Towards an Explanatory Theory of Motivation in Software Engineering: A Qualitative Case Study of a Small Software Company

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Abstract—Research on motivation has made important contributions for the software engineering practice, but it has mostly adopted quantitative approaches, towards generalizable statements. However, given the complexity of the human behavior, motivation seems to be affected by diverse environmental conditions, and to be moderated by individual and organizational characteristics. Therefore, contextualized and explanatory theories are needed to account for this diversity. This research presents a grounded theory aimed at describing and explaining the motivation of software engineers in the context of a small private software company, in Recife, Brazil. Semi-structured interviews were carried out over four months, and data were analyzed using grounded theory procedures. As a result, we present statements that connect, relate, and make sense of contextual factors, describing the central story of motivation in the company. In this case study, learning and growth needs emerged as the strongest drivers of motivation, which in turn increase the goal commitment of engineers and create the conditions for better job performance.

Keywords—motivation; people management; software development; software engineering.

I. INTRODUCTION

Empirical research on work motivation in software engineering claims that software engineers’ motivated behavior account for an important part of software projects success, affecting elements such as individual performance, product quality and people retention [3][7]. However, the study of work motivation is complex, because it seems to be affected by a diverse set of environmental conditions and is likely to be moderated by personality and individual values, beliefs, and needs [10].

The research about motivation in software engineering has been developed for more than 30 years, and has produced important knowledge about the phenomenon. However, the vast majority of the previous studies follow a quantitative approach based on survey research as the main research methodology [3][7]. Although this body of research has characterized several factors related to motivation in the context of software organizations, the results lack in explanatory power and have been of limited use in practice. Therefore, a more contextualized and explanatory approach is useful to account for the diversity of factors and contextual conditions that may affect motivation at work.

The general goal of our research is to contribute to this field with explanatory theories of motivation in software organizations in different contexts. In this article, we describe the construction of a grounded theory of motivation in the context of a small software development company. We believe that characteristics of this type of company and, consequently, the specific norms and values that develop in this context provide rich explanations about motivation of software engineers. Therefore, although some of these explanations are context specific, we believe the results can be useful in other contexts with similar characteristics.

This rest of this article is organized as follows. In Section II, we present a brief conceptual background about motivation theories and related work. In Section III, we describe the case study method. In Section IV, the results of the case study are presented, alongside with their limitations and implications for the practice of software engineering. Finally, in Section V, conclusions and directions for future work are presented.

II. BACKGROUND AND RELATED WORK

A. Conceptual background

This section presents the main concepts, theories and research challenges related to the study of motivation. Motivation can be generically defined as the set of “factors or events that energize, channel, and sustain human behavior over time” [36]. Although this generic definition of motivation effectively pictures the concept of motivation, it is important to notice that there are diverse theories, and that these theories deal with motivation from many different perspectives, which are sometimes complementary and sometimes conflicting [14]. Among the classical theories that made significant advances in this area, the most referred are Maslow’s Hierarchy of Needs Theory [21], Herzberg’s Motivation-Hygiene Theory [15], McClelland’s Needs Theory [22], Vroom’s Expectancy Theory [39], Locke’s Goal-setting Theory [17], and Hackman and Oldham’s Job Characteristics Theory [12]. It is out of the scope of this article to provide deeper discussion about motivation theories, but such discussions may be found in Hall et al. [14], Latham and Ernst [16], and Steers et al. [36]. Since the present article offers a grounded theory work, our first analysis takes to account the understanding of motivation of the participants and compares it with some theoretical perspectives in order to transfer the responsibility for defining the term motivation to our own data.

Currently, research on motivation is broadly explored in the organizational management context, since this energized behavior known as motivation is closely related to individual
performance [13][19]. However, despite of the large amount of research carried out in this field, it is still common to people to confound motivation with related constructs, such as job satisfaction, enthusiasm, self-esteem, and others. Moreover, as discussed in Latham and Ernst [16], as human relations evolve, structures of motivation may evolve together, so that more research on motivation is still needed.

In software engineering, motivation has been studied since the 1980’s. A seminal work of Couger and Zawacki [5] claimed that computing personnel have higher growth needs and lower social needs than the average population, implying that specific strategies of job design [12] could be design for this specific type of professional, in order to increase their job’s motivational potential and consequently their performance at work. According to recent literature mapping studies [3][7], at least 140 studies have been performed, approaching motivation in different types of organization from different theoretical perspectives. These studies’ main contributions are concerned to the consolidation of a general set of factors predicting the motivation of an average software engineer. The body of research in this field has been dominated by quantitative survey studies (85/140). Most of the results of these surveys point to the software engineering job itself as the main motivational factor, while performance improvements (e.g. product quality, productivity, and job excitement) and intention to leave the organization are highlighted as the most important outcomes of, respectively, high and low motivation, which can indeed help managers to deal with the motivation of software engineers.

