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EXPLORING THE TURNAWAY PHENOMENON: AN INVESTIGATION WITH SOFTWARE DEVELOPERS

Universidade Federal de Campina Grande
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Exploring the turnaway phenomenon: An investigation with software developers

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EXPLORING THE TURNAWAY PHENOMENON: AN INVESTIGATION WITH SOFTWARE DEVELOPERS

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Resumo

O abandono (turnaway) da carreira entre desenvolvedores de software pode estar associado a diversos fatores relacionados à profissão. Identificar e entender como esses fatores podem afetar esses profissionais é fundamental para que as organizações possam compreender melhor o fenômeno e traçar políticas de retenção mais eficazes.

Esta tese tem como objetivo (i) identificar motivadores que podem estar associados ao fenômeno turnaway entre desenvolvedores de software, e (ii) investigar como esses motivadores estão associados ao abandono da profissão para desenvolvedores de software atualmente ativos.

Com esses objetivos em mente, realizamos quatro estudos empíricos. Dois estudos qualitativos incluíram entrevistas com 25 ex-desenvolvedores de software brasileiros para identificação de motivadores gerais e específicos; um estudo de caso com âncoras de carreira com 24 desses participantes; e uma pesquisa com quase 250 desenvolvedores brasileiros para validação de um modelo teórico de turnaway de desenvolvedores.

Identificamos 57 motivadores diferentes, dentre os quais os motivadores gerais mais citados foram estagnação profissional, falta de reconhecimento financeiro, falta de regulamentação profissional, sobrecarga de trabalho, entre outros. Quanto aos motivadores específicos, reconhecemos retrabalho, requisitos instáveis e medo da obsolescência, entre outros. Classificamos esses motivadores em cinco dimensões da engenharia de software, principalmente: prática profissional da engenharia de software, gestão e economia. Também mapeamos âncoras de carreira tradicionais para os motivadores mencionados pelos ex-desenvolvedores. Por fim, a partir da pesquisa, confirmamos a estreita associação entre questões específicas de desenvolvimento de software e a intenção de abandonar a carreira. Os resultados sugerem várias hipóteses para novas pesquisas, relacionando o turnaway aos tipos de atividades de desenvolvimento de software. Esperamos que esses resultados contribuam para a elaboração de estratégias eficazes para as organizações reterem os desenvolvedores, minimizando adicionalmente o custo social do afastamento desses desenvolvedores.

Abstract

Career abandonment (turnaway) among software developers may be associated with many factors related to the profession. Identifying and understanding how these factors can affect those professionals is essential for organizations to design more effective retention policies and better understand the phenomenon.

This thesis aims to (i) identify motivators that may be associated with the turnaway phenomenon among software developers, and (ii) investigate how these motivators are associated to abandon the profession for currently active software developers.

With those objectives in mind, we conducted four empirical studies. Two qualitative studies included interviews with 25 Brazilian former software developers for identifying general and specific motivators; a case study with career anchors with 24 of those participants; and a survey with almost 250 Brazilian developers for validating a theoretical model for developer turnaway.

We have identified 57 different motivators, among which the most cited general motivators were professional stagnation, lack of financial recognition, lack of professional regulation, and work overload, among others. Regarding specific motivators, we recognized rework, unstable requirements and fear of obsolescence, among others. We classified those motivators into five software engineering dimensions, mainly: software engineering professional practice, management, and economics. We also mapped traditional career anchors to the motivators mentioned by the former developers. Finally, from the survey, we confirmed the close association between software development-specific issues and the intention to abandon the career. The results suggest several hypotheses to further research, relating turnaway to the types of activities of software development. We hope these results contribute to devising effective strategies for organizations to retain developers, additionally minimizing the social cost of turnaway to those developers.

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À toda minha família, que sempre me apoiou me enche de bons sentimentos todos os dias.

Contents

List of Symbols

ABES - *Brazilian Association of Software Companies*

CFA - *Confirmatory factor analysis*

EFA - *Exploratory Factor Analysis*

ES1 - *Exploratory Study I*

ES2 - *Exploratory Study II*

FA - *Factor Analysis*

GT - *Grounded Theory*

IS - *information Systems*

IT - *Information Technology*

SEM - *Structural Equation mMdeling*

TCLE - *Term of Free and Informed Consent*

UFCG – *Federal University of Campina Grande*

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Chapter 1

Introduction

For decades, human resource management has been the subject of studies by the scientific community and large organizations. The discussion of methods, practices, and approaches that can enhance the professional's individual performance can lead to important gains for all involved, that is, companies, the job market, and employees. Considering this context, Viteles proposed one of the first theories on work design in the early 1950s [147]. According to this theory, "job design" can be defined as the different ways in which a given job or task can be conceived, assigned to individuals and/or teams, and executed [147; 101].

Managing human resources becomes increasingly important with the impacts of global competitiveness and information technology changes. As technology increasingly influences businesses in the market, there is a growing concern with the management of the professionals who develop and operate it since hiring and training them involves significant investments [113]. People management has been considered a critical variable in software development, with regard to the complexity of the activity, considering that this pervades high technical capacity, also involving skills such as: soft skills. And even teams that excel in the technical part are not exempt from having their projects fail. [11; 84].

The career transition process is a phenomenon in IT and has been increasingly considered in software development. Technological advances and their wide use make professionals in this area constantly required to have high technical capacity, flexibility and mobility, which can cause difficulty in staying motivated and responding to intense challenges [83].

In this scenario, the career movement of software developers brings additional chal-

lenges. Software organizations are known to face low retention leading to high costs due to the time to find other professionals and train new hires [63]. The rate at which developers leave a team is known as turnover, which generally refers to developers moving to another software job; the concept has been widely studied at a general IT workforce level [63; 139] and also for software developers [15; 100; 4; 21; 82] However, less attention is paid to a related phenomenon known as turnaway (or career abandonment) [57; 81] in which the professional leaves the software development profession, starting to work in a different position in the same organization (turnaway-within), or, more commonly, earning a living in a completely different occupation (turnaway-between).

The shortage of software developers is a dramatic problem. In 2020, the lack of developers reaches 40 million worldwide [136]; it was estimated that software developer jobs would grow by 22% from 2019 to 2029, much faster than the average for all other occupations [8], even before the COVID-19 pandemic. As the most prominent software and services market in Latin America - also the 11th largest in the world - Brazil's software industry [83] is expected to demand 240,000 more developers by 2024 [66]. With this expectation of growth, in addition to recruiting new professionals to form new teams for future demands, organizations need to invest in retaining developers on their teams.

As far as we know, there is no estimate for the rate of developers who decide to change professions and leave professional software team jobs. However, any loss of professionals in the current scenario of the software market becomes a relevant concern. In addition, the social cost of turnaway must be considered; such a drastic decision involves frustration with the lost investment made over years of study and dedication, in addition to the emotional and financial cost necessary for professional change.

Even with all the implications described above, there is little literature available [6; 66; 70; 81; 17; 125; 8] In Brazil, the literature is even scarcer, with two scientific articles [13; 89; 112; 113; 107] and a master's thesis [9] available, to the best of our knowledge. Previous research on turnaway has focused on quantitative studies with IT workers, not considering the specifics of software development jobs [57; 113; 81].

Professional IT jobs are concerned with the general operation of computers, enabling people to use systems and devices for operational efficiency; the set of activities performed by these two types of professionals can be very different [57]. Colomo-Palacios present a

mixed study focused on the study of factors that may be related to the intention to leave [26]. However, we need to find information on studies that acquire data from former developers who have already abandoned their careers for a different occupations. In addition, qualitative studies are needed to discuss the "whys" and "hows" of respondents' experiences, gaining more profound and meaningful insights into real-life situations [118]. For any retention strategy to be effective, it is essential to understand the reasons for leaving (motivators), mainly based on reports from developers who left the profession. Therefore, the general objective of this research is to understand how turnaway affects software developers. For this, some specific objectives were outlined: i) identify the set of motivators that influenced turnaway in *former software developers*; ii) understand how these motivators may be related to aspects of the profession; iii) relate career anchors with turnaway motivators identified in previous studies; iv) explain the relationship between motivations inherent to the profession and the intention to turnaway among *currently-active software developers*.

For this, we carried out four studies. The first is an exploratory study with former software developers to investigate the motivators that may have influenced the turnaway of the profession; at this stage, it sought to expand the set of motivators found in the current literature, letting the codes emerged from the interviewees' speeches, that is, without a predefinition of codes found in other studies. This analysis identified initial 33 motivators, among which some are more general and applicable to most professions, and others are more specialized and only make sense in the software development profession.

In the second study, the interviews were reanalyzed to identify specific motivators of the software development profession. In addition, an extension of the first study was carried out, adding ten new participants to the sample, seeking greater diversification. The methodological path followed was the same as in the first study, differing only in the interview script and data analysis, which aimed to extract motivators inherent in software development activities, in addition to trying to understand the "how" and "whys" of each listed motivator in the two studies. As a result, we were able to identify 24 motivators that are closely related to software development activities. This study also made it possible to understand the causal relationships between more general and specific motivators, which made it possible to explain the phenomenon through the standardization of data found in the study, which included the following elements: motivators, contextual conditions, and precipitating factors.

The third study consisted of applying the career anchors questionnaire to verify whether there was a relationship between the motivators captured in the interviews in the previous phases and the responses collected from the career anchors questionnaire. The study included a sample of 24 former developers. The results suggest a relationship between the motivators and the anchors. Even when this was absent, they were expressed by the participants as a kind of trigger urging them to abandon the profession. The results show that the most prevalent anchors among former software developers were security/stability and lifestyle; these were also defined as the primary and secondary anchors for approximately 56% of the participants. Finally, this study suggests a relationship between motivators and anchors. Thus, career anchors can be considered reliable to indicate turnaway intention for software development professionals.

The last study comprised a quantitative study that aims to understand at what extent motivators inherent to the software development profession and the theoretical model of investiment [116] can explain the intention to turnaway of currently-active software developers. A survey was applied to a sample of 221 active software developers in the profession. As a result, we identified that three latent variables explain 77% of the data variability, and the aspects inherent to the profession more accurately explain the intentions to turnaway. Another result found was the relationship between the constructs that were part of the theoretical model through the structural equation modeling technique. Factors inherent to the profession were more closely related to lack of commitment, which in turn was related to turnaway intention. Thus, the model created from the theory of interdependence and the investment model was able to satisfactorily explain the turnaway phenomenon.

We believe that the obtained results are relevant to improve our understanding about the turnaway phenomenon, initially due to the range of identified motivators, considering that it represents the study with the highest number of turnaway motivators found so far in the literature. Moreover, the results of this thesis shed light on the relevance of aspects inherent to the profession hitherto neglected in the literature. Aiming to understand the turnaway in its completeness, this study was careful to analyze motivators listed by former software developers – professionals who lived through the process – and their effect on the intention to abandon the profession by developers. In addition, we consider factors that could influence the phenomenon, such as career anchors, relating these to the turnaway motivators found in

this research.

The practical implications for the area can be presented through a new perspective, in which organizations leave more general aspects in the background and begin to monitor insights more focused on development activities, that is, planning, requirements, estimates, and documentation. Thus, organizations need to emphasize the activities above when implementing retention policies and not just focus on extrinsic rewards, which are directly linked to the working conditions and internal policies of the organization as is commonly done. The findings above provide valuable contributions for building more tangible retention plans aimed at analyzing and intervening in problems related to professional practice affecting software developers' daily lives.

From this introduction, the remainder of this document is organized as follows. Chapter 2 presents the theoretical basis that supports this work. Chapter 3 refers to the systematic mapping that brought together the works present in the literature about the turnaway phenomenon. Chapters 4, 5, 6 and 7 present individual studies, but which are related, in which the result of one served as input for the others. Finally, Chapter 8 presents implications for research and practice, conclusions, and directions for future research.

Chapter 2

Background

In order to facilitate understanding and delimit one of the central phenomena of this study, the turnaway, an attempt was initially made to make a brief overview about the career of software developers, as well as the transition process that permeates the movement of professionals in this area. Such phenomena generated in the academic literature the concepts of turnover and turnaway are also detailed in the following subtopics. Finally, in light of career anchors, we sought to understand their influence on the professional trajectory, making the professional choice to follow a particular career, change the area of activity, reposition himself in the job market, or prepare to seek a new job.

2.1 Software Developers Career

Over time, the field of IT ceased to be merely an item of administrative support to occupy a strategic position within organizations. In this way, it became a subterfuge for competitiveness since it not only sustains existing business operations but also allows new business strategies to be implemented [67]. In this context, companies recognize the importance of software developers to increase productivity, as well as to develop products, services, and information systems (IS) management, making professionals in this area key resources for the success of organizations, projects and activities [136].

These professionals have numerous attributions since there is no standardization of the activities inherent to the position. In addition, each company uses a different terminology given to the position in its occupational structure, for example, junior analyst and program-

mer, which results in employees from different companies with the same position having different attributions or even professionals in different positions performing the same task/activity [26].

McConnell [92], in his research, defines that software developers are responsible for developing software and apps, managing projects related to software, architecting the structural design of programs, and performing tests on systems. In addition to the aforementioned attributions, these professionals may have activities related to database administration, system maintenance, and even some documentation related to project management and the composition of instruction manuals. In this work, software developers were defined as professionals who participate directly in the software development team, such as programmers, testers, system analysts, architects and software engineers [149].

About the labor market, the Association for the Promotion of Software Excellence (Softex) reveals that Brazil may have a shortage of more than 400 thousand IT professionals in 2020, among which a significant part are software developers [135]. This a worrying scenario, considering the investments destined for this area, which amounted to 38 billion dollars in 2017, with Brazil being the 1st among Latin American countries and the 9th in the world ranking. Between 2016 and 2017, growth was 4.5%, a rate higher than the expectation of 4.1%, according to data from the Brazilian Association of Software Companies (ABES). Internationally, the technology sectors are also on the rise, with a growth of 5.5% in the same period, much higher than expected: 4.3% [15].

The shortage of these professionals has been discussed in the academic field and was noted by many articles and reports. For example, [3; 51; 72]. On the one hand, the profession is suffering from erosion in its student base [100], due to the low attractiveness of the profession in terms of image [4] and status [33]. Meanwhile, several issues affect the continuity of software professionals in a given organization, such as career commitment and turnover. Furthermore, the National Graduate Survey reported that only 19% of computer science graduates remained in the profession 20 years later, while 52% of civil engineering graduates fit into the same context [97]. Consequently, the war for talent [21] in the IT sector has its battleground outside and inside the company.

Resources such as hardware and software can usually be replaced without impacting the quality of service. Still, human resources with specific skills cannot, as they represent value

for organizations and must therefore be recognized and leveraged to generate a competitive advantage for the business. Thus, software developers are essential professionals for organizations in the most diverse areas, justifying the current concern with the recruitment/retention of professionals and the future of this career [9].

2.2 Career Transition

Career transition is a broad and current topic that provides countless reflections, given the different situations professionals face throughout their lives. Because it is a topic that covers all professional categories, some of which are more affected, it is a fertile topic that is subject to scientific investigation and knowledge production.

According to Hall [63], careers in the 21st century will be "protean". That is, they represent a new configuration that arises from changes in the labor market that began to demand new forms of relationship between the company and the employees. In this way, the professional ceases to be merely a viewer and begins to manage his career, which can be reinvented from time to time by himself as the person or the environment changes.

Given this scenario, there is a significant increase in the number of career transitions in Brazil [145]. This phenomenon can be conceptualized as a period during which an individual is changing and redirecting their functions, professional roles, or career orientations. Transitions can be motivated both by the personal decision of the worker who wants to seek new challenges and by other situations that impose the need to adapt to new realities, such as the loss of a job or a proposal to change work [145].

Career transition is a process in which the individual needs time to increase his repertoire of knowledge and skills and form a new network of relationships and a new set of references. Thus, for many authors, this process can be subdivided into stages. For Quishida [110], the career transition process takes place in the passage through different stages, such as pre-transition, growing discontent, crisis, redirection and re-stabilization. For Bridges [16], the career transition comprises three phases: termination, a neutral zone, and a new beginning. The end represents the moment when an old work situation ends. The neutral zone comprises the period in which the subject does not identify with the old reality, nor is he fully adjusted to a new composition. And the new beginning represents the period when the individual

experiences a unique job opportunity. However, the author points out that although this sequence is the most usual, the phases can occur simultaneously.

The phenomenon above requires organizations to constantly seek strategies for motivating and retaining professionals. Actions against market harassment, which sometimes provides more attractive financial conditions, are discussed continuously in strategic meetings. However, there is a transition movement of professionals not only in search of better job offers but also influenced by other aspects related to the daily work of professionals, such as the pressure at work faced in everyday life [118].

Thus, considering all the challenges and requirements of the modern and competitive world, some careers tend to suffer more with the transition process, such as IT professionals. Technological advances and their wide use make IT professionals constantly required professionally, being required to have high technical capacity, flexibility, and mobility, which can cause difficulty in staying motivated and responding to intense challenges [83].

In this context, two problems have been observed with some frequency in relation to these professionals: turnover - a situation in which the professional changes jobs but remains in the IT area - and turnaway - a situation in which the professional leaves the area, assuming a position in another functional area of the company or outside it, often evolving into a managerial position [13]. Thus, this research addresses the transition of IT professionals, more specifically software developers, to other careers.

The literature has identified a range of factors that can contribute to the career transition process, from the more specific role of software developers, such as professional obsolescence, to those related to personal issues, such as identification with IT. However, most studies mention professional satisfaction and the need for growth as factors that can make a professional want to change jobs or profession [17; 125]. In the technical area, the space for development is considered small, which can lead to the evolving companies looking for another one to grow technically, or even changing area, reaching out to others where growth opportunities are more available. However, studies show that before changing areas, professionals change companies several times, only abandoning their careers after several unsuccessful attempts within their area.

2.2.1 Turnaway

In an environment marked by global competition, turbulent markets, and the search for high-quality products at low cost in a short period, organizations are increasingly dependent on technological processes that effectively help to meet market needs. The insertion of these technological processes is expensive and necessary, since they help organizations' performance. However, investments in IT are neither necessary nor sufficient conditions to keep organizations competitive in the global market, as they can be misused [26].

Successful IT exploitation depends on the availability of IT professionals to design and integrate IT infrastructure and applications [118]. However, designing, developing, and deploying these processes in organizations depends not only on the technology itself but also on professionals who create and work directly with it. These professionals work in a wide spectrum of jobs, which can be in organizations that use IT or in organizations of IT suppliers [67]. Much has been discussed about these professionals, focusing on debates on how to attract and retain them in the market. IT professionals have been highly demanded and need high technical capacity, flexibility, and mobility [13].

Retaining professionals was one of the biggest challenges faced by most companies in 2019 and the scenario suggests that it will be even more challenging in subsequent years. According to a recent Hay Group report, the combined turnover and dropout rate from 2013 to 2019 averaged 23%, with 192 million people leaving their current jobs this year. Another analysis by LinkedIn with half a billion professionals found that the highest turnover and abandonment rates are recorded in the software industry, followed by retail services and the media [105]. Given these facts, it is evident that the IT field is going through a time when demand tends to increase, while the supply of current and potential workers decreases [17]. IT, as well as to achieve the desired strategic alignment of IT with the business [142].

At the same time, organizations have increased concern about the management of IT professionals, as their hiring and training involve significant investments. According to some authors, human resource management is the critical variable in IT management [13]. In this sense, it is essential to understand the expectations of these professionals about work and career and what aspects contribute to their permanence in the IT area or transition to other areas [118].

Understanding the career transition process that can culminate in organizational aban-

donment is a continuous challenge for researchers and professionals [71]. This phenomenon has been referred to in the literature as *turnaway*, a situation in which the professional leaves the area, taking a position in another area of the company or outside it[71]

Some authors subdivide this phenomenon into *turnaway-within* and *turnaway-between*. The former does not involve any change in company but occupation, while the second represents a change in company and occupation [70]. Taking this subdivision into account, turnaway can be due to multiple factors: individual (search for recognition, salary or hierarchical advancement, experience of new challenges) and organizational (management policies, organizational objectives). A better understanding of how these factors influence IT professionals may lead to more effective and attractive methods to meet the mutual expectations of employees and employers in the work context in terms of development, career, and monetary returns, among other aspects that will be studied throughout this work.

The turnaway phenomenon has severe consequences for organizations in general due to the economic impacts. A large part of turnaway costs are hidden expenses such as training / capacity building, corporate memory erosion, and work hours interruption. The exact price is difficult to measure, but studies estimate that the average is about 1.5 times the annual salary of the job, so the turnaway of these professionals has a substantial impact on the operating costs of an organization [80]. Other aggravating factors caused by turnaway and turnover are the increase in project duration and the loss of competitive advantage. A simulation study estimated that the cost and time of software development would increase by an average of 40% to 60% [1], in addition to the loss of competitive advantage as employees leave the company with all their acquired knowledge [80].

In the national context, turnaway is still poorly studied. A few studies were carried out in Brazil [113; 89; 13; 112; 9; 118]. In their research, Ramos and Joia [112] sought to identify whether factors such as the need for growth, identification with the company, satisfaction with the IT area, search for new experiences, and professional success explain the intention of IT professionals to leave their area. Three years later, the same authors published another article refining the model proposed in the first study, where nine hypotheses were raised, among which, in addition to the aforementioned characteristics in the study [112], were included: conflicts between family life and work, exhaustion, high workloads and participant demographics [113].

The study by Assis [9] was an extension of other studies already carried out in Brazil; in addition to the hypotheses arising from previous works, two more aspects were added that can corroborate the career transition process in IT: obsolescence and professional identification. Santos, on the other hand, related career transition to psychological contracts [118].

Experts in the field describe the need for professional growth as one of the main factors that can lead an IT professional to want to leave the area [13; 112; 9]. This fact is due to the low career opportunity that companies offer to professionals who wish to evolve technically, leaving them to opt for career stagnation or change to managerial positions.

From this perspective, IT professionals are induced to choose a focus for their careers: a career of achievement or a career of advancement [10; 103]. The first, professional success, is inherent in carrying out more technical activities and is related to intrinsic motivation and recognition from co-workers, while the second occurs through obtaining new positions of authority and growth within a power hierarchy of an organization; in this, the success happens through the accumulation of new responsibilities in the company [9].

Still, regarding professional growth, a qualitative study with software developers extracted from the codifications carried out through interviews showed that professional development could cover two main ideas: evolution and professional stagnation [90]. The emergence of these topics leads us to believe that the need for growth and learning is inherent in most people who work with software. Professional evolution brings together all the reasons described on how to grow in the market and/or academically, emphasizing the need for new experiences in which developers demonstrate curiosity in learning and working with different technologies. Professional stagnation, on the other hand, is where a more negative part was found about the work of developers; respondents reported that the lack of a well-defined job and career plan by the organization leaves them unmotivated and may lead to a change of job or even abandonment of the profession.

In addition to professional development, Colombo-Palacios [26] identified characteristics such as financial motives, frustration, physical and psychological exhaustion, and lack of productivity as factors driving transition and career abandonment.

Job dissatisfaction is also one of the characteristics pointed out by studies as one of the causes for abandoning the profession; in Brooks' research [17], negative correlations were found between job satisfaction and turnaway intention among IT professionals; these

findings also apply to other professions. Sabanciogullari and Dogan [117] found that the turnaway intention the profession was higher among workers with low growth, lack of professional identification, and low job satisfaction. Also, in his study Brooks [17] also observed that professional identification is not directly correlated with turnaway intention. However, two factors mediate this relationship: job satisfaction and career commitment. Previous research provides evidence that there are two types of job identification: The first is related to the profession and the other to the organization; both exist independently of one another and have different relationships with turnaway intention. When analyzed among IT professionals, it was found that they had higher identification levels with the profession than the organization.

Many authors point out that professionals who leave the IT area for another, remaining in the organization, have a greater identification with the company than with the IT profession. This finding was studied by Assis [9], who investigated whether professionals who are highly committed to the IT area tend to do more turnover than turnaway.

Other factors can influence the intention to turnaway: age, work experience, IT experience, the complexity of change, knowledge/skills, obsolescence, professional self-efficacy, job insecurity, conflicts between family life and work, lack of autonomy, politics and internal disputes, unpleasant work environment, low teamwork, lack of flexible work practice and lack of commitment [125].

Amid this vast amount of characteristics that influence career transition and consequently abandonment of the profession, a more detailed study with software developers is necessary so that, in this context, it is possible to identify which and how these factors affect intentions. turnaway, and based on that, suggest more effective strategies to retain these professionals.

2.3 Career Anchors

The definition of the term "career" can be given to "a sequence of attitudes and behaviors, associated with work-related experiences and activities, during the lifetime of a person" [64]. It is a widely discussed term, however, difficult to define, in which several meanings can be added, and a career can be determined, for example, from two perspectives. In this case, the path is structured and organized in time and space, considering that the "words time and

space are central in defining a career since they delimit where the person will work, what he must do to reach his goals, and how long will it take for this to happen" [131]. Such perspectives, according to Fleury, are delimited from (a) occupational mobility, because of the path to be taken by a particular professional; (b) professional stability, as a profession, for example, a civil servant career [45].

To help career occupants decipher their priorities, Edgar Schein created a typology called career anchor, which is "self-knowledge of what one is good at and what the needs, motives, and values govern work-related choices" [120]. Thus, the career anchor is the set of self-perception factors indispensable to the individual in professional choices. They are the motivations that lead people to choose a particular profession, change jobs, to seek a promotion, or a replacement in the market. The anchor indicates the capabilities, needs, and individual values directly related to self-knowledge, so the more experienced the professional, the greater the self-perception of these three guiding elements and the search for balance between decisions and professional experiences [120].

Throughout his studies, Schein [121; 122; 120; 124] identified patterns of choice in professional experiences due to different self-perceptions. This led him to propose a categorization of eight career anchors: technical/functional competence, general managerial competence, autonomy and independence, security and stability, entrepreneurial capability, service/dedication to a cause, pure challenge, and lifestyle. Each anchor is associated with a pattern of motivations and rewards recognized as such [43].

A new research proposed that individuals can have a primary and secondary career anchor, making the concept proposed by Schein more flexible and reinforcing the overlap [120]. Therefore, understanding career anchors can structure a hierarchy of needs and values. In this way, organizations are intended to enable careers congruent with the career anchors of workers, at the risk of impacting motivation and triggering all associated undesirable effects. Studies [120; 43] have pointed out that the lack of balance between the career anchor and the career can cause dissatisfaction, low performance, and staff turnover [43].

The individual with the anchor of *technical competence* as the predominant value a career of specialization with professional experiences that challenge his technical capacity. He values learning and technological deepening and considers success to stem from being recognized as an expert or reference in his area of competence. Usually, this individual values

rewards from other specialists, as these dominate the specificities of their area of competence and, therefore, have greater capacity to judge their performance. Similarly, they appreciate rewards related to development and education opportunities, as well as technical leadership of teams, in addition to guaranteed (fixed) remuneration based on what they consider technical competence to be merit [120].

The anchor of *managerial competence* represents the individual motivated by the opportunity to lead, make decisions, and define behaviors with organizational impact. By estimating these particularities, career success is focused on achieving a high position in the organizational hierarchy and the power to influence others. Rewards given by hierarchical superiors are well accepted. The reward represents reaching the highest levels of responsibility associated with the perspective of vertical growth (promotion) and obtaining high remuneration according to meritocratic principles regarding the organization's results. It values rewards related to titles, symbols, and status within the organization [20]

The anchor of *autonomy and independence* is represented by people who will seek, over time, a career that allows greater independence that allows them to impose their conditions. It is related to the individual who, most of the time, is contrary to rules, norms, standards, and methods created by others and to strict supervision, as he values flexibility. Success lies in the degree of autonomy and independence at work. This individual values rewards that allow flexibility - such as movements (horizontal or vertical) in the career, greater autonomy, and independence [30]. The *security and stability* anchor identifies individuals who need to feel secure in the work environment. These value the stability and predictability of performance levels and tasks. This anchor shows the individual who values predictable and stable rewards, a preference for assured (fixed) remuneration rather than risk (variable) remuneration, using, at the same time, performance and maturity (period of experience) in determining the judgment of merit. For Schein, this individual can be defined as the organizational man, who tends to leave his career in the hands of the employer [120].

