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Boost performance of software engineers:

case study

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Abstract

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Keywords: motivation, software engineers, organizational learning, knowledge management, tacit knowledge, explicit knowledge, retention, performance.

The present thesis aims to elaborate a theoretically grounded approach toward software engineering candidate selection and performance support, based on the analysis of the existing team's motivation and tacit knowledge acquisition processes. Commissioner is a small software development and IT-consultancy company, building technologically advanced systems and products from scratch. The company employs 14 people; 2022 year's revenue is 1,1 mln euros. The talent retention rate of the case company has been 100% since 2016 and performance, measured by project delivery on time, within budget and the technical scope is over 90%. The company is co-founded and co-owned by the author of the present research.

The research strategy is a case study with the case company as a unit of analysis. Qualitative data was collected with semi-structured interviews and triangulated with quantitative data collected with questionnaires. Since this research is a deductively based explanation building directed content analysis approach was utilized for qualitative data analysis and the codes emerged from the theoretical framework. Quantitative data was analyzed with descriptive statistics methods due to the sample size (n=9), not sufficient for statistical analysis. The development part was implemented with the process design method in a collaborative development workshop with the case company CTO and team leaders.

Research findings revealed that the case company employees are a homogenous group, having similar personality characteristics and set of needs, along with university degrees in mathematics or computer science and technical propensity. Individual tacit knowledge, conceptualized as "knowing how" is obtained in the workplace with explicit learning and once applied to practical solutions of work-related tasks, prompts a sense of technical competence and satisfaction, which in turn reinforces motivation. As a result of the development workshop, adjustments to candidate selection and onboarding procedures during the first year in the company were elaborated.

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List of Symbols

JCT – Job Characteristics Theory

VIE theory – Valence-Instrumentality-Expectations Theory of Motivation

DLOQ – Dimensions of the Learning Organization Questionnaire

TTKM – Team Tacit Knowledge Measure

VUCA - Volatility, uncertainty, complexity and ambiguity

KM – Knowledge Management

CTO – Chief Technical Officer

CEO – Chief Executive Officer

MBTI - Myers Briggs Type Indicator

PTR - process terms of reference

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1 Introduction

The twenty-first century is called the era of information due to the epochal shift from a traditional industry to a knowledge-based economy and the snowballing growth of the software development industry with the demand for qualified personnel (Birkinshaw, 2014). While qualified engineers are hunted for, junior talents compete for workplaces. Due to the scarcity of qualified human resources, senior level IT-talents chose between the best companies across the globe, while small and medium-sized companies hardly possess enough attractions to hire senior-level talents. Since the software development industry is experiencing technological exponential growth and so do the technologies, the most hunted-for talents might not be those with the largest experience, but those with learning potential and high intellectual capacity (Forsbak, 2021), so the companies who can screen, onboard and develop such talents obtain a competitive advantage. Retention, superior performance, project development time, cohesion with budgets, low absenteeism, project success, reward and satisfaction are outcomes of software engineers' motivation and tacit knowledge (Beecham et al., 2007, p. 15; Sharp et al., 2009, p. 5; Whelan & Carcary, 2011, p. 675); thus, these topics are the core of this Master thesis.

This thesis aims to identify key motivation and knowledge management factors, which contributed to the case company's software development team's consistent results of project delivery. The purpose of the research is to investigate how the discovered factors contribute to the performance and retention of software engineers in the case company. The development objective is to elaborate a theoretically grounded action plan for candidate selection, onboarding and boosting performance, aligned with the commissioner's strategic goals. The direction of the development objective is future-oriented and is headed toward new employee selection and onboarding so that their performance rapidly achieves the level of the current team's performance.

Retention, productivity, project development time, cohesion with budgets, low absenteeism and project success (Beecham et al., 2007, p. 15; Sharp et al., 2009, p. 5) are outcomes of motivated software engineers, which are the desired outcomes for the case company, thus motivation theories have been granted the central place of theoretical framework. For the purpose of this research, such outcomes as productivity, project development time, cohesion with budgets and project success are further in text related to as performance. Motivation theories are studied in the second chapter of this research. Motivation stems from a certain set of needs (Locke & Latham, 2004, p. 389), which drive the behavior of

individuals and are impelled by external factors. Motivation can influence the direction, intensity and duration of an individual's actions, as well as affect the acquisition and exploitation of people's skills and abilities and the intensity of application of skills and abilities (Locke & Latham, 2004, p. 388).

Therefore, the first research question is:

1. Which factors contribute to employees' motivation in the case company?

The case company's sustainable focus is to deliver software products within the deadlines and budgets, with high quality and within the customer's business needs aimed at solving real-world problems. These outcomes are attributed to "mature" software engineering teams, which are established over time and are characterized by relational maturity, learning maturity and technical maturity (Marsicano et al., 2017, p. 239), where technical maturity is associated with increased learning maturity. Knowledge management practices aimed at developing tacit knowledge as a source of competitive advantage are studied in the third chapter of the present research and are aimed to address the second research question and enrich the research context.

2. Which factors contribute to tacit knowledge acquisition?

Individual learning is supported by an organizational context known as Learning organization, which is the process of individual learning and knowledge transfer (Xie, 2019). While leadership and organizational culture go beyond the scope of this research, the organizational characteristics which contribute to tacit knowledge creation are covered in the theoretical framework section.

The fourth chapter describes the research strategy, which is a single case study with a holistic focus on studying the company. The purpose of the research is to identify which factors contribute to employee retention and performance, therefore the research is explanatory. The context of the research is also of particular interest; therefore, the chosen strategy is justified. The research approach is deductively based explanation building (Saunders et al., 2009, p. 592) since the data was collected after the theoretical framework was defined and data collection was driven by the theoretical framework.

For the present study, multiple method data collection technique is utilized with a combination of qualitative and quantitative data collected. Qualitative data is collected with semi-structured interviews and quantitative data is collected with an online survey tool Webropol. With the semi-structured interviews qualitative primary data is collected to identify which factors, according to the employees, and

how affect their motivation and how particularly they acquire work-related skills, obtain and transfer knowledge in the workplace. Qualitative data is triangulated with quantitative data collected with questionnaires.

The justification for this developmental research is grounded on the practical business need of sustainable economic growth of a commissioner, which requires hiring, onboarding, retaining and sustainable performance of software engineers. The company effectively manages its growth with smaller-scale operations and with the daily participation of the founders in operational activities. But further growth demands a more structural and knowledge-driven (vs. gut-feelings-driven) approach toward talent and knowledge management.

The case company is a small software development company, building technologically advanced systems and products from scratch. At the beginning of the research company employed 21 persons, 7 in Petrozavodsk, Russia and 14 in Helsinki, Finland: 17 engineers and 4 non-technical personnel. By the end of 2022 the company has withdrawn operations from Russia and employs 14 people, 11 engineers, CEO, CTO and a technical support engineer. The company's revenue in 2022 is 1,1 mln euros, the growth of revenue since 2022 is 88%. The company is co-founded and co-owned by the author of the present research.

2 Motivation theories

As conceptualized by Franca, motivation precedes performance, in other words first comes motivation and then performance (França, 2014). The purpose of the theoretical aspects of motivation theories presented in this research is to identify and integrate the valid aspects of motivation theories into the practices of performance fostering of the case company software engineers. The concept of motivation has been under scrutiny of research for almost 100 years, and a plethora of theories and their variations were developed, however, a closer look allows to notice that these different approaches to motivation do not contravene each other, but rather study motivation from different angles (Locke & Latham, 2004, p. 389). Based on systematic literature review findings and the previous empirical research results we have identified the classic theories of motivation to compose the theoretical framework of the case study. According to Locke the objective requirement of a human being survival and well-being is the fulfillment of needs, which in turn drives human beings to make actions (Locke & Latham, 2004, p. 389).

2.1 Content theories

Maslow's Hierarchy of Needs. Abraham Maslow has developed one of the most widely cited motivation theories structuring the sets of goals, which are called needs, into a pyramid based on the needs' prepotency, starting from more dominant to less dominant: physiological, safety, love, esteem and self-actualization (Maslow, 2019, Chapter 2).

The desire to achieve and maintain conditions, under which our needs are satisfied, is what motivates human being behavior, among other determinants of behavior, which is guided by cultural, biological and situational contexts. However, Maslow's theory has been further criticized and the validity has not been empirically proven (Wahba & Bridwell, 1976, p. 212), further elaborations and reconsiderations of motivation theories have constituted a set of theories which are called content theories.

Content theories aim to discover the factors related to motivation – the variation of a set of needs, as a universal driver of human behavior (Kispál-Vitai, 2016). Content theories presume linear dependence

between the needs and human actions, a definable hierarchal order of needs and a fundamental role of a workplace as a source of needs fulfillment (Shields et al., 2020, Chapter 3). Despite the criticism, content theories have practical implications and theoretical contributions to the present research.

Three needs theory. David McClelland (McClelland, 2016, Chapter 2) has extended Maslow's concept admitting the volatile nature of needs over time affected by an individual's life experience with his Three needs theory: need for achievement (competitive success), need for affiliation (need for friendly relationship with others) and need for power (need to control or influence others). People with a high need for achievement tend to look for success, thus better handling challenging projects and measurable goals. Regular feedback motivates them better than monetary reward (McClelland, 2016, Chapter 4). Further development of theory has also discovered that human behavior is not only driven by a desire for success but also by fear of failure and fear of success (Miner, 2015, Chapter 4). According to McClelland, people with a strong need for achievement opt for situations, which allow them to achieve results explicitly with their effort and skills; the situation is defined as above average level of difficulty and risk, and the feedback loop is short, and the result of effort can be defined as success (McClelland, 2016, Chapter 6). These situations provide a space for innovations and orientation for the future, and once innovative solutions are delivered, a sense of fulfillment is more intense (McClelland, 2016, Chapter 6).

People with a high need for power seek managerial work and managing positions (Armstrong & Taylor, 2020, Chapter 24). McClelland further develops the concept of power need and discovers, that good managers, who can grow the organizations and support high morale in a workplace, do not have a dominant need for achievement, but for power, and have developed emotional maturity and demonstrate coaching managerial style (McClelland & Burnham, 2008). Three needs theory initially attributed high achievement needs to an entrepreneurial mindset (McClelland & Burnham, 2008). Numerous sociological research about IT talents as a separate occupational entity allows us to constitute that achievement of need-driven people corresponds to the generalized description of IT professionals (Starceva, 2016; Zemnukhova, 2013, p. 414).

The need for affiliation is the driving power of human friendship, i.e., "a positive affective relationship" with other people (McClelland, 2016, Chapter 5). People with a high need for affiliation perform better in highly cooperative environments (Armstrong, 2020, Chapter 24), however managerial performance is negatively correlated with a high drive for affiliation (McClelland & Burnham, 2008).

Two-factor motivation theory. Another influential attempt to overcome the limitations and lack of empirical value of Maslow's theory was undertaken by Frederik Herzberg and colleagues (2017) which resulted in two-factor motivation theory. The authors developed a hypothesis, that factors, motivating people at work and factors causing negative attitudes toward work have different nature (Pinder, 2014, Chapter 3), thus job satisfaction and motivation and job dissatisfaction are not antonyms in the motivation domain. The opposite of job satisfaction is the absence of job satisfaction, whereas the opposite of job dissatisfaction is the absence of job dissatisfaction. It is important to distinguish these notions because concerning human behavior at work two different sets of needs affect employee satisfaction and motivation (Herzberg et al., 2017, Chapter 12).

Growth/motivator factors are: achievement, recognition for achievement, content of work, responsibility and advancement (Herzberg et al., 2017, Chapter 8). Hygiene (dissatisfactory avoidance) factors are company policy and administration, supervision, interpersonal relationships, working conditions, salary, status and security, extrinsic to job factors (Herzberg et al., 2017, Chapter 8). Hygiene factors do not contribute to job satisfaction; however, scarcity of hygiene factors increases job dissatisfaction, thus hygiene factors are "preventive" to job dissatisfaction. As soon as these factors deteriorate to the level below a certain employee perceives as acceptable, job dissatisfaction occurs (Herzberg et al., 2017, Chapter 12). Similarly, the shortage of motivator factors decreases job satisfaction, and the availability of motivator factors reinforces job motivation since they fulfill the individual's need for self-actualization. People aspire to self-actualization in different spheres of life and the importance of the workplace in this context is central to people's lives (Herzberg et al., 2017, Chapter 12).

One set of needs derives from biologically conditioned stimuli, such as hunger, therefore hygiene factors correlate to low-order needs according to Maslow's theory. The motivator factors relate to the human-specific need for achievement and experiencing psychological growth through achievements and thus correspond to Maslow's high-order needs (Herzberg et al., 2017, Chapter 12; Shields et al., 2020, Chapter 3).

The empirical test of Herzberg's theory has delivered contradictory results about the validity of the theory and the set of hygiene and motivator factors consistent with the original theory (Ozsoy, 2019, pp. 11-13), considering the different cultural, economic and social contexts of the research conducted. The empirical test of Ozsov has revealed the dominant role of monetary reward as a motivator factor for municipal workers in Turkey. The author attributes his finding to the economic and cultural context of the

respondents, claiming that in emerging economies, such as Russia and Turkey, people often are driven to fulfill physiological and security needs. Over time the motivator role of low-order needs decreases and the high-order factors become the motivators in a workplace (Ozsoy, 2019, pp. 17-18).

Job characteristics theory. Hackman & Oldham (1976) have further developed and refined Herzberg's theory by incorporating certain job psychological processes characteristics that can positively influence employee satisfaction and professional performance with their job characteristics theory. The essence of the concept is grounded on the hypothesis of five core job characteristics, which arouse three psychological states, which entail beneficial work outcomes (Hackman & Oldham, 1976, p. 256). The theory is designed to address the positive motivational aspects of work and does not engage with demotivating aspects of work; theory addresses jobs that are performed mainly individually (Hackman & Oldham, 1976, pp. 276-277). Nevertheless, a systematic literature review (Sharp et al., 2009, p. 12) has discovered the dominance of the Hackman & Oldham job characteristics model in the literature about the motivation of software engineers.

There is an empirically proven positive correlation between the perception of an employee of their work characteristics and "affective response" to the job (Brief & Aldag, 1975, pp. 184-185) in other words – behavior and attitude. Job characteristics theory identifies core job characteristics, which prompt psychological states evoking positive outcomes (Hackman & Oldham, 1976, pp. 255-256). Thus, skill variety, task identity and task significance are evoking a sense of meaningfulness in work. Autonomy prompts experienced responsibility for outcomes of work results and feedback delivers knowledge of the actual results of work (Hackman & Oldham, 1976, pp. 255-256).

Work is perceived as meaningful if the job done is believed to be valuable, worthwhile and purposeful according to the system of values of an individual; experienced responsibility occurs when an employee understands personal effort for the results, which is also reported or made aware to be good. As an outcome, employees can experience a self-generated cycle of positive internal motivation (Faturochman, 1997, pp. 2-4). Among other outcomes later research discovered high-quality work performance, high satisfaction with the job and low absenteeism and turnover (Oldham & Hackman, 2010, p. 468), mainly connected to the social attributes of jobs. However, authors recognize that not all employees are equally motivated by the same job with high motivating potential, thus they elaborated moderators – individual-specific characteristics, that moderate level of positive reactions to work, such as individual growth need

strength, knowledge and skills and context satisfaction, especially satisfaction about the security, reward, coworkers and management (Hackman & Oldham, 1980, pp. 82-89).

The following content theories of motivation are utilized as a theoretical framework for the present research:

- Hierarchy of Needs of Abraham Maslow
- Three Needs Theory of David McClelland
- Two-factor Motivation Theory of Frederik Herzberg
- Job Characteristics Theory of Hackman & Oldham

Content theories put a workplace in a central position as a source of fulfillment of individual needs and focus on an organizational effect of the cognitive growth of employees, however, individuals can influence their behavior by consciousness, prioritize their own needs according to the context and pursue the satisfaction of needs via different means outside of the workplace (Locke & Latham, 2004, pp. 395-396; Shields et al., 2020, Chapter 3). The contribution of content theories to the theoretical framework of the present research is the set of low-order needs or hygiene factors, that prevent job dissatisfaction and high-order needs, that correspond to motivator/job content factors and also job characteristics, which support motivation and satisftaction.

However, considering the organizational structure of the case company, the motivational/hygiene role of the monetary compensation for the employees is to be scrutinized. The theoretical finding of the content theories is the notion that the motivation of employees is a by-product of the employee's journey to fulfill their needs (Shields et al., 2020, Chapter 3). Content theories revealed that dominant needs are different for people and not the need as such motivates a person, but the salience of a need (Shields et al., 2020, Chapter 3). The extent of the salience of a certain need as well as the hierarchy of needs in order of importance are contingent on the personal characteristics of an individual (Shields et al., 2020, Chapter 3).

2.2 Process theories

Process theories' central research attention is drawn toward psychological or cognitive processes as the main drivers of motivation. A systematic literature review identified the most applicable classic process theories in software engineers' motivation studies, which are Vroom's expectancy theory and Goal setting theory (Beecham et al., 2007, p. 16; Franca et al., 2012, 2013, p. 9; Sharp et al., 2009, p. 11).

Expectancy Theory. The essence of expectancy theory, elaborated by Victor Vroom and extended by Porter and Lawler is grounded on the statement that individuals differ about which goals and outcomes they prefer over others and once a desired goal is achieved, a sense of satisfaction follows (Vroom, 1964) as cited in (Miner, 2015, Chapter 7). The likelihood of achievement of a desired goal through the actions of an individual guides human behavior (Vroom, 1964) as cited in (Shields et al., 2020, Chapter 3). Thus, according to Vroom, motivation is grounded on these precepted constructs (Vroom, 1964) as cited in (Armstrong, 2020, Chapter 24; Lokman et al., 2022; Miner, 2015, Chapter 7; Shields et al., 2020, Chapter 3):

- Valence – is the function of an individual's origin of motivation, such as needs, goals and values (Vroom, 1964) as cited in (Brent & Polnik, 2012). The reward might be satisfying by itself or be perceived as a means of obtaining a satisfying outcome, for instance buying a house for money instead of accumulating money per se.