Although these studies provided important insights into characterizing what are the factors and outcomes related to motivation, they still lack in providing further explanation on what it is about the job that motivates software engineers and how motivation affects job performance and other work outcomes. Given that theoretical and empirical research, from different areas, have indicated that motivation is context dependent and varies from one individual to another, it is still necessary to produce theories capable of explaining why some software engineers seem to be motivated to perform their work while others, working in similar contexts and performing similar tasks, do not. Moreover, what and how aspects of a specific software development setting affect the motivation of these software engineers? It is the investigation of such factors and their relationships and effects on job outcomes that guide our research.

B. Related research

Among the 140 studies mentioned in Beecham et al. [3] and França et al. [7], it is possible to identify only few cases studies that provide a deep analysis of specific cases, using qualitative interpretive approaches focused in the motivation of software engineers. In this section, we briefly describe these case studies.

Beecham et al.[4] carried out a case study with five mature XP teams in order to evaluate the claim that agile methods lead to higher motivation, and concluded that agile practices are somewhat supportive to the motivation of software engineers regarding peer relationships. These results are somewhat convergent with ours regarding the adoption of some agile practices, as will be discussed further in this article.

Tessem and Maurer [38] carried out semi-structured interviews with a large industrial SCRUM team (70 people) and showed that, even in this large team, some agile practices supported the perception that motivating task design characteristics existed. In this case, motivation was signaled by the willingness of the staff to work hard to complete their tasks within the defined sprints, which is quite similar to the understanding of motivation in our case study.

Although these and other studies have been focused in very different contexts (e.g. agile development, open source, etc.), they agree, and provide evidence that motivation is highly directed by task design characteristics as well as by organizational characteristics and managerial practices. In our first case study [8], regarding a public sector traditional organization, individual growth needs came up as the most important leverage point to the motivation of software engineers, in which unclear career perspectives directly affected their intention to leave the organization.

III. Method

The previous sections discussed that motivation is closely related to performance [13]. However, although relevant results have been reached and important contributions have been made, research on motivation in software engineering has been largely dominated by quests for general results that would apply across a large number of different organizational contexts, technological contingencies, and types of individuals [3][7]. In a different direction, our research aims to explore specificities of organizational contexts, in order to develop insights and gain knowledge from the deep understanding of how individual software engineers interpret their experiences in the workplace, how these interpretations shape the meaning of motivation, and why certain combinations of contextual and individual factors lead to more or less motivated behavior. Our main research question is worded as follows:

How the motivation of software engineers in the workplace is affected by contextual and individual factors, and how motivation is perceived in terms of work-related behavior and outcomes?

Consistently with our research goals, we adopted a multi-case replication design [41], in which four instrumental case studies were performed in distinct software organizations, and analyzed from a qualitative interpretive perspective [23]. This article aims to report results for the third case study, in which the bounded-system is a small software company located in Recife, Brazil. We decided to report this case study in an exclusive article because this type of organization, according to Softex (Association for Brazilian Software Excellence) [35], is representative for the majority of the software development companies in Brazil. Nevertheless, in order to avoid repetition, this article presents only a summary of the methods. More complete information and discussion about the method can be consulted in previous reports [8].
Participants selection strategies: all selection procedures were intentional, and driven by a maximum variation sampling strategy [37]. First, four organizations with distinct characteristics were elected. This case regards only the small software development company. The unity of analysis in all case studies was the Software Engineer. Therefore, data were collected from many different sources, in order to enable data triangulation. Then, participants were chosen in order to assure a good coverage of age, background and education, years of professional experience, team roles, among other factors. We also collected data from project managers and directors, regarding their views about their software engineering employees.

Data collection: semi-structured interviews were carried out with 10 software engineers, 2 project managers and 2 directors, using interview scripts designed specifically to this end, and composed of open-ended questions. The interview guide included varied types of questions, aimed at exploring experience and behavior, opinion and values, feelings, knowledge and background of the participants. Interview guides were pre-tested and refined based on pilot interviews (see Figure 1).

Ethics: The organization signed a Term of Authorization and Commitment to the Research, which granted the researchers access to participants, to necessary documents. It also authorized the participants to use work hours for the interviews, which were carried out at the company’s own facilities, during May 2011. Each participant was first contacted in advance, and each interview occurred in a private meeting room. Participants also signed an Informed Consent Form that guaranteed confidentiality of the data provided, the anonymity of the participation, and the right to withdraw from the research at any moment. All interviews were recorded and together added up to 8 hours and 57 minutes of audio time.