Individuals who have the anchor of *entrepreneurial capability* as predominant value the possibility of establishing, creating, and structuring organizations, businesses, products, and services, the opportunity to face new creative challenges. They are not necessarily people with artistic creativity but an entrepreneurial spirit who want to establish or restructure their businesses. They are motivated to start businesses to earn money from an early age. It

is worth mentioning that the focus here is not the search for autonomy but the creation of businesses. They value public rewards, which allow for proving the success of the enterprise, with money being the measure of success [30]. The anchor *service/dedication to a cause* concerns the individual who pursues professional experiences aligned with his fundamental values and the values of the group or organization. This individual is, above all, loyal to the cause he defends and not necessarily to the group or organization. Success is represented by its values' influence on the organization or its social policies. They are professionals who want to contribute to a better world through their work. The most valued rewards are rewards for contributions and dedication, and not necessarily for results. Monetary reward is not valued, as the concern is with equity. Fundamentally, these are individuals who feel rewarded when colleagues, superiors and the organization share their values [30].

The *pure challenge* anchor fits individuals who define success as overcoming obstacles or as the ability to solve unsolvable problems. They are people who need to feel challenged so that they have the feeling that they can conquer anything. The search for challenges permeates almost everyone's career, but for those anchored in the pure challenge, it guides their trajectory. These individuals value rewards that nurture self-perceived superiority in competitive combat, gained through merit. This career anchor is close to entrepreneurial creativity, but differs in values related to competitiveness [146]. The *lifestyle* anchor values acting in professional experiences that are integrated with personal, family, and professional needs. By valuing the balance between the three spheres of life, the individual seeks stability, value flexibility at work, and dedicate time not only to career needs but to others. The perception of success is related to achieving balance, with a career not being the main objective. It values rewards that enable conditions to balance needs and show respect for personal and family interests, such as leave and flexible working hours. Often, this anchor is interpreted as that of people who do not prioritize their careers, but this is not the case. The lifestyle anchor does not point to an individual who is negligent with work but for whom work is not the center of existence [123].

Each of these anchors contains a set of scale items, where each item is judged on how true it is. Values are defined as: (1) The statement is never true for me, (2 to 3) occasionally true for me, (4 to 5) often true for me, and (6) is always true for me [123]. Given the context above, the most diverse areas have used this theory to identify their collaborators' profiles

and extract the benefits that this discovery can bring. The definition of this concept has to do with the professional motivations of employees. Still, it is mainly a bilateral relationship, in which the organization needs to consider its employees' purposes so that results are achieved. In a study that investigated the career of workers in the area of information technology in the city of São Paulo who work in a home office system, it was possible to obtain that the career anchor with the highest incidence among the respondents was that of lifestyle, marked by the desire for autonomy and flexibility. It was also possible to verify that most people chose to work remotely as a career option and that most workers understand that they have the same opportunity for career growth as those who work full-time in the office [132].

Another similar result was found in the study by Faro et al. [30], carried out with civil servants of the Federal Court of Auditors, in which the anchor's Lifestyle (5.0%), Willingness to Serve or Dedicate- to a Cause (27%) and Security/Stability (4.5%). Thus, it is worth mentioning that, in addition to the individual emphasizing the concern with personal control, there is also satisfaction with the professional career and the opportunity for a stable job [20]. Agreements of this type may suggest that professionals from different areas may, according to cultural or training aspects, have similar value anchors [123]. The study of these themes is of great importance, as career anchors, in addition to influencing decisions about the professional path, interfere with the individual's satisfaction and commitment to their work. Thus, the aim of this research phase was to verify whether there is a relationship between career anchors and the motivators found in the ES1 e ES2.

Chapter 3

Systematic Literature Mapping

3.1 Definition

Research can be classified according to modality, objectives, and approach; despite these classifications, studies can still be divided into primary and secondary. Primary studies correspond to original investigations, in which the data collected or variables observed and analyzed in the study (by a researcher) are related to the application of interventions (experimental studies) or observations (observational studies) [150]. While secondary studies aim to review primary studies relating to certain research questions, with the specific aim of integrating and synthesizing evidence related to these questions. In general, the purpose of a secondary study is to provide researchers with an overview of a research area and help identify gaps in research in that area [150].

Systematic Review (SR) and Systematic Mapping (SM) are types of secondary studies that follow a methodologically well-defined research process to identify, analyze and interpret available evidence related to a particular set of research questions, topics, or phenomenon of interest in an unbiased and, to some degree, repeatable manner [77]. The systematic literature review can be summarized in three main activities: 1 - identify and describe the relevant research; 2 - critically evaluate research reports systematically; and 3 - gather the findings into a coherent statement, that is, synthesize the research ideas. Considering the objective of this research, the study will be limited to carrying out a systematic mapping of the literature, which, for Kitchenham, Budgen, and Brereton [78], follows the same methodological route as the systematic literature review and serves as a body of research for

carrying out the systematic review, however, deals with the identification and classification of research related to a given topic, and aggregates studies in relation to defined categories. Such categories can be based on publication information, such as the authors' name and institutional affiliation, type, source, and publication date. The stages of the literature mapping study are distributed summarily: 1 - definition of research questions; 2 - carrying out research on primary studies; 3 - screening of documents based on inclusion/exclusion criteria; 4 - document classification; and 5 - data extraction and aggregation [78].

This type of study has a history of being little practiced in computing, particularly in software engineering [53; 54]. This scenario has been changing since the emergence of the evidence-based paradigm in 2004, which guided the development and consequently spread the usability of this method.

Systematic mapping in software engineering allow researchers to collect and analyze evidence from different aspects of software development, aiming to integrate experimental results. Its application can emphasize the detection of general practical problems and research gaps to guide future research [79]. Thus, in this phase of the research, a systematic mapping of the literature was carried out based on the guidelines for systematic mapping in software engineering [77], performing the following steps:

3.1.1 Research Questions

In order to list the motivators that can influence software developers to abandon the area, it was feasible to investigate in the first stage of this thesis the articles present in the literature that sought to identify the motivators that could affect the abandonment of the area among IT professionals, even that the process favors the recognition of more general aspects, as it is a systematic mapping that aims to provide an overview of the phenomenon. In addition, considering IT professionals a category that groups several professions in the area.

Thus, the systematic review was prepared with two objectives. First, to identify the constructs present in state of the art and thus understand them conceptually according to their levels of abstraction. Secondly, to review the literature on turnaway and detect existing problems and gaps. To achieve these objectives, the following Research Questions (RQ) were defined:

RQ1. *What are the motivators that can influence turnaway among IT professionals?*

RQ2. *Do the motivators positively or negatively impact turnaway among IT professionals?*

3.1.2 Data Sources and Research Process

The survey of primary studies was initially carried out through an automated search of specialized and renowned scientific sources and digital libraries in software engineering and subjects related to the objective of this thesis. The possibility of duplicating articles in more than one digital source can be observed, however, it was decided to consider them to guarantee that all primary studies analyzed in the respective databases would be analyzed. Table 3.1 lists the research sources used.

Automatic search	
Database Name	**Database Website**
ACM Digital Library	https://dl.acm.org/
IEEEXplore	https://ieeexplore.ieee.org/
Scopus	https://www.scopus.com/
Science Direct	https://www.sciencedirect.com/
Springer	https://link.springer.com/

Table 3.1: Automatic sources.

3.1.3 Search String Definition

The search string employed is based on general terms extracted from the general research question and synonyms of turnaway and information technology found in the literature, as shown in Figure 3.1. The search process was carried out in February 2021 and retrieved 241 articles.

The set of synonyms for turnaway added to the search string, along with the different terminologies to refer to IT professionals, raised the sensitivity of the search, thus increasing coverage. However, the lack of standardization both for designating people who turnaway from the profession as well as for professionals working in the IT area may have reduced

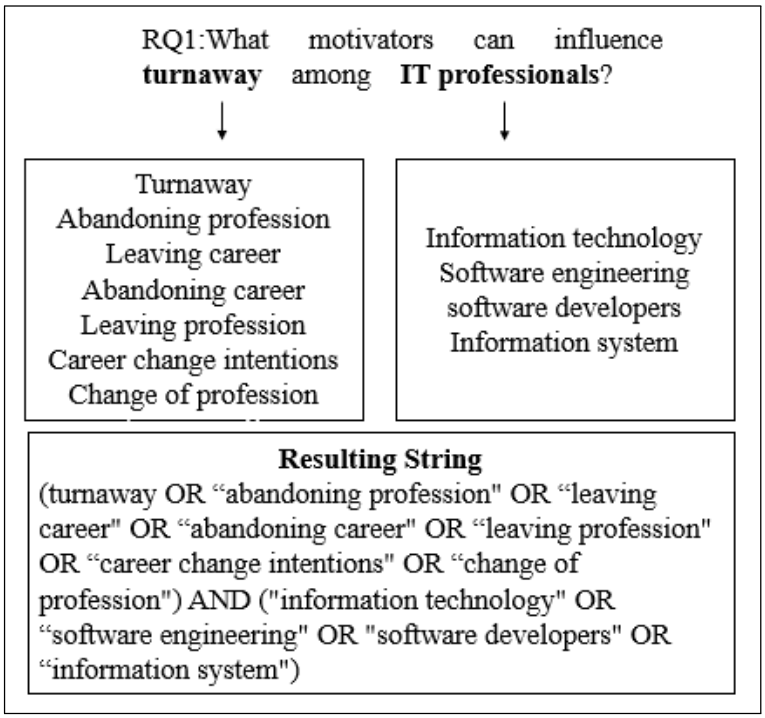


Figure 3.1: Search string.

precision, that is, the amount of non-relevant studies found in the automatic search that were excluded in the subsequent stages of this process. It should be noted that the search string was based on some secondary studies on turnover, making the necessary adjustments, such as: replacing "Abandoning job" with the keyword "Abandoning profession" or "Abandoning caree".

3.1.4 Inclusion and Exclusion Criteria

From the initial set of 241 articles, studies were selected that presented concepts, theories, guidelines, discussions, lessons learned, and experience reports on the practice of turnaway in the area of Software Engineering. Articles were excluded when they met any of the five exclusion criteria:

1. Written in any language, except English and Portuguese;
2. Studies published between 2010 and 2021;
3. Guest works, lectures, workshop reports, books, theses and dissertations;

4. Incomplete documents, drafts, presentation slides and extended summaries;

5. Addressing areas other than computer science (business and management, social sciences, health care areas and others);

6. Studies only citing or only referencing papers on turnaway but not addressing their findings;

7. Articles that do not present any type of finding or discussion about the practice of turnaway in the context of software engineering.

3.1.5 Data Selection

The pre-selection of articles was based on analyzing the full text of all articles retrieved by the automated search. Two researchers, working independently, excluded those who met any of the exclusion criteria (1) to (5). Forty-seven potentially relevant studies were pre-selected and the vast majority of articles were excluded at this stage, mainly due to the exclusion criteria (5).

In the selection phase, each researcher applied exclusion criteria (6) and (7) following three reading levels respectively, when the study referred to the practice of turnaway in the context of software engineering, it was selected for the next level, otherwise it was excluded. Below are the reading levels adopted in the study:

- Level 1: reading the titles of the studies found and excluding those that did not fit in the turn-away context for software engineering;

- Level 2: reading the abstracts of the studies selected in step 1 and excluding those that were part of the turnaway context for software engineering;

- Level 3: full reading of all remaining studies from previous stages and selection of those that fit the turnaway context for software engineering.

Even in the selection phase, duplicate articles were excluded. When a study was published in more than one journal or conference, all versions were reviewed for data extraction purposes. However, in this case, the first publication was used. Data selection ended with 15 articles.

Disagreements between the two researchers during the pre-selection and selection phases were resolved in a consensus meeting, which could involve the presence of a third researcher to resolve these disagreements. Figure 3.2 summarizes the article search and selection process.

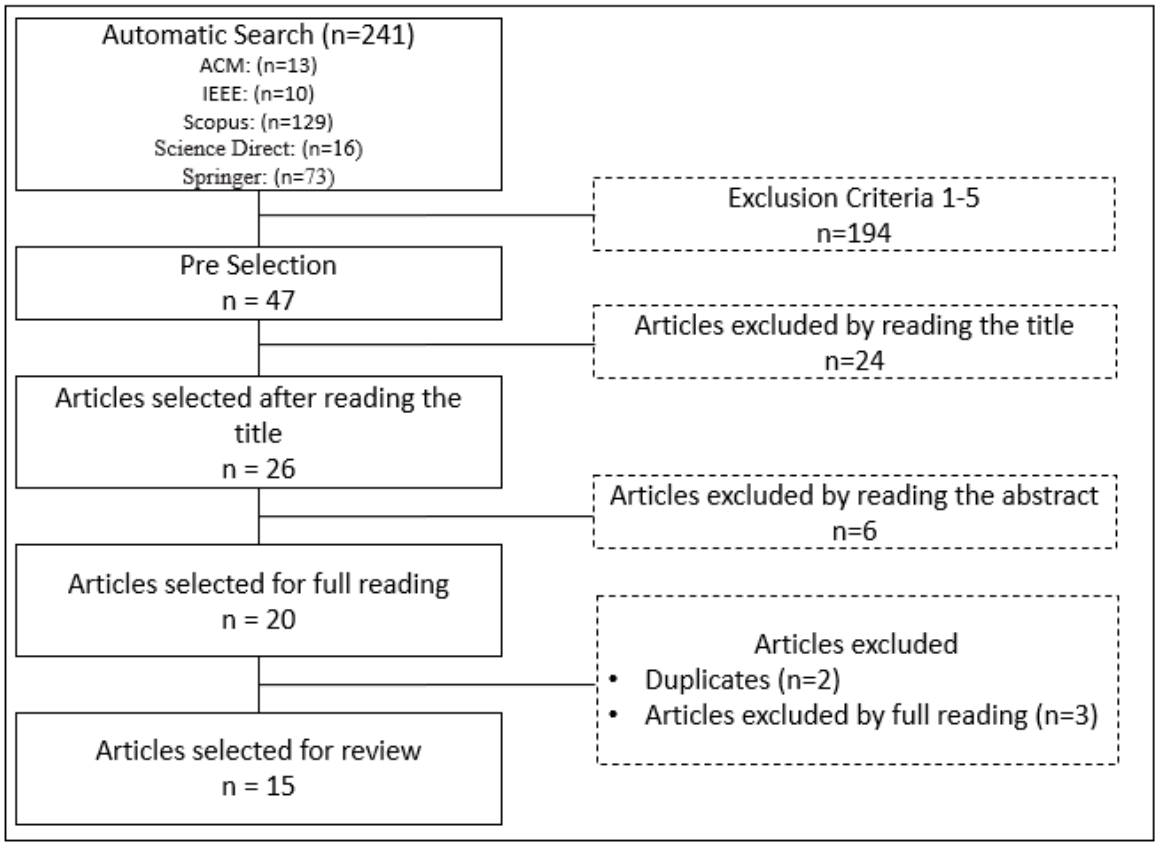


Figure 3.2: Search and selection processes

3.1.6 Data Extraction

For data analysis and interpretation, a synthesis of information extracted from selected articles was carried out. For this step, the instrument (Table 3.2) was used, consisting of the following items: (1) Title of the article, authors, journal, year (2) Objectives; (3) Method and (4) Results. In this step, two researchers, working independently, analyzed each article to fill in the form with the information described in Table 3.2. The process with two researchers working on the data extraction aims to improve the accuracy of the extraction process and, therefore, the reliability of the results. Similar to data selection, extraction conflicts were

discussed and resolved in a consensus meeting, which could involve a third researcher.

Data	**Description**
Title	Article title
Author	Author of the article
Publication year	Publication year
Publisher	Type of publication: journal or conference
Goals	Main objective of the article analyzed
Method	The article method
Results	Article results

Table 3.2: Data extraction form.

3.1.7 Synthesis and Summary of Results

To perform data summarization, the following steps were taken: initially, the identifying factors were applied, based on the qualitative coding technique [140] and consisting of identifying the motivators related to turnaway in each study and comparing the findings to ensure that they addressed the same construct. This is an analysis similar to open coding in qualitative research. The second part consists of the grouping factors, which is similar to the use of axial coding in the qualitative analysis; the representative codes of the turnaway motivators were compared and grouped when they were the same construct; this process was important to ensure that the constructs referring to the turnaway same motivator can be standardized. Finally, the creation of propositions was carried out through selective coding techniques, and the analysis of the motivators was carried out in order to find relationships between them and present these relationships as propositions.

In summary, this mapping identified identified 15 studies on turnaway focusing on IT professionals in general and extracted potential motivators that may influence the intention to turnaway the profession. These results are presented in Chapter 3.2.

3.2 Results and Discussion

The systematic literature mapping aimed to explore the state of art, seeking to identify evidence on aspects that motivate turnaway among IT professionals. The literature is still scarce when it comes to researching software developers, presenting only one article that discussed turnaway from the perspective of these professionals.

Despite the focus of this thesis being IT professionals who work directly with software development, the mapping sought to identify aspects in the software engineering literature that generally motivate any IT professional to abandon their careers, bearing in mind that some motivators would be more generalist, that is, they would apply to any profession and others more peculiar to the profession of software development. Thus, through the systematic review, it was possible to identify 15 works that address this theme, published between the period from 2010 to 2021, as shown in the table 3.3 below:

To simplify the table and not make it too long, the list of articles analyzed in the study are contained in the references of this work, using the nomenclature [Snn] where "nn" is the number of articles in the list of references.

At the end of the process of searching and selecting articles, it was found, as expected, that the vast majority of studies focus on IT professionals in general, with the exception of article [S4] which used the term software workers to represent your sample, not making it clear which positions it was about.

In general, the studies presented and discussed motivators that can positively influence abandonment; that is, the more present the motivator, the greater the possibility of abandonment or influence negatively; this means that the more present the motivator, the lower the possibility of turnaway. To classify the studies, the definition used in [S8] was used, which attributes the following taxonomy to different types of professional mobility: turnaway between (voluntary departure from an IT professional to another that is not in the same company) and turnaway within (voluntary departure from one IT profession to another within the same company). Thus, the articles were classified into two categories, those that use the taxonomy because they believe that depending on the type of turnaway performed by the professional, there may be a significant difference in the influence of the construct and those who do not use the taxonomy and treat it as the same phenomenon, not making this

ID	Title	Year	Ref
S1	Software practitioners dropping-out: a research proposal	2011	[42]
S2	Profissionais de Tecnologia da Informação e sua Transição para Funções Não Técnicas	2011	[112]
S3	I'm Leaving the IT Field: the Impact of Stress, Job Insecurity, and Burnout on IT Professionals	2012	[130]
S4	Career Abandonment Intentions among Software Workers	2012	[26]
S5	Exhaustion from Information System Career Experience: Implications for Turn-away Intention	2015	[8]
S6	Career transition antecedents in the information technology area	2015	[68]
S7	Identifying with the Information Technology Profession: Implications for Turnaway of IT Professionals	2015	[17]
S8	Turnover or Turnaway? Competing Risks Analysis of Male and Female IT Professionals' Job Mobility and Relative Pay Gap	2015	[69]
S9	Career commitment of information technology professionals: The investment model perspective	2015	[49]
S10	Motivations to Leave Engineering: Through a Lens of Social Responsibility	2017	[115]
S11	My Knowledge is not Enough: An Investigation on the Impact of Threat of Professional Obsolescence on Turn Away Intention Among IT Professionals in Bangladesh	2017	[7]
S12	Should I stay or should I go? A study of IT professionals during a national crisis	2019	[13]
S13	The Role of Job Satisfaction in Turnover and Turn-away Intention of it Staff in South Africa	2019	[125]
S14	Motivations for the IT Professional Turnaway Intention: A Delphi Approach	2019	[67]
S15	When Agile Means Staying: The Relationship between Agile Development Usage and Individual IT Professional Outcomes	2019	[129]

Table 3.3: Summary of selected papers.

differentiation in the type of professional mobility (Table 3.4).

Type of Turnaway Intention	Study Reference
With taxonomy (turnaway intention between/within)	S8
Without taxonomy (turnaway intention between/within)	S1; S2; S3; S4; S5; S6; S7; S9; S10; S11; S12; S13; S14; S15

Table 3.4: Classification of studies according to the type of turnaway.

Regarding the method, 14 studies were quantitative, a fact that can be explained by the specific methodological characteristics of the two methods, giving qualitative research greater complexity in terms of assumptions, collection, transcription, and data analysis. Furthermore, one can consider the low cost for application, the freedom the subject has in presenting their opinions, and lower expenditure. The only study that carried out mixed research was the article S4. However, important methodological aspects were not identified, such as the data collection process (interviews) and data analysis, focusing only on presenting the categorization extracted from the results, a total of five categories, and within each of the categories, the sets of motivators that could influence the abandonment of the profession.

Still on the article S4 it is highlighted that the professionals participating in the sample were still working in the profession, which can generate questionable results, considering that the person who has not yet experienced the abandonment of the profession may not be able to portray the real motivators of the phenomenon.

As for the use of models to explain the turnaway phenomenon, few articles sought to use pre-existing theories to present their results. In S12 the author verified that his data could be explained by the theory of human migration, in which each item of the theory (push-pull-morring) could be described by motivators that were analyzed in his study; the other researches presented model proposals and used their data to try to validate.

With regard to the turnaway-related motivators listed in the studies, it is possible to verify that they focus on more general aspects such as: satisfaction with the profession, identification with the career and lack of rewards, that is, motivators that will probably be present in all occupations in the labor market, not being something peculiar to the area of software

development. Still, on the motivators, another relevant point is that all the articles use in their models motivators already presented in other studies, whether in the phenomenon of turnaway or similar ones, for example, turnover. This type of characteristic can be considered a positive point since it increases the reliability of the constructs, sustaining that they impact the career when applied to different samples. However, it limits the possibility of discovering new motivators that are not present in state of the art, especially those that may be closely related to the attributions of the profession. The lack of research with exploratory characteristics of the phenomenon justifies this behavior.

Finally, the primary studies found in the mapping were analyzed in order to observe the influence of the motivator on the turnaway phenomenon, whether positive or negative. Table 3.5 summarizes these characteristics:

The mapping identified that the motivator satisfaction was present in 8 works, that is, the most studied among the identified works, this fact may be related to the high number of studies with similar phenomena, such as turnover, which also proposes to investigate how satisfaction influences the phenomenon [82]. Within the IT literature, satisfaction is typically studied at the job level [82; 70; 17] and the career level. Both reflect an individual's personality and level of satisfaction with what he or she is doing in terms of his or her work or career and, not surprisingly, were found in the analyzed studies [82]. Researchers have found that job satisfaction impacts organizational commitment and IT professionals' turnover and turnaway intentions. Satisfied individuals tend to complete their assignments faster, more efficiently and with greater resolution. Thus, individuals will continue in the profession if they are satisfied with their attributions, otherwise, they may abandon work and/or the profession.

Another motivator that is always related to satisfaction is affective commitment, which can be studied at the organizational and career level; when the employee has an affective commitment to the organization, even if he is dissatisfied with the profession, the tendency is for him to abandon his career while continuing to work in the company, that is, turnaway-within, when there is a lack of commitment to the career, the professional usually leaves the company as well as the career (turnaway - between). A more recent survey of the IT workforce highlights the importance of commitment to the profession for IT workers while also noting the lack of attention to its study [82]. Historically, career commitment has been

Motivator	Study ID and Impact of Turnaway
Satisfaction	-S1; -S6; -S7; -S9; -S10; -S12; -S13; -S14
Affective Commitment with the Profession	-S2 -S4; -S5; -S7; -S14
Professional Identification	-S7
Need for professional growth	+S2; +S6; +S14
Stress	+S3
Job security	-S3; -S4; -S12; -S13
Exhaustion	+S3; +S4; +S5; +S6; +S11
Role ambiguity	+S4
Threat professional obsolescence	+S4; +S6; +S9; +S11; +S13; +S14
Perceived workload	+S4; +S5; +S6; +S11; +S14
Role conflict	+S4
Lack of autonomy	+S4
Lack of rewards	+S4; +S8
Low job control	+S4; +S5
Lack of formal career	+S4
Low personnel develop	+S4
Lack of professional recognition	+S4
Low teamwork	+S4
Work-family Conflict	+S4; +S5; +S6; +S11; +S14
Politics and infighting	+S4
Lack of professional regulation	+S4
Agile Methodology	-S15

Table 3.5: Turnaway in different fields of IT research

shown to be an important outcome variable related to turnaway intentions in the IT area. Thus, like satisfaction, commitment tends to be negatively related to turnaway intentions, as seen in Table 3.5.

Allen and Meyer adapted the organizational commitment model to that of a team. They generated a three-dimensional conceptualization, in which the dimensions can be divided into: affective, continuous and normative commitment. Affective commitment refers to an employee's emotional attachment, identification, and career involvement. The abundance of studies that examine affective commitment, for example, [S2]; [S4]; [S5]; [S7]; [S14], shows that, as expected, employees with a strong attachment to their careers tend to have less intention to leave [148].

The threat of professional obsolescence was another important variable in relation to the abandonment decision, although it was not the one with the most excellent appearance in the analyzed articles, but whenever it was present it drew attention because it is closely related to the technology area that has a need of constant updating and above average when compared to other professions. It is estimated that the lifespan of an IT professional's technical mastery is only two years. For this reason, the risk of obsolescence is one of the main exhaustion factors in information technology professionals worldwide [114]. The threat of obsolescence requires soft workers to remain constantly updated in knowledge and skills, thus necessitating continuous training and learning to stay current.

S11 evaluated through the suggested model that exhaustion and the threat of obsolescence could explain approximately 40% of the variance in the variable turnway intention. In [Art.004], the threat of obsolescence was mentioned in 85% of the interviews as a factor that could be relevant when leaving the profession, even in that study, in a second phase, the threat of obsolescence was the one that presented the highest correlation and significant ($r = 0.731$, $p < 0.01$) which also significantly correlates with role ambiguity.

Job insecurity was cited in four studies (S3; S4; S12; S13); this refers to an employee's perception of the potential threat to continuity in their current job; that is, it is a state of uncertainty about the continuity of employment [13]. With a promising job market and is considered an area protected from unemployment due to the criticality of IT in organizations, it seems contradictory for IT professionals to feel insecure at work; however, works like [S3], [S4], [S12], and [S13] indicate that this motivator is correlated with the phenomenon

of turnover and turnaway. However, this motivator seems closely related to leaving work and the profession. Still, on the motivator of job insecurity, it was identified in some articles that this was conceptualized as instability at work; in this way, as it was about similar phenomena, they were included in the same construct.

Work overload was also present in five studies [S4]; [S5]; [S6];[S11]; [S14] . In some theoretical models, work overload was directly related to abandoning the profession, while in others, this connection was indirect; that is, overload was linked to exhaustion, which in turn was related to turnaway. The workload was found in the literature as a perceived workload when making comparisons, and it was found that it was the same construct. In development teams, overload can come from several causes, such as short deadlines, poorly dimensioned teams, excessive overtime, the imbalance between estimated activity and professional experience, high workload, accentuated routine during the development phase software delivery, and estimates performed by untrained professionals [141].