- Instrumentality – is the perception of an individual, that a certain level of performance will lead to the desired reward. Thus, instrumentality is the perceived correlation between effort and reward achievement (an instrument for achievement)

- Expectancy – is the individual's perception of the likelihood, that a certain set of actions will assure the performance sufficient for achieving the desired reward. Thus, expectancy is the perceived correlation between effort and performance.

According to Vroom, the strength of motivation is a multiplication of Valence X Instrumentality X Expectancy (Vroom, 1964) as cited in (Shields et al., 2020, Chapter 3). Therefore, motivation occurs if a perceived and effective correlation exists between performance and output, and output can be used to achieve a salient reward or need (Vroom, 1964) as cited in (Armstrong, 2020, Chapter 24), this perception is based on the individual's previous experience, self-efficacy and the possibility of goal achievement. An

individual is believed to choose the behavior with the largest motivation force (Vroom, 1964) as cited in (Brent & Polnik, 2012).

Goal setting theory is a theory of motivation introduced by Locke and Latham (Locke & Latham, 2013) aimed at investigating the reasons why some people perform work tasks better than others. The goal-oriented actions are rooted in biological aspiration for survival for all organisms which is automatic, however, human beings and animals have developed consciousness to guide their actions and benefit from learned behavior, knowledge, experience and make volitional choices. (Locke & Latham, 2013, Chapter 1). The goal is defined by the researchers "as the object or aim of an action" (Locke & Latham, 2013, Chapter 1). Goals have two main characteristics: content (sought result) and intensity (an effort needed to set a goal, a position of goal in an individual's hierarchy of goals and degree of commitment to the goal) (Locke & Latham, 2013, Chapter 1).

Numerous research and meta-analysis have proved the hypothesis that specific and challenging goal results in higher performance than abstract (such as "do your best") or the absence of any goal (Locke & Latham, 2013, Chapter 1). Another important update since the original theory is the study, which revealed that a challenging goal results in 250% higher performance than the easiest goals (Locke & Latham, 2013, Chapter 1). This finding is fair until an employee riches the limit of their ability (Locke & Latham, 2013, Chapter 1) and high task complexity (set of different and complex skills, such as attention, memory, and information processing) is negatively correlated with performance (Wood, 1986, p. 76; Wood et al., 1987, pp. 420-421).

Goals are discovered to affect performance in four directions, three of which are motivational. First is a directive function, i.e. goal directs attention and effort toward goal-relevant activities and activates skills and knowledge required for achieving a goal. This function is cognitive and behavioral (Locke & Latham, 2002, p. 706). The second function relates to the effort an individual exerts toward goal achievement. The challenging goal is driving effort with a linear correlation to the level of goal difficulty (Locke & Latham, 2002, p. 706). The third mechanism is persistence, which results in longer time spent pursuing more challenging goals. Tight deadlines provoke more rapid and intense effort; however, such work is possible for a shorter period (Locke & Latham, 2002, p. 707). The fourth mechanism is cognitive by nature – arousal of skills, knowledge and task performance strategy to attain a challenging goal, when direct attention, effort and persistence are not enough (Locke & Latham, 2002, p. 707, 2013, Chapter 1). Individuals with high self-efficacy are more capable of developing task strategies than people with lower self-efficacy and

when people face complex tasks “do your best” strategy is proved to be more effective (Locke & Latham, 2002, p. 707).

Goal setting theory thus contradicts Vroom’s expectancy theory with its motivational role of highly challenging goal, while Vroom’s theory claims that the expectancy of a goal attaining due to one’s effort drives an individual’s actions. Expectancy has a positive correlation with performance, and expectancy to achieve a difficult goal might be vague, thus resulting in lower performance (Locke & Latham, 2002, p. 706). However, meta-analysis and an empirical study conducted by Klein (1991) found similar evidence, that expectancies, when interpreted as a set of several outcomes, positively correlate with choices of goals, performance and commitment and thus expectancy theory predicts goal choices and commitment to certain goals. Another alternative allowing to align goal setting and expectancy theory is within distinguishing goal levels. Thus, higher goal levels presuming lower expectancies are associated with higher performance, therefore goal level limits the influence of lower expectancy (Locke & Latham, 2002, p. 706). This research also aims at scrutinizing the role of monetary reward for the case company’s employees and the goal setting theory has discovered, that for goals of moderate difficulty reward for achieving a goal is an effective strategy, however for a challenging goal more effective is the reward for progress or performance, rather than attaining a goal (Locke & Latham, 2013, Chapter 1).

The following process theories of motivation are found relevant to the present research:

- Expectancy Theory of Victor Vroom
- Goal Setting Theory of Edwin Locke and Gary Latham

2.3 Motivation of software engineers

Numerous research in psychological, sociological, and organizational domains aims at studying the personal and professional identity of software engineers in order to identify the integrated portrait of a tech professional. Zemnukhova, (2013, pp. 412-415) and Starceva (2016) have studied IT professionals as a social unit based on a common professional identity. According to their findings, IT professionals, despite being an internally eminently heterogeneous group, still are substantially identified with the professional community and are disassociated from the “others” (Zemnukhova, 2013, p. 415). According to the resource-based approach to the analysis of social stratification of Russian society, researchers have

identified, that the IT professional community has access to certain types of resources, that distinguish them as a community, including certain set of personal resources, such as work motivation, commitment [to professional community] and other personality characteristics (Starceva, 2016).

Cruz and colleagues (2015, p. 95) have conducted a systematic literature review of theoretical and empirical research about the personality characteristics in software engineering and could not identify any valid results about the influence of personality on software engineering processes due to the various personality tests used and especially due to the interpretations of these tests results made by the researchers who are not trained either qualified in assessing the findings. However, the researchers have supported the findings of sociological research of Zemnukhova, (2013, p. 415) and Starceva (2016) about the evident difference between software engineers as a distinct occupational group, having similar personality types and the distribution of studied personality types among the general population. The integrated findings revealed that software developers have tendencies toward introversion, intuition and thinking preferences, corresponding with three certain types (ISTJ, INTJ, and INTP) of Myers–Briggs Type Indicator (MBTI) personality types (Cruz et al., 2015, p. 106; The Myers & Briggs Foundation, 2014).

A systematic literature review on software engineers' motivation, as a distinct occupational group, conducted by Beecham and colleagues (Beecham et al., 2007, p. 12) has revealed that the most specified literature characteristics of software engineers are: growth-oriented, introverted, creative, technically competent, marketable and autonomous. A separate set of found characteristics are in essence needs, rather than characteristics, i.e. the need for: variety, challenge, identity with group, competent supervisors, feedback, contribution, involvement in personal goal setting, stability (geographic and organizational) (Beecham et al., 2007, p. 12). The extent to which these characteristics are notable for an individual is mediated by such factors as managerial or technical role preference, innate abilities and MBTI personality type; and the context nature, i.e. the state of the profession, career stage, national culture, job role and organization (Sharp et al., 2009, p. 8).

Motivators discovered for software engineers can be split into extrinsic or outer to the job itself, and intrinsic or originating from the "joy of the craft" (Brooks, 1995, p. 7). Self-determination theory is an approach that adopts empirical methods to investigate the conditions for individuals to support positive processes natural for human beings, such as curiosity, vitality and natural activity, referred to as intrinsic motivation (Ryan & Deci, 2000, p. 68). Empirically Ryan and Deci (2000, p. 68) identified the "innate psychological needs" that drive these positive processes, namely the need for competence, relatedness

and autonomy. Cognitive evaluation theory (Ryan & Deci, 2000, pp. 70-71), which aims at studying the factors under the variability of intrinsic motivation goes beyond the purpose of the present work, however, its findings that intrinsic motivation is inherent, and it flourishes in suitable circumstances, which are – "optimal challenges, effectance-promoting feedback and freedom from demeaning evaluations" are relevant for this study. People are intrinsically motivated by activities, that have value for them, and which contain novelty, challenge and esthetic value (Ryan & Deci, 2000, p. 70).

Extrinsic motivation relates to the activities, that create a separate outcome (Ryan & Deci, 2000, pp. 71-72), in other words, is driven not by the inner joy of crafting, but by a desire to gain "reward" for doing the activity. However, with the proper extent of autonomy, extrinsically motivated people can demonstrate high performance, engagement and relatedness. This happens when outer regulations are perceived as congruent with individual own values and needs, and when intrinsically motivated behavior is encouraged or valued by a significant individual (Ryan & Deci, 2000, pp. 72-73).

Thus, intrinsic motivators of software engineers, discovered by Sharp and colleagues (Sharp et al., 2009, p. 9) in their systematic literature review on models of motivation in software engineering, are task identity (clear goals, personal interest, knowing the purpose of the task, how it fits in with the whole, job satisfaction; producing an identifiable piece of quality work), employee participation, career path, recognition for work done, variety of work, development needs addressed, technically challenging work, autonomy, making a contribution, empowerment/responsibility, equity, trust/respect.

Along with that, the research team has discovered an array of motivators in the profession itself, and all these factors are intrinsic: challenging profession, changing, problem-solving, beneficial, scientific, experimental, team working, development practices and project lifecycle models (Sharp et al., 2009, p. 9). The extrinsic motivators for software developers are good management, a sense of belonging, rewards and incentives, feedback, job security, good work-life balance, appropriate working conditions, a successful company, sufficient resources (Sharp et al., 2009, p. 9). The outcomes of motivated software engineers in literature were found as follows: retention, productivity, project development time, cohesion with budgets, low absenteeism and project success (Beecham et al., 2007, p. 15; Sharp et al., 2009, pp. 5-6).

Therefore, the integrated theoretical concept of motivation for software engineers is presented in Figure 1, developed by the researcher as a combination of meta-theory of motivation, combining process and content theories of motivation (Locke & Latham, 2004, p. 390) and model of motivation for software

engineers derived from systematic literature review (Sharp et al., 2009, p. 11). This integrated theoretical framework is an attempt to draft a concept of motivation for software engineers of the case company, where, as a backbone, is utilized motivation meta-theory, developed by Locke and Latham (2004, p. 390). From the original meta-theory of Locke and Latham (2004, p. 390) only those motivation theories are adopted, which were utilized by the previous research on software engineer motivation studies (Beecham et al., 2007, p. 16; Franca et al., 2012, 2013, p. 9; Sharp et al., 2009, p. 11). For the present research concepts of motivation is a central theoretical framework, since outcomes of software engineers' motivation are productivity, project development time, cohesion with budgets, low absenteeism and project success (Beecham et al., 2007, p. 15; Sharp et al., 2009, pp. 5-6) together referred to as performance and retention, which are the focus of interest for the case company and thus the aim of the present research.

Meta-theory of motivation, developed by Locke and Latham (2004, p. 390) as a combination of a plethora of content and process theories of motivation, developed during the decades of motivational research, serves as a theoretical background for the concept of motivation draft of the case company employees. However, only the part of Locke and Latham's (2004, p. 390) meta-theory is adopted for the purpose of the present research, containing the most influential motivation theories for software engineers derived from a systematic literature review, conducted by Helen Sharp and colleagues (2009, p. 9). This meta-theory was enriched with empirical findings, such as which personality characteristics, needs, mediators and moderators are discovered as attributes of software engineers' motivation in systematic literature reviews (Beecham et al., 2007; Sharp et al., 2009). Therefore, the integrated concept of motivation for the case company software engineering team, presented in Figure 1 is a theoretical framework for research question 1.

1. Which factors contribute to employee motivation in the case company?

Motivation starts with employees' needs, but how exactly work values grow out of needs is poorly proven empirically (Locke & Latham, 2004, p. 389), however, the fact that software developers have distinct personality is based on evidence (Beecham et al., 2007, p. 3; Sharp et al., 2009, pp. 3-4; Starceva, 2016; Zemnukhova, 2013, p.415; Cruz et al., 2015, p. 106). Personality characteristics mediate employees' orientation toward certain motivation factors (Beecham et al., 2007, p. 1). Values and personality influence goal choices and self-efficacy. Goals are moderated/enhanced by feedback, individual's ability (instrumentality), commitment and task complexity (expectations). Goals affect performance and other

outcomes with such mechanisms as direction, effort, persistence and task strategies. Job characteristics affect satisfaction and hence enhance performance and outcomes, such as motivation, retention, productivity and success (Locke & Latham, 2004, p. 391; Sharp et al., 2009, pp. 5-6).

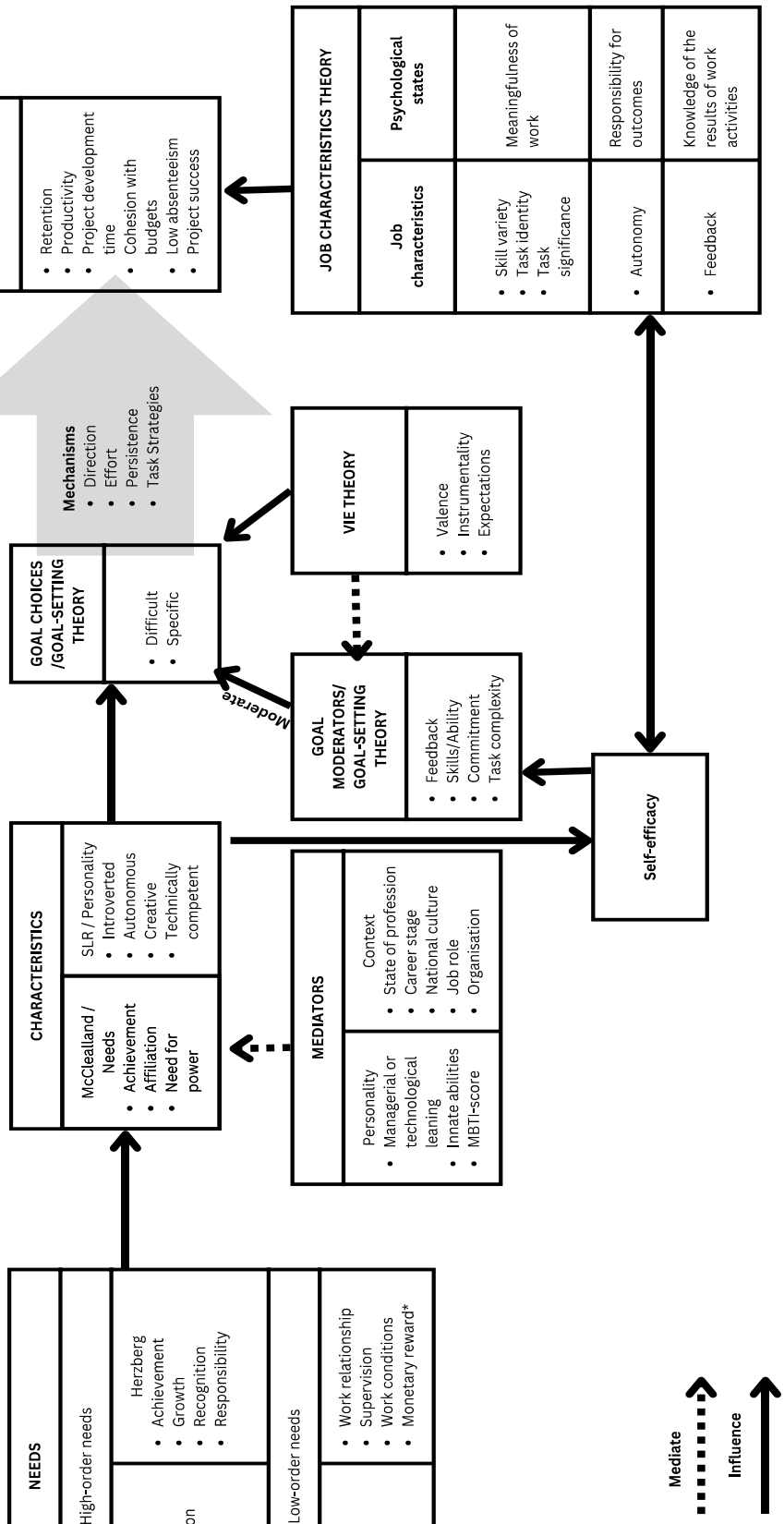

Figure 1. Integrated concept of motivation for the case company software engineers

3 Knowledge management

Motivation theories constitute the theoretical framework of individuals' lean toward certain job roles, factors, affecting the achievement of job-related goals and retention. Individual differences in cognitive abilities to acquire task-relevant knowledge is a key factor allowing to anticipate workplace performance outcomes (Colquitt et al., 2000, pp. 679-680).

The purpose of this section is to investigate theoretical concepts of explicit cognition and how it correlates with psychometric intelligence, along with implicit cognition, which contributes to complex cognition (Hadjimichael & Tsoukas, 2019, p. 20; Kaufman et al., 2010, p. 321; Montuori & Montefiori, 2022, p. 2; Yao Lartey et al., 2022, pp. 10-11), along with identifying their role in tacit knowledge.

Resource-based model of the strategic management domain depicts an organization as a set of exclusive resources and capabilities, that can bring a company above-average returns on investment, provided being strategically pursued (Hitt et al., 2016, p. 16). The authors further mention three categories of resources: physical (equipment, buildings, etc.), organizational capital and human capital – the skillset of employees and managers. The ability to combine tangible and intangible resources to create services is called organizational capabilities, which in turn is the ground for developing core competencies. Core competencies are the source of a company's competitive advantage (Hitt et al., 2016, p. 4).