Table 1. Interview guide extract (translated to English)

| Q1. Talk about yourself, your education, professional trajectory, etc. |
| … |
| Q6. What are the characteristics of this organization that stimulates you to do a good job? |
| … |
| Q11. Imagine an extraordinarily good day, in which everything goes perfectly. Describe it in details, from the early morning to late night. |
| Q12. Among your daily activities, what are those you like more? |
| Q13. What is it about these activities (Q12) that make you to like them the most? |
| … |
| Q22. What do you think are the strongest points of your current team? |
| … |
| Q31. How would you describe a clearly demotivated colleague? |
| … |
| Q33. In which way do you think that his (Q31) work is affected? |
| … |
| Q36. What does the organization do, or offers, to stimulate the software engineers’ motivation? |
| … |
| Q40. What could the organization do (but currently does not do) to stimulate the software engineers’ motivation? |
| … |
| Q41. Projecting your career five years towards the future, what do you wish you were doing? |

According to the original case study protocol, data were supposed to be complemented by the use of diary studies. A data collection notepad and a web based form had been designed to support that activity. After the interviews, six participants were selected to report any relevant event that affected his/her motivation at work, during a period of one month. Even though we have followed suggestions from Dearman et al. [6] to avoid low participation, only 10 relevant events were reported, and retrospective interviews pointed to their high workload as the main cause of low participation.

Data Analysis: we followed guidelines provided by Strauss and Corbin [37] to categorize and synthesize data, to construct an evidence-based theory of motivation for this company. Audio from interviews were transcribed and QSR NVivo 8 was used to support the analysis process. We labeled portions of text using post-formed codes and, as the concepts became clearer, the categories were named following a constant comparison method [37], as exemplified in Figure 1. Then, relationships among categories were mapped, leading to explanatory propositions that underpin the central story of the case.

Addressing credibility, consistency, and transferability: techniques such as triangulation and member checking were used to increase research data credibility. Besides, data were constantly scrutinized by the researchers. All contradicting evidence was discussed in follow up meetings, and complementary explanations were reached. All the interview transcripts, diary data and process logs were kept in case of the need for some information tracking. Evidence in both the original language – Portuguese – and English were organized and made available in a Technical Report in [9]. In order to enhance transferability, we adopted the maximum variation sampling technique to select participants. Finally, we provided as much as possible detailed information in this article, about the context and the results of the case study towards the description of a richer theory, which is unfortunately constrained by the page number limitation.

Table 1. Interview guide extract (translated to English)

Q1. Talk about yourself, your education, professional trajectory, etc.
…
Q6. What are the characteristics of this organization that stimulates you to do a good job?
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Q36. What does the organization do, or offers, to stimulate the software engineers’ motivation?
…
Q40. What could the organization do (but currently does not do) to stimulate the software engineers’ motivation?
…
Q41. Projecting your career five years towards the future, what do you wish you were doing?
…

Figure 1. Open coding category building

1 www.qsrinternational.com
IV. RESULTS AND DISCUSSIONS

A. Context description

This case study was carried out in a software company, formally established in 2006 by the initiative of five entrepreneurs from the Information Technology sector field, in Recife, Brazil. As a young company, its core mission is to support the development of people and organizations with software tools, by means of technical excellence and innovation.

This company is specialized in software development for different platforms, with expertise in different programming languages (such as .NET Framework, Java family, LUA, and others). It focuses on the on-demand development of information systems, operating in areas such as management, finance, mining, health, and others. In addition, it also develops its own products. Its flagship product, a corporative social network, stands for intra-organizational innovation management. Currently, it serves national and international customers, usually medium and big companies. Internal products and external projects significantly differ in terms of requirements management process and time pressure. People from both types of projects participated in this research.

The company follows an agile-like software development process, broadly adopting practices such as regular delivery of software, adaptive management style (SCRUM based), small teams, face-to-face meetings, and customer authority. The organizational structure is flat, and the directors eventually act as part of the development teams. The directors themselves, who have software engineering background, instead of management, administer all organizational issues, including the Human Resource Management.

At the time that the case study was carried out, the company was composed of 27 people, everyone younger than 30 years (directors included), occupying functions in one of the three types of teams: software development, research and design areas. Some of these people were in the organization for less than six months, while others had more than 3 years along with the team. As an organizational strategy, the company is closely tied to the academy, both physically (its location is near a University) and operationally, since its staff is composed of undergraduate students (trainees) as well as graduated students in software engineering. As part of our maximum variation policy, we sampled participants representing all these clusters.