The excess workload can culminate in aspects such as exhaustion, fatigue, and burnout, and the latter refers to an emotional disorder with symptoms of extreme exhaustion, stress, and physical exhaustion resulting from stressful work situations. In the systematic mapping, we found the three motivators related to the intention to abandon the articles [S4], [S5], [S13], for analysis purposes, we classified all of these as exhaustion, despite knowing that burnout can be measured in 3 dimensions and that exhaustion is the most commonly known [61].

This mapping proved that there are limitations and gaps that require a deeper analysis of the subject; thirteen of the fifteen articles in this review used quantitative methods as a methodological approach, which despite the robustness conferred through static analyses, use pre-existing motivators in the literature, which may limit the identification of important motivators. As this phenomenon is little studied in the literature, with regard to the IT area, this review confirms the need for further exploratory studies to identify possible additional motivators hitherto unreported focused on the attributions of software developers, considering that only one article identified in the present review worked with these professionals.

Finally, it is important to examine whether professionals who have already dropped out corroborate the motivators listed in the literature, given that all studies have examined the intention to turn away as the dependent variable. Still, we must take into account that the

intention cannot always predict the actual behavior and that there are external factors such as the availability of alternatives in other areas, as well as changes in family situations that directly affect turnaway and retention behaviors [82]. In this perspective, it seems feasible to carry out new studies aimed at people who went through the transitional process of becoming a profession, considering that these can more reliably portray the motivators that influenced the abandonment of the profession.

Chapter 4

Finding Motivators for Turnaway: an exploratory qualitative study

4.1 Definition

Exploratory research is used when you want to obtain data about the nature of a problem, make it more explicit, or build hypotheses. Exploratory research is highly flexible, so that any aspects related to the studied fact are important [106]. This type of research is used when there is not enough structured information to allow the conduct of a descriptive or experimental study, or when the interest of the project is precisely to obtain a volume of data that explores in depth how a given phenomenon occurs [143].

Coherent with the nature of the problem and the investigated phenomenon, the exploratory study was carried out through a qualitative approach inspired by the Grounded Theory, also known as Grounded Theory of Data (GT) [52]. GT is a qualitative research method that seeks to create a theory based on the development of a phenomenon, unveiled by the simultaneous collection and analysis of data [107; 119]. This methodological framework is used to understand the experiences and meanings that social actors have had in a given scenario, investigating the interactions, behaviors, and perceptions of individuals and their thinking about a given object. It has established itself as a relevant method in the IT area, being increasingly used in research that includes human factors in software engineering [41].

Thus, the objective of this exploratory study is to identify the motivators that influenced

former software developers to leave the profession, in addition to the dimensions with which those motivators are associated. From the results obtained, it was also possible to compare whether the identified motivators were the same as those already found in the literature, considering the scarcity of exploratory studies to determine the phenomenon, as well as the lack of research that investigates teams of software developers. For this, it raises the following research questions:

RQ1. *What are the potential motivators for the turnaway of former software developers?* In this question, we look for tasks, processes, events, or situations that could have been a motivator for the decision to abandon the software development career.

RQ2. *Which software development dimensions are turnaway motivators classified in?* For this question, we classify the motivators found in RQ1 using a predefined codebook, developed by us inspired by IEEE's Guide to Software Engineering Book of Knowledge [14].

RQ3. *Do the motivators found in this study differ from those already identified in the systematic literature mapping?* Due to the lack of studies investigating former software developers' turnaway. In this question, we tried to observe whether the motivators found in this study differ from those already reported in the literature.

4.2 Methodology

In this section, we present the methodology of our study, including participants, procedure, data collection and research method.

4.2.1 Getting Started

The first stage focused on defining the general research question and designing the case study. A comprehensive literature review was carried out seeking the following:

- Review of the motivators that can influence the abandonment of IT professionals and their relationships with other motivators. Due to the scarcity of work involving only professionals working in software teams, it was necessary to broaden the search to include IT professionals in general. It should be noted that this review was carried out

in the first study of this thesis;

- Qualitative studies that contemplate phenomena similar to turnaway, such as turnover, with the aim of guiding research regarding the theoretical and methodological path;
- Turnaway definitions for a better understanding of this phenomenon.

This step was essential to define the turnaway and delimit the research questions in order to identify important points to be considered in the interviews, as well as to increase the construct and external validity during the analysis and synthesis of the data.

4.2.2 Population and Sample

To delimit the universe of the study, access to individuals with experience in the subject is essential. In the context of research, statistical inferences play a secondary role when trying to represent a theory applied to a theme.

The universe of the study was composed of former software developers. McConnell [92], in his research, defines that software developers are responsible for implementing software and apps, managing projects related to software, architecting the structural design of programs, and performing tests on systems. In addition to the attributions mentioned above, they may have activities inherent to the administration of databases, the maintenance of systems, and even some documentation, referring to project management and the composition of instruction manuals. In this work, software developers were defined as professionals who participate directly in the development team, such as programmers, testers, full and senior analysts, software architects, or any other function that fits the attributes above.

The population was represented by software developers who went through the turnaway process, that is, they abandoned the software development profession, while the sample was composed of those considered eligible in the research criteria. The established inclusion criteria were:

- An individual having a job in a software team, being paid as a professional in this team, regardless of educational background;

- This job must have been their main source of income for at least six months, considering that six months was considered by the researchers enough time for the professional to have the necessary experience and recognize the aspects of the career;

- The individual must have been part of a team serving in one of these roles: programmer, tester, analyst, systems architect, or systems development manager [15], even when the job had different titles but similar duties.

Regarding the exclusion criteria, those who did not agree to participate freely in the research and those who did not sign the Confidentiality Term (TCLE) are excluded (Appendix A).

The study's sampling was non-probabilistic, as often reported in the qualitative research literature, promotes theoretical sampling [52]. As such, we determined the number of recruited participants based on the point of redundancy of the collected information; collection and analysis must be then performed in parallel, so the preliminary analysis of the motivators and their dimensions circumscribed the recruitment process. In qualitative research, more important than statistical significance is access to individuals with experience in the subject studied, which makes statistical inferences play a secondary role [27].

4.2.3 Crafting Instruments

In this research phase, we decided to use the interview technique, considering that it is one of the main instruments for collecting and constructing data in the social sciences for qualitative studies [107].

We used a semi-structured questionnaire containing questions to guide interviews, based on literature related to factors that influence turnaway [10, 16] and turnover [31]. This script was divided into two phases: an introductory phase in which the interviewer collects general information about the participant's career; and a core phase, including questions related to the nature of the work and potential motivators associated with the participant's decision to abandon the profession. The core phase included inquiries about why the participant abandoned software development, reasons for dissatisfaction, the most unpleasant/unsatisfactory tasks and practices, and relationship issues with the teams (the complete interview guide

is available on the companion website). The complete interview script can be viewed in appendixB.

Validation of the interview script was carried out through a pilot test in which the first two interviews were considered pilot interviews, including a superset of the questions we used in the final version for the remaining interviews. For that final version, we included/changed questions about whether they regretted leaving the profession, comparisons between the former and current professional activities, and evaluating the software job market.

4.2.4 Recruiting Participant

To our knowledge, there is no public database of former software developers in Brazil, especially those who shifted their professional careers to other areas. In this context, we followed a snowball strategy to recruit participants that fit our criteria. We first contacted seven software development managers via email, our hubs–located in diverse Brazil regions South, Southeast, Northeast, and Midwest. We asked those hubs to (i) indicate former colleagues that might fit our criteria and (ii) forward our request to other colleagues that might know additional target individuals. In the end, the hubs referred to five participants and indirectly made it possible to contact six other participants. After preliminary analysis of the first ten interviews, we were able to contact five other participants, trying to diversify the sample and acquire additional information on the detected gaps, in particular, the distinct levels of work overload, job, and gender diversity.

The process of nominating possible participants occurred by sending an e-mail containing a brief explanation about the research and a link to a Google Forms form. The recruitment form was divided into two sections, the first covering the personal information of the participant, such as name, phone/WhatsApp, and e-mail; these data were important for the researchers to be able to contact the interviewee. The second section addresses three items about the professional's career to ascertain whether the respondent fits the research inclusion criteria, as shown in figure 4.1.

Thirty-three people responded to the form; however, ten did not fit the research profile and, for this reason, were not contacted. To mitigate selection bias, an email or WhatsApp message was sent to all respondents who met the inclusion and exclusion criteria. Fifteen responded, stating that they were interested in participating, while eight did not. Once the

participants were identified, it was decided to interview all of them. The next step was to schedule an appropriate time to conduct the interviews; it should be noted that the scheduling of the next interviewee was carried out only when the data analysis coding process of the previous participant was completed.

The interviews took place remotely due to restrictions imposed by the COVID-19 pandemic; at the time, the interviewee was informed that the information was being recorded and would be used only for research purposes. It should be noted that participation was voluntary through authorization and signature of the Free and Informed Consent Term (TCLE) (Appendix A) in two copies: one for the participant and another for the researcher [1].

4.2.5 Data Collection

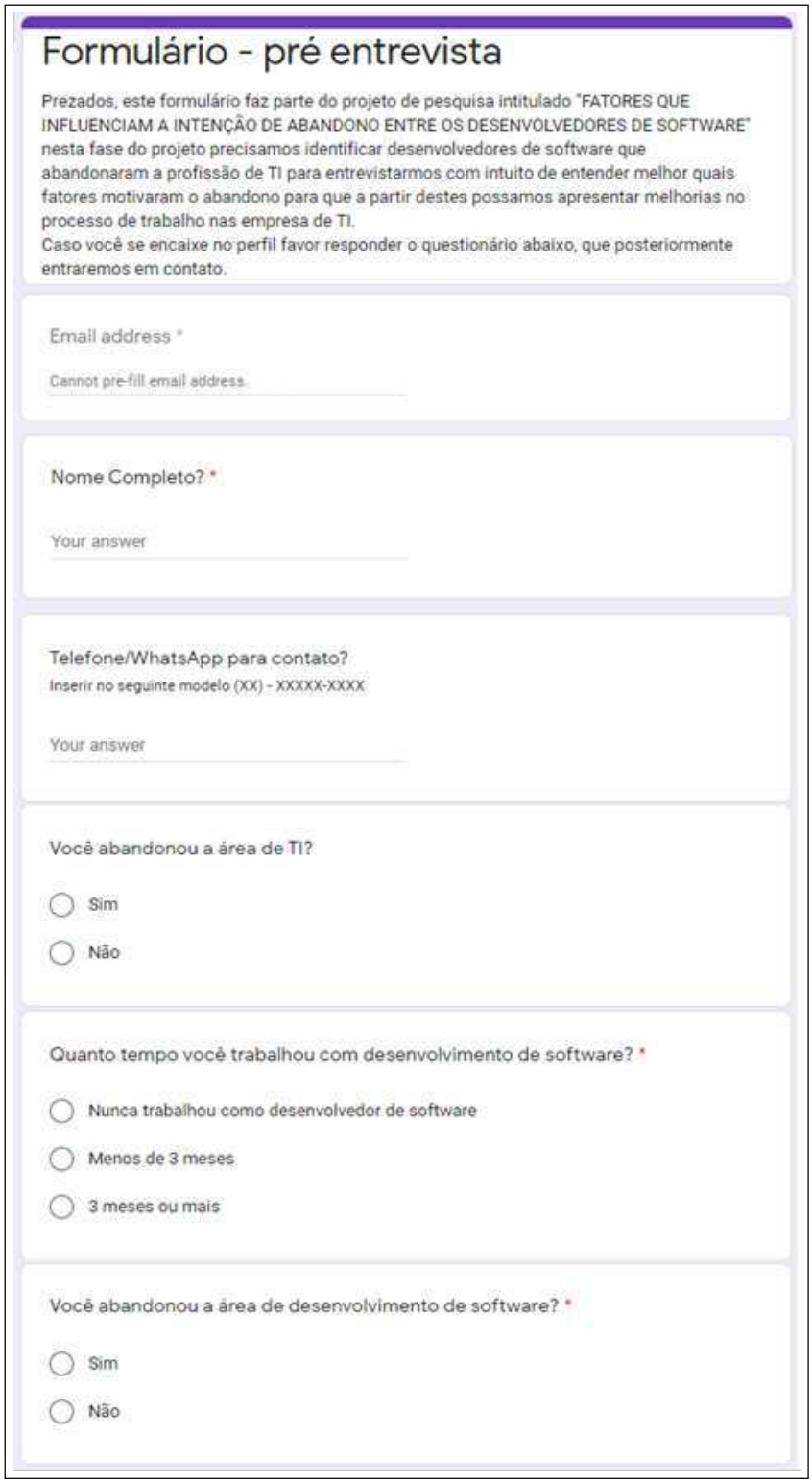
Data collection took place through semi-structured interviews between June and September 2020. The purpose of semi-structured interviews in exploratory research is to guide respondents to discuss some issues without indicating predetermined codes. For this, interviews should be composed of open questions and should not specifically mention the phenomenon in question [56].

The interviews were conducted exclusively with each participant. They lasted an average of 36 minutes per interviewee, not considering the follow-up questions we later did through email exchanges between the first author and the participants. Most interviews were conducted by the first author, while some of them had the participant interviewed by two of the authors.

All interviews were recorded and later transcribed by the first author. In the paper, we discuss free translations of transcripts to English, in which we correct grammatical errors the original audio and transcripts are in Portuguese. We employed Express Scribe[2] to make transcription more efficient; keyboard shortcuts helped with changing speeds for playback and one–to–one correspondence between audio and text excerpts.

[1] All study materials can be found online [35].

[2] `https://www.nch.com.au/scribe/index.html`



Formulário - pré entrevista

Prezados, este formulário faz parte do projeto de pesquisa intitulado "FATORES QUE INFLUENCIAM A INTENÇÃO DE ABANDONO ENTRE OS DESENVOLVEDORES DE SOFTWARE" nesta fase do projeto precisamos identificar desenvolvedores de software que abandonaram a profissão de TI para entrevistarmos com intuito de entender melhor quais fatores motivaram o abandono para que a partir destes possamos apresentar melhorias no processo de trabalho nas empresa de TI.
Caso você se encaixe no perfil favor responder o questionário abaixo, que posteriormente entraremos em contato.

Email address *

Cannot pre-fill email address.

Nome Completo? *

Your answer

Telefone/WhatsApp para contato?

Inserir no seguinte modelo (XX) - XXXXX-XXXX

Your answer

Você abandonou a área de TI?

- Sim
- Não

Quanto tempo você trabalhou com desenvolvimento de software? *

- Nunca trabalhou como desenvolvedor de software
- Menos de 3 meses
- 3 meses ou mais

Você abandonou a área de desenvolvimento de software? *

- Sim
- Não

Figure 4.1: Pre-interview form

4.2.6 Data Analysis

Qualitative data are textual data that come from interviews. Qualitative analysis consists of ordering, classifying, reducing, comparing and giving meaning to them, analyzing the content expressed directly so that it is possible to describe the phenomenon under study. Data analysis was carried out in parallel to data collection in incremental and iterative steps, as recommended by Merriam [94] and Seaman [126].

Data processing, which refers to the stages of data labeling and categorization, should generally start in the collection phase, as recommended by Merriam [94], considering that the data being collected can influence the conduction, in addition to new questions in subsequent interviews, this process tends to enrich the results obtained.

In this study, we assume interpretivism as an epistemological position [90] by understanding that the conclusions of the findings cannot be generalized to a hypothetical population that is, in fact, unreachable. The recruitment process is remarkably complex since (i) there seems to be no list or social network of former developers, and (ii) they might be unwilling to publicize their choice, given the social and emotional costs associated with that situation [127]. For the analysis method, we adopted an inductive approach [99], recommending the researcher start with the study using a previously defined problem; in accounting, she should allow concepts and categories to emerge, although they must answer the research questions.

Inspired by techniques taken from Straussian Grounded Theory [52], we applied coding to the transcribed interviews in two cycles. In the first cycle, we generated open codes by labeling statements related to software development tasks made by participants. Several memos were also added for recording potential inductions and points of notice for considering in future interviews or the follow-ups with previously interviewed participants.

In qualitative methods, three researchers carried out the open coding independently and later refined and synthesized their codes in a joint meeting, determining interrelationships between them. The researchers then considered general themes submerged from similar codes, indicating thematic gaps requiring additional interviews or follow-ups. For instance, P13 stated that the bug fixing activity was tedious and influenced him to abandon his career. We then decided to follow up by asking the participant to explain what the bug fixing process was like and what made this process tedious. We found out that the main problem was

finding the bug, which most often is tiresome due to the lack of detail about the scenario that caused the bug. During the additional interviews, we identified that the inclusion of new participants showed repetition of the codes, indicating a point of redundancy, adding the new codes mentioned by each participant. When the total number of codes does not change, we concluded that this point had been reached.

After all interviews, the main researcher proceeded to the second cycle by extracting motivators (called concepts in GT) from the coded fragments and discovered themes. Motivators were then grouped into dimensions (called category in GT), representing a general classification for software development activities. The basis for these dimensions is the list of activities and practices provided by the IEEE Guide to the Software Engineering Book of Knowledge (SWEBOK) [14], version 3.0. The guide results from an effort to characterize the software engineering discipline and promote a consistent view of software engineering worldwide, which lays a solid ground for research in general. Another author then revised the judgment over those fragments. Any disagreement was discussed and a consensus was reached, generating a further refinement of the motivators.

As an example of how we proceeded in those two cycles, see Figure 4.2. In the fragment by P9, we highlighted four relevant portions for the research questions in the analysis. During the first cycle, two of the researchers agreed on the following codes for the first sentence: *burnout* and also *too many hours at work*. As there was a divergence for the labels, the third researcher merged the ideas and converged the code to *working overtime* - all researchers agreed that extracting *burnout* was not based on evidence from the sentence. In the second cycle, in agreement, the researchers classified the code as a motivator after observing the code was consistent with fragments of other participants, reaching agreement on the more general term *work overload* (MOT4). For dimension, this motivator was then classified into dimension Software Engineering Management (DIM4).

For coding, we used the MAXQDA Standard for Windows [3], importing text files with interview transcripts. The tool makes it possible to create, categorize, and organize codes. Also, memos are attached to the fragments and codes, containing initial insights into the discussion.

[3]https://www.maxqda.com/products/maxqda-standard

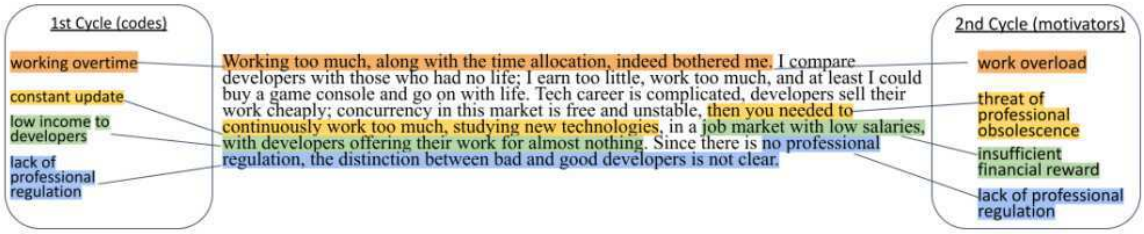


Figure 4.2: Two cycles of coding.

4.2.7 Engagement Literature

At the end of the data analysis phase, all motivators that emerged from the categorization process were confronted with those present in the literature, and those not found in other studies were labeled according to the researchers' understanding; based on SWEBOK version 3.0, this refers to a tab that lists all activities and practices in software engineering. As for the existing motivators, they were labeled by the researchers using the terminology of other studies; this process is important to improve the definitions and generalizations of the motivators and raise the theoretical level.

During the process of data analysis, the redundancy or theoretical saturation of the sample was identified; that is, the collection of additional data did not lead to the identification of new codes. The redundancy can be calculated by adding the new codes mentioned by each participant; when the total number does not change, it is concluded that this point has been reached [102] (Table 4.2.7) .

Interview ID	Total Codes per Interview	Identified unique codes	Total codes
1	7	7	7
2	35	32	39
3	35	23	62
4	24	9	71
5	26	4	75
6	22	3	78
7	19	5	83

8	25	2	85
9	23	3	88
10	18	1	89
11	17	1	90
12	27	1	91
13	18	0	91
14	23	0	91
15	16	0	91

Table 4.1: Point of redundancy.

Although we conducted 15 interviews, in this study, the point of redundancy was reached in the twelfth, and no new codes were identified (Figure 4.3). This amount corroborates with some authors who use different methodologies and suggest that saturation can be obtained with about 8 to 15 interviews, among which two or three are added to obtain confirmation [50; 47; 24; 60].

4.2.8 Research Reliability and Validity

Qualitative research has its scientific rigor criteria that ensure the legitimacy of the data generated in its use, including reliability and validity. In this sense, validity is the confidence with which correct conclusions can be drawn from an analysis and reliability is the consistency with which a research procedure will evaluate (measure/interpret) a phenomenon in the same way in different attempts [36].

In GT, to establish reliability, it is suggested that several researchers carry out the interview coding process. These should preferably have experience in qualitative research. If the sample is small, it is suggested that the coding process be performed by more than one researcher in 100% of the interviews. As the total number of pages of transcripts increases, it becomes impossible for each reviewer to code each text. There are usually two coding rounds covering a sample of texts (5 - 10%). This subset of texts must be chosen at random.

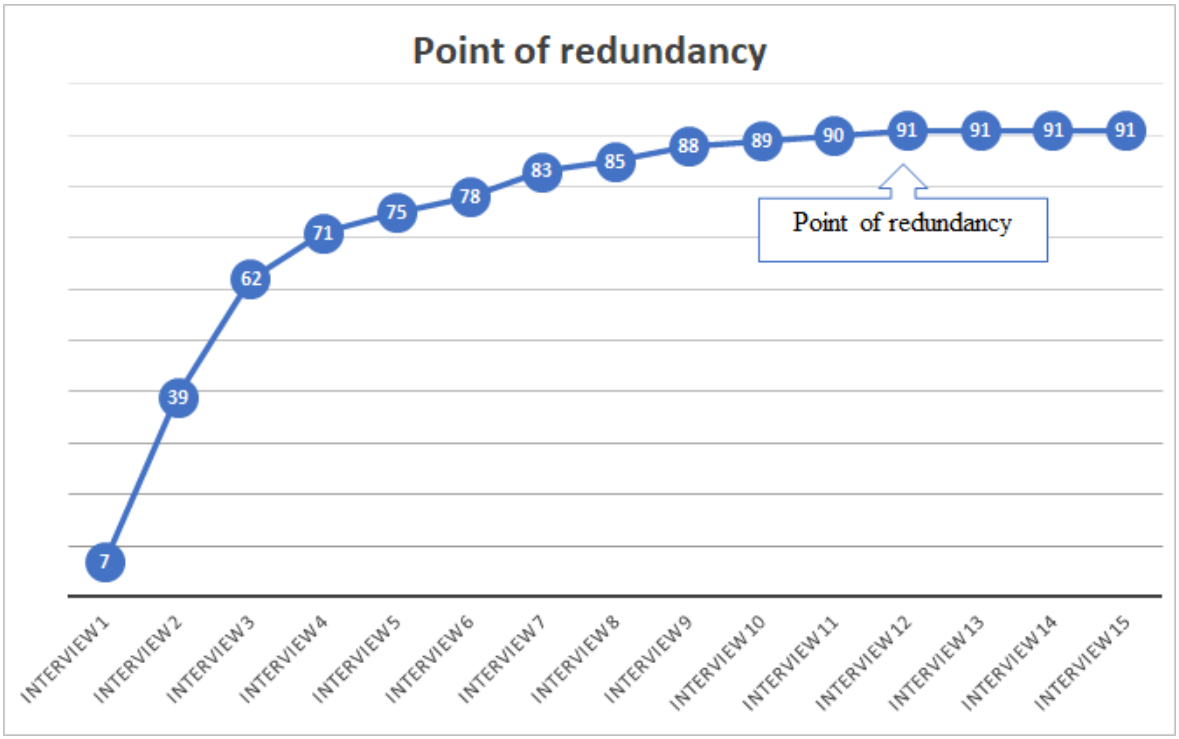


Figure 4.3: Point of redundancy.

Comparisons are made for agreement and disagreement between researchers, if there is disagreement, these are resolved through discussion. Inter-researcher reliability is calculated by measuring the level of agreement in the identification and labeling of codes [27].

In the present study, the reliability process was carried out by six researchers (a professor/supervisor and master's and doctoral students at UFCG), who are part of a research group investigating human aspects in software engineering. Two interviews were randomly selected for coding by the group, totaling a sample of 13%. All discrepancies in the process were discussed among the researchers and resolved. It should be noted that the entire coding scheme was carried out by two researchers, one who participated in the research group and the other externally.

Concerning the validity of the study, initially, the researchers contacted all the participants, among whom five were willing to carry out the validation; in this process, a document was sent containing the result of the coding of their interview, as well as the categorization, which brought together all the motivators, so that each participant in this stage could reflect on their propositions and compare them with the elaborated collective proposition.

This process is carried out mainly individually; however, in this research, we chose to

conduct online brainstorming due to the pandemic moment and to recognize that the discussions arising from this technique would bring more excellent validation value. Brainstorming is a technique used to propose solutions to a specific problem, in which participants should be free to expose their suggestions and discuss the contributions of colleagues [5]. There were a few objections or refutations in relation to the presented results, all of which were adjusted in this unified codification process.

4.2.9 Ethics

Because this study contemplates some phases involving human research, ethical principles had to be observed, established by Resolution 466/12 of the National Health Council (CNS) that revokes 196/96, which it recommends in its Chapter III, that research involving humans must meet fundamental ethical and scientific requirements, highlighting, among its ethical principles (Chapter III, item 2.g) the need for the Free and Informed Consent Term TCLE of the target individuals; thus, this study was submitted to the ethics and research committee of HUAC, approved by CAAE opinion No. 29946520.2.0000.5182 [4].

Due to the COVID-19 pandemic, the TCLE was sent by email to each participant who signed electronically or manually and returned the document in digital format. This step was performed in advance to ensure that on the day of the interview, the participant was aware of the general and sacred purpose of the study and the guarantee of confidentiality and anonymity of their participation.

4.2.10 Summary of Report

The exploratory qualitative study served to collect the insights that motivated former software developers to leave the profession, given that this study differed from others in the literature by capturing information from people who have already abandoned their careers and are therefore able to provide information more consistently when compared to professionals who only turnaway intention. Another relevant point is that the study did not stop to research the motivators present in the literature, that is, an inductive coding method was used in which the motivators emerged from the interviews and not from a predefined group.

[4] https://plataformabrasil.saude.gov.br/, reference number 29946520.2.0000.5182.

As a result of the study, it was identified that the abandonment phenomenon among former software developers is multifaceted, having a subjective character, in which each individual weighs differently the groups of motivators that led to abandonment. These results are presented in section 4.3.

4.3 Results and Discussion

This section presents the results of the exploratory study I with the main motivators that influenced the turnaway among former software developers. In this phase, professionals who had worked on the Brazilian labor market in any region of the country were interviewed. However, with the objective of having a diversified sample, it was decided to include individuals with varied characteristics with regard to age, education, experience, and previous positions (Table 4.2).

The table 4.2 shows the interviewees profiles in terms of the information we consider relevant to the research questions in this study. Their IDs are used in this paper to anonymize the interview fragments shown in the following sections. We also present gender, their location in Brazil, their role in the last development job, and their current occupation, along with how long they were software developers in years. We also asked how many years since they left their software careers. Of the 15 interviewees, only two left the profession but remained in the company they already worked (turnaway-within). In contrast, the others changed their company and profession (turnaway-between).

Regarding the sociodemographic profile, it was found that the sample was predominantly male, considering that of the 15 respondents, 12 were male (80%), with only three women (20%). Regarding age, there is a relatively young population, aged between 23 and 40 years (73%), with an average age of 35 years. As for education, it was possible to verify that almost half of the sample (47%) had a post-graduate degree at the specialization level; masters and doctorate. It should be noted that even with a high degree of training achieved through years of study and career investment, this factor may not be predominant when the professional decides to leave the area.