Capabilities originate from exchanging knowledge and obtaining expertise by the company's employees and managers (Hitt et al., 2016, p. 13) and it is argued that tacit knowledge plays a key role in the development of employees' expertise (Hadjimichael & Tsoukas, 2019, p. 14). Managerial level and practices are not under the investigation of the present research, due to the cultural context with large power distance, meaning that the society members accept the unequal distribution of power within the society (Hofstede, n.d.) and stemming from it possible distortions with collected data validity and credibility.

3.1 Tacit knowledge

Tacit knowledge is understood as practical knowledge of work-related skills, obtained informally in the workplace (Fenoglio et al., 2022). Tacit knowledge is the central driver of practical intelligence (Kaufman & Grigorenko, 2008, Chapter 5) and originates from an implicit learning experience (Montuori & Montefiori, 2022, p. 4; Reber, 1989, p. 219). Tacit knowledge, as conceptualized by Sternberg, can be conscious (explicit) and non-conscious (implicit) (Sternberg et al., 1981) as cited in (Kaufman & Grigorenko, 2008, Chapter 5) or articulable and non-articulable as conceptualized by Busch and colleagues (2003) and it can be shared to some extent verbally or by example/imitation (Davies, 2015, pp. 1-2). Thus, tacit knowledge derives from the combination of implicit learning and explicit learning.

The ability to automatically identify and distinguish complex consistencies in surrounding is the basic aspect of human cognition. Mostly this learning occurs unintentionally, and it significantly contributes to structuring our skillset and drives our behavior. Such learning is referred to as implicit (Kaufman et al., 2010, p. 321).

Implicit learning is a set of automatic, unintentional, unconscious and associative processes, which is distant from conscious, purposeful learning processes, referred to as explicit learning, which is associated with working memory and executive functioning (Kaufman et al., 2010, p. 321). Implicit learning is an ability, and it is shaped by such individual factors as openness to experience, intuition (alternatively conceptualized as personality type by MBTI, personal perception), impulsiveness (“tendency to make decisions without premeditation”) (Kaufman et al., 2010, p. 337) and it is more protected from cognitive disruptions and was proven to be not affected by anxieties, while tasks, related to explicit learning, are affected (Montuori & Montefiori, 2022, p. 5).

Based on the assumption of individual differences in implicit learning ability independent of psychometric intelligence and explicit learning ability, Kaufman and colleagues (2010, p. 321) found empirical evidence of verbal reasoning skill, processing speed, academic performance and self-reported personality to predict the implicit learning ability (Kaufman et al., 2010, pp. 334-336) and the implicit learning ability itself predicts high potential in metaphoric thinking, abstract thinking and language acquisition skills (Montuori & Montefiori, 2022, pp. 4-5). However, further practical application of implicit learning predictors is very

challenging due to procedural limitations to measuring implicit learning ability in organizational conditions during the interviews with candidates (Montuori & Montefiori, 2022, p. 8).

Implicit learning has been stated to potentially contribute to workplace performance to the extent that successful acquisition of work-related skills predicts workplace performance (Montuori & Montefiori, 2022, p. 7), however, findings of Danner (p. 32) show that implicit learning and dynamic decision-making (which can be positively correlated to psychometric intelligence) show a strong correlation with objective professional success (social status, educational attainment and income) until psychometric intelligence is considered as a predictor (Danner, 2011, p. 21). A possible explanation of these opposite findings might lie within the different nature of work-related skills to be acquired. However implicit learning does not strongly correlate to professional success, this type of cognition is nonetheless integrated into general cognitive ability as a separate ability component (Danner, 2011, p. 32), even though further research on this contribution mechanism is needed.

Explicit learning is the process, implying learning the type of knowledge that the possessor can obtain intentionally, consciously find regularities, articulate, formalize and transfer verbally (Andringa & Rebuschat, 2015, p. 187; Davies, 2015, p. 1; Fenoglio et al., 2022). Explicit knowledge is formal and systematic and therefore transferrable in various forms (Nonaka, 2008), starting from a product specification to instructions and procedures.

Explicit knowledge has been empirically proven to strongly correlate with workplace performance to the extent that workplace performance results from the effects of cognitive ability, particularly the acquisition of job-relevant skills and on-the-job problem-solving skills (Montuori & Montefiori, 2022, pp. 6-7). As discussed in the previous paragraph in the goal setting theory part, the effects of task complexity on motivation have been discovered as affecting workplace performance, which stems from cognitive ability (Kaufman et al., 2010, p. 322-323) and the level of task complexity that an individual is capable of performing depends on individual's cognitive abilities (Hunter et al., 1990, p. 38).

This effect stems from basic cognitive mechanisms, behind explicit learning ability, precisely: working memory, explicit associative learning, and processing speed which contribute to psychometric intelligence (Kaufman et al., 2010, p. 322-323). And psychometric intelligence is the key predictor of learning outcomes and explicit learning in its turn predicts workplace performance. Its effect on workplace performance is mediated by learning task-relevant skills and by job-specific knowledge, which occurs during training in the workplace (Kaufman et al., 2010, p. 322).

On the overlapping of implicit and explicit learning rests tacit knowledge, which is an unexpressed knowledge, gained from experience (Kaufman & Grigorenko, 2008, Chapter 5). Tacit knowledge "is highly personal" (Nonaka, 2008) and originates with an individual's mastery and commitment to a certain craft, therefore it is difficult to elicit, formalize and pass to others.

Tacit knowledge is associated with the company's ability to achieve competitive advantage and increased performance, even when there is an excessive, above required, number of human resources possessing tacit knowledge (Lecuona & Reitzig, 2014). Tacit knowledge is reported to show a meaningful association with performance (Kaufman & Grigorenko, 2008, Chapter 5), however, implicit learning does not reportedly show any meaningful correlation to workplace performance (Danner, 2011, p. 32), thus probably it is the input of explicit learning into the tacit knowledge, which contributes to the effect on performance.

The ability to acquire tacit knowledge from everyday work-related practices and apply this knowledge to cope with everyday practical situations on incomplete data is referred to as practical intelligence (Kaufman & Grigorenko, 2008, Chapter 5). Practical intelligence is conceptualized as a skill and therefore it is developed with experience (Kaufman & Grigorenko, 2008, Chapter 5). The development of practical intelligence is an effort, it is driven by certain constructs, not stemmed from ability, such as motivation and personality, which affect work-related performance and outcomes and are addressed in the previous chapter (Ericsson et al., 2018, pp. 774-775).

Acquisition of tacit knowledge is driven by cognitive components, which allow one to manipulate the information about the context in an often nonconscious manner and apply this information in new circumstances (Kaufman & Grigorenko, 2008, Chapter 5). These components are: selective encoding, selective comparison, selective combination, and they allow to increase the volume of tacit knowledge and affect the behavior through practical intelligence (Ericsson et al., 2018, p. 774). This behavioral domain is attributed to implicit learning (Kaufman & Grigorenko, 2008, Chapter 5; Kaufman et al., 2010, p. 337).

Practical intelligence and tacit knowledge are the requisites to develop expertise (Ericsson et al., 2018, Chapter 39). Expertise is a level of mastering the skills, that allows one to outperform in a consistent manner other individuals, possessing the same skills (Ericsson et al., 2018, Chapter 38). In practice, expertise can be captured by the reduced effort of an expert to find the most optimal solution for a problem. Thus, chess grand masters consider smaller chess combinations in search of the most effective

move (Baumard, 1999). And this process of seeking the move is tacit. Numerous research discovered the correlation between a certain display of expertise and tacit knowledge (Ericsson et al., 2018, Chapter 38). For instance, people achieving higher scores on tests, measuring tacit knowledge, such as STAT-test and tacit knowledge inventories, have demonstrated higher levels of performance, measured with domain-specific criteria. (Ericsson et al., 2018, Chapter 38).

However, in the software development industry criteria for one's expertise are not unambiguous and independent of self- and/or peer assessments. Thus, Petre (2002, p. 2) claims that an expert in the industry is someone with over ten years of hands-on programming experience, practice in applied high-scale high-load real-time problem solving, proficient in multiple programming paradigms and is acknowledged by peers as an expert. In the qualitative study of large-scale projects Curtis and colleagues (1988, p. 1271) found a similar pattern, they interviewed software developers from multiple projects, who named one or two project gurus, who actually "saved the project" and while the original purpose of the study was to investigate organizational factors contributing to successful project development practices, this uneven distribution of expertise within the team could not be ignored. These experts were designated as an "intellectual core of the project" by other team members (Curtis et al., 1988, p. 1271). Nonetheless, domain-independent characteristics of an expert include the approaches to knowledge organization, storage and access to this knowledge in an expert's memory (Bryant, 2005, p. 20; Curtis et al., 1988, p. 1272; Petre, 2002, pp. 3-5) as well as correlation with years of experience (Bryant, 2005, p. 25; Petre, 2002, p. 2).

Theoretical findings constituting the framework of tacit knowledge acquisition is compiled by the author of the research into the following schema and demonstrate a graphical representation of key theoretical findings from this chapter. Individual differences in cognitive abilities to acquire task-relevant knowledge is a key factor allowing to anticipate workplace performance outcomes (Colquitt et al., 2000, pp. 679-680). Knowing how to solve practical workplace tasks is referred to as tacit knowledge. Tacit knowledge is knowledge acquired at work through personal experience, is procedural, i.e. has practical implications for solving real-life tasks and influences behavior since it is relevant to personal goals (Ryan, 2005). Tacit knowledge can be conscious (explicit) and non-conscious (implicit) (Kaufman & Grigorenko, 2008, Chapter 5) and thus it can be articulable and non-articulable as conceptualized by Busch and colleagues (2003) and it can be shared to some extent verbally or by example/imitation (Davies, 2015, pp. 1-2). Thus, tacit knowledge is acquired with implicit learning and explicit learning.

Explicit learning is associated with psychometric intelligence and basic cognitive mechanisms, such as working memory, explicit associative learning and processing speed (Kaufman et al., 2010, p. 321). Psychometric intelligence is a predictor of learning outcomes (Montuori & Montefiori, 2022, p. 4) and learning is a predictor of workplace performance, mediated by training in a workplace and work-related skills acquisition (Colquitt et al., 2000, pp. 679-680). Tacit knowledge is associated with the company's ability to achieve competitive advantage and increased performance (Lecuona & Reitzig, 2014), and even though tacit knowledge contains unintentional and unconscious implicit learning, which is integrated into general cognitive ability, there is no empirical evidence, that implicit learning contributes to workplace performance (Danner, 2011, p. 32).

The ability to acquire tacit knowledge from everyday work-related practices and apply this knowledge to cope with everyday practical situations on incomplete data is referred to as practical (Kaufman & Grigorenko, 2008, Chapter 5). Practical intelligence and tacit knowledge are the requisites to develop expertise which is understood as a level of mastering the skills, that allows to outperform in a consistent manner other individuals, possessing the same skills (Ericsson et al., 2018). Curtis and colleagues (1988, p. 1271) found that in the development of large software systems, interviewees name project gurus, who actually "saved the project". Such level of mastery or expertise Busch and colleagues conceptualize as tacit knowledge in the software engineering industry - articulable implicit managerial knowledge on how to perform software projects (Busch et al., 2003). Thus, domain-specific tacit knowledge is conceptualized as expertise in general research on tacit knowledge(Kaufman & Grigorenko, 2008, Chapter 5). Since workplace performance, which is the topic of the present research, is affected by learning and tacit knowledge acquisition, studied in the present chapter, a summary of key findings of the chapter is compiled into Figure 2, developed by the author of the present research.

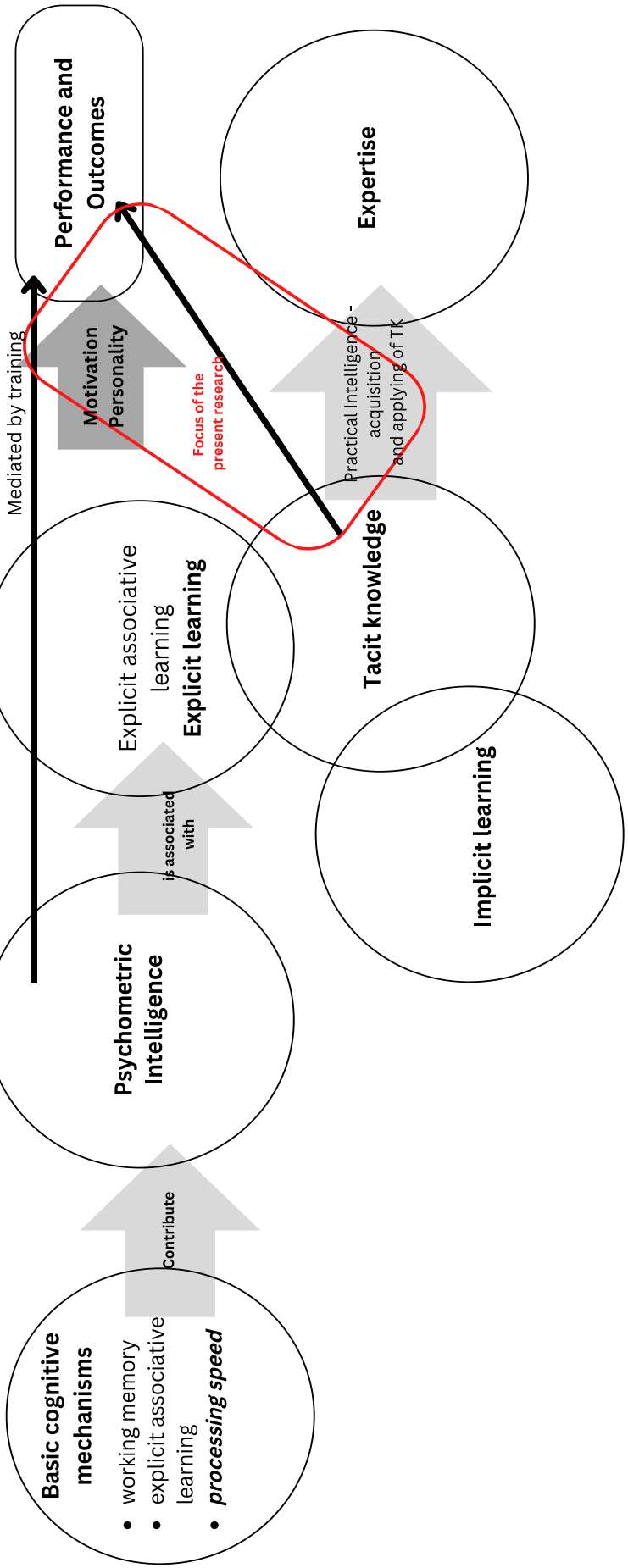

Figure 2. Integrated concept of learning process

3.2 Tacit knowledge transfer

Tacit knowledge is work-related knowledge utilized to solve practical work problems learned informally and stored in the heads of employees, however, it belongs to the company (Fenoglio et al., 2022) since it was created during working hours at the company's facilities. Due to the implicit nature of tacit knowledge and the absence of a systematic approach within companies to collect and incorporate this knowledge into companies' knowledge base, tacit knowledge transfer happens to a significant extent informally and in a disorganized manner, for example via on-site training, one-on-one mentoring, through internal reports and rules collector systems (Fenoglio et al., 2022).

A conventional approach toward an organized tacit knowledge transfer process is a knowledge lifecycle framework. Thus, Nonaka depicts a "spiral of knowledge", where knowledge comes through a certain spiral (Nonaka, 2008):

1. Socialization stage, when tacit knowledge of one individual becomes tacit knowledge of their peer(s), tacit-to-tacit

2. Articulation stage, when tacit knowledge is becoming explicit with attempts to test and apply it to the practice, tacit-to-explicit

3. Combination stage, when an individual is combining different pieces of explicit knowledge into a new explicit procedure, explicit-to-explicit

4. Internalization stage, when new explicit knowledge is diffused within an organization, thus refining the tacit knowledge of employees, explicit-to-tacit (Nonaka, 2008).

According to the author, this spiral of knowledge is a dynamic process, where articulation and internalization are the critical stages, and the approach toward managing these unstructured processes is for the company to articulate the role of tacit knowledge and organize team members' rotation and cooperation (Nonaka, 2008).

A different perspective of knowledge lifecycle framework is suggested by Birkinshaw and Sheehan (2002, p. 76) in the managerial context of generating revenue from a certain stage of the knowledge lifecycle and thus managing the processes happening during every stage, which are:

1. Creation, or nurturing an idea in one's head
2. Mobilization, or testing and modification of an idea as a prototype
3. Diffusion stage, or circulation of an idea in the domain
4. Commoditization, or an idea, becoming the actual knowledge (Birkinshaw & Sheehan, 2002, p. 76).

Unlike Nonaka (2008), Birkinshaw and Sheehan (2002, p. 82) believe that companies can only effectively act in one or two stages of knowledge, generating revenue from the processes happening during the stage. Despite for different contexts of application of the knowledge lifecycle framework, both approaches highlight the central role of informal communication between individuals for tacit knowledge transfer, and the role of a company or management in this process is to provide space and time and facilitate the process (Birkinshaw & Sheehan, p. 79, 2002; Nonaka, 2008). Similar findings were presented by Curtis and colleagues (1988, p. 1272) who identified the role of direct articulation of ideas usually happening in the form of knowledge sharing of an expert with the team members.