B. How individuals understand motivation

The first results are concerned to the understanding of participants about what the concept of motivation actually means to them. The last question in all questionnaires regarded this issue, and the answers underpinned the whole analysis about factors and outcomes related to motivation, because their perception about the concept could have affected the way they answered all previous questions.

Motivation became a popular issue, in spite of having no clear academic agreement on its definition (as discussed in Section II). Therefore, one could expect that people hold unclear and/or confusing understandings of the concept. Indeed, two participants described motivation only from the perspective of its causative factors (e.g. “motivation is having autonomy”, “motivation is having recognition”), while another one described it from the perspective of its outcomes (e.g. “motivation is having a high performance”).

The discourse of three participants seemed to agree that motivation is (I) a strong internal feeling of wellbeing or contentment, for doing a good work, conditioned not only by work environmental characteristics (e.g. Herzberg’s Hygienic Factors [15]) but also by individual feelings of self-esteem, self-respect, self-efficacy, usefulness, or success in the job. This understanding recalls to the definition of job satisfaction given by Locke’s Affect Theory [18], which states that job satisfaction is a “pleasurable (or unpleasurable) emotional state resulting from the appraisal of one’s job”. The following excerpts illustrate this understanding:

- “Motivation is being happy with what you are, with what you do. Being motivated is doing what you like, and want to keep doing that” (Software Engineer)
- “I think that the first word [sic] that defines motivation is a person that goes to work happy.” (S.E.)

On the other hand, eight participants defined motivation as (II) an individual’s willingness to apply effort or keep high the interest for work, conditioned by an internal determination to achieve a personal goal by means of work. This second definition is close to the definition of goal commitment, given by the Goal Setting Theory of motivation, which states that “commitment refers to one’s attachment to or determination to reach a goal, regardless of the goal’s origin” [20]. The second definition can be illustrated as follows:

- “Motivation is doing something not for obligation, but doing that because you want to achieve some goal” (S.E.)
- “Motivation is an engagement with the goals of your work, of that project. It happens when you see that it is going to give you a professional feedback.” (S.E.)
- “Motivation is being interested in doing something, enjoying doing that job, being engaged and energized to do that well.” (Director)

The company espouses the term “commitment” as one of its core values, which may have contributed not only to the fact that the majority of the participants related motivation to commitment, but also to the fact that all project managers’ and director’s understanding of motivation fell into this last definition. It was not possible to find any other pattern relating these definitions to the interviewed functional roles (software engineers, project managers, and directors), age, educational level, type of project, and employment time.

Anyway, it is important to notice that all these definitions agree on the fact that the behavior is directed by a set of expected outcomes (e.g. recognition, performance, self-esteem, self-respect, or personal goals), responsible for stirring the employee’s willingness to apply effort in a task, as described in former motivation theories [22][39].
C. What factors affect software engineers’ motivation?

After making sense of how participants understood motivation, the next step was to identify reported antecedents of motivation (hereafter called factors), through the coding process, in order to serve as basis of the theory of motivation for the studied case. Excerpts from the interviews were used as evidence, and unambiguous and non-conflicting descriptions were attributed to categories, in order to maintain these categories internally coherent and consistent with other theories of motivation found in the literature and in our own work on other cases. Due to paper length restrictions, the definitions of these factors could not be framed in this paper. Alternatively, they were made available in a technical report that can be found in França et al. [9].

Table 2. CURRENT EFFECT OF TASK-RELATED CHARACTERISTICS

<table>
<thead>
<tr>
<th>Task characteristics</th>
<th>Negative</th>
<th>Effect on motivation</th>
<th>Positive</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low learning</td>
<td>High learning</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Low intellectual challenge</td>
<td>High intellectual challenge</td>
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<tr>
<td></td>
<td>Low self-efficacy</td>
<td>High self-efficacy</td>
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<td></td>
<td>Low autonomy</td>
<td>High autonomy</td>
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<td></td>
<td>Low task identity</td>
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</tbody>
</table>

Table 3. CURRENT EFFECT OF CHARACTERISTICS OF THE ORGANIZATION

<table>
<thead>
<tr>
<th>Organizational Practices</th>
<th>Negative</th>
<th>Effect on motivation</th>
<th>Positive</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low career progression support</td>
<td>High career progression support</td>
<td></td>
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<tr>
<td></td>
<td>Low skill development</td>
<td>High sociable environment</td>
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<td></td>
<td>Low Salaries</td>
<td>High employee participation</td>
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<td></td>
<td>Low customer feedback</td>
<td>High recognition</td>
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<td></td>
<td>High time-pressure</td>
<td>High work lifestyle flexibility</td>
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Table 4. CURRENT EFFECT OF TEAMWORK ASPECTS

<table>
<thead>
<tr>
<th>Team collision</th>
<th>Negative</th>
<th>Effect on motivation</th>
<th>Positive</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>High collaborative work</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>High integration</td>
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</table>

The identification of the factors was not straightforward. Some excerpts communicated participants’ opinions only, while other supported relational propositions with factual evidence (practices, attitudes, emotions, etc.). Besides, as the axial coding evolved, we noticed that some factors were merely instrumental, meaning that the actual drivers of the behavior were beyond them. For instance, some participants described an effective requirement management process as a motivator, but the actual factors were self-efficacy and task identity.

