarities	Differences
Knowledge	• The positive support from the organization in form of internal education, programs and career advancements.	• One female talked about the positive support from managers and colleagues as several males talked more about their own performance and taking the opportunity to learn more.
Group dynamics	• Diversity was mentioned as a positive aspect, diversity included different backgrounds, professional experiences in a combination with individual's personalities. • The benefits of having a mixed team and that this was preferable since it increases the efficiency of the group and that it enhances the working climate. • Manager's values have an influence on the group dynamics and that the manager's contribution in form of ethics and group assembly can affect the group dynamics in a positive way. • Teams that consist of only males have a bit harder approach and that they tend to slide into typical guy talk. This was not preferred.	• Females communicate easier with other females and when challenged they bring a broader perspective and are more tolerant. None of the males mentioned any characteristics of either gender that would contribute to a good working climate. • The male's awareness of females being a minority in the company and that they take actions in order to make females feel more included. This aspect was not brought up by any of the females.
Assessment	• The performance evaluations and the expectations on your colleagues and manager and what they expect from you, was seen as a positive process that enhanced the working climate. • Men were being perceived as more technical than females. • Males are more positive when it is positive and more optimistic when receiving feedback.	• Females mention that male managers are more direct and women are more polite in the way they give feedback. One of the males said that he had a preconceived view of a female manager, but when he got a female manager his preconceived ideas was contradicted by her behavior. • A male said that improvement suggestions hit harder on females whilst the female says that females more often try to see the positive.

organizations in general in the software engineering field to increase the number of female employees since mixed groups prove to be more efficient.

B. Gender equality

In our study we can see that the females that we interviewed did not show any signs of insecurity, unfair prejudgment resulting in unfair treatment or being insecure due to isolation as reported in the theory of Trautner, Chou, Yates and Stalnaker [1]. The women that we interviewed showed strong confidence. However, people are individuals with different personalities and this may generate different results with different females. It is worthwhile reflecting on this, and to consider the notion of gender equality in Sweden. There is a long history in the Swedish society about initiatives for equality between men and women, which to some extent has positioned the Swedish society as a role model of gender equality at the International arena. This has also been an aspect of pride in the society, and could lead to denial of issues in order to keep up appearances - an issue that is not talked about or discussed may lead to the perception that it does not exist.

If we look at the overall picture of the answers given we can see that females do not seem to be concerned about the fact that they are a minority in the company and they did not give any indications of feeling excluded or treated differently. Women are more collaborative; this is both shown in the literature [14] as well as in the interviews. Interestingly, our findings reveal that males are concerned with females well being in the company and some even take actions that are aimed to make females feel more included in the working climate. This is shown in table II, group dynamics and differences, last segment. This difference could be due to women being a minority group in the company. Since men are already a majority they may not feel a substantial need to support and encourage other men, but rather supporting the women in the organization. This is shown in table II group dynamics and differences. At the same time, women being a minority in the organization would most likely want to feel solidarity towards other females. This can be related back to how minority groups within an organization influences the behavior of women [2].

In relation to this, one of the men talked about how improvement suggestions tend to hit harder for women and that men tend to stick to the good part, as shown in table II, assessment and differences. Since none of the women did mention this aspect, we cannot know if this perception is confirmed, or if it is due to the individual's personality and characteristics [17]. However this shows that men within the company are concerned about how women react to feedback.

C. Increase interest

Looking at software engineering students it is clear that fewer women have interest for technology and science [10]. Also at the company, one of the interviewees said that they try to attract more women, she pointed out that the uneven distribution is due to the circumstance that there are more men studying software engineering than women and therefore naturally the industry would not be able to have an equal distribution. This is mentioned in the findings, "other" category F. This perception corresponds very well to the existing literature. The literature indicates the same problem [8] [10]. There is a general perception presented in literature that implies that women are not seen as suited for an engineering profession [1] [2] [4] [22].

One female did talk about programming being a male hobby and that there is a very technical climate in the organization, this perception did to some extent occur amongst the males too. One of the males described that males are seen as more technical and females more organized. This is shown in table II, assessment and similarities. Even though these two responses were said in different context they show correlation with each other. These similar perceptions can also relate back to the literature describing that men are more interested in an engineering career, which indicate that men have a more technical interest [8]. Though both did mention that they did not know the reason for this perception. Furthermore, the woman could not really understand this perception since she did not think that technology was a hard thing to learn. Looking at the women's reasoning behind this perception, it suggests that she thought of the technical part as being a potential challenge for women. This can lead to more reasoning such as: are women reluctant to work with technology because it is perceived as hard to learn and if it is not hard to learn, is it the perception that hinders them to not choose the field, or could it be something else that influences their choice of field?

The company is already taking actions, such as increasing the number of females in the IT field and ensuring better supply of engineering and technology education to young women. These are all great initiatives that we encourage to increase in order to create enthusiasm and gain women's interest in technology. This can include reaching out to more women in young ages to try to capture their interest. The result of the work and effort that is put in now will not give an immediate result but more of a long-term investment for the future generations. In addition, by hiring more women, the women can feel more solidarity and relate to one another, which some of the women said that they prefer. These are very comprehensive recommendations; however there are still small adjustments that can also make an impact on the working climate.