Numerous research state, others imply the role of trust in the process of tacit knowledge transfer (Roberts, 2000, p. 430; Shafiei Sarvestani et al., 2022, p. 325; Zaqout & Abbas, 2012, p. 345). Trust has been articulated as a prerequisite for successful knowledge transfer (Roberts, 2000, p. 430). Empirical findings of Sarvestani and colleagues (2022, p. 325) and Zagout and Abbas (2012, p. 345) support this thesis, however, research of Shah & Mahmood (2016, p. 502) discovered the opposite results, which might be rooted in the contextual and cultural differences between the pool of respondents from the studies conducted. Roberts (2000, p. 434) identified the influence of social context on building trust between employees, which is facilitated by shared cultural, social, national and linguistic backgrounds, and mitigated by different cultural and social backgrounds. Neither use of ICT technology can enhance this process unless people have invested time and effort into building direct face-to-face social communities (Roberts, 2000, p. 437).

Amongst other knowledge transfer enablers, research revealed empirical evidence about the role of supportive leadership and individual enablers, such as enjoyment in helping others (altruism) and self-efficacy, having positive relation to knowledge-sharing behavior in an organization (Cavaliere et al., 2015, p. 6, p. 14). However, a supportive leadership style has a strong correlation with knowledge sharing

(Cavaliere et al., 2015, p. 2), leadership domain goes beyond the scope of this research, while individual factors, which have been studied in the previous chapter on motivation theories, are to be stated.

A study on knowledge-transfer barriers has identified a lack of educational background, inadequate training and lack of knowledge platforms to operate effectively in a knowledge-based environment (Yao Lartey et al., 2022, p. 2). Teng & Chennamaneni (2011, p. 6) have introduced a framework for effective tacit knowledge transfer based on the level of knowledge tacitness. Organizations can adopt and utilize the present framework according to their organizational conditions and strategy, since knowledge-creation processes, i.e. the articulation of tacit knowledge into explicit (Hugo-Burrows, 2022, p. 64), are context specific (Shariq & Vendelo, 2006, pp. 833-834).

Degree of knowledge tacitness	Knowledge transfer mechanisms
High (creative and entrepreneurship skills)	• Apprenticeship • Mentoring
Medium (unrecognized knowledge)	• Apprenticeship • Mentoring • Metaphor • Analogies • Story Telling • Concept Mapping • Process Mapping • Repertory Grid • Fish Bone • Prototype • Brainstorming
Low (skills learned explicitly, but internalized, technical skills)	• Expert Systems • Case Based Systems • Neural Networks • Brainstorming • Expert Interviews (Structured) • Protocol Analysis • Lessons learned • Best Practices

Table 1. Framework for effective tacit knowledge transfer, Teng & Chennamaneni (2011, p. 6)

The next chapter is devoted to the investigation of the organizational conditions, contributing to the knowledge-creating processes.

3.3 Organizational implications on knowledge management

Investigating individuals without understanding an organization in which they are integrated and vice versa is a complicated exercise (Argyris, 2017, Chapter 1). The case company is characterized by little hierarchy, the absence of a middle management level, a high level of employee autonomy, and a policy of open doors, granting direct access to the decision-makers. One might refer to the case company as a "flat organization", "liquid organization", or "bossless company" (Doblinger, 2022, p. 2; McCaffrey, 2022; Sharma, 2021, p. 2).

McCaffrey (2022) argues that a flat organization is only vital in a certain context of a stable environment and apart from being unscalable, often struggles for financial performance and innovativeness. However, the same limitations are attributed to hierarchical organizations (Lee & Edmondson, 2017, p. 4), and other authors the contrary state that flat organization is designed to address the challenges of VUCA (Volatility, Uncertainty, Complexity and Ambiguity) (Pfutzenreuter et al., 2021, p. 11). The lack of reliable empirical studies on flat companies' performance and soundness, as well as insufficient theoretical background for this organizational structure (Lee & Edmondson, 2017, p. 15), is another challenge to conceptualize the case company as flat for the purpose of this research.

Nonetheless, internal organizational characteristics of the case company might positively influence learning and performance results. Further in this chapter notion of knowledge management (KM) is utilized as a set of guided activities intended to create, diffuse and utilize knowledge for the purpose of achieving the goals of an organization (Mahmoudsalehi et al., 2012, p. 519). Such internal organizational characteristics, which are universal for companies – structure, culture, and strategy – constitute an organizational environment in which a company acts (Zheng et al., 2010, p. 764). Numerous research, however, unite organizational structure and culture into the organizational context/environment and little focus on investigating the effect of these enablers on KM separately from each other (Sadovykh & Sundaram, 2015).

Knowledge management is hypothesized as a mediator of organizational context on organizational performance. Thus, KM was discovered to fully mediate the influence of culture on organizational performance and partially mediate the impact of structure and strategy on organizational performance (Zheng et al., 2010, p. 763). In turn, KM is context-dependent, since the actors and authors of KM are defined by the context (Nonaka, 2008). Lee and Choi (2000, pp. 205-206) have provided empirical

evidence, that organizational structure and culture are essential factors, affecting the KM processes. According to the sociotechnical framework, structure, culture and people are social subsystem, enabling KM, while the technical subsystem comprises information technology tools, techniques and knowledge (Lee & Choi, 2000, pp. 188-189). Customers are a part of the environmental subsystem (Lillies, 2011, p. 16). A sociotechnical framework is an approach to designing job-related processes aiming at balancing the social and technical variables of a workplace to address inner and outer challenges and achieve organizational goals. (Ghosh & Sahney, 2011, p. 34)

The evolution of the organizations within the sociotechnical framework is guiding companies from mechanistic bureaucratic hierarchical structures to self-managed teal organizations (Ellis, 2022, pp. 3-4). While a teal organization is an "ideal" and yet unachievable form of organizational structure, Lillies (2011, pp. 82-84) argues that "adapting organization" is compatible with a knowledge-driven strategy of a learning organization. According to Jankowicz (2000, p. 472), in theoretical sources learning organization is conceptualized as "adaptive", since it can pass through turbulent conditions and achieve its goals, while the concept of adaptive organization implies, that an organization can question and review its goals.

Organizational structure attributes, that are most widely studied, are – centralization, formalization, integration and complexity (Chen & Huang, 2007; Lee & Choi, 2000, p. 188; Liao et al., 2011, p. 729; Mahmoudsalehi et al., 2012, p. 521). Centralization is a concentration of control and decision-making authority within one unit. Formalization refers to a degree by which decisions are guided by prescribed procedures and rules. (Lee & Choi, 2000, p. 192). The empirical research on these factors' contribution to KM processes has revealed that centralization is negatively correlated to KM, while formalization does not significantly negatively affect KM (Lee & Choi, 2000, pp. 205-206). These results coincide with the empirical findings of other groups of scholars, who argue that decentralized organizational structure contributes to enhanced KM processes (Chen & Huang, 2007; Mahmoudsalehi et al., 2012, p. 526). However, research conducted within a medical center has demonstrated the opposite correlation, and an enhanced level of organizational learning management is associated with a greater level of centralization (Shamir-Bladerman, 2021, p. 12). These findings are explained by the domain-specific conditions of the studied organization (Shamir-Bladerman, 2021, p. 12). And the results regarding formalization was partly coinciding with the findings of Liao and colleagues (2011, p. 733), who studied the effects between variables in an uncertain environment and discovered the positive correlation between KM and formalization.

Complexity means how clearly an organization defines and distinguishes specific functions and roles. Integration presumes the level of coordination of actions and efforts of separate units and/or individuals within an organization. Both were positively correlated to the KM practices development (Chen & Huang, 2007; Liao et al., 2011, pp. 732-734; Mahmoudsalehi et al., 2012, p. 526). Chen & Huang (2007) attribute these results to the fact that in less centralized, less formalized and more integrated organizations social interaction is more favorable, which enhances the processes of knowledge creation, sharing and utilization due to the enablers, such as trust and others, studied in the previous section.

Liao and colleagues (2011, pp. 732-734) have discovered a similar positive correlation between KM capability and integration, complexity and formalization, while the authors claim that environmental uncertainty is the enabler of these structural changes. These findings indicate that organizations operating in uncertain environment are forced to use more formalized, integrated structures and complex mechanisms in order to deliver more results with fewer resources (Tran & Tian, 2013, p. 3) which is possible with enhanced application of knowledge, which is in turn effectively cultivated in order to function in an uncertain environment (Liao et al., 2011, pp. 734-735). Authors of the research believe that organizations with enhanced KM capabilities will be pushed to adopt hybrid organizational forms, where key functions, such as finance, are centralized, and functions requiring the use of tacit knowledge, such as marketing, are decentralized for enhancing organizational adaptability and resilience in an uncertain environment (Liao et al., 2011, pp. 734-735).

Performance of robust (hybrid) structures, however, was found to be the worst during the Dynamic Distributed Decision-Making simulation, measured by Hollenbeck (2000), and was mostly affected by the cognitive abilities of team members, while the divisional (decentralized) structure's performance was identified as most effective during the uncertain and unpredictable environment. The test revealed that divisional structure performs with stable results regardless of the cognitive level of its team members, as long as the environment remains unpredictable (Hollenbeck, 2000). This effect is an interesting topic for further research to uncover mechanisms with which cognitive abilities, which predict the acquisition of explicit knowledge and tacit knowledge consequently, become insignificant to the performance of decentralized teams in uncertain environment.

Within the sociotechnical framework, a self-managed team is a critical condition for high performance, and along with high demand for challenging managerial changes in order to align strategic goals with the demand for high autonomy, there must be practices designed to address group (team) dynamics and

behavior. Empirical evidence reveals that self-managed teams adapt individual behavior as well as collective structures to ensure self-management and performance. Therefore, it is recommended to limit the hierarchical functions in order to provide guidance and confidence to support the teams in their operations (Pfutzenreuter et al., 2021, p. 2). Decentralization of decision-making was identified as the most important internal factor, affecting the organizational structure, while customer interaction was identified as the most powerful external, or staying outside of the organization's control, factor, influencing organizational structure (Tran & Tian, 2013, p. 6).

According to the socio-technical framework and research of Lee and Choi (2000, p.191) on knowledge management enablers' effect on organizational performance, organizational culture, organizational structure, people and information technology are knowledge management enablers. For the purpose of the present research culture and IT-technology are excluded from the scope of research. The case company organizational performance, measured by financial results compared to the industry results in Finland is presented in Table 3 in the empirical section further. These numbers indicate yearly growth in revenue and margin, which along with a 100% talent retention rate allows to estimate the processes, happening in the case company as positive and worth attention and investigation, which is the key focus of the present research with the aim at identifying key contributors of employees' retention and performance. Organizational performance is also excluded from the focus of the present research due to potential conflict of interest and the researcher's position in the case company – CEO and co-founder. Graphical interpretation of theoretical framework, embracing theoretical concepts, influencing workplace performance, is elaborated by the author of this Thesis and is presented in Figure 3.

Organizational structure (centralization, integration, complexity and formalization) and people are knowledge management enablers of the case company. Knowledge management (KM) is a set of activities aimed at the creation, diffusion and utilization of knowledge in order to achieve organizational goals (Mahmoudsalehi et al., 2012, p. 521) and is understood as domain-specific tacit knowledge creation, i.e. articulable implicit managerial knowledge on how to perform software projects (Busch et al., 2003) due to its essence and nature (Lee & Choi, 2000, p.181). Organizational structure is a knowledge management enabler. People are knowledge management enablers. The outcomes of motivated software engineers are retention and performance. Tacit knowledge in the software development domain is the knowledge of how to perform software projects. Elaborating a theoretically grounded action plan on how to consistently perform in the future with the same or higher level of projects delivered on time, within budgets and assessed by customers as "success" is the development objective of the present research,

captured as “foster performance of software engineers”. Such performance and retention are an outcome of software engineers’ motivation as long as the presence of domain-specific tacit knowledge.

One might argue whether “foster” or “boost” is the correct word for the processes, which are aimed at nurturing in the case company or is “support” a more suitable adverb. The author of the present research believes, that since in the software development industry performance metrics are seldom free from biased interpretations and subjective peer assessments (Curtis et al., 1988, p. 1271), either adverb is suitable for capturing the topic of the present research, as long as the results are delivered sustainably and consistently.

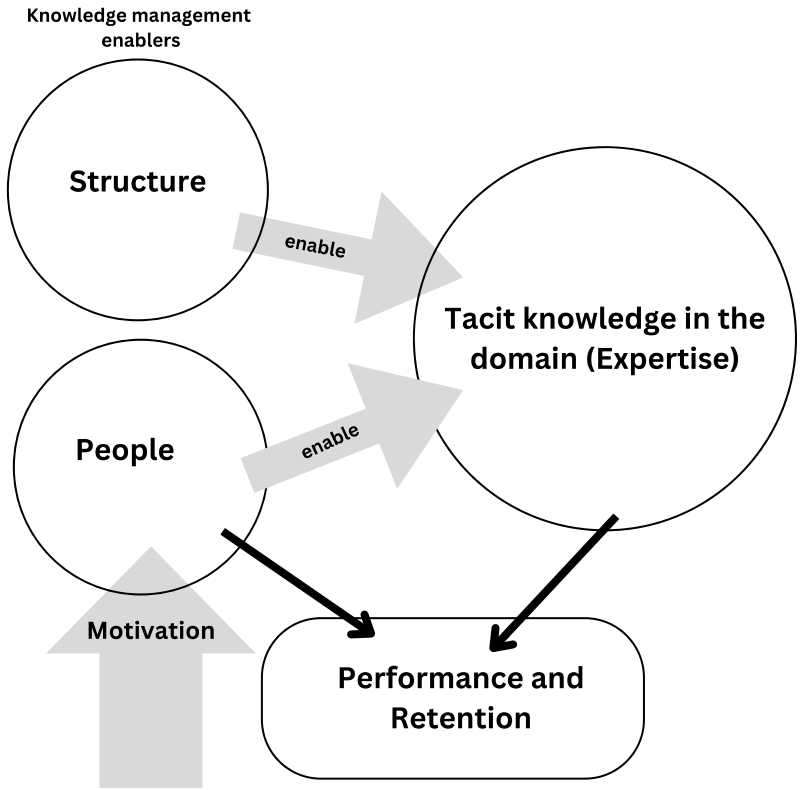

Figure 3. Integrated theoretical concept of the research

3.4 Summary of key findings

The purpose of the literature review section is to identify key theories, factors, concepts and other relevant findings, affecting employee motivation, knowledge acquisition, sharing and applying, which are assumed to be present in the investigated case.

Software engineers are a distinguished professional entity characterized by introversion, intuition, autonomy, growth orientation, technical competence, achievement orientation (Sharp et al., 2009, p. 7). Introversion, the right skill set, and leading internal needs (Herzberg et al., 2017; Maslow, 2019) define which are the values that drive individual behavior and which motivators can affect an individual's workplace performance; while personality, career stage, national culture and role in the organization moderate the effect of certain motivator, for example, a junior developer aiming at buying a house can be more motivated with money than challenging tasks (Hall et al., 2008, p. 93). Personality type (Cruz et al., 2015, p. 106), need for power/achievement (McClelland & Burnham, 2008) and abilities (tacit knowledge) mediate engineers' characteristics. Work that requires skill variety, task identity and is perceived as significant evokes a sense of meaningfulness; autonomy prompts responsibility and feedback deliver acknowledgment (Hackman & Oldham, 1980, pp. 82-89). These psychological states cause motivation, workplace performance, satisfaction, low absenteeism and low intention to leave.

Values and personality influence goal choices (Locke & Latham, 2004, p. 391) and commitment to certain goals (Klein, 1991). According to the Expectancy theory (Vroom, 1964) as cited in (Lokman et al., 2022) high motivation arises when effort/performance brings desired output and the output allows to achieve a salient need or reward, thus predicting goal choices (Klein, 1991). Goals affect performance in four directions: direction (activates skill and knowledge), effort, persistence and arousal of task strategies (Locke & Latham, 2004, p. 391; 2013, Chapter 1). People with high self-efficacy are more capable of developing task strategies (Locke & Latham, 2002, p. 708). Challenging goals result in higher performance until individuals reach the limit of their ability (Locke & Latham, 2013, Chapter 1).

Individual differences in cognitive abilities to acquire task-relevant explicit knowledge is a key factor in predicting workplace performance outcomes (Colquitt et al., 2000, pp. 679-680), which is moderated by training in a workplace (Kaufman et al., 2010, p. 322). A combination of explicit and implicit knowledge, obtained informally in a workplace as a set of practices on how to solve real-life problems is tacit knowledge (Fenoglio et al., 2022). Tacit knowledge in the software engineering industry is conceptualized

as articulable implicit managerial knowledge on how to perform software projects (Busch et al., 2003). The implicit nature of tacit knowledge is particularly difficult to transfer, thus tacit prevalently knowledge is shared informally and in a disorganized manner (Fenoglio et al., 2022). The empirical research discovered trust (Roberts, 2000, p. 430; Shafiei Sarvestani et al., 2022, p. 325; Zaqout & Abbas, 2012, p. 345), supportive leadership, altruism and self-efficacy (Cavaliere et al., 2015, p. 2) as tacit knowledge transfer enablers.

Articulation of tacit knowledge into explicit is context-specific (Shariq & Vendelo, 2006, pp. 833-834) and culture, structure and people comprise organizational context (Sadovykh & Sundaram, 2015). Knowledge management (KM) is a set of activities aimed at the creation, diffusion and utilization of knowledge in order to achieve organizational goals (Mahmoudsalehi et al., 2012, p. 521). KM mediates the effect of organizational structure on organizational performance (Zheng et al., 2010, p. 763). Such organizational structure attribute as centralization is negatively correlated with knowledge transfer, while integration and complexity have a positive correlation (Chen & Huang, 2007; Liao et al., 2011, pp. 732-733; Mahmoudsalehi et al., 2012, p. 526), which means that less centralized, more integrated and more complex organizations are able to enhance knowledge creation, sharing and utilizing, and controversial results of formalization influence on KM. Less centralized and less formalized structure in practice means self-managed or autonomous. Self-managed teams empower workplace performance (Pfutzenreuter et al., 2021, p. 1) and hybrid organizations with centralized key functions, such as finance and autonomous function, requiring a high level of tacit knowledge, are critical for organizational adaptability and resilience in uncertain environment (Liao et al., 2011, pp. 734-735).