Tables 2, 3, and 4 communicate the grounded factors, positioned according to their hypothetic effect on the motivation of software engineers in that company, based on the participants perception of each factor. These tables were also organized in factors related to the task itself (Table 2), to the organization (Table 3), and to teamwork (Table 4), and they only show motivators grounded in valid evidence. For instance, participants mentioned that they had the opportunity to have significant interdisciplinary work, but none of them mentioned how it affected their willingness to apply effort towards a task. Therefore, interdisciplinary work was not included as a valid motivator.

Finally, it is possible to see that these tables are still full of apparently conflicting information, so we interrogated the data in order to understand these dilemmas and to find a reasonable explanation for each of them, leading us to uncover characteristics of the individuals that may mediate these conflicts, which are discussed below.

1) Motivating characteristics of the task (Table 2):

Learning emerged as the most relevant factor in this company, as exemplified in the following excerpt:

— "[about stimulant characteristics of the organization] I think that the fact of being constantly learning, of other professionals being always available to be teaching" (Software Engineer)

In fact, given the proximity that the company has to the university, just over half of the participants (08/14) were undergraduate students. However, participants that reported a high level of learning in the job were mostly freshmen, while the older employees pointed out a lack of learning activities (Table 2c), as exemplified below:

— "I feel limited, frustrated, because I am not currently learning anything new (...) I feel like the time is passing and I’m not learning." (Software Engineer)

In addition, learning activities can also be seen as a waste of time, exerting the opposite effect (Table 2d), if it is not closely related to individuals’ personal interests. Therefore, employment time seem to be an important mediator for the perception of learning experiences and, consequently, the motivation in this company. Intellectual challenges are similarly mediated by the employment time (Table 2e):

— "In my current task, like, I feel like the things I’m doing are starting to get monotonous (...) then I feel like I want to work with more advanced things..." (Software Engineer)

Self-efficacy also was highlighted as a strong driver of motivation, because it was mentioned as being affected by constant unexpected requirements changes, project reallocation, and other types of impediments (Table 2f):

— "It’s embarrassing when you promise to someone to finish something in a date, but the date arrives and you do not have anything to deliver" (Software Engineer)

On the other hand, the very short sprint time (only one week) seemed to positively contribute to engineers’ evaluation on what they are able to do or not to do within those time slots (Table 2g):

— "I think that delivering software in short time slots [is motivating]. No one wishes to wait 6 months of work to receive a customer feedback." (Project Manager)
It was reported that engineers could manage their own time inside a sprint, and chose their own activities towards the sprint backlog:

- "Here we have autonomy regarding the way we implement things, the architecture we use, trying new technologies if the case. We have a specific time for that inside the sprints, on Fridays." (Software Engineer)

Therefore, Autonomy acted as an important factor towards positive motivation, except in case of requirements change in the middle of a running sprint (Table 2), practice strongly discouraged by agile processes.

- "Because when we think in something to do, sometimes we get confused. We estimate and define what we are going to do in the beginning. Then, someone takes it out and we remain with no autonomy." (Software Engineer)

Finally, low task identity was a consensual characteristic, due to not only the lack of development process standards, but also the small amount of documentation and the low quality of the documentation in some cases;

- "What demotivate the most are the new features, which come from nowhere, and new projects that come from nowhere, without any enough specification, to conduct our tasks in the best way." (Software Engineer)

It is important to notice that, even though the Job Design Characteristics described by Hackman [12][13] commonly appeared in related research (see ILB), the factors Skill variety and Task significance did not appear in any valid evidence in this case study. One interviewee mentioned that one of the motives to choose Software Engineering as a profession, was to help developing useful tools to help people (Task Significance) and two other participants mentioned that they felt their software had no clear audience. However, since these citations were totally disconnected from the context, we did not consider this as an evidence for Task Significance in this case. Another participant described his job routine as quite variable, but did not give clues about how that affected his/her motivation.