D. Supporting the working climate

Females mentioned colleague and manager support as a positive aspect that the organization deals with very well. According to the responses of the interviewees the company does a lot to improve the working climate, such as internal education and programs. The data revealed that many of the employees did perceive that they had good support from the company and that the working climate in the company was overall satisfying to their individual' needs. This is shown in table II knowledge, in both the similarities and differences. However, lack of organizational support was still mentioned as a negative aspect but only as a minor aspect. This was due to too high expectations and being accountable for the result

when his opinion was not listened to. Even though all this was only one case, it is important to see individual's perspective and if there is one person feeling this way, we cannot be sure how extensive this feeling is amongst employees. This point to the importance for companies to make sure that managers have a close dialogue with their team members, so that everyone feels important and that their opinions are recognized. This is also mentioned by employees, as shown in table II, group dynamics and similarities as well as in assessment and similarities. Another aspect that we would recommend is from a manager perspective to discuss the expectations and outcome of the task with the employees and listen with an open mind to their opinions. When looking at how to create a strong working climate, Soomro and Salleh [16], mention manager and leader support and that everyone should feel equally treated and respected. The example from one of the interviewees about how the company supports people with Asperger shows that they are treating people well regardless of who they are.

Not only should the managers support their group, it is also necessary for the managers in order to develop and grow in their roles to receive support and feedback from their employees. One of the managers did not feel that she was assessed enough by her team members and that more assessment would help both the team and her to perform better. When it comes to assessment, some people feel reluctant to give their manager criticism; therefore using anonymous feedback could potentially give more valid feedback. Increasing the amount of assessment occasions and for the employees to stay objective would increase support for the managers in the company.

When talking about manager behavior one of the women mention that male managers are more direct and women are more polite in the way they give feedback, however she said that she had become used to the male climate and now thought of that as normal. This is shown in table II, assessment and differences. This was an aspect that was not recognized amongst males. One of the males said that he had a preconceived view of a female manager, but when he got a female manager his preconceived ideas was contradicted by her behavior. The preconceived ideas of a female manager were similar to those Rigg and Sparrow describe as "femininity" [24]. This would probably not occur to a big extent if the women were not a minority group in the company.

E. Employees combined perception of the working climate

When looking at the combined perceptions amongst females and males in the company one of the most evident data that we collected from the interviews was the perception that mixed groups are preferable; this is due to the utilization of knowledge and experiences. This confirms the theory of mixed groups having a higher performance and produce higher quality product [16] [19] [21]. Furthermore, many mentioned that diversity contributes to a good working climate and that diversity is the background of the individual, as shown in table II group dynamics and similarities. Already in the 1970s studies had aspects that investigated the working climate, such as individuals' feelings and perceptions, those aspects contribute together to an improved working climate [18]. We can now see that this is still relevant in today's software engineering climate.

When investigating the negative aspects it becomes apparent that we did not receive much data, which could be for various reasons, for instance, reluctance to say anything negative about the company that would harm the company or their own position. It could also be due to the order in which the questions are asked, or just the personality of the individuals. Or, it could simply reflect their genuine perceptions. During the interviews, we observed the participant's behavior, body language and actions, which can be used to try to see the underlying meaning of the response, and we do believe that there may be a natural concern and reluctance to talk about these negative aspects in the company.

Since the topic of this study is sensitive to a company, and the society at large, it is difficult to reveal true perceptions. The study is also complex regarding to distinguish whether it is gender related or just the individual's personality and characteristics that is perceived and impacting the working climate in a certain way. Lastly, based on our findings, the employee's perceptions are more likely dependent on their surroundings, such as individuals, performance, knowledge and their personalities rather than the gender differences. The unevenly distribution and the preconceived ideas that are associated with gender perspectives does not seem to be the main concern when it comes to the working climate.

F. Limitations

After analyzing our collected data and reflecting on our findings there are several things that can be done to improve the study even further. We decided early on that the participants would be guaranteed anonymity; this forced us to leave out background information that could reveal their identity in the company. However the reason behind this decision was that, we believe, that if we could guarantee anonymity we would get more trustworthy answers. However, we do understand that previous background and experience could influence the perceptions of the participants. This would include, age, educational degree, ethnicity, culture etc. Nonetheless, the aim was to investigate how employees in software engineering perceive their working climate and to explore similarities and differences between genders. The research that we conducted would not be able to cover all these background aspects in depths to provide a valid answer regarding other factors. Furthermore these aspects are only a contributing factor and are not the main objective of the study. In addition, the study that we conducted covered six interviews and aimed to capture in depth data. However, elaborating further after the interviews and having a second set of interviews where we would be able to ask questions that we might have overlooked the first time would increase the quality of the study. Also by investigating further literature and increasing the number of participants would give a broader understanding, however this would require more time. Additionally, conducting the interviews with both genders present, the interviewers might allow for a more open and

comfortable dialogue rather than having only women as interviewers [31] [32].

To improve the study even further we would recommend triangulation in the data collection. Triangulation involves data that is collected from different sources in order to confirm the result, such as observations, documents and interviews [25]. In this case we were not able to gather any internal documents from the company and observations require a longer period of time. We believe that observations would be helpful when in investigating employees' individual behavior and actions. Furthermore, seeing the employees' body language and expressions would possibly reveal a more accurate understanding of the working climate regarding gender. The study was investigating one organization's working climate. We do understand that the working climate can vary dependent on the organization's approach and different attitudes towards the subject. Therefore conducting a study that involves several organizations may give a different outcome. Also, using a different context could potentially affect the result.

VIII. Conclusion

Our study was conducted to understand the perceptions of the working climate in a real setting where women are working in an environment as a minority group. Based on our findings we can conclude the following: The working climate in the organization is most affected by individual's characteristics and personalities rather than gender aspects. However, this does not eliminate the gender aspect having an impact on the working climate. It does still contribute to the overall perception of the working climate. There are concerns regarding the uneven distribution of females being a minority in software engineering companies as well as universities. Though this is recognized as an issue it does not prove to be the main concern of the employees regarding the working climate. We could also conclude that since this topic is complex and sensitive, receiving open and genuine answers can prove challenging.

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