Therefore, hybrid organizations, employing talents with the combination of appropriate general intelligence and implicit learning ability factors, offering onsite face-to-face training in a workplace by an expert and offering a meaningful and challenging job, can experience a high level of employee motivation and performance.

A summary of the most relevant empirical sources is presented in Table 2.

RESEARCHER AND THE PUBLICATION YEAR	THEORETICAL FRAMEWORK (Theories used)	DATA	RESEARCH METHODS	RESULTS

Beecham et al., 2007	Motivation theories, motivators, demotivators	92 papers related to motivation in Software Engineering	Systematic literature review	Gap in the understanding of the software engineers' job, what motivates software engineers, how they are motivated, or the outcome and benefits of motivating software engineers, as well as no research acknowledging the changing environment of software engineering jobs.
Hackman & Oldham, 1976	Job characteristics theory, motivation hygiene-theory, activation theory, socio-technics theory.	658 employees, working on 62 jobs in 7 organizations	Quantitative research: zero-order correlation, partial correlation and multiple regression	Psychological states are mediators between job characteristics and the outcome measures. Job dimensions predict experienced meaningfulness and knowledge of results as expected from the job characteristics model. The results provide validity of the job characteristics model.
Locke & Latham, 2002	Goal setting theory	Systematic research of 400 empirical studies	Inductive theory building	Linear relationship between goal difficulty and performance; specific difficult goals lead to higher performance that no goals or vague goals.
Montuori & Montefiori, 2022	Cognitive ability, implicit learning	Overview of the recent research about the implicit learning	Literature review	Knowledge gap about the absence of a robust implicit learning measure identified
Kaufman & Grigorenko, 2008	Tacit knowledge acquisition and transfer, practical intelligence	228 U.S. participants (149 female, 76 male, and 3 participants who did not report their gender; 227 Spanish participants (112 female, 112 male, and 3 participants who did not report their gender	Quantitative research: factor analysis	Tacit-knowledge inventories were designed and validated to capture tacit knowledge.
Ryan & Deci, 2000	Self-determination theory, intrinsic motivation, extrinsic	Data set for initial theory building not	Empirical psychological study, inductive	Satisfaction of three basic psychological needs for autonomy, competence, and relatedness are essential for

	motivation, organismic theory of human motivation, cognitive evaluation theory,	available in the article	theory building	individuals to achieve psychological growth, internalization, and well-being
Liao et al., 2011	Knowledge management, Organizational structure, environmental uncertainties	161 largest firms in Taiwan	Quantitative research: structural equation model was tested using the maximum likelihood method	Knowledge management is a mediator between environmental uncertainty and organizational structure attributes.
Ryan, 2005	Individual-level, group-level and tacit knowledge	181 people, constituting 48 teams in 46 organisations in Ireland and the UK completed the survey consisting of 75% (N=121) males and 25% (N=60) females.	Quantitative research: Pearson Product Moment Correlation Coefficient, Standard Multiple Regression, Hierarchical Regression and Dummy Coding, IRA.	A measure of Team Tacit Knowledge developed; tacit knowledge is acquired and shared through direct good quality social interactions, which are encouraged by smaller teams. Coordination of knowledge within teams is the most essential predictor of performance. Effective and efficient teams empower product delivery to the market faster.
França, 2014	Job-characteristic theory, work motivation, job satisfaction	4 cases of 4 different organizations, 32 interviews conducted, 8 participants provided 91 diary entries	Qualitative research, cross-case analysis	New theory of motivation and satisfaction for software engineers developed; motivated software engineers are engaged, demotivated are distracted; task characteristics and colleagues' engagement affect motivation; work motivation positively influence satisfaction, moderated by feedback; individual characteristics affect motivation and satisfaction

Table 2. Summary of the most relevant theoretical sources

4 Research strategy and research and development methods

4.1 Research philosophy

The aim of this research is to identify the factors which contributed to the case company's software development team's retention and performance, measured by the high level of software projects' delivery on time, within budget and within the technical scope. The purpose of this research is to investigate, how particularly these factors contribute to the case company's employee retention and performance. The development objective is to elaborate a theoretically grounded approach for the case company of the candidate selection and boosting their performance.

Since this research is exploring individuals' motivation, which is grounded on needs and values, it is relevant to present the research philosophy, resting on the researcher's values (Saunders et al., 2009, p. 124) prior to the research strategy and methods, since research philosophy sheds light on how the author of the research approaches to the reality (ontology), relies on what is true knowledge (epistemology) from which stems how the knowledge is developed (methodology) (Antwi & Kasim, 2015, p. 217). The research philosophy allows to understand what the author considers as valid research and which methods to select to develop the knowledge (Antwi & Kasim, 2015, p. 224).

A pragmatism research philosophy constitutes the philosophical stance of this research. According to this philosophy, the choice between epistemology, axiology and ontology is determined by the research questions (Saunders et al., 2009, p. 152). Ontological underpinning induces objectivism and subjectivism (constructionism) (Antwi & Kasim, 2015, p. 218; Eriksson & Kovalainen, 2015, Chapter 2). According to objectivist ontology, the world exists independently of individuals' perceptions and actions, the world is objective and real (Antwi & Kasim, 2015, p. 218; Eriksson & Kovalainen, 2015, Chapter 2). Subjectivist ontology studies the world through meanings that individuals lay to them, which construct reality, it consists of individuals' perceptions and subjective feelings and cognitive processes (Antwi & Kasim, 2015, p. 218). Subjectivism constitutes the ontological perspective of the present research.

In terms of epistemological underpinning, the pragmatism research philosophy focuses on applied research, it starts with a problem and aims at developing a practical solution (Saunders et al., 2009, p. 152), therefore, what works - is important to investigate in order to answer the research questions (Antwi

& Kasim, 2015, p. 219). The interpretivist position approaches knowledge through subjective meanings and people's interaction with each other and social systems and relevant theory is the one, which empowers successful actions (Antwi & Kasim, 2015, p. 219; Saunders et al., 2009, p. 140). From this stance, human behavior is subject to patterns and causalities, which are built upon individuals' interpretations and social systems which people create with their interactions with each other (Antwi & Kasim, 2015, p. 219). It is critical for interpretivism that the researcher is empathetic, becoming appropriate for human resource, organizational behavior and marketing fields research (Saunders et al., 2009, p. 141).

A pragmatism research philosophy has been adopted as a philosophical stance of this research due to the nature of the research questions, which are:

1. Which factors contribute to employee motivation in the case company?

2. Which factors contribute to tacit knowledge acquisition in the case company?

The literature review section is designed to uncover relevant factors, contributing to the phenomenon studied (structure) and affecting that phenomenon (causality) followed by the empirical section, addressing the research questions.

4.2 Research strategy

For the purpose of this research case study is utilized as a research strategy. Driven by the pragmatism research philosophy, the present research has started from a sense that something unusual is happening (Saunders et al., 2009, p. 143) in the case company, because of the 100% retention rate of the employees, which is worth studying in order to nurture and intentionally adopt as normal practice in the case company. The choice of research strategy is determined by its functionality and applicability to be used as a tool to reach research objectives and answer the research questions (Saunders et al., 2009, pp. 184-186). The chosen research strategy – a single case study with a holistic focus on studying the company as a unit of analysis. A case study is particularly appropriate when a rare phenomenon or rare conditions are scrutinized to discover possible theoretical explanations for the phenomenon (Saunders et al., 2009, pp. 184-186). This strategy allows to empirically scrutinize a phenomenon of software engineers' performance within the real-life context – within a commissioner's company, utilizing various sources of evidence (Saunders et al., 2009, pp. 184-186).

A case study strategy is a research strategy for explanatory study, which aims at studying the phenomenon in order to explain the relationship between the variables (Saunders et al., 2009, pp. 184-186). The context of the research is also of particular interest; therefore, the chosen strategy is justified. This research strategy is the right choice for the mixed research method when both quantitative and qualitative research methods are utilized (Antwi & Kasim, 2015, p. 223).

4.3 Research approach

Present research employs an integrated research approach since the main factors contributing to motivation outcomes and tacit knowledge development were discovered based on relevant theoretical background and quantitative and qualitative data collection was driven by theoretical findings (Saunders et al., 2009, pp. 171-172). Data collection methods for case study strategy are various and allow triangulation of multiple data sources in order to provide credible research results and adequate interpretation of the data acquired (Saunders et al., 2009, p. 173). Due to the researcher's position as a case company CEO and her involvement and active participation in the case company operations, multiple data sources, namely qualitative data, collected with semi-structured interviews, and quantitative data, collected with questionnaires, are utilized for triangulation purposes, in order to overcome observer bias in interview analysis and thus ensure credibility of the research results.

The answer to the RQ1, namely, which factors contribute to the case company employee motivation, allows motivating the team in order to influence retention and performance, thus preserving the precious knowledge within the company. Based on theoretical findings of motivation theories and systematic literature reviews, the motivation theories domain has been chosen to constitute theoretical stance of this research, since its wide and mature development stage, covering spheres from personality traits and individual leaning toward certain types of projects and tasks. The outcomes of highly motivated personnel are retention, productivity, project development time, cohesion with budgets, low absenteeism and project success (Beecham et al., 2007, p. 15; Sharp et al., 2009, p. 5)

The answer to the RQ2, namely, which factors contribute to tacit knowledge creation, allows to develop practical knowledge about the important criteria for candidate selection and knowledge management practices, predicting the development of tacit knowledge, which is the key aspect of the commissioner's competitive advantage. Research questions are addressed with qualitative data collected with semi-

structured interviews and triangulated with quantitative data, collected with questionnaires with Webropol. Seven respondents participated in interviews and nine respondents filled in questionnaires, thus the present research is qualitative.

4.4 Researcher's position

Qualitative research's goal is to scrutinize the research topic in a real-life context, therefore, within qualitative research a researcher is immersed into the context, by observing people and the reality that they construct with their behavior and interaction, as well as participating in these processes by interviewing the key participants and studying relevant artifacts (Antwi & Kasim, 2015, p. 220). The present research is conducted by a co-founder and co-owner of the case company with the purpose to uncover factors, which allow to nurture the company's competitive advantage and to grow the business with the processes of selecting, professional growth, retention and motivation based on theoretically and empirically justified procedures.

100% retention rate of tech talents is recognized as a phenomenon for a small company operating in a highly competitive environment and since the commissioner's performance depends upon the retention and motivation of core team members, it is necessary to understand, what processes and on what levels lay beyond the core team retention and performance, or whether these outcomes stem from individual characteristics of the team members. Due to the researcher's role and position in the company, the present research is limited to investigating the factors apparent from the role of the researcher in the processes, therefore such topics as leadership, values and culture are excluded from this research in order to avoid biases in data collection and interpretation. Technological and technical aspects are also beyond the scope of the present research.

The credibility of data gathered with qualitative methods, shall they include any aspects of the researcher's work field responsibility would be questioned due to the cultural dimensions of Russia, where all team members hail from, and particularly Power distance dimension, scoring 93 out of 100 (Hofstede, n.d.). Power distance depicts how society members, especially those with less access to power, accept inequalities (Hofstede, n.d.). Therefore, the researcher, holding a CEO position in the company is perceived as a powerful person assuming a top-down status toward interviewees. Lower-hierarchical organizational structure allows to mitigate the cultural effect; however, such national cultural aspect is

taken into consideration during the qualitative phase of the present research and in order to contribute to the validity of collected data, interview questions shall be designed in the manner, that avoids people talking about organizational conditions, rather their personal. The data concerning organizational, job characteristics, quality of education and mentoring in the workplace or other sensitive spheres are collected with an anonymous survey.

4.5 Data collection method

A single case study is utilized as a research approach, which is developed with mixed research methods, both quantitative and qualitative research methods are utilized (Antwi & Kasim, 2015, p. 223). However, due to the small sample size, basic descriptive statistics are utilized to analyze the quantitative data. The minimum sample size required for reliable statistical analysis aiming at discovering correlation and dependencies is 50 (Saunders et al., 2009, p. 277).

The company's software engineers' performance, expressed in the form of projects' delivery on time, within the defined technical scope and budget, is argued as stemming from tacit knowledge and motivation (Beecham et al., 2007, p. 15; Sharp et al., 2009, p. 5; Whelan & Carcary, 2011, p. 675);. Workplace performance, according to the theoretical framework, is an outcome of motivated (Beecham et al., 2007, p. 15; Sharp et al., 2009, p. 5) and effectively socially interacting and properly coordinated teams (Ryan, 2005). Tacit knowledge in the software engineering industry is conceptualized as articulable implicit managerial knowledge on how to perform software projects (Busch et al., 2003) or coordinate teams, while social interaction inside a team is covered in the tacit knowledge transfer paragraph. Therefore, prior to analyzing factors that have contributed to tacit knowledge acquisition, the fact that tacit knowledge indeed is present in the case company needs to be validated.

Quantitative data collection. Individual tacit knowledge is measured with multiple approaches, no one of which is free from criticism and construct validity questioning. These methods are - situational judgment tests, known as the Yale group approach, experiments on acquiring artificial grammar, various proxy methods, measuring a substitutional domain or phenomenon (Ryan & O'Connor, 2009) etc. The scope of a Master thesis research imposes constraints on the methods which can be utilized to measure tacit knowledge in the present research. The proxy method of Team Tacit Knowledge, or measuring a

substitute, is adopted to collect quantitative data to verify whether the case company indeed contributes to the acquisition of tacit knowledge in the software development industry.

A systematic literature review on leadership styles and organizational learning culture, conducted by Xie (2019) identifies Dimension of Learning Organization Questionnaire (DLOQ) as the most often used tool for measuring Learning Organization. However numerous research use the term Learning Organization, Organizational Learning and Organizational Learning Culture as synonyms, Xie claims, that these concepts are distinct by the object of acquiring knowledge (Xie, 2019). The concept of Learning Organization embeds the processes of individual learning when knowledge is stored inside and outside an individual and thus can be transferred to other individuals (Xie, 2019).

DLOQ consists of 43 questions covering 7 Dimensions of the Learning Organization: continuous learning, promotion of inquiry and dialogue, encourage collaboration and team learning, create systems to capture knowledge, empower people, connection between the organization and its environment, strategic leadership for learning and 12 questions to address Learning Organization results at the Organizational level, which are aimed at C-level respondents (Marsick & Watkins, 2003, p. 138). Participants are asked to estimate the degree to which the statement is true or not for an organization or which situation, described by the statement, occurs always or never, with a six-range scale. The results of DLOQ are mean points for 7 Dimensions of the Learning Organization, which can be compared to the means, provided by Marsik and Watkins (2003, 140), while it is recommended to assess the overall tendency or pattern of results within all domains to identify the extent of producing knowledge within the organizations (Watkins & O'Neil, 2013, p. 139). Watkins and O'Neil (2013, p. 139) evaluate the domains which score above the average mean as a strategic advantage of a company, and domains below the average mean – as strategic leverage.

Team Tacit Knowledge Measure (TTKM), developed by Ph.D. Sharon Ryan (2005) is utilized as a proxy measure for tacit knowledge acquisition by team members, which is conceptually, statistically and theoretically valid, as per Messick's framework of validity. TTKM is utilized to collect quantitative data. The benefit of this measure is that it is constructed on the basis of a direct measure of tacit knowledge, developed by the Yale group, redesigned with a repertory grid, capturing both context and personal essence of knowledge (Ryan, 2005). TTKM is designed as a checklist of 14 bipolar factors, affecting a software team's performance on successful projects, which is assessed with a 5-point differential scale (Ryan, 2005). The respondents are asked to choose the closest pole, that they perceive influencing teams'

successful project performance. Tacit knowledge is measured by comparing the scores of each factor to the expert's profile, provided by Ph.D. Sharon Ryan (2005).

In order to identify the group unanimity or the within-group interrater agreement (Rwg), independently of the group size Rwg index is measured (Cohen et al., 2001, p. 308). Interrater agreement index is a valid method of building organizational construct, and it measures the conjunction of responses within a group in order to estimate the true construct of the organization (Wagner et al., 2010, p. 610).

Rwg index is computed with the formula (Lindell et al., 1999, p. 129).

$$r_{WG} = 1 - \frac{s_x^2}{s_{mpv/m}^2}$$

S_x^2 (Observed Group Variance) is computed with the formula (Wagner et al., 2010, pp. 594-599)

$$s_{mpv/m}^2 = \frac{k[M(H+L) - M^2 - H \cdot L]}{(k-1)}$$

where H – is the highest rating on the scale

L – lowest rating on the scale

k – number of observed ratings

M – mean rating under maximum variance

M = ((k/2*H)+(k/2*L))/k

As a rule of thumb, results of 0,70 represent the group homogeneity (Cohen et al., 2001, p. 300), however, it is still argued, that as a rule of thumb >0,70 is inadequately small and can be obtained from random samples (Harvey & Hollander, 2004, p. 1).

DLOQ and TTKM are accompanied by a background data collection questionnaires. The number of questions aims at collecting basic information with the aim to perform the descriptive statistical analysis: age, gender, years of IT experience, years in the case company, highest education degree. According to the TTKM, the average experience of IT experts is 10-12 years and years of experience is utilized as a proxy measure for domain knowledge (Ryan, 2005). For the purpose of this Thesis, the years of experience of interviewees are benchmarked with the years of experience, required to obtain the expert level of knowledge.

Several questions aims at collecting quantitative data which is found to affect tacit knowledge acquisition according to the theoretical framework. Thus, to estimate the explicit learning ability factors, data on math performance is collected, since it was discovered to strongly positively correlate with the level of general intelligence in Russian secondary and higher education institutions (Krasnoryadceva et al., 2015, pp. 238-239).