Concerning the positions held, the professional self-declared different positions but with similar attributions, which leads to the perception that there is still no standardization in

ID	Gender	Last Role	SW Career time (yrs)	Current occupation	Yrs since turnaway	Br Region
1	female	Programmer	0,75	Manager	7	Central-West
2	male	Junior analyst	2	Manager	3	Southeast
3	male	Analyst / Consultant	8	Teacher	1	Northeast
4	male	Tester / Analyst	5	Government employee	5	Northeast
5	female	Programmer	2	Saleswoman	7	Northeast
6	male	Analyst / Project Manager	10	Businessperson	9	Northeast
7	male	Analyst / Project Manager	2,5	Government employee	4	Northeast
8	male	Programmer	7	Businessperson	6	South
9	male	Programmer	6	Government employee	9	Southeast
10	male	Programmer	5	Policeman	1	Northeast
11	female	Programmer	4	Government employee	4	Southeast
12	male	Programmer / Analyst	9	Teacher	10	Central-West
13	male	Programmer	5,5	Manager	9	South
14	male	Tester	8	Manager	3	Southeast
15	male	Tester	4	Government employee	8	South

Table 4.2: Exploratory sociodemographic profile study I.

the terminology. This lack of standardization can cause difficulties in hiring and retaining professionals [27].

Finally, the interviewees described some frequently performed activities, such as developing systems, coding and executing test cases, participating in meetings (sprint planning; daily meeting, sprint review, and other types of meetings), alignment and customer support, and generating documentation. As for the activities inherent to the development process (impact analysis; operational manual; technical drawing; requirements document) and bug correction. In addition to more sporadic ones such as team management, framework training, requirements gathering, software quality process, and systems architecture.

4.3.1 RQ1: Potential Motivators for the Turnaway of Former Software Developers?

Based on the data collected in this study, the motivators that appeared more frequently in interviews were: professional stagnation and inadequate financial reward (93%) followed by Lack of Professional Identification, Lack of professional regulation (73%), Work overload and Threat of professional obsolescence(60%), Regarding motivators related to turnaway, table 4.3 shows each one found in this study, followed by the number of references (Cit.) and the participants (Part.) who mentioned them. It should be noted that the motivators with the same number of citations (Cit.) were grouped in the same line.

Professional stagnation (MOT1) is represented by a feeling of inertia at work, which can be accompanied by intense demotivation, ill-being, and even psychological illnesses [68]. P4 relates the reasons mentioned above: *"...Career development is limited, [...] stagnant with time, due to lack of career growth, due to lack of salary recognition..."*. Professional stagnation is related to 3 main reasons: financial, learning, and development.

The results of this study show professional stagnation related to two of the three reasons mentioned above, namely: financial, in touching the absence of a load plan and consequently salary increase; and development, characterized by the limitation of the career as a developer, most of the time having to migrate to a managerial career (MOT22) even identifying with the development career. As identified in the speech of P13 *"...if he wanted to continue progressing in the IT area, he should follow this path and migrate to a managerial role [...] I*

Mot.ID	**#Cit.**	**Motivator**
MOT1	35	Professional stagnation
MOT2	27	Insufficient financial reward
MOT3	20	Lack of professional regulation
MOT4-6	16	Work overload; Lack of Professional Identification; Threat of professional obsolescence
MOT7	11	Poor leader and subordinate relationship
MOT8	9	Lack of valuable opportunities
MOT9-11	8	Highly technical requirements; Overcharging; Pressure on deliveries
MOT12	7	Harassment at work
MOT13	6	Unproductive Meetings
MOT14-15	5	Job insecurity; Lack of job feedback
MOT16	4	Professional insulation
MOT17-23	3	Team communication problems; Insufficient team size; Poor job feedback; Lack of technical autonomy; Exposition to extraneous issues; Migration to management career; Lack of flexibility in working hours
MOT24-28	2	Lack of Job Significance; Lack of predictability; High employee turnover; Customer x team disagreement; Activity misallocation;
MOT29-33	1	Lack of collaboration within the team; Lack of commitment at profession; Role conflict; Mismatch between theory and practice; Neglecting standards and processes

Table 4.3: Motivators by citation frequency.

think this is something that limits the professional's permanence as a software developer...".

Also, high competition among team members for promotion is an issue, as mentioned by P4: *"...a career plan that you don't promote two people from a team of 30, [...] this generates unhealthy competition in the team affecting interpersonal relationships...".*

Similarly, insufficient financial reward (MOT2) was almost unanimous among the interviewees - it is related to financial stagnation, absence of a salary equalization, and low remuneration. Thus some interviewees are direct and emphatic in reporting this, such as P7: *"...I looked for jobs that paid better[...], you know, without a doubt the main factor was the pay...".* Other interviewees associated the lack of financial recognition with the feeling of devaluation and disappointment with the profession, which requires constant professional training and relevant understanding of other areas from the professional but does not reward it in the same proportion, hindering cost-benefits, as highlighted by P1: *"...The jobs I found in the area, my mother's secretary earned more than the staff wanted to pay me as a programmer or systems analyst...".*

A study carried out by Joia and Assis [[67]], whose objective was to identify the main motivations that lead IT professionals to change areas, discussed the salary issue in the motivator "search for professional growth" characterizing the salary cap perceived in the technical area as a great to bother and motivate for career turnaway from IT to other areas.

The speeches above refer to the view of the interviewees about the financial reward, being perceived by them as something present only in managerial careers and far from the developer. Furthermore, when compared to the demands of the position, the interviewees saw their salaries as low, unfair, and demotivating. Finally, the result of this study identified financial reward as an influencing factor of turnaway, which is related to motivation and satisfaction.

Regarding the Lack of professional regulation (MOT3), two aspects are important: devaluation of the profession and lack of regulation. These are related to each other, considering that one probably leads to the occurrence of the other. P10 emphasizes that his work was *"...not recognized, because the profession is not even regulated, it was what happened a lot there...".* We noticed indications that the absence of regulation opens the door to job insecurity, resulting in feelings of devaluation, dissatisfaction, and consequently turnaway [26].

Further, in some fragments, this feeling of devaluation is associated with a lack of pro-

fessional significance, considering that these professionals see themselves within software development as the lowest level, the one responsible only for the technical part, according to an excerpt from P12: *"...it is less recognized, it is [...] the lowest level, so it would be the one with the least competence, regardless of being a great developer, [...] he is recognized as if he were an ant that does the legwork..."*. This motivator was also identified in the article by Colomo-Palacios [26] that sought to investigate the main motivators of abandonment in Software Workers, showing that 65% of the participants related the lack of a formal career to abandoning the profession.

Work overload (MOT4) may be related to the volume of activity delegated to employees without sufficient time for execution [128]. The perception of overload in software development seems to be something cultural and inherent to the profession, experienced since school, as reported by P9 *"...those in the computing career are already used to it, at the university the teachers already applied this rhythm, passing exercises that we had to spend the night, we consider this normal, but it is not..."*. Excessive overtime, sometimes related to poorly estimated deadlines or/and poorly dimensioned teams, are factors that can accentuate work overload.

As the software development profession is a cognitive and exhausting job, in addition to requiring the professional to be focused on carrying out their activities, it is, therefore, essential to pay attention to the time needed to restore the professionals mental rest, avoiding burnout, as reported by P5 *"...I worked until dawn and on the next day I would give the hours normally [...] I got sick and everything, getting to the point of getting sick, a lot of work without recognition..."*. This frequent motivator opens space for questions such as: would the overload be directly related to the developer's work, or would it be something that can be associated, especially with professions that deal with projects and delivery times?

Professional identification (MOT5) is the feeling of unity that individuals have and the degree to which they define themselves as members of a profession [55]. In this study, the lack of identification with a profession was a motivator for turnaway approached from two perspectives: In the first, the professional did not identify with the area since school, being proven during his(her) career as a developer, not being satisfied in acting in any position related to the profession, as reported by P1 *"... I never identified myself with computing. I graduated, but it was not something I had [...] pleasure or not, but I was not very happy..."*.

In the second perspective, participants revealed that they did not identify with activities that involve logical reasoning and programming. Still, they stated that they like working in the area and that they could work in related roles such as, for example, business analyst, DBA, or project manager. However, the market requires that the professional has experience in development to claim these positions, which ends up frustrating and leads to the profession's abandonment. This feeling of frustration due to the lack of identification of activities can be evidenced in P11 fragment *"...I never identified with the bulk of the computer course, the computer area was always a lot of system development, and I never liked it. I was never good at it, so I always wanted the accessories for the computer course. I liked database, but I wasn't that good at programming databases, so my focus was never pure computing. It was constantly computing mixed with something. For example, computing + administration or computing + marketing, [...] I ended up leaving the area..."*.

As identified in the systematic mapping carried out in the previous chapter (Chapter 3), the lack of professional identification is a motivator in the current scientific literature [17]. Brooks in his study observed that professional identification was directly correlated with commitment and satisfied and responded with intentions to leave. Important questions emerge from these results, with the lack of professional identification directly related to the lack of feedback with the activity/area in which the professional is allocated? Would the turnaway have occurred if the professional had been allocated to the activity as he has an affinity?

Threat of professional obsolescence (MOT6) is characterized by the technical knowledge or skills necessary to maintain adequate performance in your current or future job [114]. This motivator is probably present for knowledge workers that require high levels of cognition to carry out activities, such as doctors, nurses, lawyers, and software development.

Unlike other professions, however, in which knowledge and skills dissolve at a less accelerated pace, the lifespan of the technical domain for a software professional is perceived as much shorter, so developers are obliged to be constantly updating and iterating about new technologies, programming language, and frameworks for development. For this reason, the risk of obsolescence is one of the main motivators to turnaway in general for IT workers (including software developers), generating stress, overload, emotional exhaustion, and demotivation [26]. P13 reports that *"...with passing the time that you also observe needed*

constant updating of every 3 years, which very exhausting you are competing with people who just left college [...] in the end, this is what ends up taking people out of the development environment...".

Some scientific studies corroborate the findings of this research and relate obsolescence to the phenomenon of turnaway, stating that once obsolete, it remains for the individual to get involved in areas where the pressure for renewal is less and less or to face the loss of employable grade. The degree of commitment and satisfaction with the career as an IT professional will determine whether the individual will be willing to start over in another profession, in which their knowledge base and skills are more stable and suffer less pressure from the industry, or if they will face the loss of the employable grade and will seek to renew its knowledge base [34; 58; 111]. However, this path is not easy, and sometimes it can lead to exhaustion, dissatisfaction, and stress, as can be seen in the P10 fragment: *"...the stress of the profession itself is that you are always studying new technologies and are updating yourself, so I ended up like this...".*

The threat of professional obsolescence was present in the speech of most interviewees, showing that this constant threat negatively influences developers' careers. These professionals live their careers feeling pressured by the need to constantly update themselves at the speed of new technologies and the risk of missing out on job opportunities if they fail to keep up to date with market needs.

The need for constant updating stems from the high technical requirement (MOT9), which is closely related to the threat of professional obsolescence (MOT6) was commonly found in the interviewees' speeches, P2 judges the motivator as harmful *"...I believe that it is something that it is harmful to the individual [...] the need for a lot of knowledge, you have to know the programming language, frameworks, databases. I think it is an exaggerated amount of content required from the professional...".* The two motivators discussed in this paragraph are reasons for concern in software developers and positively influence the phenomenon of turnaway, dissatisfaction and demotivation.

In general, it is possible to observe that professionals who decide to abandon the software development profession are influenced by various motivators, some more and less. This balance may change according to the professional's profile, making sure that the companies have to give importance to all the motivators listed in this study, as P13 reports *"... you know*

that when you make a decision like that it's not one or two factors that make you decide it's a set of factors, in my case it was the high workload, the lack of recognition of the profession, and not being recognized financially, even the professional having to study all the time so as not to be technologically out of date...". It is possible to perceive a connection with various motivators, mainly that there are cultural questions of the profession to be treated and aspects inherent to the profession that can be enhanced by the organizations to retain professionals.

4.3.2 RQ2: Which software development dimensions are turnaway motivators classified in?

We rank motivators in *dimensions* according to A Guide to the Software Engineering of Knowledge (SWEBOK) [14]. This classification is accepted by the community and is intended to facilitate understanding and guide the grouping of issues related to software engineering. It could help the community to realize the degree of association of turnaway with different areas of SE practice; for example, requirements specialists can focus on motivators for that area. Table 4.4 presents the seven dimensions identified and their respective motivators. The dimensions are:

- Software Construction: covers aspects related to languages and coding;
- Software Engineering Management: includes aspects related to the management of software teams such as effort, schedule, and cost estimation;
- Computing Foundations: encompasses aspects related to the concepts and fundamentals of programming;
- Software Engineering Professional Practice: Includes items related to professional practices, such as job conflicts, the leader-subordinate relationship, and job insecurity;
- Software Engineering Economics: includes challenges associated with financial aspects and estimation techniques.

Most motivators are classified into Professional Practice (DIM4), particularly those motivators related to the Lack of recognition and professional growth. Next, Management

DIM.ID	Dimension	SWEBOK	MOT.ID
DIM1	Software Construction	Chapter 3	MOT6, MOT9, MOT19-20, MOT33
DIM2	Software Engineering Management	Chapter 7	MOT4, MOT10-11, MOT15, MOT18-19, MOT22, MOT25, MOT28
DIM3	Computing Foundations	Chapter 13	MOT5, MOT32
DIM4	Software Engineering Professional Practice	Chapter 11	MOT1, MOT3, MOT7-8, MOT12-14, MOT16-17, MOT21, MOT23-24, MOT27, MOT29-31
DIM5	Software Engineering Economics	Chapter 12	MOT2, MOT26

Table 4.4: Dimensions for motivators, exploratory study I.

(DIM2) includes motivators such as Work overload (MOT4), Overcharging (MOT10), Pressure on deliveries (MOT11), and Migration to management career (MOT22). When analyzing the two dimensions (DIM2 and DIM4), the most cited among the interviewees, we noticed that the motivators that influence the abandonment of the profession are not related to technical aspects of the career. That is, they do not refer to the qualification or skills to perform the function. Given this and considering the influence of managerial aspects in the phenomenon, some questions are formulated: Are these aspects inherent in the software career, or would other professions be present? Could these be avoided? If so, in what way?

In the Software Construction dimension (DIM1), motivators related to technological issues used in the construction of software were reported, such as threats to professional obsolescence (MOT6), highly technical requirements (MOT9), and lack of technical autonomy (MOT20). The latter refers to the lack of autonomy to express opinions on more technical aspects of the project, such as framework, tools, and even deadlines; according to P12 *"...we had to accept it, there was no negotiation [...] we had no freedom in relation to modernizing some systems..."*. This dimension seems to have a more negligible influence on abandoning the profession, according to the interviews.

For the Software Engineering Economic dimension, the motivators Insufficient financial reward (MOT2) and high turnover of employees (MOT26) were included. Financial issues

were present in most of the interviewees' speeches as something negative, which influences the turnaway of the profession. Financial motivators are always associated with the technical requirement that the market imposes on these professionals, who are pressured to master various paradigms and programming languages, frameworks, databases and test tools. Thus, when a parallel is made between technical/cognitive knowledge and remuneration, it is perceived that this is below the value considered fair. P13 reports this problem in his speech *"... the professional in the technology area has to have the ability to study, [...] it is not something trivial and then I think it is even unfair when you compare it to other careers here in Brazil , [...] you need to know at least a little English, so the amount of knowledge you have to have to be a good IT professional is gigantic, since the salary is not so consistent with this effort...".*

4.3.3 RQ3: Do the motivators found in this study differ from those already identified in the systematic literature mapping?

The exploratory study with former software developers allowed the extraction of 33 motivators related to turnaway. Some of these motivators had not yet been identified in the literature (Table 4.5); two aspects can justify that. The first refers to the pioneering nature of the study with a sample of professionals who have already gone through the turnaway process; so far the articles found in the literature research IT professionals in general, and only one article deals with this theme with software workers, not leaving clear what professions are practiced. The second factor may be related to the fact that it is an exploratory study that allows the categories to emerge from the interviewees' speeches, not being restricted to the pre-established motivators by the researcher.

Professional stagnation (MOT1) was the motivator that appeared in practically all the interviews and was also the most mentioned by the participants, who called the development career stagnant. Despite not having been found in the literature with this terminology, Professional stagnation has already been observed in other studies [112; 68; 67] in which it was described as need for professional growth. The need for professional growth perceived by software developers comes from professional stagnation. These concepts exercise a cause-and-effect relationship and are always found in association. Thus,

Mot.ID	Motivador
MOT7	Poor leader and subordinate relationship
MOT8	Lack of valuable opportunities
MOT9	Highly technical requirements
MOT11	Pressure on deliveries
MOT12	Harassment at work
MOT13	Unproductive Meetings
MOT15	Lack of job feedback
MOT17	Team communication problems
MOT18	Insufficient team size
MOT19	Poor job feedback
MOT21	Exposition to extraneous issues
MOT22	Migration to management career
MOT23	Lack of flexibility in working hours
MOT24	Lack of Job Significance
MOT25	Lack of predictability
MOT26	High employee turnover
MOT27	Customer x team disagreement
MOT28	Activity misallocation
MOT29	Lack of collaboration within the team
MOT32	Mismatch between theory and practice
MOT33	Neglecting standards and processes

Table 4.5: New motivators exploratory study I.

regardless of the terminology used, it expresses the feeling of concern of the interviewees in the face of issues such as the lack of a formal career.

In addition to Professional stagnation (MOT1), other motivators identified in exploratory study 1 corroborate those found in the literature mapping. These will be mentioned below with the respective concepts already observed in the literature: insufficient financial reward (MOT2) - lack of rewards; lack of professional regulation (MOT3) - lack of professional recognition; work overload (MOT4) - perceived workload; lack of professional identification (MOT5) - professional identification; threat of professional obsolescence (MOT6) - threat of professional obsolescence; job insecurity (MOT14) - job security; professional insulation (MOT16) - low teamwork; lack of technical autonomy (MOT20) - lack of autonomy; lack of commitment at profession (MOT30) - affective commitment to the profession; role conflict (MOT31) - role conflict.

In line with table 4.5, 22 motivators were extracted so far not reported in the literature; some of these motivators are related to more general aspects of the profession, that is, they could be applied to other professionals, such as Poor leader and subordinate relationship (MOT7), lack of valuable opportunities (MOT8), team communication problems (MOT17), lack of flexibility in working hours (MOT23) and lack of collaboration within the team (MOT29). Others seem to be closely related to software developers, considering that they refer to the practice of the profession, for example, highly technical requirements (MOT9), pressure on deliveries (MOT11), and unproductive meetings (MOT13).

Among the 22 new motivators, the poor leader and subordinate relationship (MOT7) was present in the speech of most respondents. Work relationships, more specifically those established between leader and subordinate, can be considered an exchange resource capable of impacting commitment, performance, and, therefore, results at work. However, this type of relationship can undergo positive or negative variations.

Concerning the scope of software development, the negative variations are centered on the lack of empathy on the part of leadership with their subordinates. This context encompasses scenarios in which decision-making leaders tend to give in to pressure from customers and organizations, not considering, for example, the planning and estimates made with their team. This situation seems recurrent and harmful in companies, causing the environment to become overcharged and pressured. P4, in an excerpt of his interview, reports this harmful

relationship and attributes his departure from the area to this type of leadership. *"...so both of these project heads had a very bad relationship, it was a demanding relationship, little praise, [...] they were people who only wanted to know about the delivery, deadlines and gave you a lot of pressure, real evidence of moral harassment [...] until I left the company and consequently the area was very much attributed to this type of leadership..."*.

This scenario may be explained by the fact that most leaders are professionals in the area who stood out for their high technical capacity and were invited to management positions (MOT22 - Migration to management career). Still, they will not necessarily develop the characteristics of a good leader.

The highly technical requirements (MOT9) motivator was also well discussed among respondents and was always related to the Threat of professional obsolescence (MOT6), which is the erosion of knowledge or skills needed to maintain effective performance either in their current work roles or in the future. Thus, the greater the highly technical requirements, the greater the risk of becoming obsolete. Considering that the development profession requires a constant need for updating as well as learning new technologies.

Faced with the pressures found in the work of software developers, such as that exerted by work overload and the threat of obsolescence, pressure on deliveries (MOT11) seems to have a greater influence on the turnaway of these professionals. Pressure on deliveries stems from failures in planning that culminate in work overload and stress, according to the speech of P8 *"...The pressure and stress have always been in this IT area, but it was greater at the time of deliveries, so there it was huge..."*.

The unproductive meetings (MOT13) were another motivator related to the turnaway from the profession. Usually, software developers criticize excessive bureaucratic activity such as: answering e-mails, carrying out alignments, excessive meetings, and excessive documentation. All these activities distance developers from the technical part and are detrimental to the development and schedule of activities, in addition to generating a feeling of unproductiveness, and loss of time, culminating in feelings of dissatisfaction and frustration.

A study that investigated software developers' perceptions of productivity by asking each respondent to complete the following sentence: "When do I have a productive workday?" concluded that one of the reasons that make the day of these professionals more productive is the absence of meetings [96]. These findings reaffirm the results found in the interviews,

according to P6. *"...the meeting itself is a very unproductive method. A paradigm was created on top of the word meeting that you end up being more status than to solve problems..."*.

Finally, other motivators were found: lack of valuable opportunities (MOT8); harassment at work (MOT12); lack of job feedback (MOT15); team communication problems (MOT17); insufficient team size (MOT18); poor job feedback (MOT19); exposure to extraneous issues (MOT21); migration to management career (MOT22); lack of flexibility in working hours (MOT23); lack of job significance (MOT24); lack of predictability (MOT25); high employee turnover (MOT26); customer x team disagreement (MOT27); activity misallocation (MOT28); lack of collaboration within the team (MOT29); mismatch between theory and practice (MOT32) and neglecting standards and processes (MOT33) not being deepened because they were not directly associated with the phenomenon by the interviewees.

Chapter 5

Extending Motivators for Turnaway: a complementary qualitative study

5.1 Definition of Exploratory Study II

This phase of the study consisted of two steps: the first, a reanalysis of the data collected in the exploratory study I (ES1), considering that the motivators extracted from ES1 were very general. That is, they could not be resolved in the context of software engineering, so it was necessary to go deeper into software development activity, trying not to prioritize generalist factors such as those presented in the literature articles. When the reanalysis was insufficient to extract aspects of the software development profession, the interviewee was once again contacted to ask additional questions. This step sought to observe what was preceding the motivators present in the literature and extracted from the ES1, that is, the causes that generate these motivators and how they can affect professionals in this area. To clarify doubts, the interviewee was always asked to report some situation experienced about the context discussed. With this change in the way of analyzing the data, it was possible for more general motivators, such as work overload and dissatisfaction, to reach activities inherent in the software development profession, such as lack of quality in the requirements and rework.

The second step consisted of an extension of ES1, following the same focus on the approach of the stage mentioned above. Ten new participants who also abandoned the profession were interviewed, with the purpose to capture new motivators related to the software

development profession, in addition to achieving greater diversity in the sample, by confronting aspects such as gender, type of employment, region, and company size. Thus, this comparative process serves to detect new motivators and to clarify questions such as: are the motivators that influence abandonment of the profession the same ones found in software developers who work in a public or private company? Are these considered the same when it comes to different genres or even company sizes?

In both stages mentioned above, which constituted exploratory study II (ES2), the same methodological paths of ES1 were applied (Section 4.2). Only the script and the execution of the interviews were modified, to obtain motivations inherent to software development activities.

5.2 Methodology

In this section, we present the methodology of our study. We present the data reanalysis stage (Section 5.2.1) and data extension stage (Section 5.2.2).

5.2.1 Data Reanalysis

The data reanalysis stage was of paramount importance to characterize the research in the context of software engineering, considering that the ES1, which comprises phase 2 of this thesis, identified more generalist motivators, that is, which would not necessarily be linked or could not be resolved in the context of software engineering's, such as professional stagnation, lack of financial recognition, lack of professional recognition, job insecurity, pressure, stress, and work overload. Thus, the reanalysis stage, and consequently ES2, consisted of detailing the extracted motivators to understand what could be causing the reported behavior.

As more detail was sought in the analysis, new motivators that were closely related to software development activities emerged. In summary, the process of reanalysis was carried out in each of the 15 interviews, seeking to codify motivators that were often implicit in the interviewee's speeches, that is, when, for example, the professional reported that he left the area due to the high load of stress in the analysis in the ES1, the excerpt was coded as "high-stress load" and consequently related and discussed as a probable reason for abandon. In ES2, this motivator was analyzed to verify whether the interview indicated any "how" and

"what are the main causes" that would be excessively generating this stress, considering that stress comes from some cause. If the information contained in the transcript of the interviews, the excerpt was labeled; otherwise, the researcher would contact the interviewee to ask additional questions introduced in the script in order to capture the point of view about some activities inherent to software development, whose context deserved further elucidation.

5.2.2 Data Extension

At the end of the data reanalysis, it was possible to observe the emergence of some motivators; however, it was noticed that only the reanalysis process had not reached theoretical saturation, that is, repetition of the motivators inherent in the software development profession, which was the focus of ES2. At the time, we understood that it would be pertinent to include new interviewees in the sample to clarify situations reported by the interviewees that deserved a better investigation, such as, for example, whether a certain situation only occurs in public companies, or whether that characteristic was present in all the companies where the professional worked. Also, what could be causing this situation, or whether the size of the organization facilitate the emergence of the motivator. In this sense, seeking to clarify these and other questions that emerged in the data reanalysis stage, we decided to carry out a data extension stage, which consisted of interviewing ten (10) new participants who also abandoned the profession, to obtain a greater representativeness in the sample.

The sampling technique was non-probabilistic, in which respondents were indicated by people who had already participated in previous phases of the study, a technique known as snowball sampling. The criteria for selecting individuals took into account whether the participant to be interviewed could contribute with additional information about software development activities that deserved a better explanation, that is, if the researchers wanted to clarify a motivator that could be related to a context of public companies, an attempt was made to select people with this profile.

Similar to ES1, the interview technique was used to collect data in both stages mentioned above, which were conducted through a semi-structured script. Considering the change in the focus of the analysis of ES2, which focused on identifying motivators related to software development activities, the need arose to introduce questions that involved attributions inher-

ent to the development profession into the script that guided the interviews[1](Appendix C). As the additional questions came from the insight collected in ES1, applying a new pilot to validate the interview script was unnecessary.

5.3 Results and Discussion

In this phase, the interviews of the 15 participants of the ES1 (Table 4.2) were reanalyzed, and ten new former developers who worked in the Brazilian labor market in any region of the country. To elucidate some questions raised in the previous study, it was decided to include participants who could add new insights in the sample. Table 5.1 refers to the sociodemographic profile of new participants.

ID	**Gender**	**Last Role**	**SW Career time** (yrs)	**Current occupation**	**Yrs since turnaway**	**Br Region**
16	female	Tester	10	Businessperson	1	Central-West
17	male	Programmer	4,5	Policeman	4	Southeast
18	male	Senior analyst	11	Government employee	9	Central-West
19	female	Tester	4	Psychologist	2	North
20	female	Programmer	3	Teacher	3	South
21	male	Programmer	6	Driver	3	Northeast
22	female	Senior analyst	3,6	Saleswoman	4	North
23	female	Tester	5	Government employee	3	North
24	female	Programmer	2	Government employee	3	Southeast
25	female	Junior analyst	4	Businessperson	1,5	South

Table 5.1: Sociodemographic profile exploratory study II.