2) Motivating characteristics of the company (Table 3): Career progression support was the most strongly cited factor related to the organization, which is consistent to the claim that software engineers generally have high Growth needs [5]. Since the organization is young, small, and flat, there are no career ladders to climb (Table 3), as described in short in this excerpt:

- "While in other places, people have a clear vision about what career to pursue, because of the existence of a hierarchy, here you cannot visualize it. Everyone is very close, so you do not know for how long you will stay here." (Software Engineer)

On the other hand, the company performs a regular career revaluation that aims to assess the employees’ job satisfaction and raise salaries. In addition, the company is perceived as a good first-job opportunity for most of the students that carry out their internships in there (Table 3 b):

- "We always focus in training and preparing these professionals [interns] to be in the future part of our staff, and to be with a high level of competence, above the market average." (Director)

Moreover, given the learning opportunities offered by the company, together with the professional network that may be built while working for this company, some participants pointed up that the greatest opportunities for career progression come from outside the company, which is motivating for the professionals, but not exactly beneficial to the company itself (Table 3 c):

- "Personally, I like what I do. I think I'm lucky to like what I do. I wake up with a willingness to get to work and to produce as much as I can. What is interesting to me is not only doing my job, but also build up good professional references" (Software Engineer)

- "The motive [for turnover] is the fertile market, so other career opportunities are always coming by, from other organizations that are arriving from other states and other countries." (Project Manager)

High sociable environment, high employee participation, high recognition, high work lifestyle flexibility, low skill development, low salaries, low customer feedback, were consistently described among participants’ discourses, as exemplified in summary in the following excerpts:

- "I feel very well working here, it is an excellent working environment, everyone that is above my position are excellent people, they have a great work relationship with us" (Software Engineer)

- "I think that it could do things like workshops, weekly meetings to discuss and teach new technologies, so we could feel like learning, evolving, not only making money." (Software Engineer)

- "The salary that is paid to engineers... I think that it may be the only thing to complain here." (Software Engineer)

Only one participant was concerned with the high work lifestyle flexibility (Table 3 d), which includes time-flexibility, because it seems to affect the team communication because people held quite different work times, and sometimes they met just for a couple hours a day. Additionally, only participants working in external projects complained of excessive Time pressure (Table 3 e), as recognized by this project manager:

- "The climates from internal and external projects are clearly distinct. Day by day activities are taken easier in internal projects, the workload is kind of lower, we are able to better define the activities than with external customers." (Project Manager)

Work infrastructure is a commonly cited factor that somehow affects motivation, and is also part of the Herzberg’s Hygienic Factors [15]. In our case study, participants described it just as “enough”. Assuming, from this, that these engineers have a good work infrastructure would be a weak inference, so we were not able to draw any further conclusions about its effect on engineers’ motivation.

3) Motivating aspects of teamwork (Table 4): collected data clearly pointed to High collaborative work and High integration as the main motivating aspects of the teamwork, as exemplified by the excerpts below:

- "A strength of our team is that there is nobody trying to be better than the others, everybody is working towards the same objective." (Software Engineer)

- "Every time someone has a problem, everybody gather around to help him/her." (Software Engineer)

- "Periodically, there are parties, like the company’s anniversary, or more general events, to meet outside the work" (Software Engineer)
Besides, participants spontaneously mentioned that the level of perceived motivation in other team members affect their own willingness to apply effort on the work (Table 4), adding strength to the claim raised in our previous case study [8], about the possible existence of a causal loop in which highly motivated behavior leads to more motivation, whereas poorly motivated behavior spirals down to less motivation:

- "I think that the peers' motivation are contagious, if you have a motivated peer, you tend to get engaged to perform the same way." (Software Engineer)

Employment time also mediated the distinct perceptions of high/low teammate’s technical competence:

- "I think that every software engineering team is like that, nobody is totally experienced, there are always newbies." (Software Engineer)

D. Signs of motivated behavior

As the signs of level of motivation emerged from the coding process (Table 5), they were classified either in Behavioral signs (individual feelings, attitudes, etc.), or Job performance (related to work-products). As expected (see Section IV.B) participants naturally emphasized goal commitment (Table 5) as the strongest sign of motivation:

- "The most important trait is that the motivated person should keep his/hers focus, showing commitment with the goal, with the deliveries." (Software Engineer)
- "Last week, one of the engineers told me that he has worked without reporting the working hours (…) he was just trying to solve that problem regardless he was at home or at work..." (Project Manager)

<table>
<thead>
<tr>
<th>Behavioral signs</th>
<th>Low</th>
<th>Effect on motivation</th>
<th>High</th>
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<tbody>
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<td></td>
<td>High absenteeism</td>
<td>High concentration</td>
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<td></td>
<td>Low concentration</td>
<td>'High goal commitment'</td>
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<td></td>
<td>Frustration</td>
<td>Happiness</td>
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<td>Low proactivity</td>
<td>High proactivity</td>
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<tr>
<td>Job performance</td>
<td>Low quantity of work</td>
<td>High quantity of work</td>
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<td></td>
<td>Low quality of work</td>
<td>High quality of work</td>
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E. Relating factors and building hypothesis

The next step in the data analysis was drawing relationship among motivational factors and outcomes, grounded in the data. We then built the propositions discussed in this Section, which not only organize and connect the strongest elements of the theory, but also communicate a particular view of the phenomenon in the organization.