Implicit learning ability is associated with foreign language acquisition skills (Montuori & Montefiori, 2022, p. 4) and verbal reasoning skill. Processing speed, academic performance and self-reported personality predict the implicit learning ability (Kaufman et al., 2010, pp. 323-324). In order to assess the implicit learning ability of the commissioner's employees, academic performance is measured by collecting data on graduation with honors from school and university as indicating exceptional academic performance in Russian Federation and self-reported foreign language skill(s) level.

The measure of motivation stems from systematic literature review findings of Beecham and colleagues (2007, p. 1), who discovered that demotivated software engineers take more sick leaves and consider resigning, while motivated engineers stay longer in the organization and enhance productivity. A similar approach was utilized by Marco and colleagues (2003, p. 17), who developed a questionnaire, measuring the effects of compensation and workplace performance on motivation, where motivation was measured with three questions: "I've often seriously considered quitting and work elsewhere"; "How many days have you approximately been absent in 2000 due to health reasons?", "Estimate your overall work satisfaction with a ten-point scale".

Qualitative data collection. Data collected with questionnaires is utilized as a triangulation method for findings from semi-structured interviews. Triangulation is an accepted method of data validation in a case-study research strategy aimed at ensuring that collected material is interpreted correctly (Saunders et al., 2009, p. 173) and enhances the credibility of the research and aims at avoiding researcher bias. Interview

as a method of data collection is widely spread in social science, however, it is criticized for its limited reliability because respondents may lie, have false memories, or simply not behave the way they report to (Flick, 2022). The present thesis's purpose is to study a holistic single case with the aim to elaborate "best practices" for the commissioner and not aiming at the findings' transferability and generalizability; bearing in mind the small sample size making it impossible to conduct statistical analysis; and context-sensitive nature of expertise (Ryan, 2005) interviews reliability as a method of study is appropriate for the purpose of answering the question "why?" (Saunders et al., 2009, p. 176). In explanatory study semi-structured interviews are utilized to understand the relationship between the variables discovered during theoretical study (Saunders et al., 2009, pp. 171-172).

4.1 Development methods

The development part of the present research includes the elaboration of a theoretically grounded approach toward candidate selection and performance boosting of entrant employees aligned with the commissioner's strategy. The justification for this developmental objective is grounded on the practical business need of sustainable economic growth of a commissioner, which requires hiring, onboarding, retaining and performance of software engineers.

Process design was selected as an appropriate collaborative development method, aimed at conducting workshops or larger initiatives. For the purpose of the present research, a workshop is conducted with an aim at improving existing processes' effectiveness and efficiency with as minimum resources, as possible.

At this stage, relevant stakeholders from the case company, namely Chief Technical Officer (CTO) and two team leaders are invited to participate in a process design workshop and the researcher participates as a facilitator, presenting the findings from empirical results and theoretical framework as a support for new processes design. The workshop process draft (appendix 7) was sent to the participants on the 14th of April and the workshop was held on the 18th of April in the case company premises.

As an outcome of the workshop, a roadmap of employees' selection, onboarding and performance boost is created. The roadmap is subject to adjustment upon its implementation and execution. The elaborated roadmap is presented in the Development section.

Six steps of the process design framework elaborated by Strachan and Tomlinson (2008, Chapter 1) are presented in Figure 4. This framework is utilized to structure collaborative workshop facilitation processes, to empower process effectiveness and efficiency and achieve the workshop goals within an agreed workflow. There are six steps of Process design: process terms of reference (appendix 7), block the agenda, develop and confirm the agenda flow, build a preliminary design, check the preliminary design, complete the design, which is presented in Figure 4, adopted from Strachan & Tomlinson (2008, p. 10) practical guide on workshops facilitation.

This framework was chosen, as it puts people, participating in workshops, at the center of the process, aiming at achieving the expected outcomes (Strachan & Tomlinson, 2008, p. 2). Since the present research is devoted to employees of the case company, a people-centric approach toward the collaborative part is relevant and aligned with the research aim and purpose.

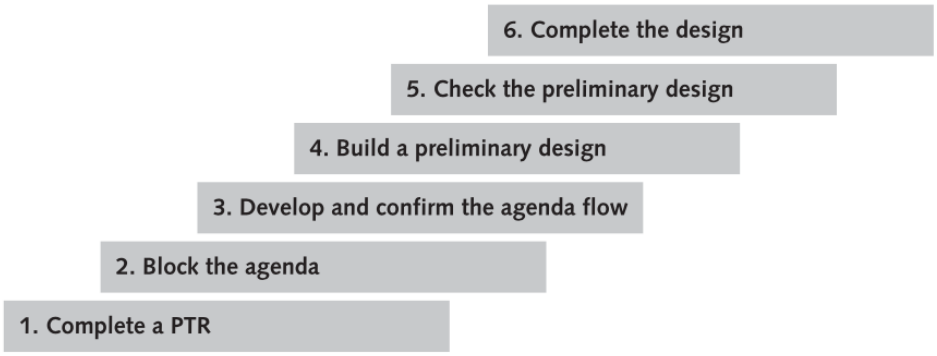

Figure 4. Six steps of Process design (Strachan & Tomlinson, 2008, p. 10)

As a first step of process design, process terms of reference (appendix 7), containing eight key elements of the workshop process, namely "situation, purpose and objectives, stakeholders, core assumptions, key considerations, work plan, governance, and documentation for an initiative" (Strachan & Tomlinson, 2008, p. 10). The second step, namely block the agenda, refers to organization activities of a workshop, such as scheduling with all the participants data, place and time frame of the workshop, making necessary reservations and sending preliminary PTR (Strachan & Tomlinson, 2008, pp. 12-14). On the step "develop and confirm the agenda flow" the workshop process flow is designed and explained to the participants and important adjustments, are agreed upon (Strachan & Tomlinson, 2008,

pp. 15-21). On the step “build a preliminary design” a map of the workshop is created, making every step of the process explicit and supporting the facilitation process. Thus, workshops often flow through the following stages: opening session, enabling actions, thinking critically, addressing issues, closing session (Strachan & Tomlinson, 2008, p. 22). On the step “check the preliminary design” draft design is validated with the participants or the key members of the participating team and their recommendations are accepted and the design is adjusted and confirmed on the step “complete the design” (Strachan & Tomlinson, 2008, pp. 26-27).

A collaborative workshop was arranged with the case company team leaders as participants and the researcher as a facilitator within the presented process design framework. The development objective of the present research is to elaborate a new candidate selection and onboarding action plan. The workshop process and resulting action plan are discussed and presented in Chapter 6.3.

5 Empirical section

5.1 Commissioner

The case company is a small software development company, building technologically advanced systems and products from scratch. The company was founded in 2016 in Petrozavodsk, Russia and employed 5 people, including two founders, which currently hold the roles of CTO and CEO. The company is providing software development and IT consultancy services for customers from the US, Australia and Canada. The commissioner's main business is outsourced software development and IT consultancy services, including research and development services.

In 2018 the company incorporated a legal entity in Finland, in order to address the risks of conducting business activity in the emerging market, i.e. Russian Federation. By the time when this research was planned, the company employed 21 people, 7 residing in the capital region of Finland and 14 residing in Petrozavodsk, Russia. By the end of 2022 the company has withdrawn its operation from Russia, working contracts with 7 people from the Petrozavodsk office were suspended, most part of the team was relocated to Finland.

Currently, the company employs 14 people, 11 software development engineers, 1 support engineer, CTO and CEO, all residing in the capital region of Finland.

The commissioner has been effectively bootstrapped and managed its growth and is financially sound, compared to the median industry (namely Software development and delivery) performance as can be seen from Table 3 (*CompanyReport_29152024*, 2023). Industry financials are acquired from the database of financial statements of Finnish companies Asiakastieto (*CompanyReport_29152024*, 2023). According to the data acquired, the commissioner's growth has been on average 4 times as high as the industry median and close to the upper quartile of the industry, net profitability on average is twice as high as the industry median.

	Revenue growth, the case company, %	Revenue growth, median industry, %	Revenue growth, upper quartile industry, %	Net profitability, the case company, %	Net profitability, median industry, %
2022	88 %	5,3%	38,3%	18,8 %	8,7%
2021	28,2 %	7,1 %	38,2 %	11,9 %	6,5 %
2020	27,6 %	2,6 %	33,3 %	8,1 %	6,4 %
2019	38,2 %	4,8 %	34,9 %	0,5 %	4,3 %
2018	n/a	5,5 %	40 %	12,9 %	4,0 %

Table 3. Commissioner's financial performance compared to the industry in Finland

Due to the small size of the commissioner and moderate financial opportunities in terms of monetary compensation, the company's human resource management activities were designed to hire candidates with the right mindset and growing talents inside the company through certain work-related tasks and permanent mentoring by an expert (CTO) on the workplace through direct face-to-face coaching and support. Therefore, retention has always been crucial for the company's development, since the employees with the right skillset and hands-on experience are hunted for and the competition for talents is tough in the industry. Since 2016, when the legal entity in Russia was founded, zero software engineers have left the company on their own incentive, working contracts with 4 engineers were suspended on the company's incentive, despite 2022's contracts suspension due to the withdrawal from Russia.

The company's values are: Professionalism, Due Diligence, Ethics and Maturity. The company's vision is to develop software engineering mature team(s). The company's mission is – Technological singularity. The company's financial goal is an annual growth of 40% in order to stay in the industry's upper quartile growing companies and net profitability of 15%. The strategic goal of the company is to develop a competitive advantage out of the company's ability to grow mature software development teams.

5.2 Data collection process

The data was collected in two phases. The first phase included quantitative data collection with questionnaires compiled and conducted with Webropol during the period of 22.02.2023 – 27.02.2023. Three questionnaires were conducted anonymously – Dimension of Learning Organization (DLOQ), Team Tacit Knowledge Measure (TTKM) and Motivation. Link to the questionnaires was sent to all the case company employees by email on 21st February and the reminder was sent on 24th February 2023, along with the invitation to participate in interviews for Phase 2 of the research. The questionnaires were composed in English and translated into the Russian language by the researcher (as a qualified interpreter), the respondents were free to choose the language of the questionnaire to minimize the chance of possible misperception in responses.

The aim of DLOQ questionnaire (appendix 1) is to measure whether the case company indeed creates tacit knowledge. DLOQ is the tool most often utilized to measure Learning Organization (Xie, 2019), a concept, according to Xie (2019), describing the processes of individual learning when knowledge is stored inside and outside an individual and can be transferred to the workplace. The original DLOQ consists of 43 questions, covering 7 Dimensions of the Learning Organization and 12 questions aimed at collecting data on the Organizational level, which were excluded from the questionnaire as they are supposed to be answered by companies' executives (Marsick & Watkins, 2003, p. 138). Excluded questions are aimed at assessing leadership and managerial domains for C-level respondents, this domain is not covered by the present research due to the researcher's position in the case company. 10 respondents out of 13 employees of the case company have completed the questionnaire.

The aim of TTKM (appendix 2) questionnaire is to collect quantitative data about Team Tacit Knowledge and compare the mean results of the respondents with the expert profile, developed by PhD Sharon Ryan (2005). This questionnaire was specifically designed to measure the tacit knowledge of software engineers (Ryan, 2005) and in the present thesis it is utilized as a triangulation measure of interview results in order to validate that the case company indeed produces tacit knowledge in the software development industry. As a part of TTKM background information about respondents is collected. 9 respondents out of 13 employees of the case company have completed the questionnaire.

The motivation survey (appendix 3) comprised 3 questions (Marco et al., 2003, p. 17) and 1 background question was responded to by 9 people out of 13 employees of the case company. The questionnaires

were pilot tested by two people in order to identify possible vague questions, technical issues during data collection and recording. The pilot test resulted in questionnaires being translated into the Russian language by the researcher possessing a qualification of English-Russian interpreter to allow respondents with limited English language skills to avoid misunderstanding questions, it was also allowed with Webropol settings to switch between languages during the answering process.

Phase 2 of the research included semi-structured interviews with the case company employees volunteers, conducted remotely via Teams and Zoom on 27 February – 1 March 2023. Interviews were conducted in the Russian language, recorded and transcribed with an automatic transcription tool Sonix.ai. Transcriptions were manually checked by the researcher and recordings were listened to for the second time in order to verify that the transcripts fully correspond with the recorded interviews. The interview protocol (appendix 4) was grounded on the interview protocol utilized by Ph.D. Alberto Franca (2014) in his doctoral thesis about the new motivation theory of software engineers and adapted according to the research questions, particularly, a section devoted to the process of learning on the workplace and company structure were included into the protocol. Seven employees volunteered to participate in the interview Phase of the research.

	DLOQ	TTKM	Motivation	Interview
Number of respondents	10	9	9	7
% of the case company employees	77%	70%	70%	54%

Table 4. Response rate for questionnaires and interview

Due to the small sample size (n=9) descriptive statistics methods were utilized to analyze the quantitative data collected with questionnaires. The quantitative data was extracted from Webropol as an Excel sheet and imported into PSPP for descriptive statistical analysis.

5.3 Data analysis process

In order to estimate whether the case company is a Learning organization, i.e. it creates tacit knowledge (Xie, 2019), respondents were asked to take Dimensions of the Learning Organization Questionnaire (DLOQ, appendix 1) developed by Marsick and Watkins (2003, pp. 143-145). In order to assess the organization on each dimension, means are calculated in Excel in order to identify the overall tendency and assess the range of variations. The obtained results are utilized as a benchmark for the case company's further assessment of the tendency. Results (Tables 8 and 9) are also compared to the mean results of the companies from the original research as a benchmark (Marsick & Watkins, 2003, p. 140).

In order to identify, whether the case company creates tacit knowledge in the software development domain, Team Tacit Knowledge Measure questionnaire (appendix 2) is utilized and for the purpose of the assessment of the results, the mean results of the case company respondents are calculated and compared to the expert profile of the original research of Sharon Ryan (2005), who has developed the measure. Data collected with Webropol was extracted into Excel and mean and standard deviation results are calculated in Excel and the results are presented in Table 10. Mean results are then compared to the expert profile developed by Sharon Ryan (2005) and the results are presented in Table 10. Background information of respondents is collected with this questionnaire, extracted into Excel and manually input into PSPP software for performing basic descriptive statistics (Tables 5, 6, 7).

In order to identify, how the mean results represent the group unanimity, i.e. the agreement measure within the group, independently of group size (Cohen et al., 2001, p. 308), Rwg index (>,70) was calculated and the results are presented in Table 11.

The motivation survey (appendix 3) is utilized as a triangulation method for qualitative data obtained with semi-structured interviews. However, no benchmark from theoretical framework was obtained to interpret the findings, the case company has reported 100% employee retention rate and retention is an outcome of high motivation, findings of the motivation survey are interpreted in this respect and compared between each other in order to find anomalies, possible suggesting, that respondents with the high number of sick leaves, little satisfaction score and high intention to leave, are less motivated.

Qualitative data, collected with semi-structured interviews (appendix 4), conducted in Russian (the native language of the interviewees) are transcribed automatically with sonix.ai software and the transcriptions

are read and manually checked. After that, the interview recordings are listened to once again and compared to the transcribed text, all unnecessary pieces of text, such as “hmm…” “errrr”, “uh” are removed. The remaining text is codified with a directed content analysis approach (Hsieh & Shannon, 2005, p. 1281) on the basis of three theoretical backgrounds, comprising three themes for analysis and interpretation – motivation, tacit knowledge and organizational structure. The purpose of codification is to summarize and categorize each piece of data and group it into categories, reducing the amount of material, based on theoretical background (Lapan et al., 2011, Chapter 3).

The directed content analysis approach is a qualitative data analysis method, guided by a more structured process compared to the conventional approach (Hsieh & Shannon, 2005, p. 1281). Since this research is a deductively based explanation building the interview protocol and the codes were created based on theoretical findings (appendix 5). Existing theory provides direction and guidance toward the variables, themes and concepts, and their relationship with each other. Therefore, the approach to interview protocol and coding is guided by the findings from the previous research and literature review (Hsieh & Shannon, 2005, p. 1281). Themes for analysis and codes derive from the research questions, aim and purpose of the research, supported by the literature findings. Codes, derived from theoretical framework and literature are called “a priori” codes (Saunders et al., 2009, p. 583) and are presented in appendix 5. NVivo.14 software was utilized to support the qualitative data analysis process and the transcribed interviews were codified with NVivo.14 by labeling units of information (sentence, paragraph, phrase or words) with a relevant code. The coded items occupy 40 pages of text, since the whole sentences or paragraphs were coded to preserve the context. Codebook, containing examples of units of transcribed interviews coded into specific codes, categories and themes, is presented in Appendix 5.

Several units of data were discovered to have no relevant code, derived from theory, thus new codes were created to comprehend the important relationship between the variables under each theme of analysis (appendix 5). The codes are visualized with NVivo.14 by the number of items (units of text) coded to a specific code, categories and theme (Figure 5).

Tacit knowledge for the purpose of the present research was conceptualized as articulable implicit managerial knowledge on how to perform software projects (Busch et al., 2003) and to confirm that the case company creates tacit knowledge about the performance of software projects TTKM questionnaire (appendix 2) was utilized (Ryan, 2005).