As ES2 reanalyzed and expanded exploratory I with 10 new participants, the IDs of the

[1]All study materials can be found online [35]

interviewees started from number 16, considering that the sociodemographic profile of the first to the fifteenth interviewees can be found in table 4.2. When drawing the sociodemographic profile of ES 1 and 2, a predominantly male sample was identified, in which 15 of the 25 respondents were male (60%), while 10 were female (40%). It should be noted that even using a non-probabilistic sample in which we sought to interview females, the number of women was lower when compared to the number of men. This fact may denote what the literature on the subject already reveals, that the number of men working in software development is greater [137; 17; 8].

As for age, there is a relatively young population, aged between 30 and 40 years (40%), with an average age of 35. This finding was similar to that found by Bellini et al. [13], in which 37% of the participants were also in this age group. As for educational background, it was possible to verify that almost half of the sample (36%) had a postgraduate degree at the specialization level, master's, and doctorate degrees, data corroborating the statistics found in the literature [13; 125; 8]. With regard to regionalization, a diverse sample was identified, with former developers from all regions of the country, with 28% from the northeast region, 16% from the central-west, 12% from the north, 24% from the southeast, and 20% from the south. With regard to current occupations, 32% of participants worked in public companies, while 68% worked in the private sector.

5.3.1 RQ1: What motivators related to software engineering activities influenced former software developers to abandon the profession

Poor planning of tasks (MOT1) was the most cited; poor estimation of deadlines (MOT4), lack of re-estimation of deadlines (MOT8), activity overload (MOT20), badly sized teams (MOT13), multiple activities in parallel (MOT22) were often cited as they also evidence planning issues. The poor estimation of deadlines is the factor that most hinders the planning of activities; this fact is due to the complexity of this task. The bad estimate of deadlines (MOT4) can come from multiple contexts: the professional's lack of technical capacity, pressure from the client, and incomplete, subjective, and non-existent requirements. P16 portrays this situation in the following excerpt: *"...The person responsible for transmitting the requirements was not aware of the system, and when we had doubts about the requirements,*

Mot.ID	**#Cit.**	**Motivator**
MOT1	39	Poor planning of tasks
MOT2	33	Poor requirements
MOT3-4	28	Rework; Poor estimation of deadlines
MOT5	23	Ever-changing requirements
MOT6-7	11	Lack of documentation; Bad code quality
MOT8	15	Lack of reestimation of deadlines
MOT9-10	13	Inefficient methodology; Keep documentation
MOT11-12	12	Bad allocation of activities; Too many code metrics (Patterns)
MOT13-14	6	Badly sized teams; Aversion to changes
MOT15-18	5	Problems in collecting requirements with customer; Daily technical challenges; Legacy technologies; Process with excessive bureaucracy
MOT19-20	4	Difficulty in working in subareas of development; Activity overload
MOT21-22	3	Bug fixes; Multiple activities in parallel
MOT23-24	2	Negligence with standards and processes; Solutions that do not meet customer expectations

Table 5.2: Motivators by citation frequency exploratory study II

they did not clarify. In some situations, we needed to deduce some things...".

Regarding the lack of deadline re-estimation (MOT8), it is often neglected by companies and project managers, who, in certain situations, choose to include changes requested by the client in the project's current scope without consulting the development team to analyze the impact of alteration. This type of problem is recurrent in software development teams and tends to generate high levels of pressure especially during deliveries, stress, disrupts the relationship between leader and subordinate [32]. For P14, *"... the problem is aggravated when some activities are not well planned, so the person asking was not aware of the impact of that change ...".*

The overload of activities (MOT20), poorly sized teams (MOT13), and multiple activities in parallel (MOT22) were also motivators found in this study that may be related to each other. In this way, poorly sized teams culminate in an accumulation of activities and consequent overload of activities, as observed by P25 *"... manager when the project reduced the number of developers and overloaded the others, we had to perform multiple activities in the sprint as develop and fix bugs...".* In this sense, poor planning requires attention from organizations, considering that it can generate a feeling of rework (MOT3), overload, and high demand for overtime. Furthermore, MOT1 can be indicative of other motivators, such as constantly changing (MOT5) requirements or poor requirements (MOT2).

Still, regarding the motivators that refer to planning and considering the analyzes arising from the interviewees' discourse, it can be observed that the specific motivators to the profession culminate in the more general ones found in ES1, in a connotation of causality. This finding is very explicit in fragments taken from the interviews, in which the former developers report that the lack of planning causes issues such as work overload, pressure, and short deadlines, as reported by P13 *"...The pressure was due to deadlines; sometimes, the company committed itself to short deadlines, and the planning was flawed, forcing the developer to work more hours a day, several times a week. It was also more the mental fatigue of working so many hours daily...".*

As important as planning are the requirements elicitation and analysis activity. Most problems that generate negative impact and burden companies originate in the initial stages of software development, precisely in the requirements specification phases, in which the main activities are defined, and the product requirements must be objectively identified,

mapped, and clarified [133]. Bad specification (MOT2) as well as changing requirements (MOT5), if not managed correctly, can lead to rework (MOT3) and overload, in addition to poor product quality. Poor specified software will undoubtedly disappoint the user, with solutions that do not meet expectations (MOT24) and cause problems for the development team, who will have to modify it to suit the user's needs. The lack of clarity of the requirements arising from poor specification and constant changes requested by the customer was reported by the participants as disorganized and stressful in organizations, as seen in the excerpts from the interview P16 *"...the user asked for something, and the people who worked with requirements understood it, and we implemented it, and then when the user was going to use it, he said it was not what I had asked for, and it came back to us, and that was very stressful and frustrating since we want these things to be well done..."*.

Changing requirements is a natural process in software engineering, considering that systems evolve and that customers are not able to pass on all information clearly to the analyst, these changes start to become a substantial problem when they are poorly managed, ignoring the stages of evaluating the impact, effort and cost of changes, as recommended in the change management process [133]. According to interviewees, these steps are usually neglected by organizations that request changes in requirements that are being codified without any control, this type of attitude affects software quality, overloads developers as well as generates high levels of stress, as reported in the fragment above.

Rework (MOT3) was frequently found in the participants' excerpt and may be related to other motivators found in the study. Rework represents a form of waste and directly affects the quality of the product developed. The consequences of rework are cost increase, customer/team dissatisfaction because the product does not meet their requirements, and schedule commitment, among others [32]. P19's fragment represents these contexts: *"...there was a bad definition of requirements, you pass a deal next week it's something completely different, then you do it again, and there's a whole rework, so the bad specification of requirements was something you did with you getting into friction with your superiors..."*. It is estimated that 25% to 40% of the effort in software development is spent on rework, and 70% to 80% of the cost of rework is due to errors in requirements specifications [32]. In the software development process, rework seems to be inevitable, considering that with each new iteration, it may be necessary to correct and/or refine a feature. Furthermore, bugs are found in the

testing phase and need to be fixed, requirements are changed, and new features are added. However, the amount of rework also represents the quality of the process since an exorbitant amount can demonstrate a lack of clarity in the requirements and flaws in the planning [32].

Within the software development activities, an important step refers to the writing of the documentation, which will guide all the people who are part of the project's development, including the client. Software engineering understands the relevance of this practice and has even standardized some artifacts that must be generated in the software development phases. Software documentation is considered the primary source of information for software; currently, there are several types of documentation, each type being valid for different situations: API reference, code comment, installation and deploy guide, requirements document, and UML diagrams, among others [46]. However, in this study, the motivators related to documentation were: The lack of documentation (MOT6) as negative points that generate dissatisfaction and can act in the decision to abandon from the profession. Regarding the lack of documentation, respondents reported that this condition could lead to rework, delays in deliveries, and the generation of bugs. P17 reports that the lack of well-documented code creates difficulty in understanding the functionality, increasing the possibility of coding incorrectly. *"...the vast majority didn't care, for example, they put the variable name, nothing that wasn't self-explanatory, some calculations that only they understood, without any documentation..."*.

One of the strategies to reduce software bugs is related to code quality. Code quality is related to its level of complexity and readability. When very complex and macaronic, the code becomes difficult to understand and maintain. Therefore, it is considered poor quality (MOT7). Complex code, in addition to having significant impacts on team productivity, generates a high maintenance cost. It can also create system errors and incompatibilities, which, if not dealt with quickly, can prevent the end user from losing confidence in the product/software. The context above is present in the excerpt of P17 *"...lack of comments and bad codes, I always commented and documented money, but people don't do that, and it harms our work..."*.

In general, the results of this study made it possible to extract particular motivators of software development, that is, flaws found in the development process that generate difficulties in the daily lives of these professionals. This set of motivators can even be found in other

professions, but they present themselves in different ways. The issue of requirements is a good example to explain the statement above; even if this motivator can be applied to other areas in software engineering, this issue is much more malleable, allowing severe changes in the listed requirements. For example, in engineering/architecture, these changes may even occur, but they do not drastically change the product to be delivered.

Despite identifying new motivators related to software development activities, it should be noted that the generalist motivators, already identified in ES1, remained present in the relationships identified in the interviewees' discourse. It is understood that the turnaway phenomenon is complex, requiring deeper analysis of the relationships that permeate it for a greater understanding and elucidation of it. Therefore, the next step of this study aims to study the relationships between the motivators.

5.3.2 RQ2: How do turnaway related motivators interact with each other?

After analysis, as codes were identified and abstracted into concepts, it is possible to observe a few relationships between those concepts. Figure 5.1 illustrates some associations found in this study. Those associations are represented as solid lines between the boxes that represent motivators (the concepts in this study). We represent turnaway as the central concept of the qualitative study.

In figure 5.1 we present the most important relationships extracted in this study. Activities are inherent to software development, such as poor planning of tasks, poor requirements, poor estimation of deadlines, and generated work overload. As well as rework from bad code quality and lack of documentation can also be related to work overload in the profession. Work overload was one of the motivators directly linked to the turnaway. The highly technical requirements were one of the motivators closely associated with the threat of professional obsolescence, which in turn was also related to the abandon from the profession.

The relation between the concepts became more evident with the analysis of data from ES2 when it was possible to understand that software developers do not abandon the area just because of work overload, professional stagnation, or threat of obsolescence, but that there is a set of factors related to the development activity that generate these feelings, as can be seen

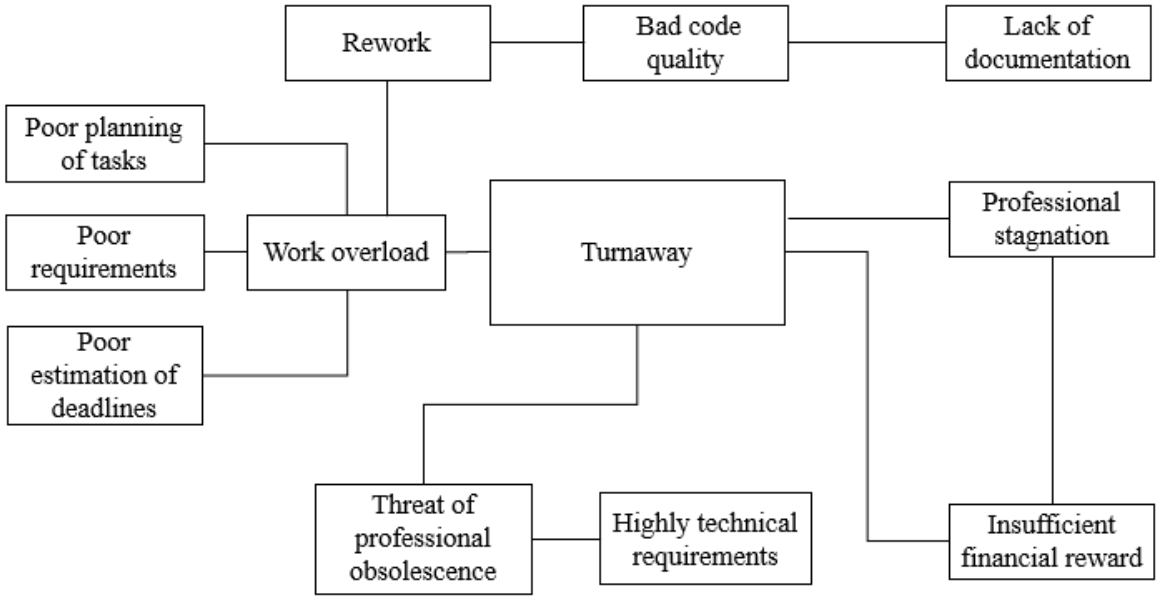


Figure 5.1: Association between motivators.

in the excerpt of one of the interviewees *"...we had a very heavy workload until five years ago with a lot of overtime, I say it would not be a problem of team sizing, the problem was in the planning..."*. P23's fragment shows issues related to the software developers profession, such as poor planning and poorly sized teams that culminate in work overload.

Other types of relation can also be observed in other motivators of this study, such as high technical demand, the threat of obsolescence, and exaggerated segmentation of professionals by technology/language, considering the highly specialized needs of the profession, which in turn segment knowledge and, consequently, limits the field of work and job opportunities. This relation was also found in other studies [2; 48; 114]. Still, as other examples we have: poor planning of tasks, poor estimation of deadlines, excessive demands, work overload, and pressure on deliveries. These concepts seem to be directly related, given that they always appear together in the interviewees' discourses [26].

Turnaway is considered a complex, multi-factorial, and poorly understood phenomenon, considering most studies trying to find factors correlating with turnaway intention [13]. Research challenges include understanding how the factors interact with each other to minimize or enhance this phenomenon. Thus, to design more effective professional retention strategies, it is necessary to identify the factors and map the circumstances and the context that precedes the phenomenon. As we analyze the relationships between the motivators, we begin

to realize that the turnaway process does not happen instantly and seems to follow a pattern, and it is possible to identify two common elements that precede the turnaway phenomenon, either implicitly or explicitly. First, *Contextual conditions*, which are the particular set of conditions within which action/interaction strategies are taken about the management of the central phenomenon, that is, conditions related to the environment in which the professional is inserted [86], such as professional's location, background education, the available jobs within his/her reach and the wages. Second, the precipitating factor or *trigger* that represents a current event in the individual's life effectuates the act [18]. Almost all participants explicitly stated triggers for the decision or gave us enough evidence about it. Figure 5.2. illustrates how this process can take place.

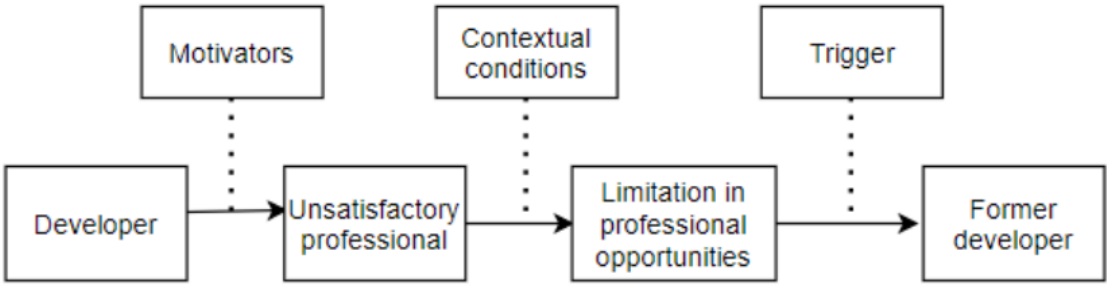


Figure 5.2: Generic theory.

The phenomenon can be understood through the formulation of a theory with representations about the process, explaining the elements involved and how they interact. Long before leaving the profession, the professional may feel dissatisfied with a set of factors that negatively impact the profession (motivators to turnaway), according to P21: *"... I became dissatisfied long before I left, small everyday things that were undermining my patience and satisfaction with the profession, such as problems with planning, which we had on a daily basis and this had a direct impact on my life due to the overload..."*. He then realizes that options are limited due to the contextual conditions in which he is inserted. The context sometimes exerts a predominant influence on the individual's life, being a significant element of this phenomenon's multi factors. For P10, contextual conditions related to family, workplace, and city were decisive for the motivators to affect his decision: *"... here where I live there is no specialized company, [...] there must be about three software companies, all*

of them only worked with support and were small...".

In other opportunities, the professional does not envisage change and believes that motivators to turnaway will continue to generate discontent; according to P4: *"... but what made me give up there was no use changing the company or project within the company and always meeting the same person [...] each being the same character being the same type of boss ...*". At a given moment in his career, an alternative becomes available, acting as a kind of trigger, which associated with the limitation in opportunities makes him decide to leave the area, because he believes that the motivators that generated discontent will disappear or be minimized with the choice of this alternative, according to P8: *"... I saw the opportunity on a working trip. [...] a chinese restaurant [...] temaki [...] saw that the investment was not so high and I decided to take the risk. Then it worked very well ...".*

Chapter 6

Applying the Career Anchors Theory to Former Software Developers: a case study

In this study, we apply the *career anchors model* [124] to collect data from former software developers who were interviewed in the ES1 and ES2 and capture their perceptions about which career anchors are predominant in these professionals. We then carried out a case study, considering that this makes it possible to investigate a contemporary phenomenon through several aspects [152]. Coherent with the nature of the problem and the investigated phenomenon, in this research, the case study aims to investigate whether there is a relationship between the career anchors that govern the behavior of these professionals and the motivators in which they were reported in the interviews, these studies were restricted to ES1 and ES2 participants. The methodological course followed was based on the principles presented by Pfleeger and Kitchenhan [109]. These steps can be applied in studies related to several areas, including software engineering, and help collect information at a fixed point in time. The data collected can provide a picture of the situation at that moment.

Following the principles mentioned above, the study was designed following this set of methodological steps: definition of specific objectives, planning and scheduling of the research, questionnaire design, data collection, and Data Analysis. Some items presented by Pfleeger and Kitchenhan, such as elaboration of the data collection instrument and validation of the instrument, did not need to be applied, as there already exists a validated instrument

that allows the measurement of career anchors.

6.1 Study Objectives

This this study had as its main objective to relate the qualitative data collected and analyzed in ES1 and ES2 with answers given by these same participants of Schein's career anchor test. The results of these studies can increase the reliability of the data found in ES1 and ES2, based on the coherence between the motivators and career anchors. In addition, it is highlighted that Schein's career anchors can be a useful tool to understand the needs of software developers, considering that in the existence of coherence with the motivators, companies can apply the career anchors questionnaire to discover the principles guides and motivations of employees and thus direct activities and functions that are aligned with their anchors, aiming at a better use of their skills and satisfactory work performance, in addition to helping organizations to involve, recruit and retain professionals more effectively. To this end, we formulated two research questions that must be answered at the end of this study.

- What are the general results regarding the career anchors of 24 former software developers in Brazil who were previously interviewed in ES1 and ES2?
- What is the relationship between individual career anchor results and the content of the interviews for each participant?

6.2 Methodology

In this section, we present the methodology of our study, including participants, procedure, data collection and research method.

6.2.1 Survey Planning and Scheduling

Initially, the researcher got in touch with each of the 25 interviewees who participated in ES1 and ES2, this contact was made through email, whatsapp and phone call, depending on the information in the pre-interview questionnaire (Figure 4.1). At this time, they were informed that a new study was being carried out with the same people who had participated

in the previous phases, and the objectives and purpose of the study were explained. Once the participant accepted, a time was previously scheduled to send the questionnaire. On the previously scheduled day, a file was sent with the questions from the career anchors questionnaire, which could be sent by e-mail or mobile chat, thus facilitating data collection. When the participant finished, he returned the file to us in digital format.

6.2.2 Questionnaire Design

The questionnaire used to measure each participant's career anchors was the career anchors inventory, proposed by Schein [124]. This instrument is a self-assessment measure containing 40 items[1], in which the individual establishes how much each question applies to their self-perception about their values, needs, and capabilities [30].

To avoid neutral responses, a 6-point Likert-type scale was used for subjects' responses to each of the 40 items. Based on Schein [124], eight career anchors model these items related to perceived importance and agreement of statements. The higher the individual's identification with the question, the higher the score assigned to that item. The scale provides the following alternatives for the question, "How much does each question apply to you?": never/never (1 point), occasionally (-) (2 points), occasionally (+) (3 points), often (-) (4 points), often (+) (5 points), and always (6 points). When applying the inventory, the career anchor is identified by calculating the arithmetic mean of the five questions for each anchor.

The Career Anchor Inventory provides a pretested instrument with demonstrated high internal validity and reliability [19; 29; 39; 40; 151]. Custodio [29] reports Cronbach's alpha coefficients ranging from 0.78 to 0.84, while Coetzee and Schreuder [25] report Cronbach's alpha coefficients ranging from 0.46 (lifestyle) to 0.85 (entrepreneurial creativity). As the objective of this study was not to make individual predictions, but rather to investigate whether there is a relationship between the eight anchors and the dropout-related motivators, the instrument was considered psychometrically acceptable.

It should be noted that each participant can have an affinity with the characteristics of several career anchors, resulting in two or more anchors predominating in the individual. Corroborating this statement, Feldman and Bolino [43] in their study proposed the existence of primary and secondary career anchors, thus enabling the presence of a hierarchy of career

[1]The career anchors questionnaire can be found in site https://psycho-tests.com/test/sheins-career-anchors

anchors, relating them in scoring order according to the chosen answers.

6.2.3 Data Collect and Sample

As previously reported, the population of this study referred to all respondents from ES1 and ES2; however, one individual refused to participate in this phase of the study, which totaled a sample of 24 people.

Data collection, carried out in December 2021, included former software developers or professionals who worked directly in the development team. The complete table with the sociodemographic profile is a combination of Tables 4.2 and 5.1. Among the participants, professionals from all Brazil regions were included to diversify; the choice for research at the national level is justified by the vast extension of the Brazilian territory, which offers great regional and cultural diversity, implying different work relationships. This characteristic is considered in the definition of the population, bearing in mind that a local or regional study could compromise the external validity through sampling bias.

6.2.4 Data Analysis

The data analysis identified which career anchors were prevalent for each individual. As these were considered interval scales, the measurement of career anchors was calculated through the arithmetic mean of its items. This convention is commonly used to analyze the results extracted from the career anchors questionnaire, as can be identified in articles dealing with this theme [23; 30; 146; 31]. After finding the anchors that influence the individual most, this information was crossed with data from the interviews, to analyze whether the turnaway motivators were related to the career anchors. The score was a measure adopted in this study that aims to assess the level of coherence between the interviewees' anchors and the motivators by which they abandon the profession. In order for this measure not to be something subjective, thus allowing evaluation/review by other researchers, some criteria were applied for this value. The score's measurement unit is in points, in which the participant can have a minimum of zero; that is, their career anchor disagrees with the motivators, and a maximum of five points, when their anchor demonstrates agreement with motivators. This process of evaluating the scores was carried out by one researcher and reviewed by an-

other; at the end, the two analyzes were confronted, and, in case of divergences, these were discussed, and a consensus was reached. Below are listed the criteria and their respective scores:

- 2 points: Interview fragments consistent with the main anchor;
- 2 points: Interview fragments consistent with the secondary anchor;
- 1 point: Interview fragments partially consistent with the main anchor;
- 1 point: Interview fragments partially consistent with the secondary anchor;
- 1 point: Relationship between the anchor and current job.

The formula for calculating the score is represented by the sum of the following variables: score linked to the main anchor, score related to the secondary anchor and the relationship between the anchors and the current job. With this formula, it is possible to identify in the "score calculation" column how much each participant scored in each criterion.

6.3 Results and Discussion

This section presents general results on the career anchors of former software developers who participated in ES1 and ES2.

6.3.1 RQ1: What are the general results regarding the career anchors of 24 former software developers in Brazil who were previously interviewed in ES1 and ES2?

According to the data obtained by applying the questionnaire, the average results of the questionnaire proposed by Schein [124] are shown in Figure 6.1, for the 24 participants, in particular the predominance of their anchors, with no ties. The security/stability anchor ranks first (4.41), followed by the lifestyle anchors (4.33) and autonomy and independence (3.81).

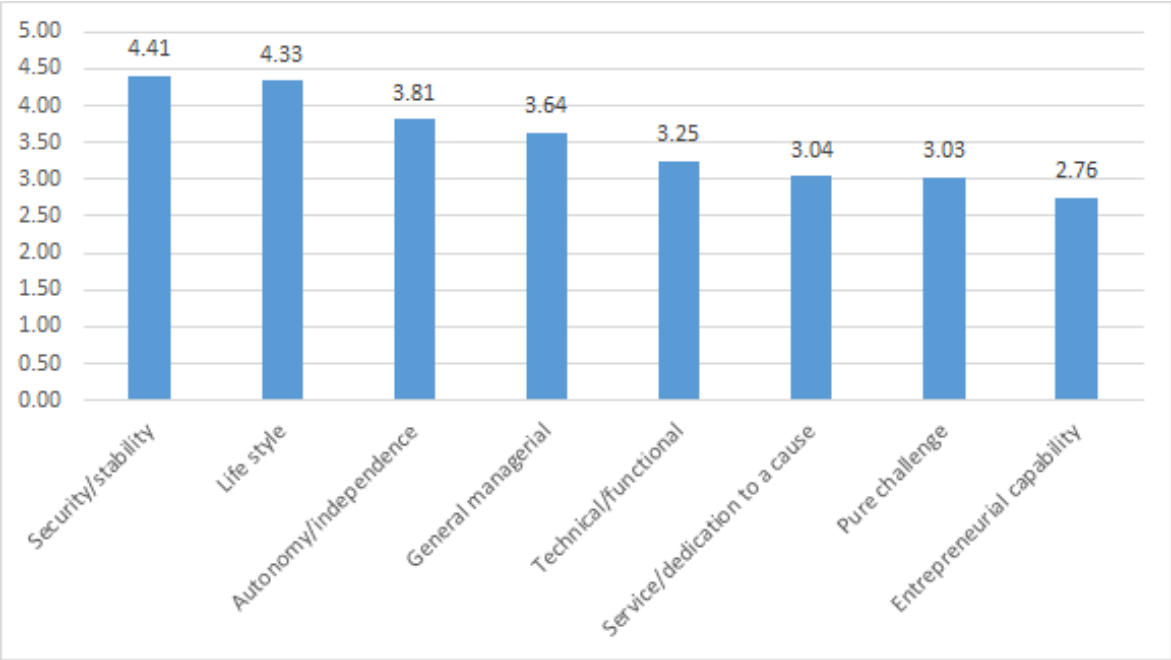


Figure 6.1: Career anchor averages.

The Security/Stability anchor, most prevalent among the interviewees, demonstrates an important representativeness, which may be related to these professionals' desires for a secure job that guarantees financial stability. This context may be related to the results identified in exploratory studies, whose lack of financial recognition was associated with abandoning the profession. Financial recognition capable of guaranteeing security and stability is often found in public initiative.

The lifestyle anchor was ranked second by former software developers, who, according to Schein [124], seek to balance professional and personal spheres by integrating individual needs with work and family needs. People with this anchor are autonomy oriented and crave flexibility. This anchor is sometimes dominant among software workers, who are subjected to a hectic routine. This profession is known for its high workload, constant change in the technological field and the definition of quick solutions for customers compared to other industries. Professionals must adapt and correspond to what is expected, usually working on implementation projects, customer support, and systems/software control. Considering this scenario, professionals increasingly value jobs and career opportunities that enable better lifestyles, such as flexibility in their work routines.

The third most common anchor, Autonomy/independence, has aspects that establish con-

nections with the previous anchor. This may explain the presence of high averages in this study. Software developers inclined to anchor lifestyle often value autonomy and independence in conducting their activities. Furthermore, people aligned with this anchor like to define their deadlines in terms of delivery, time, and dedication. This scenario may not occur in the projects they are working on due to deadlines and estimates provided by the client or managers of the organizations.

Another anchor that is also relevant for developers is the General Administrative (3.64), which is associated with challenging and heterogeneous work [32], in which leadership possibilities allow contributing to the organization and interests of high salaries, whose reward is related to promotions based on performance in terms of results or merit. About exploratory studies, the general Administrative anchor is linked to motivators such as lack of financial recognition, professional stagnation, significance at work and migration to a management career.