First, as discussed before, learning is a critical factor of motivation in this organization, both to interns that pursue his/her first formal job and to professionals who pursue a career promotion. In this case, two elements of the teamwork – Teammates’ technical competence and collaborative work – clearly conditioned the establishment of an effective learning environment, since the support given by the team contributed to constructive learning behaviors. However, the apparent lack of skill variety may lead software engineers to perceive their activity as repetitive after some time doing the same tasks. Moreover, when engineers perceive the fruitful results of learning experiences on the job, they have their self-efficacy increased, generating in turn more willingness to learn and more Goal commitment.

Proposition 01: Intellectual challenge, autonomy, collaborative work and teammates’ technical competence combined with skill variety, are conditions for the establishment of an effective permanent constructive learning job environment, which increases self-efficacy and goal commitment.

The role of high sociable environment, team integration and work lifetime flexibility on goal commitment is another issue evident in this case. In addition, as reported by participants, one’s motivation equally affects the other’s motivation and vice-versa, representing a self-enhancing or a self-destructive loop, which in turn may feedback the team cohesion. In this case, the friendly environment conditioned by the team cohesion factors stirred up the employee cohesion, given that even the company directors are part of the productive team. According to Locke et al. [20], participation is a factor that supports a better goal acceptance, and therefore a higher goal commitment. Therefore:

Proposition 02: Team cohesion factors benefits the power of the enhancing effects and attenuates the disruptive effects of the association between the individual and the team motivations, and employee participation may help to maintain this association healthy by maintaining the goal commitment high.

Also according to Locke et al. [20], self-efficacy is an influential factor in goal commitment, since it is responsive to maintaining the belief that the goal can be attained, which is also in consonance with the Expectancy Theory of motivation [39]. Similarly, our data cleared up the harmful role of the low task identity and low customer feedback in the self-efficacy, mitigated by the task characteristics autonomy and intellectual challenge augmented by the recognition that the supervisors offered for good job performance. Moreover, the engineers’ perception that they are part of a learning environment provided them with a self-confidence shield in the advent of missed goals or low performance, as if their failures could be justified for their lack of experience and as if they were continuously acquiring knowledge and developing their competence to better achieve their goals in the future. Therefore:

Proposition 03: A learning environment protects the engineers’ self-efficacy through self-esteem and self-confidence mechanisms of overcoming individual failures, contributing to the constant increase of goal commitment and consequently job performance factors.

The high growth needs of software engineers were also evidenced in this case, in which career development opportunities and salaries were constantly mentioned as the most negative characteristics of the organization towards motivation. Unclear or limited internal short-termed career opportunities had a doubled sided effect on software engineers: on one hand, they may want to take full advantage
of the learning experiences to find better-paying jobs outside the organization, generating a short-time but high-competent staff; on the other hand, they may get committed with the long-term goals of the organization, expecting that if the organization grew, and their efforts are to be recognized, they could be promoted to work in whatever function they wanted. Then, another proposition could be described as follows:

**Proposition 04**: Given the high growth needs of software engineers, career opportunities attached to job performance factors are effective elements to increase their goal commitment.

Finally, according to the own directors discourse, due to budget limitations, the organization is still not able to compete with higher salaries offered by other companies in the same context. Therefore, even though people seem to have a general feeling of satisfaction with the job, the turnover rates are still higher than they expected. Thus, we draw the following proposition:

**Proposition 05**: Goal commitment, self-efficacy, learning, team cohesion, and job performance are not enough to prevent the intention to leave, if the growth needs of the software engineers have not been fulfilled, because of external opportunities for career progression.

**F. Building the Central Story of the Case**

Finally, the propositions presented in the previous section were combined in order to build the central story that explains motivation in this company. In short, the relationship between commitment and job performance appears in the center of the story, but the essential drivers of the motivated behavior in this organization are learning and growth opportunities.