Qualitative data was collected with semi-structured interviews and analyzed with Nvivo.14 software. The codes are visualized with NVivo.14 by the number of items (units of text) coded to a specific code, categories and themes. A graphical representation of the number of items coded under each category, to visually estimate, that personality, self-efficacy, job characteristics and goal setting theories items occupy the largest portion of coded items, due to their larger influence on the motivation of case-company employees, is presented in Figure 5. In the tacit knowledge theme the role of public repositories (code - open repositories) in tacit knowledge acquisition and transfer processes is what stands out. Code “time” means, that respondents were able to acquire tacit knowledge, because they are allowed to take extra time and adjust deadlines, or they had enough time to develop new approaches and try out new ways of doing work-related tasks, and this is how they acquired tacit knowledge. Organizational structural implications on knowledge management were shortly covered during the interviews, due to its enabling effect on knowledge management, however, there is no intention to adjust organizational structure due to the findings of this research. Such codes as a monetary reward, higher education, background of the respondents and context are coded separately because these codes derived from the data.

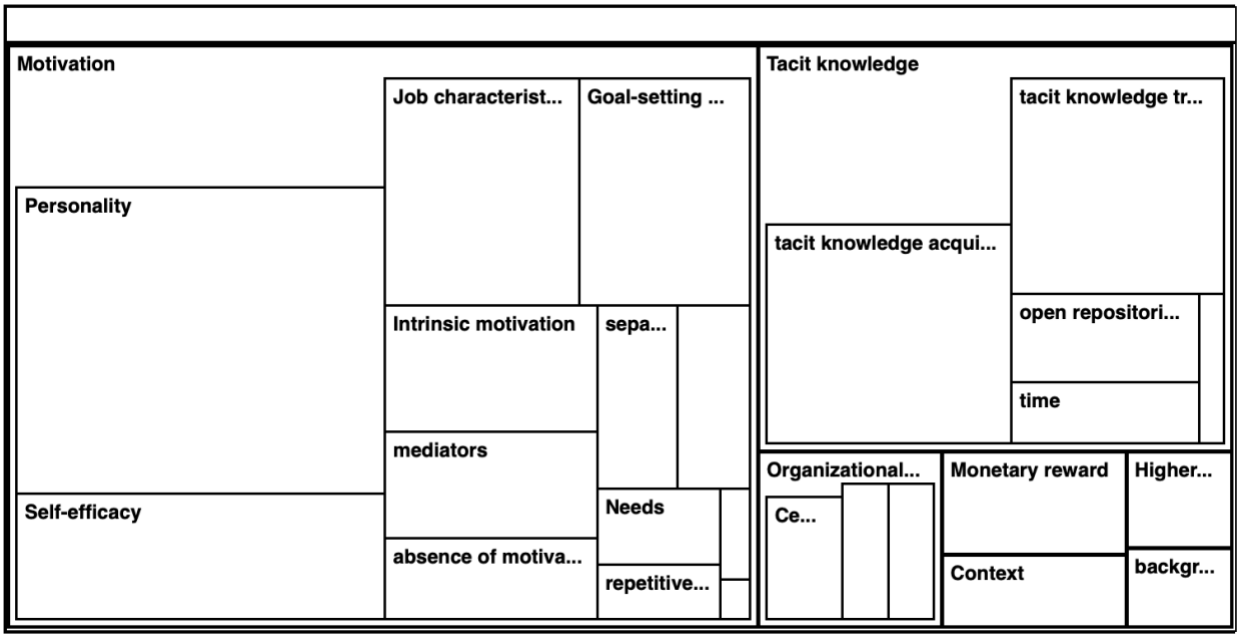

Figure 5. Visualization of codes by the number of coded units

After the first coding, transcripts of interviews were read for the second time and the accuracy of codification was verified, several units of text were recodified. During the second reading in the motivation theme interrelated and concurrent codes from different categories were discovered, for

example, self-efficacy appeared in both motivation and tacit knowledge themes. After the proper scrutiny of the theoretical section, it was decided to consolidate items from different themes under code “self-efficacy” in the theme “motivation”, without undermining the sentiment of the initial unit of text.

Visualization and the analysis of the frequency of codes, clusters and themes (Figure 5) generate the empirically supported explanation derived from the theoretical background and answer the research questions:

1. Which factors contribute to employee motivation in the case company?

2. Which factors contribute to tacit knowledge acquisition?

The purpose of the qualitative data analysis is to scrutiny the relationship between the variables in a real-life context and provide a comprehensive understanding of the relationship between the variables and concepts discovered during the theoretical study. Findings from quantitative and qualitative data analysis linked to the findings from theoretical section and the previous research are presented in the discussion section.

The interpretation of the findings and the updated motivation theory for the case company is presented in the findings section.

6 Findings

6.1 Descriptive statistics

Findings of the descriptive statistics (Tables 5, 6 and 7) and qualitative analysis and the interpretation of the results as well as development task and results are presented in this chapter. Since the sample size (Table 4) of the present research is insufficient for conducting the statistical analysis, the basic descriptive statistical analysis method is utilized for the quantitative data analysis (Saunders et al., 2009, p. 277). Mean, standard deviation, variances, ranges and frequency tables with full responses are presented in appendix 6.

Gender composition of the respondents is presented by 6 males (66,70 %), 1 female (11,10 %) and 2 people (22,20 %) did not reveal their gender (appendix 6). Years of experience among the respondents vary from 0 to 40 years, with two people having less than a year of experience in the industry, one respondent having 3, 6 and 10 years each, and four people with over 15 years of experience. Team mean results is 12,11 (Standard Deviation (further SD) 12,62) which is close to the mean number of years of expert profile of Team Tacit Knowledge research – 11,64 (SD 4,97) (Ryan, 2005). However, due to the large variance 159,36, skewness 1,41 (normal distribution skewness measure is 0,00) and kurtosis 2,39, indicating that the distribution of results is asymmetrical and it is far from the mean result (Leekley, 2010) because one respondent has 40,00 years of experience. Median is an important indicator to understand the distribution of respondents' years of experience in software engineering. The previous research point out the benchmark of 10,00 years of experience for expertise development (Ryan, 2005). The median result is 10,00 years of experience, meaning that the top half of the team has over 10,00 years of experience, and the down-half of the team has less than 10,00 years of experience in software engineering. 10,00 years of experience is less than the expert profile of TTKM – 11,64 (SD 4,97) (Ryan, 2005), though still comparable to the results of previous research (Petre, 2002, p. 2). The respondents have worked in the case company on average for 3,00 years (SD 2,89). 3 people have worked in the case company for less than a year, 1 respondent for a year, two people worked for 4,00 and 6,00 years each, and one respondent replied 7,00 years, which is above the company's existence.

Statistics

		id	Gender	How many years of IT experience you have	How many years you have worked in the company
N	Valid	9	9	9	9
	Missing	0	0	0	0
Mean		5,00	1,56	12,11	3,11
Median		4,00	4,00	10,00	4,00
Mode		.	male	.	,00
Std Dev		2,74	,88	12,62	2,89
Variance		7,50	,78	159,36	8,36
Kurtosis		-1,20	-,45	2,39	-2,00
Skewness		,00	1,19	1,41	,06
Range		8,00	2,00	40,00	7,00
Minimum		1,00	male	,00	,00
Maximum		9,00	prefer not to tell	40,00	7,00

Table 5. Gender composition and experience range in years of the case company employees (n=9)

All respondents possess higher education degrees 33,30 % of each Bachelor, Master and Specialist level (see appendix 6). State math exam grade which is associated with the level of psychometric intelligence (Krasnoryadceva et al., 2015, pp. 238-239) is 5,00 for 100,00 % of respondents, which is the highest grade in the Russian secondary education system. According to the report of the Russian Federal Education Supervisory Service, the majority of IT and engineering students in Russia score 61,00 – 80,00 points on math state exam (Ященко et al., 2022б, p. 6) which supports the results of the case company respondents median score 77,50 with high standard deviation result 11,70, due one respondent scoring 92,00 points (Table 6), which is an extremely rare result, representing less than 0,50 % of all math state exam results (*State Exam in Republic of Karelia*, n.d.). Thus, state exam on Math results represent normal numbers for students entering the engineering and IT departments of the Universities and in general do not represent any anomalies in general intelligence.

Statistics

		Score on state math exam	Your grade on math when you graduated from school
N	Valid	4	9
	Missing	5	0
Mean		77,50	5,00
Median		5,00	5,00
Mode		.	5,00
Std Dev		11,70	,00
Range		28,00	,00
Minimum		64,00	5,00
Maximum		92,00	5,00

Score on state math exam

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	64,00	1	11,1%	25,0%	25,0%
	74,00	1	11,1%	25,0%	50,0%
	80,00	1	11,1%	25,0%	75,0%
	92,00	1	11,1%	25,0%	100,0%
Missing	.	5	55,6%		
Total		9	100,0%		

Your grade on math when you graduated from school

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	5,00	9	100,0%	100,0%	100,0%
Total		9	100,0%		

Table 6. Math performance school results of the case company employees (n=9)

Implicit learning ability factors, which were measured with the data collected and presented in Table 7, such as academic performance, indicate that 44,40 % do not demonstrate high academic performance and 55,60 % of the respondents demonstrate high academic performance assessed by graduating with honors from either school or university or both. The same distribution of foreign language skills, which is also associated with implicit learning, with 44,40 % of respondents having " grade 4" and 55,60 % of respondents having grade "5,00" on foreign language exam in school (Table 7), however according to the results, different groups of people get "fours" for foreign language and do not graduate with honors, so that these results do not indicate that a certain group of people evidently demonstrates lower implicit learning abilities, assessed by these two factors. About 7,00 % of school graduates, according to the available data for 2019-2020 years (*Информационные Материалы к Отчету Главы Республики Карелия о Результатах Деятельности Правительства Республики Карелия в 2020 Году*, 2021) and 20,00 % of math department students, according to available data for 2011, 2014, 2022 years, graduate with honors (*Petrozavodsk State University*, n.d.), thus 55,60 % of the case company respondents, demonstrating high academic performance along with 55,60 % of respondents knowing at least one foreign language with grade "5" might indicate, that the respondents supposedly possess implicit learning

ability factors which contribute to tacit knowledge creation. However, there is no measure to benchmark the implicit learning ability factors with a sufficient level of validity, since academic performance and foreign language skills are predictors of implicit learning ability, but not a measure of it (Kaufman et al., 2010, p. 321, Montuori & Montefiori, 2022, p. 4). Thus, key findings on the background data are as follows: respondents have a normal level of cognitive abilities for tech-professionals measured with math performance; respondents might have an advanced level of implicit learning abilities; respondents have on average 12,11 years of professional experience which is normal for obtaining domain expertise.

	Your highest education degre	Score on state foreign language exam	Your grade on foreign language when you graduated from school	Have you graduated with honours
N Valid	9	1	9	9
Missing	0	8	0	0
Mean	3,00	75,00	4,56	2,89
Median	3,00	75,00	5,00	3,00
Mode	.	75,00	5,00	None
Std Dev	,87	NaN	,53	,78
Range	2,00	,00	1,00	2,00
Minimum	University Bachelor Degree	75,00	4,00	University
Maximum	University Specialist	75,00	5,00	Both

Table 7. Academic performance and foreign language performance of the case company employee (n=9)

In order to estimate whether the case company contributes to tacit knowledge creation Dimensions of the Learning Organization Questionnaire (DLOQ) (Watkins & O'Neil, 2013, pp. 143-145) questionnaire results presented in Table 8 are analyzed. The initial intention of DLOQ results is to estimate the tendency of whether the case company is a learning organization by assessing the mean results of the questionnaire in order to identify the pattern and comparing its means to the means of other companies. However, the authors of the questionnaire specify that the questionnaire is intended to trace the tendency of the company's means compared to the company's results from various years, assessing t direction of the tendency (Marsick & Watkins, 2003, p. 138; Watkins & O'Neil, 2013, p. 139), thus these findings provide the benchmark for further research and for tracing the tendency after the adaptations and improvements of the current procedures. The lowest mean result of the case company is ranked in "Systems to Capture Learning" (Table 8).

Visual assessment of the ranks given by the respondents indicates similar tendencies for domains "Continuous Learning", "Inquiry and Dialog", "Collaboration and Team Learning", "Empower People" and "Connect the Organization" as ranked high score means (4,00 – 6,00) and large variability in "Systems to Capture Learning" scored lower ranks from all the respondents. Domain "Strategic Leadership for Learning" is outside of the scope of the present research. The outstanding results of respondent #5, who

consistently put lower ranks for all the domains, are addressed further in the section regarding findings from the Motivation survey.

Respondent	Years in the case company	Continuous Learning	Inquiry and Dialogue	Collaboration and Team Learning	Systems to Capture Learning	Empower People	Connect the Organization	Strategic Leadership for Learning
1	7	4,71	5,33	4,33	3,67	5,50	5,50	5,67
2	0	5,86	6,00	6,00	4,67	5,67	4,83	6,00
3	0	4,14	5,33	5,50	3,33	4,33	4,67	4,50
4	123	4,14	5,00	4,67	3,83	4,67	4,67	5,17
5	4	3,00	3,17	3,33	2,17	1,67	1,83	2,50
6	4	4,71	5,17	4,50	3,83	3,67	4,67	4,67
7	6	5,14	5,33	4,50	3,50	4,83	4,83	5,50
8	0	5,00	4,83	5,17	4,00	5,50	5,17	5,83
9	0	4,14	4,67	4,33	4,17	4,50	4,50	4,17
10	1	5,14	5,67	5,33	5,33	5,17	5,17	5,33
MEAN	2,44*	**4,60**	**5,05**	**4,77**	**3,85**	**4,55**	**4,58**	**4,93**
SD	2,83*	**0,78**	**0,77**	**0,75**	**0,83**	**1,19**	**1,01**	**1,04**

*answer “123” excluded

Table 8. DLOQ results of the case company (n=10)

By comparing means of the case company and the original research results, the case company’s results are ranked highest in every dimension but for “Continuous Learning” and “Systems to Capture Learning” (Table 9). The dimension “Continuous Learning” indicates, how jobs are designed to support people’s learning in the workplace and whether the opportunities for continuous education are provided, capturing the individual learning level (Marsick & Watkins, 2003, p. 139). “Systems to capture learning” dimension is the only predictor of the organization’s knowledge performance, which is an organizational ability to utilize knowledge to innovate, improve processes and create new knowledge (Kyoungshin, 2016). “Continuous Learning” and “Systems to Capture Learning” are the field of potential growth for the case company’s core competencies.

Given the nature of the questionnaire, designed to estimate the tendency of an organization and trace the results of an organization compared to itself and considering the nature of the present research as being qualitative with no ambition of external validity, rather than generating an organizational construct about knowledge management, the credibility of the results is the correct measure of validity. Wagner and colleagues argue whether pursuing statistical representation in managerial research regarding

organizational constructs instead of carefully selecting the right pool of respondents might challenge validity with larger randomness of responses provided with less knowledgeable participants (Wagner et al., 2010, p. 583). Thus, when the aim of the research is to generate an adequate idea of an organizational measure, results allow to estimate that the case company has the tendency to be assessed as a learning organization, in other words, producing tacit knowledge.

Author	Context	N	Organizational type, Respondents	Continuous Learning	Inquiry and Dialogue	Collaboration and Team Learning	Systems to Capture Learning	Empower People	Connect the Organization	Provide Strategic Leadership for Learning
Case Company	**Finland**	**10**	**Small IT-consultancy, all employees**	**4,60**	**5,05**	**4,77**	**3,85**	**4,55**	**4,58**	**4,93**
Watkins and Marsick	International	389	Multiple, managers and employees of Columbia Business School Executive Program	3,94	3,91	3,98	3,50	3,74	4,00	4,13
Selden	Southeaster region	142	Small family businesses, CEO or designee	5,01	4,05	4,09	3,44	3,83	4,17	4,49
McHargue	Natinal	264	Nonprofit organizations, directors	4,16	4,15	4,33	3,78	4,20	4,35	4,73
Lien, Yang, and Li	Taiwan	79	Financial and high-tech firms, management, technical, and professionals	3,97	4,05	4,00	4,13	4,08	4,01	4,26
Hernandez	Colombia	906	For-profit, all levels	3,94	4,16	4,01	4,09	4,21	3,96	4,27
Maria	Malasia	628	Government,mostly higher-level staff	4,05	4,08	3,84	3,96	3,79	3,98	4,21
Ellinger	National	208	For-profit, logistics, managers	4,12	4,04	4,13	3,70	3,93	4,19	4,26
Milton and Watkins	Global	37	Association, members and association staff	4,26	4,35	4,32	3,13	4,15	3,99	4,42
MEAN				4,18	4,10	4,09	3,72	3,99	4,08	4,35

Table 9. Dimensions of the Learning Organization means (n=10)

In order to identify, whether the case company creates tacit knowledge in the software development domain, Team Tacit Knowledge Measure questionnaire is utilized and for the purpose of the results assessment, mean results of the case company respondents are compared to expert profile of the original research of Ph.D. Sharon Ryan, who has developed the measure (Ryan, 2005). The data collected with Webropol was extracted into Excel and mean and standard deviation results are calculated in Excel and the results are presented in Table 10. Mean results are then compared to the expert profile developed by Sharon Ryan (2005) and the results presented in Table 10. Neither mean results, nor median results of the case company coincide with the expert profile, which does not allow to estimate the case company Team Tacit Knowledge Measure as being of expert level, however the statistical validity of these findings is also questionable due to the small sample size (n=9). Statistically valid results can be generated on the sample size of over 50 cases (Saunders et al., 2009, p. 277). The original research does not provide another benchmark for the results assessment, other than the expert profile (Ryan, 2005; Ryan & O'Connor, 2009).