It is known that the professionals of this anchor value the monthly remuneration greatly and as a form of recognition when they reach the programmed objective. However, these are not the only forms. These individuals see promotions to positions with greater responsibility as the main form of recognition. Software developers feel that their careers are stagnant and may migrate to a management career, in search of greater financial and career recognition.

Considering the eight anchors in the sample, those that show less representation are: (3.25) - Functional technician; (3.04) - Dedication to the cause; (3.03) - Pure Challenge; and finally, (2.76) - Entrepreneurial creativity. Finally, the Entrepreneurial Creativity anchor with the lowest average is related to former software developers who do not give up developing their enterprise, built by their willingness and ability to take risks and overcome obstacles.

According to a study carried out by McKnight [93], the Entrepreneurial Creativity anchor occupied the penultimate place in the Engineering area (3.23) and the Health area (3.14). This anchor involves the most sought-after and valued professional categories today, those with a preference for entrepreneurship. The decision to undertake is challenging and involves risks that need to be considered by those who decide to take this path. This characteristic may explain the antagonism between the lowest average anchor (Entrepreneurial Creativity) and the highest (Security/stability). Individuals who value security and stability in their professional careers may move away from activities that involve greater risk.

Although it is relevant to analyze the averages of the anchors, Feldman and Bolino [43] emphasize the idea that each individual can have more than one career anchor, making the concept proposed by Schein [124] more flexible and reinforcing the overlap. In this sense, organizations must consider the primary and secondary anchors of their employees and seek a balance that enables careers aligned with their needs and values. Table 6.1 below shows the most frequent results.

Primary anchor	%	Secondary anchor	%
Security/stability	33%	Lifestyle	25%
Lifestyle	21%	Security/stability	21%
General managerial competence	16%	General managerial competence	21%
Technical/functional competence	13%	Autonomy/independence	13%
Entrepreneurial capability	13%	Pure challenge	8%
Autonomy/independence	4%	Technical/functional competence	4%
Service/dedication to a cause	0%	Service/dedication to a cause	4%
Pure challenge	0%	Entrepreneurial capability	4%

Table 6.1: Percentage of primary and secondary anchors.

The primary and secondary anchors that obtained the highest percentage among former software developers were security/stability and lifestyle, respectively. This result may be explained from the perspective that these professionals seek in their careers characteristics such as a solid and successful career, flexible schedules, and satisfaction related to personal activities. The two anchors that occupied the second place refer to lifestyle and security/stability, that is, the opposite of the first.

Considering the sociodemographic profile of the interviewees, it can be seen that security/stability is again among the most important for former developers, however, when the other anchors are analyzed, a difference in the predominance between genders is identified. For the female gender, lifestyle seems to be preponderant in the career. This fact may be linked to the choice of women for jobs and occupations that meet their needs in reconciling family life with their careers. According to Mouli, Mello, and Correia [37], professional issues still occupy the background in women's lives. This thought can be observed in this

study with the more significant presence of an anchor that values the career but does not place it above family issues.

About men, a more uniform distribution can be seen between the predominant career anchors, in which two attract attention, technical/functional and general managerial, given that female participants did not prioritize these. This fact can be explained by the lack of incentives on the part of organizations that often do not provide opportunities for these professionals to assume highly technical and managerial positions. This stereotype that men are better in the exact sciences while women do better in the humanities reflects the lack of representation of women in the area and is also a critical factor in repelling women from technical/managerial positions. This under-representation can lead to wasted effort and a lack of diversity in professional organizations. [104]

This result currently identifies an inequality between genders; that is, the reason why the balance between private and professional life concerns women more, while technical and managerial issues are very strong within male behavior[146].

When analyzing the five questions that obtained the highest scores, the predominance of security/stability and lifestyle anchors can be seen: three out of the five best scored refer to these anchors. Also noteworthy is the presence of two questions related to service/dedication to a cause and entrepreneurial capability. The three questions with the highest scores had the three lowest standard deviations (0.83 and 0.88 for lifestyle and 0.88 for security/stability), indicating greater consensus in the sample regarding the importance of these aspects for their careers: they predominantly want jobs that allow them to reconcile personal, family and professional needs and also provide greater security and stability.

6.3.2 RQ2: What is the relationship between individual career anchor results and the content of the interviews for each participant?

To answer this research question, a cross-comparative analysis was carried out with the participants looking for evidence that could confirm or not the connection between career anchors and the motivators that influenced the turnaway from the profession among former developers. We summarize the result in Table 6.2, in which we highlight the participant number (1-24), the primary anchor, the secondary anchor, the score calculation, and the

score.

From triangulation of data, it was possible to observe that some participants obtained the maximum score in the classification; that is, their primary and secondary career anchors were related to the motivators inherent to the turnaway reported in the interviews. P1 had a score of (5.0) in competence security/stability and (4.8) in an entrepreneurial capacity; the two anchors corroborate with the interview content, which includes that the lack of financial recognition made her leave the profession to study for public employment in order to obtain better financial stability, as follows *"...In the city where I lived, I studied for the contest, the jobs that I thought my mother's secretary earned more..."*. The maximum score in the security/stability competence demonstrates coherence with the interviewee's interview and current activity, considering that the lack of financial recognition can have a negative impact on security and stability, which can justify the abandonment of the software development career and entry into public service.

Regarding the secondary anchor entrepreneurial capacity, the interviewee reported that the lack of opportunity in the profession, lack of identification and the loss of network made her abandon the area and invest in expanding the family business, as follows *"...I ended up in the family business; we expanded the company, which was small, and we expanded it so that everyone could make a living from it..."*. This anchor seems to be involved in the turnaway process working as a trigger. Motivators throughout the process exerted a negative influence causing dissatisfaction. However, it was the opportunity to undertake that made her decide to abandon the career.

P2 was another interviewee whose anchors were congruent with the motivators. This participant predominated in the technical/functional and general managerial anchors. Despite having a technical profile, problems such as poor planning, short deadlines, and high technical requirements generated dissatisfaction *"...a lot of things that you had never seen in your life arrived at the last minute and you have to solve it from here to the morning from here to the afternoon this generated pressure..."*. As seen in the interviewee's excerpt, no matter how much you identify with the area, technical issues can culminate in turnaway. Regarding another anchor, the interviewee was able to visualize an opportunity for professional and salary growth if he migrated to a managerial career, given his dissatisfaction with stagnation and poor remuneration in the profession. Although he does not directly relate that the turnaway

ID	Primary anchor	Secondary anchor	score calculation	score
1	Security/stability	Entrepreneurial capability	2+2+1	5
2	Technical/functional	General managerial	2+1+1	4
3	Security/stability	General managerial	2+2+1	5
4	Security/stability	Technical/functional	2+2+1	5
5	Entrepreneurial capability	Lifestyle	2+2+1	5
6	General managerial	Pure challenge	2+1+0	3
7	General managerial	Security/stability	2+2+1	5
8	Entrepreneurial capability	Lifestyle	2+2+1	5
9	Security/stability	General managerial	2+1+1	4
10	Security/stability	Lifestyle	2+1+1	4
11	Security/stability	Pure challenge	2+0+1	3
12	Lifestyle	Autonomy/independence	2+2+1	5
13	Lifestyle	Autonomy/independence	1+1+0	2
14	General managerial	Lifestyle	1+2+1	4
15	Security/stability	Service/dedication to a cause	2+1+1	4
16	Lifestyle	Security/stability	2+2+1	5
17	Technical/functional	General managerial	2+0+0	2
18	Technical/functional	General managerial	2+2+1	5
19	Security/stability	Lifestyle	1+2+1	4
20	Lifestyle	Security/stability	2+1+1	4
21	General managerial	Security/stability	0+1+0	1
22	Autonomy/independence	Security/stability	2+2+1	5
23	Lifestyle	Security/stability	2+2+1	5
24	Entrepreneurial capability	Lifestyle	0+2+1	3

Table 6.2: Result of the comparative analysis between anchors and interview codes.

came from his affinity with the management area, he states that he does not regret leaving, as he has a greater affinity in his current profession *"...my life is much better because, in terms of my education, I have always worked in this area of administration, which is an area that I have a greater affinity..."*.

Another situation observed in the analysis consists of the proximity of values between three predominant career anchors for P8: entrepreneurial capability (5.0), lifestyle (4.8), and general managerial (4.6). Studies usually address only the primary and secondary anchors as the main drivers of the professional path, neglecting important relationships between career anchors. Feldman and Bolino, in their study, observed these similarities and suggested a new classification into three different groups: talent-based (management competence, technical/-functional competence, and entrepreneurial creativity), need-based (security and stability, autonomy and independence and lifestyle), and value-based anchors (pure challenge and service and dedication to a cause) [43]. This relationship was also found in this study, in which entrepreneurial capability and general managerial belonging to the talent-based group had very close values and were related to each other, as seen in the fragment *"...The main reason was the desire to be an entrepreneur, and there at the company, I saw that I couldn't do it; I really wanted a management position, a more strategic position, and I couldn't. What I saw was very far, especially from the IT area, for you to get a good position and a good salary..."*. In this case, it seems sensible that organizations do not use the results obtained from career anchors based only on numerical results but seek to understand relationships and how they may affect the individual. For P8, as much as general managerial is not among the first anchors, this has an important bond that was taken into account when the participant decided to turnaway from the profession.

A study carried out in São Paulo, brazil with the objective of investigating the career of workers in the information technology area who work in a home office system identified that the career anchor with the highest incidence among the respondents was that of lifestyle, marked by the desire to autonomy and flexibility [132]. These results corroborate those found in this research, in which P12 related work overload with the decision to turnaway *"...My decision to leave software development first and the biggest reason was that, at the time, I worked too much, I worked a lot, I didn't have and didn't take care of my health, and I didn't have time for anything..."*. People inclined towards lifestyle and autonomy/independence

career anchors feel more intensely and negatively about a plastered and overwhelming work routine and therefore tend to look for professions that offer greater flexibility. P12, a former software developer and current teacher, expresses this clearly in the following statement *"...My quality of life is good; I work less than I used to, and I suffer some pressure, but it is manageable, I set deadlines, so I have no regrets..."*.

For some interviewees, the career anchor had little coherence with the turnaway motivators. An example of this low coherence can be seen in the result of the P21 questionnaire, which apparently has management as a primary anchor, and Safety and stability as a secondary anchor, but in his interview, the author was unable to extract assertive fragments, or he/she was unable to demonstrate traits similar to his/her anchor.

When analyzing the data in table 6.2, it is observed that the scores are concentrated closer to the values 4 and 5, considering that a score equal to the value 3 represents the average value in this study, the participants who had a score above 3 had greater consistency of the anchors of a career with turnaway. This statement can be seen in the boxplot below (Figure 6.2).

Through the boxplot graph, we can see that more than 75% of the sample is above the average defined in this study, that is, above the value 3. With regard to symmetry, it is verified that these are positively asymmetric, and data dispersion is between the values 5 and approximately 3.5. Participants who had a score of 1 were considered outliers.

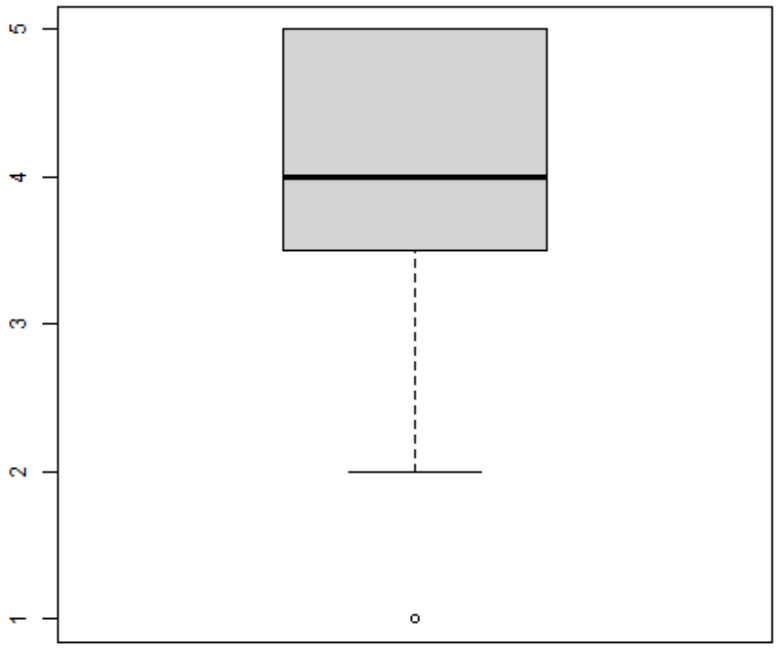


Figure 6.2: Boxplot of career anchor scores

Chapter 7

Motivators and the Theory of Investment: a Survey with Software Developers

After identifying a wide variety of motivators extracted from previous studies (ES1 and ES2) and formulating a theory (Figure 5.2) for a tentative explanation of the studied phenomenon, gaps still need to be clarified. In theory, it was observed that a set of motivators influence the transition from a developer to a dissatisfied professional. However, it is still unknown how these motivators affect perceptions regarding the intention to turnaway. Thus, to better understand the phenomenon, it is necessary to identify which motivators are most related and the strength of the relationships between these with the intention of turnaway.

For this, a quantitative study was conducted with 221 active software developers from all over Brazil. A survey covering questions about the activities inherent to the development profession was applied.

7.1 Study Objectives

This study aimed to understand how the motivators related to software development activities collected in ES1 and ES2 affect the intention to turnaway among active software developers. To this end, we formulated three research questions that must be answered at the end of this study.

- What are the latent variables extracted from the theoretical model?
- What is the relationship between factors inherent to the profession, availability of alternatives, career investment, lack of career commitment, and intention to turnaway?

7.2 Methodology

The purpose of this section is to describe the methodology used in the quantitative study. This stage of the thesis was designed following this set of phases: research classification, design and evolution of the questionnaire, population and sample, and data analysis.

7.2.1 Classification Research

This study is a survey-based quantitative research, in which the main objective is to identify a population or sample that are characterized by factors or can justify a certain event. This approach is appropriate for many types of research and has been well accepted in the area of Software Engineering, as the objects of study are contemporary phenomena, which are difficult to control experimentally [59; 87; 73].

Quantitative research is recommended to assess respondents' explicit and conscious opinions and attitudes, using standardized instruments. This research works with numbers and uses statistical models to analyze and discover information. In this study, the questionnaire technique was used for data collection. This type of instrument is used when the exact objective of the research questions is known [88].

7.2.2 Definition of Study Constructs

In previous studies (ES1 and ES2), 57 motivators related to the turnaway phenomenon were extracted. Among these, generalist aspects common to other professions can be noticed, as well as specific aspects inherent to the activities of software developers. Considering the objectives of the study and the impossibility of analyzing so many motivators, the need arose to delimit the number of motivators that would be explored in this study, so we chose to prioritize the motivators related to software development aspects, that is, problems that could

be resolved by software engineering, this delimitation reduced the number of motivators to 34.

The next step was grouping, in which motivators that dealt with similar aspects and activities, such as change of requirements, poor specification of requirements, and problems with requirements, were gathered in a group called requirements quality. This process was carried out for the 34 motivators, which culminated in the formation of six groups, called in this study the construct: documentation, quality of requirements, rework, planning of activities, quality of code and the threat of professional obsolescence. One researcher carried out this step and reviewed it with another; in the end, the divergences were discussed and resolved.

Finally, constructs such as availability of career alternatives, career investment, lack of career commitment and turnaway intention were included in this study. Despite not being directly related to the profession like the others, these were present in the speeches of the participants of ES1 and ES2, playing an important role in the process of abandoning the profession. Furthermore, these constructs make up the investment model based on the theory of interdependence [116], which was used as the basis for building the theoretical model (Figure 7.1) to be validated in this study.

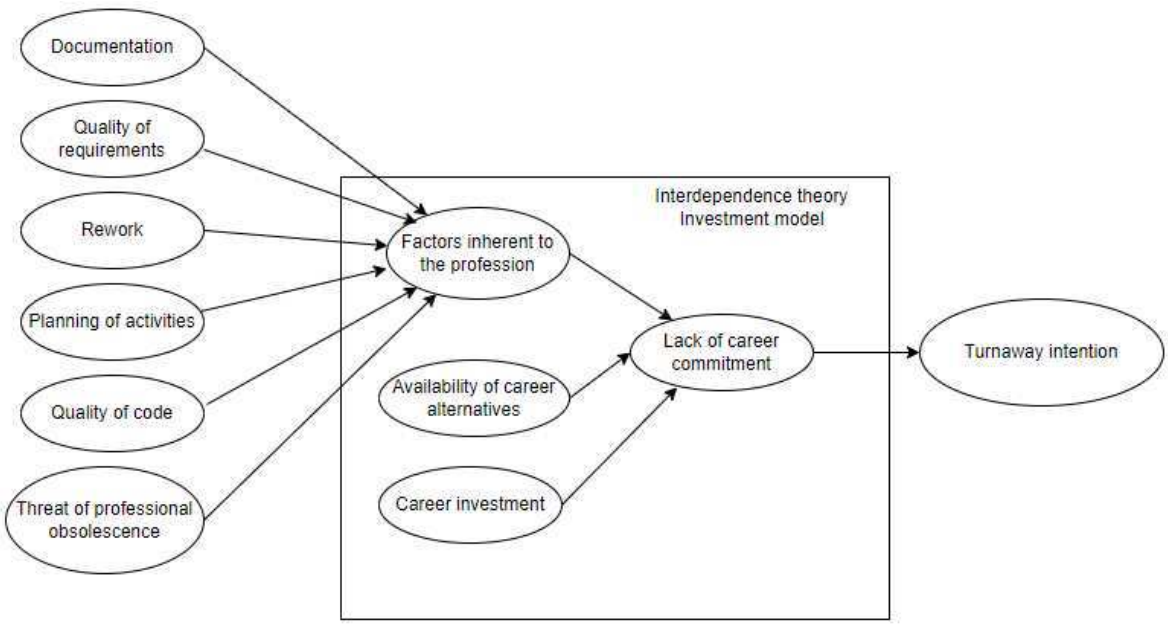


Figure 7.1: Theoretical model proposed in the study.

To evaluate each construct, a set of questions was used, each of which was called a variable. That is, C1_P1 defined the first question for construct 1, C1_P2 the second question for construct 1, and C2_P1 defined the first question for construct 1. construct 2, and this rule can be applied to the other items. Table 7.2.2 illustrates the acronym named for each construct and the variables that represent it. Section 7.2.3 demonstrates how these variables were used and organized in a validated instrument.

Acronym	**Construct**	**Variables**
C1	Documentation	C1_P1; C1_P2; C1_P3; C1_P4
C2	Quality of requirements	C2_P1; C2_P2; C2_P3; C2_P4
C3	Rework	C3_P1; C3_P2; C3_P3; C3_P4
C4	Planning of activities	C4_P1; C4_P2; C4_P3; C4_P4
C5	Quality of code	C5_P1; C5_P2; C5_P3; C5_P4
C6	Threat of professional obsolescence	C6_P1; C6_P2; C6_P3; C6_P4
C7	Availability of career alternatives	C7_P1; C7_P2; C7_P3
C8	Career investment	C8_P1; C8_P2; C8_P3
C9	Lack of career commitment	C9_P1; C9_P2; C9_P3; C9_P4
C10	Turnaway intention	C10_P1; C10_P2; C10_P3; C10_P4

Table 7.1: Abbreviation of the study constructs and their variables.

7.2.3 Designing and Evaluating the Questionnaire

Data was collected using a structured questionnaire with 38 questions on a five-point Likert scale [88]. The Likert scale is a psychometric response scale widely used in various opinion polls. Typically, five or seven-point response levels are used. When answering the questions with answers on a Likert scale, the participants specify their level of agreement or disagreement according to the statements presented in the statements of questions [38].

The questionnaire was built using already tested measures and existing instruments in order to make comparisons with related work and increase the reliability of the study, as recommended in the guidelines [109]. The exceptions to the use of existing instruments refer to measures related to software development activities (documentation, requirements

quality, activity planning, code quality, rework), considering that the searches carried out in this study did not find psychometric questionnaires that dealt with these themes, which the specificity of the constructs can explain.

For measurements with existing instruments, the Meyer questionnaire was used to assess the intention to turnaway, consisting of 4 items widely used in studies that propose to measure this construct. The availability of career alternatives was measured using the three-item career alternative scale adapted from Dam [144]. An example item is "I can easily get another comparable/better career opportunity if I want to". In addition, career investment was assessed using the six-item career investment scale adapted from Dam [144]. In this study, three of the six specific items were used, referring to career investment, training, and length of service. Items such as an adjustment in the private sphere were removed because they were not part of the scope of the research.

The professional obsolescence threat measure was adapted from Pazy and Kaufman [95]. Following Pazy, the threat of professional obsolescence was composed of three subdomains: scope, time and social comparison, ten items in total [95]. In this study, four items were used, two of which refer to the scope, that is, they evaluated personal currentness about the knowledge required in their area. As for time, the two items assessed how quickly the professional realized that his knowledge had become obsolete. The comparison items were not used, as they did not add information to the research context.

Career commitment was assessed using the nine-item scale developed by Carson and Bedeian [22] and later validated by Kidd and Green [75]. It measures three sub-dimensions of career commitment. Career identification, career planning, and career resilience. For this measure, only four items were used among the nine; three belonged to resilience and one to career identification.

Regarding the constructs related to software development activities that did not find existing and pre-validated instruments, a new instrument was created with four items for each of the constructs. The elaboration of all items was based on interviews carried out in ES1 and ES2, in addition to taking as a basis the Perceived Workload instrument by Kirmeyer and Dougherty [76].

Before applying the questionnaire, it was necessary to translate the instruments into Portuguese for the pre-existing measures. As recommended in the guidelines, a pilot study was

carried out in order to validate the complete instrument. The pilot included 20 participants who worked in the area of software development and served to clarify and identify some ambiguities in the statements of the items. According to Grossman, the range of 10 to 20 questionnaires are sufficient to validate the instrument regardless of the sample size [59].

Finally, a reliability and validity test of the constructs that make up the questionnaire was performed using the pilot data. The validated instrument was applied in this study and is presented in Appendix D. In addition, all individual and original instruments are available in each of the cited studies [48; 8]. Table 7.2.3 presents the validation of the measures obtained in the sample of this study.

Acronym	**Construct**	**M**	**SD**	**Cronbach's Alpha**
C1	Documentation	2.775	1.211	0.95
C2	Quality of requirements	1.85	1.85	0.828
C3	Rework	1.625	0.769	0.912
C4	Planning of activities	2.362	0.983	0.893
C5	Quality of code	2.175	0.775	0.854
C6	Threat of professional obsolescence	4.25	0.934	0.851
C7	Availability of career alternatives	3.416	1.331	0.933
C8	Career investment	3.066	1.313	0.969
C9	Lack of career commitment	3.775	1.078	0.828
C10	Turnaway intention	3.75	1.277	0.879

Table 7.2: Means, standard deviations, and reliability.

7.2.4 Procedure and Sample

The research population consists of currently-active software developers. The sample was defined using the criterion of non-probabilistic convenience sampling, also known as unintentional sampling [134]. This sampling criterion was chosen because it makes it possible to obtain a more significant number of responses.

The strategy applied to increase the number of respondents and greater diversity of the sample was as follows: an email containing information about the research and the link

to the questionnaire was sent to people who are partners in the project called *Hubs*, who were responsible for forwarding it to lists of software developers. Contact was also made with ES1 and ES2 participants to reach the companies in which they had worked. Finally, the sociodemographic groups with the lowest number of respondents were verified, and an active search for these professionals was carried out. The questionnaire was applied through an online tool (surveymonkey) [1] and answered by 221 software developers. As the Hubs distributed the link containing the form, we could not identify the response rate. Once a significant number of responses accumulated, preparing the data for analysis began. Data were formatted in an electronic spreadsheet and imported into RStudio, a free statistical tool for performing descriptive and factorial statistical analysis.

7.2.5 Data Analysis

When studying a subject seeking to broaden the understanding of it, it is often necessary to take into account many variables. Considering the large number of motivators extracted from the previous steps (ES1 and ES2), data analysis was performed using factor analysis (FA).

During the exploratory factorial analysis phase, a *Correlation Matrix* based on Spearman's correlation was generated, in which variables that made up the study constructs had a high correlation; that is, the magnitude of the correlation coefficients was examined, and it was verified that almost 100% of the values are above 0.30 and that the average value exceeded the index of 0.50, which, according to Hair et al., the matrix is factorable [62].

After that, the adequacy of the database was checked for residual mean square root (RMSR), the root mean squares of approximation errors (RMSEA), and the Tucker-Lewis Index (TLI). Furthermore, the KaiserMeyer-Olkin (KMO) criterion and the Bartlett Sphericity Test were applied to verify whether factor analysis is valid for the chosen variables [91; 12]. To finalize the analysis of the first research question of this study, the *eigenvalue* was observed, which is used in exploratory factor analysis as an indicator of the number of latent factors/variables that explain/are explained by the items of a scale.

With the factors identified through correlation patterns in the variables, a theoretical model was built based on the interdependence theory and on the investment model [116].

[1] `https://www.surveymonkey.com/`

To validate the theoretical model, structural equation model (SEM) was applied. This technique is used to observe the goodness of fit of a given theoretical model and the correlational structure that emerges from the data [28].

Thus, when using the SEM, the researcher already has a pre-established theory arising from the exploratory factor analysis of the current study or the results of previous studies to verify whether what the theoretical model used is being observed in the data [24]. In other words, the SEM is a technique that helps the researcher to find a better fit for the theoretical model used.

At first, the score was used for each of the constructs (documentation, quality of requirements, code quality, rework, activity planning, and threat to professional obsolescence) that were linked to the factor inherent to the profession. This strategy aimed at simplifying the model, considering that each construct had a set of four items, making the graphic representation difficult. It is noteworthy that the sum of the items that make up a construct is a technique adopted in the analysis of structural equations and is only feasible when the results found in the exploratory factor analysis show items that represent well-aligned constructs, which occurred in this study. In this type of analysis, it is considered that each item represents an addition to the positive or negative feeling of each question, resulting in the characterization of the construct.

In this research, the R language was used in version (R CORE TEAM, 2022) with the lavaan package (latent variable analysis) [12], which seeks to perform the analysis based on covariances. Due to the use of scores to represent some constructs, a new analysis was performed to verify the suitability of data for factoring. Bartlett's sphericity test, Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) were evaluated, as well as the Tucker Lewis Index, root mean square of the residuals (RMSR) and root mean square error of approximation (RMSEA). Subsequently, the model with latent variables was specified, in which factor analysis, confirmatory analysis and structural equation modeling were used to analyze the data.

Finally, the Tucker-Lewis Index, root mean square of the residuals (RMSR), and root mean square error of approximation (RMSEA) were also evaluated, and the model with latent variables was specified, in which factor analysis, confirmatory analysis, and structural equation modeling to analyze the data.

7.3 Results and Discussion

This section presents general results of the quantitative study with software developers in an attempt to reach a deeper understanding about the turnaway phenomenon.

7.3.1 RQ1: What are the latent variables extracted from the theoretical model?

Before starting the factorial analysis, the suitability of the database for the application was checked, according to Miles and Shevlin [98], based on the estimation of the multivariate model, three tests were performed, as shown in Table 7.3, the results of all these tests satisfactory for the use of the Factor Analysis method.

Test	Observed value
Residual Mean Square Root (RMSR)	0.03
Root of Mean Squares of Approximation Errors (RMSEA)	0.099
Tucker-Lewis Index (TLI)	0.853

Table 7.3: RMSR, RMSEA and TLI test results.