**Central story of motivation in the Organization** (Figure 2): As presented in Section IV.A, the company studied in this case is a small, young and successful software development organization. Given the natural limitations of budget faced by organizations in this stage of business maturity, this company seems to have adopted a strategy of being physically close to a University, offering students opportunities to carry out their internships and to learn and develop their technical knowledge, serving as a basis for their future career. This organizational strategy has had a strong impact on the motivation of this company’s staff.

As reported in previous sections, factors such as intellectual challenge, autonomy, collaborative work and teammates’ technical competence serve as basis for an effective learning job environment, which benefits the goal commitment of the software engineers. However, as time passes, employees start to find their activities repetitive and with low motivational potential, given the low variety of skills demanded in some phases of the projects, regardless of whether they were working for the internal product or for external customers (**Proposition 01**).

This learning environment seems to contribute to the engineers’ self-efficacy, and consequently to job performance factors (**Proposition 03**). On the other hand, unclear task identity (in particular, the requirement management process), the low quality of intermediary artifacts, and the distance between the end-user and the development teams generate large amount of impediments such as requirements changing and rework, which negatively affect engineers’ self-efficacy.

The high sociable environment and team integration help determine the high team cohesion, creating a very reciprocal work environment, filled with mutual help, shared experiences, and self-responsibility. Responsibility, in turn, is enhanced by the high employee participation, conditioned by the small teams and the direct participation of the high management in the productive teams (**Proposition 02**).

But even with a high agreed sense of commitment in the team, and the presence of all these other contextual motivators, turnover rates are still kept high (**Proposition 04**). Since the organization does not offer long-term career opportunities, growth needs of the software engineers have not been fulfilled, and external opportunities for career progression are unavoidably constant (**Proposition 05**).

In summary, this company is positioned as a great experience for engineers’ first job, where they may take advantage of the effective learning environment to improve both their knowledge and general competence, and to build their reputation (through recognition for high job performance) in their professional networks towards future job opportunities of growth in other organizations, as can be seen in Figure 2. From the point of view of the company, there seemed to be no means to wrestle against the turnover intent of experienced professionals, at the time of the study.

![Diagram](Image)

**Figure 2. Core factors and relationships**
G. Using the Results to Improve Factors that Affect Motivation

In this Section, we briefly discuss how to apply our findings to improve the motivational aspects of the organization. It is important to notice, however, that these recommendations have not been tested in practice, so it only illustrates how strategies can be derived from the results of an explanatory theory.

Beforehand, it is worthy to point out that some agile practices such as daily meetings, regular delivery of functional software, and agile task management, have positively acted towards a motivated behavior of engineers, because they serve as instrumentation for factors such as collaborative work, and autonomy. However, some aspects in the software development process could be improved to assure a better task identity and customer feedback, which are reportedly low.

Regarding the general organizational setting, the job design and organizational practices seem to significantly contribute to establish a motivational environment, but there are barriers in aspects that are not apparently manageable, such as the repetitive work in some stages of the projects and the limits for growth opportunities. Nevertheless, technological solutions for automatizing work (testing or code generation) could contribute to avoid repetitive work. Moreover, a formal career plan, offering profit shares attached to performance results for staff with more employment time, could create more internal growth opportunities, making them more committed with the organizational long term goals and avoiding turnover.

V. CONCLUSIONS

The research about motivation in software engineering has produced an important body of knowledge to characterize what factors seem to influence motivation in the workplace. In this article, we presented the main results of a qualitative case study about motivation in a small software development company, located in Recife, Brazil. Our results contribute to this body of knowledge in three complementary ways:

- First, uncovering new factors of motivation, offers a reasonable categorization of these factors, and adds new information about behavioral signs and work outcomes of motivated software engineers;
- Second, providing practical evidence that illustrate motivational factors previously discussed in literature in action, in an actual representative software development environment;
- Finally, showing a theory that explains the complex interplay among motivational factors at the task, organization, and teamwork levels.

Although the findings of the case study reported in this article should not be assumed to be universally valid, the central tenets of the theory and the research method can assist others to reinterpret the theory in specific contexts. Besides, it was developed following a multi-case replication design, which can be used by other researchers in other contexts and situations.

The next step in our investigation is to produce a cross-case analysis of the results of this study and other two case studies conducted in the same period of time, one of which has been presented by França et al. [8]. The consolidated results will then be compared and integrated with other case studies found by Beecham et al. [3] and França et al. [7].

We have been seeking to understand why some software engineers seem to be more motivated to perform their work than others, because motivation is closely tied to performance [13]. In this report, we did not discuss individual characteristics, such as personality and cognitive styles, but elements as such may appear in future reports. We are also interested in explaining why different levels of motivation are found among employees that work in the same organizational context and perform similar tasks. Ultimately, we hope that our research efforts are useful to improve the general understanding of how to build and develop more effective software teams.

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