The correlation matrix showed a KMO = 0.97, representing high factorability. According to studies [65; 108], the KMO can vary from zero to one, in which values lower than 0.5 are considered unacceptable, values between 0.5 and 0.7 are considered mediocre; values between 0.7 and 0.8 are considered good; values greater than 0.8 and 0.9 are considered optimal and excellent, respectively. The factorability of the correlation matrix was confirmed by Barlett's sphericity test, considering that the null hypothesis was rejected, confirming the appropriation of the model for factor analysis.

Once the sample adequacy validation process was completed, it was necessary to identify the number of factors that encompass the study variables. To obtain this number, factor analysis was used, which verifies the explained variance and the eigenvalues. Following this rule, three factors were extracted that represent with good statistical significance the variance presented in the sample data matrix. Table 7.4 shows the eigenvalues, the variance explained by each factor, and the accumulated variance for each variable.

ID.Factor	**Eigenvalues**	**Var.porc**	**Var.acum**
Factor 1	23.72	62.43	62.43
Factor 2	3.36	8.84	71.27
Factor 3	2.31	6.09	77.35
Factor 4	0.97	2.56	79.91
Factor 5	0.88	2.32	82.24

Table 7.4: Results of eigenvalues.

The criteria used to group the 38 variables of the study into three factors were based on eigenvalues (Eigenvalues), variance explained by each factor, and the accumulated variance. The Eigenvalues represent the sum of the column of squared factor loadings for a factor, in which the result must be greater than one (eigenvalue > 1.000). In this study, it can be seen that the Eigenvalues value is less than one when passing the third factor. Regarding the variance explained by each factor, the literature considers that it should be at least 3%, corroborating the eigenvalues analysis.

Finally, the accumulated variance was observed, which with only three factors was able to explain approximately 78% of the total variance, a percentage considered good, according to Hair [62]. The slope diagram (Scree test) that represents a graph of the eigenvalues (y-axis) and their associated factors (x-axis) also justify the choice of three factors. With regard to the diagram, it is usual to find factors with very high eigenvalues to the detriment of factors with eigenvalues considered low. Therefore, this graph has a very characteristic format: a very sharp slope on the curve followed by a practically horizontal tail [44], as can be seen in Graph 7.2:

The graph above demonstrates the cut-off point for deciding on the number of factors, represented by the inflection of this curve. It can be seen that the proportion of variance explained by each of the factors decreases significantly from the fourth factor onwards. According to Stevens, with samples of more than 200 subjects, the slope diagram is a reliable criterion [138].

This study generated six models with different parameterizations: maximum likelihood with varimax rotation, maximum likelihood without varimax rotation, principal components

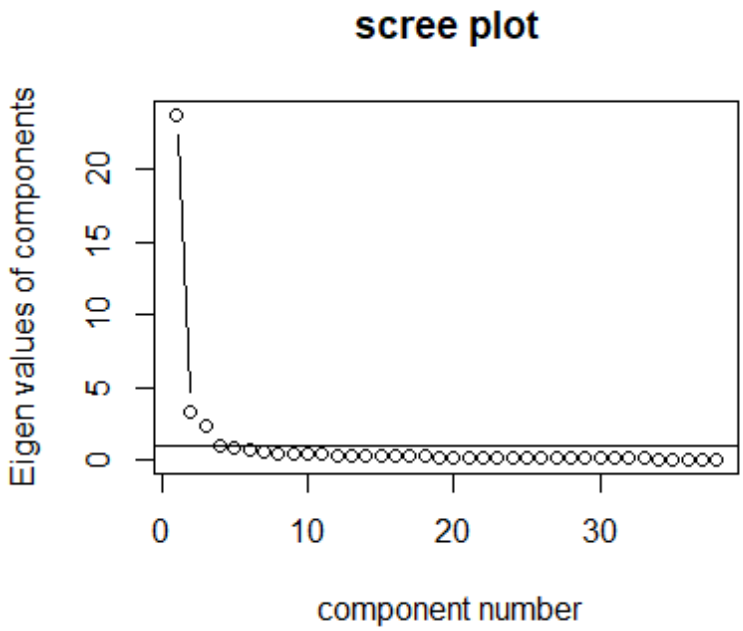


Figure 7.2: Screeplot of principal component and factor analysis.

without varimax rotation, Square Root of Mean Approximation Error without rotation, Ordinary Least Square and Ordinary Least Square with oblique rotation. For all parameterizations, the root mean square residual (RMSR) was close to zero, the root mean square of approximation errors (RMSEA) was below 0.5, and the Tucker-Lewis Index (TLI) was equal to 0.9 when rounding to decimal places is performed. In the end, it can be seen that all models converge regardless of the parameterization used, which suggests the uniqueness between the models, increasing the reliability of the study. This characteristic indicates that the participants understood the questionnaire well and that it was not answered randomly, resulting in more cohesive and coherent data.

Among the models above, we chose to use oblique orthogonal rotation (rotate = "oblimin") because we believe there is a correlation between the factors. At the same time, the factoring method was Ordinary Least Squares (fm = "minres") because it provides similar results maximum likelihood without assuming a multivariate normal distribution and deriving solutions through iterative autodecomposition as a main axis. The factorial loads generated by the chosen model can be seen in the table 7.3.1, in which each variable represents a questionnaire question that was grouped in the factor to which it belongs. As the

study had 38 variables, we chose to group some that belonged to the same factor in just one line.

Variable	Factor 1	Factor 2	Factor 3
C1_P1	0.944		
C1_P2	0.934		
C1_P3	0.956		
C1_P4	0.951		
C2_P1	0.855		
C2_P2	0.843		
C2_P3	0.767		
C2_P4	0.892		
C3_P1	0.782		
C3_P2	0.816		
C3_P3	0.711		
C3_P4	0.851		
C4_P1	0.910		
C4_P2	0.946		
C4_P3	0.955		
C4_P4	0.930		
C5_P1	0.629		
C5_P2	0.607		
C5_P3	0.614		
C5_P4	0.573		
C6_P1	-0.640		
C6_P2	-0.614		
C6_P3	-0.660		
C6_P4	-0.618		
C10_P1	-0.457		
C10_P2	-0.559		

C10_P3	-0.471	0.451	
C10_P4	-0.448		
C9_P1		0.862	
C9_P2		0.894	
C9_P3		0.915	
C9_P4		0.810	
C8_P1			0.953
C8_P2			0.899
C8_P3			0.931

Table 7.5: Factor loading matrix.

The results of the factor loadings demonstrate that the variables of construct 1 to 6, from C1 to C6, were grouped in Factor 1. With C8 in Factor 2 and C9 in Factor 3. Factor 2 is formed by only one construct that refers to career investment, which means that all questionnaire items referring to this construct are aligned with Factor 2. It is understood from the result of this analysis that people with the same level of investment may respond differently to the intention to abandon. Even present in the interviews of the previous studies (ES1 and ES2) the investment in the career, for composing a different factor of the intention to turnaway, has groups of independent answers.

With regard to Factor 3, this is also represented by only one construct, which is lack of career commitment and, therefore, explains less the intention to turnaway. Findings that corroborate some studies [26; 8; 17; 67] which indicate that the lack of commitment is proportional to the intention to turnaway [48; 17].

Unlike Factors 2 and 3, the first Factor was composed of multiple constructs, with these related problems: documentation, quality of requirements, rework, planning of activities, quality of artifacts, and the threat of professional obsolescence. It can be seen that the constructs that form Factor 1 are closely related to activities inherent to software development. The previous phases of this study (ES1 and ES2) corroborate with these findings, in which

the participants when they were going to report the motivators that influenced the turnaway of the profession, cited more constructs and sometimes related them. The constructs above rarely occur individually in software development teams, so Factor 1 seems to be present in teams or software projects with problems. It is still impossible to identify the order in which these constructs occur, but it is clear that the problems occur in a chain, that is, poor planning generates inconsistent requirements, which in turn affects the quality of the code and documentation of the projects.

Still on Factor 1, the threat of obsolescence (C6) may not be directly related to software development activities, however it is a feeling present in professionals in this area. However, programming languages and techniques, as well as methodologies for software development evolve so voraciously that these professionals feel insecure for fear of becoming obsolete. Linked to this is the pressure of studying to remain eligible for the job market. In this study, C6 obtained values inversely proportional to the other constructs that make up this factor. However, both are related to the intention to turnaway. The inversion was restricted only to the distribution of values for this construct; that is, the respondents attributed a maximum score because they felt very threatened by obsolescence, while they attributed a minimum score because they felt dissatisfied with problems related to software development activities.

Thus, this analysis identified three practically independent response groups that culminated in the latent variables of this study, Factor 1 classified as "factors inherent to the profession", Factor 2 as "career investment", and Factor 3 as "lack of career commitment". These behave as follows: People who tend to give the same score to the constructs that make up Factor 1 tend to define the same level for the intention to turnaway. For example, people who assign a low number to a problem with the quality of requirements put a high number on the intent to turnaway. However, people with the same career investment (Factor 2) or with the same lack of career commitment(Factor 3) may respond to the intention to turnaway in a completely different way, which may demonstrate that these factors are not preponderant in the intention to turnaway.

Finally, we conclude that Factor 1 (inherent to the profession) probably contemplates the internal aspects of software development and explains the intention of turnaway. However, investment and lack of career commitment, more generic aspects that can be applied to any career, explain less the intention to turnaway, being weakly linked to Factor 1. Until then,

attempts were made to explain the turnaway phenomenon through more general aspects, such as commitment, satisfaction, and identification with the profession. This study had an innovative character in the search for motivators closely related to software development activities that explain the intention to turnaway. Identifying these aspects may be related to the methodological path taken, which allowed the immersion of new concepts from the initial exploratory studies (ES1 and ES2) so that later these could be properly related.

7.3.2 RQ2: What is the relationship between factors inherent to the profession, availability of alternatives, career investment, career commitment, and intention to turnaway?

In the exploratory factor analysis to answer the first research question, it was possible to observe a clear separation between the constructs inherent to the profession and the more generalist constructs (carrier-based construct), which can be applied to any career. In this analysis, the structural equation modeling technique was used, allowing a more in-depth view of the constructs and their relationships; we are detailing the first analysis.

Before applying the structural equation modeling technique, it is recommended to verify some indices, and this one aims to indicate that the factorial structure used is consistent. Table 7.6 presents the index, the values obtained in the data sample, and the reference values that should be taken as a basis.

Index	Value	Reference Value
TLI (Tucker-Lewis Index)	0.927	TLI $\geq$0.9
RMSEA (Root mean square erro of approximation)	0.1	RMSEA$\leq$0.08
RMSR (Root mean square of the residuals)	0.02	RMSR$\approx$ 0
Bartlett's Sphericity Test	0	Bartlett's$\leq$ 0.05
Kaiser-Meyer-Olkin Measure of Sampling Adequacy	0.92	KMO$\approx$1

Table 7.6: Confirmatory factor analysis indices.

From Table 7.6, only the RMSEA was higher than the proposed limit (0.01). However, some authors have suggested that RMSEA values lower than 0.05 are good, values between

0.05 and 0.08 are acceptable, values between 0.08 and 0.1 are marginal, and matters greater than 0.1 are bad. [74; 85]. Thus, the present index was considered acceptable in this study.

Therefore, the correlations between the variables observed in the theoretical model were calculated to verify whether most of the correlation coefficients present a value greater than 0.3. To facilitate the visualization of these correlations, R has handy graphical tools to represent them, in which we use the corPlot function to verify the numerical matrix through the figure 7.3

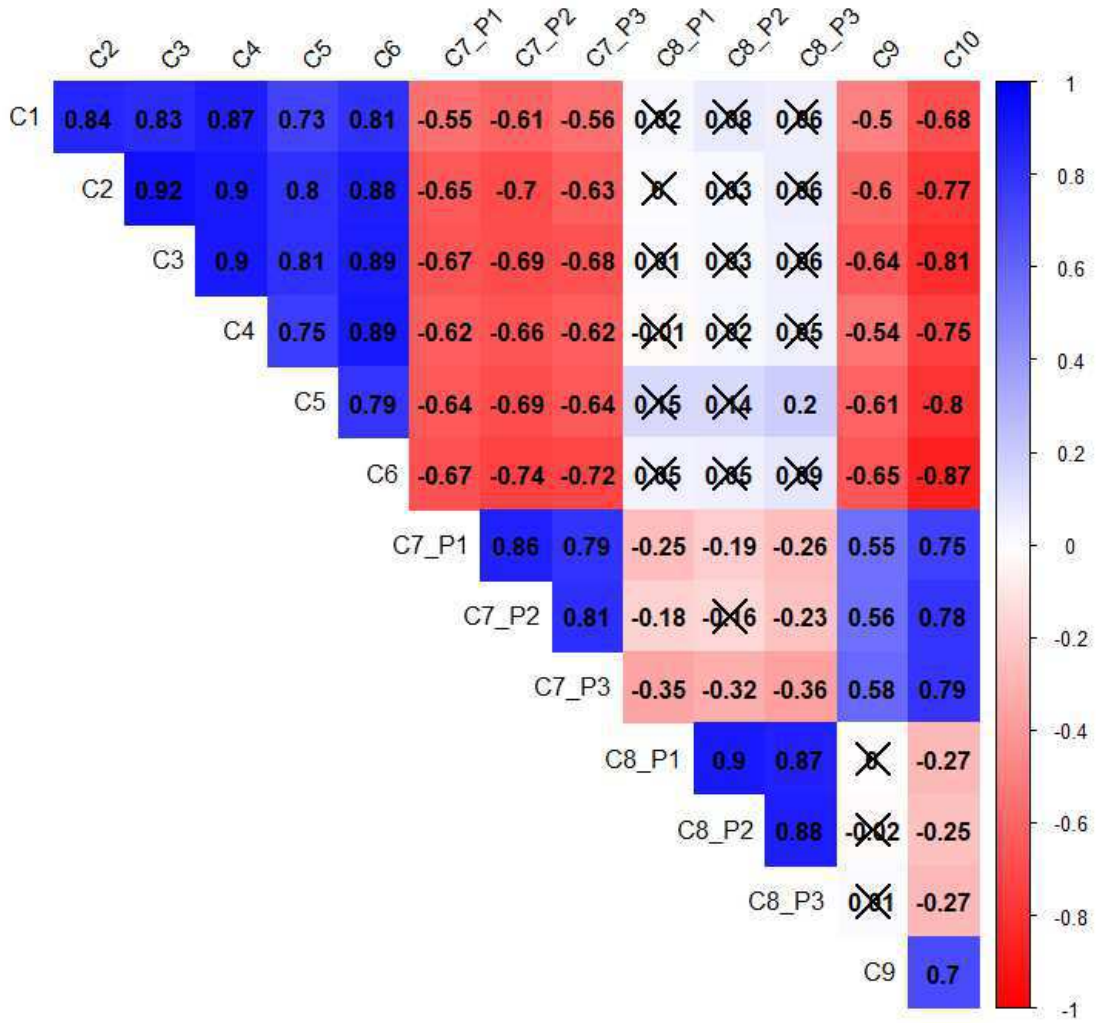


Figure 7.3: Correlation matrix.

Figure 7.3 shows that most of the correlations are above 0.3. The stronger the blue and red shade, the more significant the correlation. The area represented by the blue hue indicates the presence of a positive correlation, while the one in red indicates a negative correlation. The white color represents weak correlations between the variables.

The correlation matrix shows that from construct C1 to C6, the items are well related, justifying the results of the first research question. Thus, it is possible to observe that the factors inherent to the profession have a strong correlation ($|0.6| < r \leq |0.9|$) and are all positively related. Some correlation coefficients drew attention in this study due to their intensity. The quality of requirements (C2) and rework (C3) have a correlation coefficient of 0.92, a value considered very strong ($|0.9| < r < |1|$). This finding was also observed in the ES2 results and the study of career anchors. The strength of this correlation can be contextualized in the fragment extracted from the interview by P23 *"...requirements survey as it was not done with much detail[...], but the deadlines remained the same, there was a change, but the delivery milestone was the same, and then you had to work overtime a lot because of that..."*.

The lack of quality in the requirements sometimes generates rework resulting in excessive overtime. This characteristic is present in the context of software engineering because when the requirement is listed incompletely or undergoes changes, most of the time, it generates rework. For P23, technical issues seem dominant, hurting his career, a fact the little inclination can explain that this individual has in the functional technical anchor.

Other correlations considered very strong involved planning activities with rework and quality of requirements constructs. These results in the quantitative research reinforce that technical issues are correlated to the point of merging into a single factor and impacting the turnaway process.

Factors inherent to the profession (C1 to C6) showed negative correlations with a lack of career commitment and intention to turnaway. In this way, people who assigned a lower score to factors inherent to the profession, that is, those who were very dissatisfied with these activities assigned a high score to lack of commitment to their career and intention to turnaway.

The construct availability of career alternatives was positively correlated with a lack of career commitment and intention to turnaway. This fact can be justified in the context where people with several careers available tend to be less committed, leaving their careers more easily.

When analyzing the correlation matrix in its entirety, we verified that the items that are correlated in the theoretical model present correlation levels from moderate to very strong.

This situation indicates that the model seems to represent the data satisfactorily.

As the theoretical model was consistent with the correlational matrix, we applied the structural equation modeling technique (confirmatory factorial analysis), for which it is important that the variables are correlated as presented in this study. The next step was to reproduce the theoretical model in R; this import consists of describing the composition of each construct in the statistical language. Considering the factorial structure of the instruments used, the specified model made use of latent variables, named as factors inherent to the profession, availability of alternatives and investment, as they are multifactorial, and observed variables such as documentation, requirements, rework, planning of activities, quality of code, the threat of obsolescence, lack of career commitment, intention to turnaway, as they are unifactorial, as shown in figure 7.4.

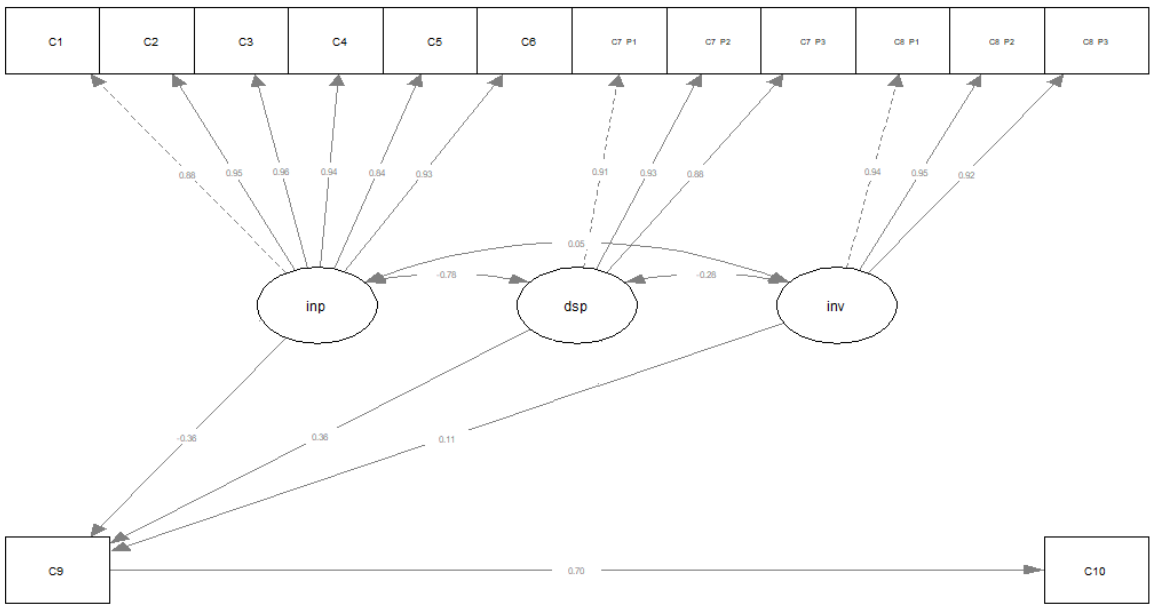


Figure 7.4: Visualization of correlations with structural equation model.

To generate the model using Structural Equation Modeling, it was necessary to label the name of the variables and constructs with acronyms so that all the graphic elements were clearly visible in the image. The acronyms with their nomenclatures are detailed below to facilitate the understanding of the model: "inp" represents factors inherent to the profession, "dsp" availability of career alternatives, "inv" career investment, "C7_P1, C7_P2 and C7_P3" items from the questionnaire that measure the availability of alternatives, "C8_P1, C8_P2, and C8_P3" questionnaire items that measure career investment and "C1, C2 C3, C4, C5, C6,

C9, and C10" are respectively documentation, quality of requirements, rework, planning of activities, code quality, the threat of professional obsolescence, lack of career commitment and intention to turnaway.

When starting the analysis of the structured equations model, one can observe the paths with the standardized structural parametric estimates of each relation. The important point is that the loading of the items with regard to the factors, in general, is above 0.60, thus indicating a strong relationship between the things and the [62] factor. In this study, all loads were above 0.85, well above the value considered acceptable.

The first findings that can be extracted through structural equation modeling are the variables that most contribute to the formation of the construct. When analyzing the “inp” construct, which represents factors inherent to the profession, it can be seen that the variables that exerted the most significant contribution in the formation of this construct were C3 (standardized factor loading = 0.96), C2 (standardized factor loading = 0.95), C4 (standardized factorial load = 0.94) and C6 (standardized factorial load = 0.93). Thus rework, quality of requirements, planning of activities and the threat of professional obsolescence seem to explain more the construct factors inherent to the profession. These results corroborate with ES2, which identified the importance of these constructs as the most cited motivators in the decision to leave the profession.

With regard to the relationships presented in the model generated through structural equation modeling, it is possible to observe that the factors inherent to the profession (inp) have a standardized regression coefficient of -0.36 for lack of career commitment (C9). This result means that people who give a high score to "factors inherent to the profession" tend to have the slightest lack of commitment, that is, more commitment. Therefore, the model indicates that the "factors inherent to the profession" are negatively related to the lack of commitment to the career and that individuals who are more dissatisfied with aspects of the profession tend to be more uncommitted to the career.

The availability of alternatives (dsp) is also related to lack of commitment; the standardized regression coefficient between these constructs was 0.36, so the more significant the availability of other options, the greater the lack of commitment. Individuals who have several job opportunities and manage to adapt and work in different areas have a lower obligation to their careers. In a study carried out with IT professionals in general, this hypothesis

was also verified and found to be true [48]. The important point is that, in this work, the push–pull–mooring framework was used, and even, so the availability of alternatives was related to the lack of commitment.

The next analysis verifies the relationship between investment in the career (inv) and lack of commitment, this one is presented with a lesser intensity, but it is still significant. The more investment in the career, the greater the lack of commitment. This fact can be justified from the view that people with a certain degree of qualification are directed towards other careers. This result was also found in ES1 and ES2, where it was observed that at a given moment in the career, after acquiring a high degree of qualification, the range of opportunities opens up for these professionals, making it easier for them to migrate to other careers, such as the management area. Investing in a career generates expectations, and when these are not met, professionals tend to look for new paths that allow them to continue growing, avoiding financial and professional stagnation.

The last relationship observed in the model refers to a lack of career commitment and intention to turnaway, which is the most significant in the study. The standardized regression coefficient between these constructs was 0.70. In this way, people who lack the commitment to their careers are more likely to leave the area.

In general, the theoretical model built in this study, based on the theory of interdependence and the investment model, *explains well the phenomenon of turnaway intention*; this statement can be evidenced in the significant relationships between the constructs that compose it. This study also demonstrates that aspects of the profession neglected in other studies are relevant and should be considered by organizations when developing retention strategies for their employees.

Chapter 8

Conclusion and Future Work

This thesis provides a comprehensive view of the turnaway phenomenon with software developers. The studies carried out in this thesis sought to understand the phenomenon, making use of important and necessary aspects, often neglected. Data were collected from various sources, applying *mixed methods* and performing different types of analysis. The results obtained from the studies evolved into a model that sought to explain the particularities of the turnaway phenomenon in the context of software development.

With the aim of identifying the primary motivators associated with distancing among software developers, the first exploratory study (ES1) was carried out. This study was the first, to the best of our knowledge, to be carried out with a sample of former software developers, that is, people who have already gone through the experience of abandoning the profession and who, consequently, can more reliably portray the turnaway phenomenon. From this, 33 motivators were identified, of which 22 had not yet been observed in other studies; these were grouped into 5 SWEBOK dimensions.

Among the identified motivators, the threat of obsolescence, work overload, lack of professional identification, professional stagnation, and lack of professional regulation stand out, considering how the participants referred to them. Such findings add to software workers' knowledge about the turnaway phenomenon. The result of this study observed a strong tendency for generalist motivators, that is, that can be applied to any profession. This finding supports questions, such as: can the turnaway phenomenon be explained by these generalist motivators, such as work overload, or would these be the consequence of factors still little elucidated in the literature, or even, what are the causes of these generalist motivators?. Due

to these questions, there was a need for another study with more data and more detailed investigations to understand which problems focused on software engineering may be related to more general motivators.

For this, the ES2 was carried out, which proposed to answer two research questions. The first aimed to identify *the motivators inherent to software development activities*. And the second is to understand how turnaway-related motivators interact with each other. Among these, those that appeared in a more significant number of interviews were: Poor planning of tasks (MOT1), poor requirements (MOT2), rework (MOT3), Poor estimation of deadlines (MOT4), Ever-changing requirements (MOT5), lack of documentation (MOT6), bad code quality (MOT7), lack of reestimation of deadlines (MOT8) and inefficient methodology (MOT9). These motivators together correspond to 72% of coded excerpts.

Regarding the interaction between the motivators, important relationships emerged from the interviewees' speeches; these occurred both between the more specific motivators, as well as with the more general ones, already identified in ES1.

Regarding the interaction between the motivators, important relationships emerged from the interviewees' speeches; these occurred between the more specific motivators and the more general ones, already identified in ES1. These relationships were meaningful in the sense of understanding not only that the effect occurs but also to understand why they are occurring. In the case of activities inherent to software development, poor planning of activities, poor requirements, and poor estimation of deadlines are related to work overload. Another example is the rework that may come from poor code quality and lack of documentation; these motivators may be related to work overload in the profession. Work overload was one of the motivators that were directly linked to turnaway.

Understanding these relationships is essential for understanding the phenomenon. By identifying the motivators related to software activities and understanding their interaction with the phenomenon, it was possible, through the standardization of the data, to formulate a generic theory. This proposes to explain the phenomenon through the data found in these studies, through elements such as motivators, contextual conditions, and precipitating factors. The pioneering spirit of this study is highlighted by considering the motivators inherent to software development activities when other studies found in the literature investigated aspects related to the IT profession.

After identifying the motivators that influence turnaway, this thesis continued the investigation of the phenomenon considering factors that can interfere with the process, such as career anchors. Thus, the third stage of the research sought to analyze the relationship between career abandonment (turnaway) and the anchors of former software developers from various places in Brazil. The study of these themes is of great importance, as career anchors, in addition to influencing decisions about the professional path, interfere with the individual's satisfaction and commitment to their work. Based on survey research carried out through a questionnaire, the first relevant finding refers to Security/Stability, in which individuals demonstrate concern for stability, aiming at the family's importance; they intend to have a stable job and financial stability. It can be inferred, through this observation, the concern of these former software developers with professional qualifications and, consequently, with the development of their careers and salary appreciation.

Lifestyle was the second most common anchor in this study. This anchor is characterized by the search for flexibility and balance between the professional, family, and personal spheres [123]. Poor planning, problems with estimates and work overload, motivators related to turnaway, and identified in previous studies (Exploratory I and II) can negatively impact the quality of life, making professionals inclined towards the lifestyle anchor more dissatisfied with the profession. In addition, it was found that lifestyle was the most common career anchor among women, given their greater desire for a balance between professional and family life. Finally, the results of this sample indicate that career anchors can be a reliable measure to perhaps indicate an intention to turnaway software development professionals. Possible use of such a measurement can trigger actions within organizations to address the problem, supporting professionals, better understanding their profile for better allocation of professionals, or even incentives for new roles.

The last study of this thesis revealed that the constructs related to the profession (C1 to C6) were strongly correlated, constituting a single factor (factor 1), entitled "factors inherent to the profession", and C9 arising from the investment model, which generated two new factors, career investment and lack of career commitment.

Exploratory factor analysis supported constructing the theoretical model to explain the phenomenon. The model's suitability was tested, and all hypothesized relationships were significant, highlighting the factors inherent to the profession that had a high coefficient of

relationship with lack of commitment, which in turn is related to the intention to turnaway.

The evidence identified and synthesized in this thesis aggregates the body of knowledge about the turnaway phenomenon in the context of Software Engineering. The multiple facets of the studies carried out helped to collect information for the construction of the theoretical model proposed in the study. This thesis tries to explain that software developers do not leave the profession due to factors common to any area, such as salary, family, or career, but due to issues related to development activities. Prior to this research, findings related to turnaway were focused on more general factors applied to any profession. Now, with the evidence discovered in this study, a change of perspective may occur, in which researchers should not neglect aspects inherent to the profession. The uniqueness of these results can be attributed to the methodological path followed.

Altogether, the results of this doctoral research can benefit research and practice in complementary ways. In the context of research, software engineering researchers may be able to reuse theoretical backgrounds and methods to investigate issues intrinsically related to turnaway. Furthermore, the methods and procedures presented here can be replicated to investigate similar research problems. On the other hand, organizations can seek improvements in the software development process to minimize the recurrence of problems related to projects, in addition to benefiting from the questionnaires used in this study to have an overview of the collaborators and be able to develop policies and strategies for stronger retention. Team leaders working in companies with a high turnaway rate can use the identified motivators and the results of career anchors to direct activities according to the employee's profile so that this professional can develop and have a high performance.

However, the model and body of theoretical knowledge as they currently stand leave open at least four questions and opportunities for future research, such as: i) The study was carried out in a national context (Brazil), as the profession of software development has a global character; that is, there are differences between regions and cultures that could be neglected; on the other hand, each region has its particularity that is added to the context of development, so it is essential to replicate this study in other regions/countries to analyze whether the motivators found in this study coincide with the replications carried out. ii) The model used in this study was adapted and based on the theory of interdependence; in this study, we did not test alternatives and possible variations in the theoretical model. The modification

and improvement of the model is a stage of the Structural Equation Modeling methodology suggested by Hair [62]. In this sense, it is relevant to test some variations in the original model to make comparisons to verify the adequacy of explaining the turnaway phenomenon. iii) Finally, the data from this study were analyzed in general, not considering the differences between sociodemographic groups (position, gender, region, age group); this aspect may have limited the identification of a relevant relationship. In this perspective, researchers can perform associations of sociodemographic variables with the constructs analyzed in this study.

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Appendix A

FREE AND INFORMED CONSENT (TCLE)

ESTUDO: Fatores que influenciam a intenção de turnaway entre os desenvolvedores de software

Você está sendo convidado (a) a participar do projeto de pesquisa acima citado. O documento abaixo contém todas as informações necessárias sobre a pesquisa que estamos fazendo. Sua colaboração neste estudo será de muita importância para nós, mas se desistir a qualquer momento, isso não causará nenhum prejuízo a você.

Eu_____, profissão_____, residente na_____ _____, domiciliado na_____ portador da Cédula de identidade, RG_____, nascido(a) em _____/ _____ /_____ , abaixo assinado(a), concordo de livre e espontânea vontade em participar como voluntário(a) do estudo "Fatores que influenciam a intenção de turnaway entre os desenvolvedores de software". Declaro que obtive todas as informações necessárias, bem como todos os eventuais esclarecimentos quanto às dúvidas por mim apresentadas.

Estou ciente que:

i) O estudo se faz necessário para que se possa identificar os fatores que levam os desenvolvedores de software abandonarem a profissão (turnaway). Especificamente a pesquisa irá: verificar empiricamente as relações entre variáveis externas/internas ao indivíduo e o turnaway entre os desenvolvedores de software; construir um mapa causal com os fatores

extraídos das entrevistas realizadas com os desenvolvedores de software que abandonaram a profissão.

ii) A pesquisa consiste em um estudo exploratório de abordagem qualitativa. A coleta de dados será através de entrevista pré-agendadas e gravadas com os participantes. A amostra será composta por desenvolvedores de software que abandonaram a profissão. O método para análise dos dados é o mapeamento causal revelado que é indicado para representar a cognição, pois esse captura a estrutura das afirmações causais de um indivíduo ou grupo.

iii) Após entender especialmente os métodos que serão usados para a coleta de dados e estar ciente da necessidade da gravação de minha entrevista AUTORIZO os pesquisadores envolvidos realizar a gravação da minha entrevista sem custos financeiros a nenhuma parte.

OBS: Quando a entrevista for presencial será utilizado o gravador de áudio já instalado no smartphone, caso seja via Skype a gravação de áudio será realizada através de uma funcionalidade do próprio software.

iv) O estudo proposto trará riscos mínimos, visto que pode trazer constrangimento ou desconforto perante a entrevista, além do tempo disponibilizado para responder os questionamentos. Visando minimizar os riscos da pesquisa as entrevistas serão realizadas de forma individual em um ambiente no qual estarão presentes apenas os pesquisadores e entrevistado. Outra medida para evitar o desconforto do participante é se caso a entrevista exceda o tempo de 25 minutos, será perguntado se o entrevistado precisa de uma pausa para que a entrevista continue. Os benefícios da pesquisa se pode ser visto através de várias perceptivas, da ótica organizacional refere-se a técnicas mais eficazes utilizada pelas empresas com objetivo de reter e motivar os funcionários o que indiretamente gera um menor dispêndio financeiro e uma maior competitividade no mercado. Do ponto de vista da profissão pode-se ter uma redução nas taxas de turnaway entre os desenvolvedores de software, vindo a minimizar o déficit de profissionais dessa área. Já com relação ao cunho científico, a pesquisa contribuirá para um entendimento melhor da temática, tento em vista a escassez de trabalhos na literatura.

v) Tenho a liberdade de a qualquer momento que desejar, entrar em contato para obter informações sobre este projeto de pesquisa, sobre minha participação ou outros assuntos relacionados à pesquisa, com o(a) pesquisador(a) responsável ou equipe executora pelo telefone (83) 99655-5612 ou pelo e-mail ruan.pierre.oliveira@gmail.com ou pelo endereço profis-

sional Hospital Universitário Alcides Carneiro - HUAC, situado na Rua: Dr. Carlos Chagas, s/ n, São José, CEP: 58401 – 490.

vi) Tenho a liberdade de desistir ou de interromper a colaboração neste estudo quando desejar, sem necessidade de qualquer explicação;

vii)Os dados obtidos por meio desta pesquisa serão confidenciais e não serão divulgados em nível individual, visando assegurar o sigilo e a privacidade dos participantes durante todas as fases da pesquisa.

viii) Os resultados obtidos durante esta pesquisa serão mantidos em sigilo, mas concordo que sejam divulgados em publicações científicas, desde que meus dados pessoais não sejam mencionados; Atestado de interesse pelo conhecimento dos resultados da pesquisa

( ) Desejo conhecer os resultados desta pesquisa

( ) Não desejo conhecer os resultados desta pesquisa.

ix) O participante da pesquisa receberá uma via do Termo de Consentimento Livre e Esclarecido e essas deverão ser rubricadas em todas as páginas.

x) Caso me sinta prejudicado (a) por participar desta pesquisa, poderei recorrer ao Comitê de Ética em Pesquisas com Seres Humanos – CEP, do Hospital Universitário Alcides Carneiro - HUAC, situado na Rua: Dr. Carlos Chagas, s/ n, São José, CEP: 58401 – 490, Campina Grande-PB, Tel: 2101 – 5545, E-mail: cep@huac.ufcg.edu.br.

Campina Grande - PB, _____ de _____de _____.

Sujeito da pesquisa _____

(Assinatura)

Testemunha 1 : _____

Nome / RG / Telefone

Testemunha 2 : _____

Nome / RG / Telefone

Responsável pelo Projeto:_____

RUAN PIERRE DE OLIVEIRA. DOUTORANDO EM CIÊNCIAS DA COMPUTAÇÃO PELA UFCG. TELEFONE (83) 9655-5612, E-MAIL: RUAN.PIERRE.OLIVEIRA@GMAIL.COM

Appendix B

SCRIPT INTERVIEW EXPLORATORY STUDY I

UNIVERSIDADE FEDERAL DE CAMPINA GRANDE

Centro de Engenharia Elétrica e Informática

Coordenação de Pós-Graduação em Informática

ROTEIRO DAS ENTREVISTAS

Olá bom dia/boa tarde/boa noite meu nome é Ruan Pierre estamos aqui realizando uma entrevista para a pesquisa de título: "Fatores motivadores ao abandono/intenção abandono da carreira de desenvolvimento de software".
Apresentar o TCLE (formato digital ou papel).

Inicialmente, gostaria de explicitar que todos os dados fornecidos na entrevista serão somente para o uso do pesquisador, dito isso, estes não irão transparecer ou identificar em momento algum o entrevistado, dando-se assim seu completo anonimato para com a sociedade.
Informo também que esta entrevista será gravada, não será compartilhada publicamente, e para isso é necessário que o entrevistado forneça autorização ao pesquisador/entrevistador, para utilizar as informações prestadas na elaboração da pesquisa, se concorda, afirme "Autorizo" neste momento.

1- Gostaria de pedir que o entrevistado contasse quais locais onde trabalhou, quais funções

exercidas e quanto tempo trabalhou em cada local?

2 - Quais foram os motivos que fizeram com que você abandonasse a área de desenvolvimento de software?

3 – Você pode enumerar os principais aspectos que lhe deixavam mais insatisfeito na sua carreira como desenvolvedor de software?

4 – Que fator você considera que mais lhe desestimulava no trabalho e que influenciou na sua decisão de abandonar desenvolvimento de software?

5 – Havia alguma tarefa em especifico que mais influenciou para que você abandonasse sua a carreira de desenvolvedor de software? Quais?

6 – Você se arrepende de ter saído da área de desenvolvimento de software? Porque?

7 - Você está mais satisfeito com a escolha profissional que você fez? No caso, a atividade atual? Compare a atividade atual com a atividade que você desempenhava quando era desenvolvedor de software.

Appendix C

SCRIPT INTERVIEW EXPLORATORY STUDY II

UNIVERSIDADE FEDERAL DE CAMPINA GRANDE

Centro de Engenharia Elétrica e Informática

Coordenação de Pós-Graduação em Informática

ROTEIRO DAS ENTREVISTAS

Olá bom dia/boa tarde/boa noite meu nome é Ruan Pierre estamos aqui realizando uma entrevista para a pesquisa de título: "Fatores motivadores ao abandono/intenção abandono da carreira de desenvolvimento de software".

Apresentar o TCLE (formato digital ou papel).
Inicialmente, gostaria de explicitar que todos os dados fornecidos na entrevista serão somente para o uso do pesquisador, dito isso, estes não irão transparecer ou identificar em momento algum o entrevistado, dando-se assim seu completo anonimato para com a sociedade.
Informo também que esta entrevista será gravada, não será compartilhada publicamente, e para isso é necessário que o entrevistado forneça autorização ao pesquisador/entrevistador, para utilizar as informações prestadas na elaboração da pesquisa, se concorda, afirme "Autorizo" neste momento.

1 - Gostaria de pedir que o entrevistado relatasse quantos empregos você já teve? Quais

cargos você já exerceu? E quanto tempo trabalhou em cada local?

2 - Como era a sua rotina como desenvolvedor?

3 - Dessa rotina de trabalho tinha algum aspecto ou atividade que de incomodava e de alguma forma de influenciou a abandonar a profissão? Se Sim quais e porquê?

4 - Quais foram os motivos que fizeram com que você abandonasse a área de desenvolvimento de software?

5 - Quais os aspectos que lhe deixavam mais insatisfeito na sua carreira como desenvolvedor de software e te influenciou a abandonar a profissão?

6 - Existem outros aspectos ou atividades que te deixavam insatisfeito e de alguma forma influenciou a abandonar a profissão?

7 - Havia alguma tarefa/atividade em específico que mais influenciou para que você abandonasse sua a carreira de desenvolvedor de software? Quais?

8 - Como você avalia o processo de especificação de requisitos na(s) empresa(s) que você trabalhou? Existia falhas ou algo nesse processo que te incomodava? Se sim, poderia exemplificar?

9 - Como você avalia a constante mudança de requisitos em alguns projetos de software? Como isso acontecia nos projetos que você trabalhava? A que você atribui essa prática?

10 - Como você avalia o processo codificação/implementação dos softwares na(s) empresa(s) que você trabalhou? Existia atividades ou algo nesse processo que te incomodava? Se sim, poderia exemplificar?

11 - Sabemos que no processo de codificação tem muita interrupção em geral e se reclama

muito que essas interrupções que acabam atrapalhando o processo de desenvolvimento. Como é que isso acontecia com você? Você acha que a motivação para tanta interrupções poderia ter sido evitada?

12 - Como você avalia o processo qualidade/teste dos softwares na empresa última que você trabalhou? Existia atividades ou algo nesse processo que te incomodava? Se sim, poderia exemplificar?

13 - Como você avalia o processo entrega/delivery dos softwares na(s) empresa(s) que você trabalhou? Existia atividades ou algo nesse processo que te incomodava? Se sim, poderia exemplificar?

14 - Dentro do processo de desenvolvimento de software como todo você se recorda de alguma situação ou atividade que você precisava realizar que te incomodava?

15 - Como você avalia a qualidade do código na última empresa que você trabalhou? Nas demais também era assim? Poderia exemplificar?

16 - Como você avalia os problemas de integrações/comunicação dos sistemas que você desenvolveu com sistemas de terceiros (API REST, Web services)? Na sua percepção por qual motivo esse tipo de atividade gera tanto problema?

17 - Como você avalia a questão de trabalhar em vários sistemas ou várias equipes simultaneamente?

18 - Como você avalia a falta ou escassez de documentação nos projetos que você trabalhou? De que maneira essa situação afetava sua atividade?

19 - Como você avalia sobrecarga de funções que é desempenhada pela maioria dos desenvolvedores full stack, que tem que ter conhecimento em Banco de dados, UX e UI, Linguagem de BackEnd, protocolos de comunicação e Segurança de Dados?

20 - Como você avalia a curva de aprendizagem que inexiste ou é extremamente rápida para se aprender novas tecnologias?

21 - Como você avalia a imposição métrica como (Cobertura de teste, performance, refaturamento de código, clean code) em projeto de desenvolvimento de software? De que maneira elas podem atrapalhar?

22 - Como você avalia a oportunidade de crescimento na carreia de desenvolvimento de software? Você ver alguma limitação? Se sim quais?

23 - Como você avalia o crescimento de carreira em desenvolvimento de software quando comparado com outras carreiras?

24 - Como você avalia remuneração em relação as atribuições no seu trabalho?

25 - Como você avalia o reconhecimento da profissão de desenvolvedor de software?

26 - Como você avalia a valorização da profissão de desenvolvimento de software? Você consegue se recordar de alguma situação que evidenciou essa falta de valorização no ambiente de trabalho?

27 - Como você avalia a carga de trabalho quando você era desenvolvedor de software? A que você atribui a carga horaria elevada? (Falta de profissionais; Pressão do cliente; Estimativa má realizadas; estimativas influenciadas pelo gestor; falta de experiencia da equipe)

28 - Como você avalia o processo o processo de estimativa e prazos para entrega das atividades na(s) empresa(s) que você trabalhou? Você presenciou algo que te incomodou nesse tipo de atividade? Se sim, poderia exemplificar?

29 - Como era sua relação com seus superiores? Em caso de má relação poderia relatar uma situação que você presenciou.

30 - Como era o seu contato com cliente? Qual sua opinião do desenvolvedor ter contato com cliente?

31 - Como você avalia as reuniões que você participava do ponto de vista de produtividade? Você poderia exemplificar alguma situação? No seu ponto de vista o que ocasionava essa improdutividade?

32 - Considerando que as reuniões são frequentes no processo de desenvolvimento de software (cliente, superiores e equipe) e que por vezes essas podem atrapalhar o andamento das atividades. Como você avalia esse processo? Em quais situações você julgava a reunião desnecessária?

33 - Como você avalia o ato de receber feedbacks na sua profissão? Onde você trabalhou essa prática era corriqueira?

34 - Como era a pressão/estresse na profissão? A que você atribui essa alta carga de pressão e estresse na profissão de desenvolvimento?

35 - Como você avalia a metodologia/processo de desenvolvimento de software utilizado na empresa que você trabalhava? Algo nesse processo influenciou na sua decisão de abandonar a área de desenvolvimento?

36 - De alguma maneira o excesso de burocracia atrapalhava alguma atividade inerente ao desenvolvimento de software? Se sim poderia exemplificar? De que maneira atrapalhava?

37 - Como você avalia o mercado de trabalho e as oportunidades dentro da carreira de desenvolvedor?

38 - Como você avalia a quantidade de tecnologias que o desenvolvedor precisa dominar? Você acha que isso pode afetar as oportunidades de trabalho?

39 - Como você avalia a velocidade como as tecnologias (frameworks e linguagem de programação) mudam e evoluem quando comparados com outras áreas? De que maneira isso interferiu na sua decisão de abandonar a profissão?

40 - Como você avalia a falta de autonomia dos desenvolvedores nos projetos que você trabalhou? Você poderia exemplificar uma situação que você presenciou? Em que atividade relacionadas a desenvolvimento você considera que o dev não tem autonomia (arquitetura, autogerenciamento, tecnologias, horários)?

41 - Você se arrepende de ter saído da área de desenvolvimento de software? Por quê?

42 - Compare a atividade atual com a atividade que você desempenhava quando era desenvolvedor de software?

Appendix D

SURVEY QUESTIONNAIRE

UNIVERSIDADE FEDERAL DE CAMPINA GRANDE

Centro de Engenharia Elétrica e Informática

Coordenação de Pós-Graduação em Informática

QUESTIONÁRIO DE PESQUISA

Nome Construtor: Documentação

Na carreira de desenvolvimento de software:

1. Como você se sente quando as documentações produzidas no projeto são aquém do que o esperado.

( ) - Totalmente satisfeito ( ) - satisfeito ( ) - Neutro ( ) - Insatisfeito ( ) - Totalmente insatisfeito

2. Como você se sente quando é alocado para trabalhar em projeto em que possuem pouca documentações.

( ) - Totalmente satisfeito ( ) - satisfeito ( ) - Neutro ( ) - Insatisfeito ( ) - Totalmente insatisfeito

3. Como você se sente quando de modo geral quando as documentações do projeto são deixadas em segundo plano.

( ) - Totalmente satisfeito ( ) - satisfeito ( ) - Neutro ( ) - Insatisfeito ( ) - Totalmente insatisfeito

4. Como você se sente quando participa de projeto que exigem baixa carga de documentação.
( ) - Totalmente satisfeito ( ) - satisfeito ( ) - Neutro ( ) - Insatisfeito ( ) - Totalmente insatisfeito

Nome Construtor: Qualidade dos Requisitos
Na carreira de desenvolvimento de software:
1. Como você se sente quando os requisitos do projeto não estão bem definidos.
( ) - Totalmente satisfeito ( ) - satisfeito ( ) - Neutro ( ) - Insatisfeito ( ) - Totalmente insatisfeito

2. Como você se sente quando a qualidade dos requisitos interfere no quão bem a atividade é realizada.
( ) - Totalmente satisfeito ( ) - satisfeito ( ) - Neutro ( ) - Insatisfeito ( ) - Totalmente insatisfeito

3. Como você se sente quando o número de mudança dos requisitos é maior do que o esperado.
( ) - Totalmente satisfeito ( ) - satisfeito ( ) - Neutro ( ) - Insatisfeito ( ) - Totalmente insatisfeito

4. Como você se sente quando os requisitos não estão tão claros quanto deveriam.
( ) - Totalmente satisfeito ( ) - satisfeito ( ) - Neutro ( ) - Insatisfeito ( ) - Totalmente insatisfeito

Nome Construtor: Retrabalho
Na carreira de desenvolvimento de software:
1. Como você se sente quando precisa refazer uma atividade por mais de uma vez.
( ) - Totalmente insatisfeito ( ) - Insatisfeito ( ) - Neutro ( ) - satisfeito ( ) - Totalmente satisfeito

2. Como você se sente quando precisa refazer uma funcionalidade devido a alguma mudança

prevista ou imprevista no projeto.

( ) - Totalmente insatisfeito ( ) - Insatisfeito ( ) - Neutro ( ) - satisfeito ( ) - Totalmente satisfeito

3. Como você se sente quando precisa refazer uma atividade que já havia sido realizada, devido a não se ter alcançado o objetivo esperado.

( ) - Totalmente insatisfeito ( ) - Insatisfeito ( ) - Neutro ( ) - satisfeito ( ) - Totalmente satisfeito

4. Como você se sente quando precisa refazer uma atividade, seja de forma parcial ou total por falha humana ou mudanças de diretrizes.

( ) - Totalmente insatisfeito ( ) - Insatisfeito ( ) - Neutro ( ) - satisfeito ( ) - Totalmente satisfeito

Nome Construtor: Planejamento das atividade

Na carreira de desenvolvimento de software:

1. Como você se sente quando a quantidade de horas para realizar uma atividade é aquém do estimado.

( ) - Totalmente insatisfeito ( ) - Insatisfeito ( ) - Neutro ( ) - satisfeito ( ) - Totalmente satisfeito

2. Como você se sente quando o prazo para realizar uma atividade interfere no quão essa bem foi feita.

( ) - Totalmente insatisfeito ( ) - Insatisfeito ( ) - Neutro ( ) - satisfeito ( ) - Totalmente satisfeito

3. Como você se sente quando número de atividades é maior do que estava sendo esperado.

( ) - Totalmente insatisfeito ( ) - Insatisfeito ( ) - Neutro ( ) - satisfeito ( ) - Totalmente satisfeito

4. Como você se sente quando é alocado(a) para atuar em uma atividade fora de sua área de

expertise.

( ) - Totalmente insatisfeito ( ) - Insatisfeito ( ) - Neutro ( ) - satisfeito ( ) - Totalmente satisfeito

Nome Construtor: Qualidade do código

Na carreira de desenvolvimento de software:

1. Como você se sente quando a qualidade do código fonte de um projeto está aquém do esperado.

( ) - Totalmente insatisfeito ( ) - Insatisfeito ( ) - Neutro ( ) - satisfeito ( ) - Totalmente satisfeito

2. Como você se sente quando a qualidade do código fonte de um projeto interfere na qualidade das entregas.

( ) - Totalmente insatisfeito ( ) - Insatisfeito ( ) - Neutro ( ) - satisfeito ( ) - Totalmente satisfeito

3. Como você se sente quando a quantidade de métricas e padrões de um projeto interfere na entrega das atividades.

( ) - Totalmente insatisfeito ( ) - Insatisfeito ( ) - Neutro ( ) - satisfeito ( ) - Totalmente satisfeito

4. Como você se sente quando a legibilidade do código fonte de um projeto está aquém do esperado.

( ) - Totalmente insatisfeito ( ) - Insatisfeito ( ) - Neutro ( ) - satisfeito ( ) - Totalmente satisfeito

Nome Construtor: Ameaça a obsolescência profissional

Na carreira de desenvolvimento de software:

1. O conhecimento técnico necessário do meu trabalho atual muda constantemente.

( ) - Discordo totalmente ( ) - Discordo ( ) - Neutro ( ) - Concordo ( ) - Concordo totalmente

2. Algumas tecnologias que antes eram valiosas e consideradas importantes no meu campo profissional não são mais úteis.

( ) - Discordo totalmente ( ) - Discordo ( ) - Neutro ( ) - Concordo ( ) - Concordo totalmente

3. O conhecimento técnico da minha profissão fica desatualizado rapidamente.

( ) - Discordo totalmente ( ) - Discordo ( ) - Neutro ( ) - Concordo ( ) - Concordo totalmente

4. Meu conhecimento profissional torna-se obsoleto em ritmo acelerado.

( ) - Discordo totalmente ( ) - Discordo ( ) - Neutro ( ) - Concordo ( ) - Concordo totalmente

Nome Construtor: Disponibilidade de alternativas de carreira

Na carreira de desenvolvimento de software:

1. Se quiser posso facilmente obter uma oportunidade de carreira comparável/melhor que a atual.

( ) - Discordo totalmente ( ) - Discordo ( ) - Neutro ( ) - Concordo ( ) - Concordo totalmente

2. Há um número suficiente de opções de carreira que eu posso atuar no mercado de trabalho.

( ) - Discordo totalmente ( ) - Discordo ( ) - Neutro ( ) - Concordo ( ) - Concordo totalmente

3. Vai ser difícil mudar para outra carreira.

( ) - Discordo totalmente ( ) - Discordo ( ) - Neutro ( ) - Concordo ( ) - Concordo totalmente

Nome Construtor: Investimentos na Carreira

Na carreira de desenvolvimento de software:

1. Investi muito na minha carreira profissional.

( ) - Discordo totalmente ( ) - Discordo ( ) - Neutro ( ) - Concordo ( ) - Concordo totalmente

2. Tenho investido na formação específica na minha carreira profissional.

( ) - Discordo totalmente ( ) - Discordo ( ) - Neutro ( ) - Concordo ( ) - Concordo totalmente

3. Tenho um tempo de serviço investido na minha carreira profissional.

( ) - Discordo totalmente ( ) - Discordo ( ) - Neutro ( ) - Concordo ( ) - Concordo totalmente

Nome Construtor: Falta de Comprometimento com a Carreira

Na carreira de desenvolvimento de software:

1. Os desconfortos associados à carreira de desenvolvimento de software às vezes parecem grandes demais.

( ) - Discordo totalmente ( ) - Discordo ( ) - Neutro ( ) - Concordo ( ) - Concordo totalmente

2. Dados os problemas que encontro na carreira de desenvolvimento de software, às vezes me pergunto se consigo tirar o suficiente disso.

( ) - Discordo totalmente ( ) - Discordo ( ) - Neutro ( ) - Concordo ( ) - Concordo totalmente

3. Dados os problemas na carreira de desenvolvimento de software, às vezes me pergunto se o fardo pessoal vale a pena.

( ) - Discordo totalmente ( ) - Discordo ( ) - Neutro ( ) - Concordo ( ) - Concordo totalmente

4. Eu me identifico fortemente com a ideia de uma carreira na área de desenvolvimento de software.

( ) - Discordo totalmente ( ) - Discordo ( ) - Neutro ( ) - Concordo ( ) - Concordo totalmente

Nome Construtor: Intenção de abandono

Na carreira de desenvolvimento de software:

1. Pretendo continuar trabalhando na carreira de desenvolvimento de software até me aposentar.

( ) - Discordo totalmente ( ) - Discordo ( ) - Neutro ( ) - Concordo ( ) - Concordo totalmente

2. Espero trabalhar em uma carreira diferente da desenvolvimento de software em algum momento no futuro.

( ) - Discordo totalmente ( ) - Discordo ( ) - Neutro ( ) - Concordo ( ) - Concordo totalmente

3. Eu frequentemente penso em sair da carreira de desenvolvimento de software.

( ) - Discordo totalmente ( ) - Discordo ( ) - Neutro ( ) - Concordo ( ) - Concordo totalmente

4. É provável que em breve eu explore oportunidades de carreira fora da carreira de desenvolvimento de software.

( ) - Discordo totalmente ( ) - Discordo ( ) - Neutro ( ) - Concordo ( ) - Concordo totalmente