Factor No	Left pole of Construct	**Expert Profile**			**The case company, all respondents**		
		Mean	SD	Median	Mean	SD	Median
1	Clear Goals	1.00	0.00	1	1.44	0.53	1
2	Highly motivated team	1.56	0.51	2	1.33	0.50	1
3	Highly co-operative team	1.72	0.75	2	1.67	0.71	2
4	Knowledge required available within the team	2.56	0.92	3	2.00	1.00	2
5	Innovative project	3.11	0.96	3	2.44	0.73	3
6	Experienced team	2.16	0.62	2	1.67	0.71	2
7	Adequate resources	2.00	0.77	2	1.56	0.73	1
8	Diverse team membership	2.89	0.83	3	2.00	0.87	2
9	Small project	2.44	0.51	2	3.33	0.71	3
10	Strict deadlines	2.72	0.46	3	3.22	0.83	3
11	Big team	4.17	0.78	4	3.56	0.88	3
12	Low morale	4.28	0.46	4	3.67	1.22	4
13	Intrenal competition	3.83	1.09	4	4.44	0.73	5
14	One clearly identified leader	1.44	0.70	1	1.78	0.44	2

Table 10. Team Tacit Knowledge Measure of the case company compared to the Expert Profile (n=9)

Figure 6 represents the answer distribution for the variables and allows to estimate the tendency of the group and the factors with wider answer distribution are potential growth opportunities for the case company to develop expert knowledge about how to perform software projects, such as “knowledge required available within the team” and “low morale”. Figure 6 demonstrates the unequal distribution of relevant knowledge about delivering software projects among the domains and the domains with larger variability shall be compared with the expert profile and potentially addressed within the team.

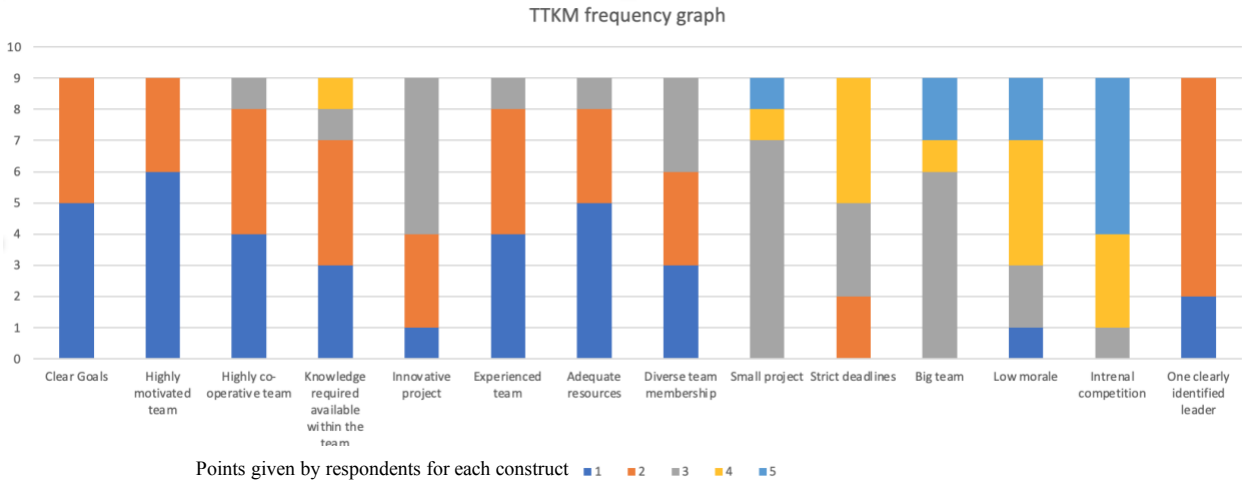

Figure 6. Team Tacit Knowledge frequency graph (n=9)

Rwg index measures group unanimity, i.e. the agreement within the group, independently of the group size (Cohen et al., 2001, p. 308) (Table 11). As a rule of thumb, results >0,70 represent the group homogeneity (Cohen et al., 2001, p. 300), thus the results of the case company (Rwg 0,67-0,96) on TTKM are interpreted as adequately representing team results, however, it is still argued, that as a rule of thumb >0,70 is inadequately small and can be obtained from random samples (Harvey & Hollander, 2004, p. 1) The Rwg index of the TTKM expert profile is 0,76-0,96 (Ryan, 2005), indicating similar team level of agreement as the case company.

	Clear Goals	Highly motivated team	Highly co-operative team	Knowledge required available within the team	Innovative project	Experienced team	Adequate resources	Diverse team membership	Small project	Strict deadlines	Big team	Low morale	Intrenal competition	One clearly identified leader
1	2,00	1,00	3,00	2,00	2,00	1,00	3,00	3,00	4,00	4,00	3,00	4,00	5,00	2,00
2	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	5,00	2,00	5,00	5,00	5,00	2,00
3	2,00	2,00	2,00	4,00	2,00	2,00	2,00	2,00	3,00	2,00	5,00	4,00	4,00	2,00
4	2,00	2,00	2,00	2,00	3,00	2,00	2,00	2,00	3,00	4,00	4,00	4,00	5,00	2,00
5	1,00	1,00	1,00	1,00	3,00	1,00	1,00	3,00	3,00	3,00	3,00	5,00	5,00	1,00
6	1,00	1,00	1,00	2,00	2,00	1,00	1,00	1,00	3,00	4,00	3,00	4,00	5,00	1,00
7	1,00	2,00	2,00	1,00	3,00	3,00	1,00	3,00	3,00	3,00	3,00	1,00	3,00	2,00
8	2,00	1,00	2,00	2,00	3,00	2,00	1,00	2,00	3,00	3,00	3,00	3,00	4,00	2,00
9	1,00	1,00	1,00	3,00	3,00	2,00	2,00	1,00	3,00	4,00	3,00	3,00	4,00	2,00
Mean	1,44	1,33	1,67	2,00	2,44	1,67	1,56	2,00	3,33	3,22	3,56	3,67	4,44	1,78
r_{WG}	0,94	0,94	0,89	0,78	0,88	0,89	0,88	0,83	0,89	0,85	0,83	0,67	0,88	0,96
>=.80	*	*	*		*	*	*	*	*	*	*		*	*

Table 11. Agreement index of The case company TTKM (n=9)

While TTKM purpose is to identify whether the case company produces tacit knowledge, conceptualized as articulable implicit managerial knowledge on how to perform software projects (Busch et al., 2003), company-wide, all employees, not only those who have hands-on experience in managing software projects, were suggested to participate in this questionnaire. Wagner and colleagues (2010, p. 583) argue, that for the purpose of identifying organization-wide valid result, the researcher shall properly select respondents according to their knowledge of the topic under investigation and with more respondents possessing less knowledge about the subject, research validity will decrease (Wagner et al., 2010, pp. 610-611). This position contradicts with statistical validity recommendation of having at least 50 cases for probability sampling to avoid randomness in results (Saunders et al., 2009, p. 277). For this particular purpose interrater agreement index was computed to identify the organizational construct of the expert profile, which does not allow to confirm that the case company contributes to the tacit knowledge acquisition, conceptualized as articulable implicit managerial knowledge on how to perform software projects (Busch et al., 2003). Due to the qualitative nature of the present research, aiming to address the processes only in the case company as a unit of analysis and no intention to generate reliable and valid results in terms of scientific canons, but rather generate valuable results in terms of pragmatism philosophy, which values knowledge for enabling practical actions (Saunders et al., 2009, pp. 142-143) and keeping in mind the nature of knowledge studied, which is organizational construct, not statistically representative construct, results of the TTKM questionnaire are credible.

Workplace performance is identified as an outcome of motivated employees (Sharp et al., 2009, p. 5) and motivation was measured by a simple survey (Table 12). Since no benchmarks were presented in the

previous research, measuring motivation with these questions (Marco et al., 2003), and the case company is reported to have zero voluntary turnover rate for 6 years, the results of the case company are interpreted as presenting high company-wide employee motivation. The overall work satisfaction varies between 6,00 and 10,00, with a mean 7,89; the intention to quit mean results is 1,56 (respondent considers quitting a couple of times and four people never seriously considered quitting and find another job) and average of 4,38 days of sick leaves during the previous year. With the combination of three questions, respondents #5 and 6 might be less motivated compared to other team members, with their lowest work satisfaction and highest absenteeism results. Respondent #5 also put the lowest scores for the case company DLOQ questionnaire, thus, it can be a potential indicator of lower motivation than compared to other respondents.

ID	**Work experience in the case company** (years)	**I've seriously considered to quit and work elsewhere** 1 – Never 2 – Couple of times 3 – From time to time 4 – Often 5 – Right now	**Overall work satisfaction** (on a scale from 0 to 10)	**Sick leaves in a previous year** (days)
1	7,00	1,00	8,00	3,00
2	0,00	1,00	10,00	0,00
3	0,00	2,00	8,00	0,00
4	6,00	2,00	7,00	5,00
5	4,00	1,00	7,00	14,00
6	4,00	2,00	6,00	10,00
7	6,00	2,00	9,00	3,00
8	0,00	2,00	7,00	
9	1,00	1,00	9,00	0,00
MEAN	**3,11**	**1,56**	**7,89**	**4,38**
SD	**2,89**	**0,53**	**1,27**	**5,15**

Table 12. Results of motivation survey (n=9)

Given the small sample size (Table 4) making the statistical validity of the results questionable, the findings from three questionnaires can serve as a benchmark for the case company's further inner research of employee motivation and tacit knowledge creation in the future and the tendency can be traced. Findings from this research are only intended to be utilized for the case company and not intended for generalizability.

6.2 Interview analysis findings.

For the purpose of the present research 7 interviews with volunteer employees of the case company were conducted. The interview analysis process is conducted with a directed content analysis approach (Hsieh & Shannon, 2005, p. 1281). The thesis is deductively based explanation building; thus, themes and codes are derived from the theoretical framework and "a priori" codes i.e. codes derived from the literature review findings (Saunders et al., 2009, p. 583) are applied for the interview analysis and codification. Findings from questionnaires are utilized as a triangulation method for findings retrieved from interviews, which generate a deeper understanding of the phenomenon in a real-life context and answer two research questions:

RQ1: Which factors contribute to employee motivation?

RQ2: Which factors contribute to tacit knowledge acquisition?

Semi-structured interviews were conducted with volunteer employees of the case company. Background data about the participants is presented in Table 13.

Respondent #	**Professional occupancy**	**Experience in the industry, years**	**Experience in the case company, years**	**Gender**	**Education**
1	CTO	Over 20 years	Over 6 years	Male	University degree in Mathematics
2	DevOps engineer	18 years	5 years	Male	University degree in Engineering
3	Full stack engineer	8 years	Over 6 years	Male	University degree in Mathematics
4	Head of Technical Support	Academic experience, no practical experience	1 year	Male	University degree in Mathematics (Information security)
5	Backend engineer	Less than 1 year	Less than 1 year	Female	Bachelor of Software Engineering

6	Backend engineer	1,5 years	Less than 1 year	Male	Master of Applied Mathematics
7	Backend engineer, Team Leader	9 years	Over 6 years	Male	University degree in Information Systems and Technologies

Table 13. Background information about the case company interviewees

Motivation. Above all, the interview protocol did not contain a direct question about the current level of employee motivation, however, 6 out of 7 respondents articulated themselves, that they love their jobs, are happy with what they do, are satisfied and enjoy their choice of profession and work.

> *Respondent 5: "I do really like it [work] and I want more learning."*
>
> *Respondent 2: "Primary motivational factor for me is the willingness to perform tasks good and in a meaningful manner."*
>
> *Respondent 3: "For me job is not just a job. It is something that has developed from my hobby, my childhood. I love to work with computers, I like to work with code, with programs to do something. It is the motivation of that type."*
>
> *Respondent 4: "I love it [job] because I have never ever faced such jobs."*
>
> *Respondent 6: "I see people, who, in my opinion, do great things and in general the company is moving toward the good, I also want to move there."*

In order to answer RQ1 in the first instance personal characteristics of the case company employees are analyzed.

Personal characteristics. The respondents of the case company are autonomous, technically competent, growth-oriented and creative, however, such trait as intuition was not discovered and only one respondent has clearly articulated to demonstrate introversion.

Respondent 5: "Most likely everyone needs informal communication, but in general I don't need it much."

Technical competency was discovered by respondents in childhood and the role of family, either being engineers themselves or creating conditions for respondents to get involved in engineering, was noted in 6 out of 7 cases.

> *Respondent 3: "When I was four, computer entered my life and since then I [walk] hand by hand with technologies."*
>
> *Respondent 5: "It is possibly due to the fact that we used to have a culture of table games in the family, we love logic and logic tasks."*
>
> *Respondent 2: "I was a first-year schoolboy when I came to my father's work, and he showed me a computer and since then I've got this urge toward computers."*

Needs. Set of needs, discovered to drive the motivation of the case company employees include affiliation need (4 respondents), need for achievement (5 respondents) and growth need (6 respondents). The monetary reward was discovered to be a motivator factor for more experienced respondents, and they perceive performance as an instrument to receive a higher monetary reward. Respondents with less experience already knew, when they chose their professional path, that software engineering was a well-paid job and monetary reward in their current career stage is a hygiene factor.

> *Respondent 1: "Monetary reward motivates me very well."*
>
> *Respondent 4: "Monetary reward would have been very significant. … When your salary is not enough and you have to care about various things but for your professional development, it bothers. I guess, survival is not the task that you want to solve right now."*
>
> *Respondent 5; "Software development was already considered a well-paid job."*
>
> *Respondent 6: "By that time it became clear that IT is a developing industry and salaries are good, mildly speaking."*
>
> *Respondent 7: "And then [when I knew the salaries] I became even more interested. It's good that you have interest [toward the field of studies], but money is even better."*

Job characteristics. The respondents value task identity and task significance, which according to job characteristics theory prompt meaningfulness of work, however, skill variety was mentioned by only one

respondent. Respondents value autonomy and the ability to influence the tasks that are assigned to them, which prompts responsibility for outcomes. Perceiving themselves as competent with observing the results of effort and receiving fast feedback has been mentioned as a motivator by 4 respondents. This characteristic prompts knowledge of the results of work activities according to job characteristics theory.

> *Respondent 3: "I do it [frontend] and see the result immediately. This is actually why I am still in frontend. I love to see the result."*
>
> *Respondent 4: "I love small tasks so that I could close 20 tasks easily. It's cool."*
>
> *Respondent 7: "I like to work in the format that one task is delivered within one-two days, then the next one."*

Peer (de)motivation role. According to the respondents, a demotivated software engineer is most likely the one, who is distracted, poorly communicates, systematically misses deadlines, is not engaged and complains. Three people clearly articulated, that demotivated behavior of colleagues influences their work, others either responded, that they are affected by motivated behavior, or are not affected by their colleagues' behavior at the workplace.

> *Respondent 2: "Yes, it [demotivated behavior] irritates me and I notice it. Noticed."*
>
> *Respondent 1: "I am ultimately demotivated by the sclerosis of my beloved colleagues and their, sometimes, misunderstanding of the importance of the task at hand."*
>
> *Respondent 7: "If we work together as a team, I feel I don't like it [if a demotivated colleague misses deadlines] and I feel indignation inside."*

A motivated software engineer looks focused and engaged, is competent in communication, proactive; and five out of seven respondents say, that the behavior of a motivated colleague influences their motivation and behavior.

> *Respondent 2: "When you see motivated colleagues, you understand that your company is result driven and without your input there might not be results, thus you must be motivated."*

Respondent 3: "I want to be hand by hand with motivated people. When you come in the morning and do not notice how a day has passed, you want to have motivated people nearby."

Respondent 6: "When I see people who do great things and I understand that a company is moving forward, I also want to move forward."

Separate professional entity. 5 out of 7 respondents believe that software engineers are a separate professional entity, which is distinguished by their intellectual capacity and technical competence, however, similar peculiarities are believed to be an attribute of other experts and professions, requiring special knowledge, such as doctors and teachers. National culture enlarges the gap between software engineers and other population due to unequal access to financial resources.

Task variety. Three respondents mention that they don't like most routine and mundane tasks at the workplace and if they have time, they develop tools to automate these routine tasks on their own initiative, which makes them feel competent and prompts a state of meaningfulness of work.

Intrinsic motivation factors are most often mentioned by respondents as a motivator in their work. Among intrinsic motivation factors respondents mention innate curiosity, autonomy, technically challenging work, "joy of craft", meaningfulness of work.

Respondent 2: "This desire to dig out the essence [of things] is important."

Respondent 1: "I particularly love to invent something which is not possible to invent without having given proper thoughts to it."

Respondent 4: "Electronics then move to the second place and algorithms are in the first place."

Respondent 6: "I always loved creative activities."

Respondent 7: "I have an idea in my head that I need to perform it in a universal way, so that it was "wow, beautiful", this is what I love."

Respondent 5: "Because I really like to understand how this or that code structure or technology works thoroughly, to know its features and problems, so that I can then combine

> *them or create something else, already like a constructor that has no clear edges. And you need to think thoroughly, about how best to build."*

However, one respondent is driven by the extrinsic factor of not becoming an obstacle to his colleagues, while they wait for him to complete his part of the project and he was the only one who mentioned that he does not like most tasks that engage major learning.

> *Respondent 2: "Honestly lately I began to hate long-term tasks, connected with education. Because every time I start to do them, I don't complete them. It makes me mad."*

The role of self-efficacy in both motivation and learning processes during the interview phase was discovered to take a significant place, as a method of gaining tacit knowledge and developing task strategies leading to performance. Self-efficacy is affecting the development of relevant and successful task-related strategies, which in turn enhance motivation through the mechanisms of feedback which arouses a sense of technical competence and in turn enhances self-efficacy again.

Thus, self-efficacy is discovered as an important factor in addressing research question 2.

Knowledge management theme was studied with questions aimed at scrutinizing the process of learning and task-related skills acquisition in the workplace in order to answer the RQ2.

RQ2: Which factors contribute to tacit knowledge acquisition?

Individual tacit knowledge. Prior to uncovering the role of self-efficacy in acquiring tacit knowledge, it is important to uncover, that respondents indeed possess individual tacit knowledge, conceptualized as "knowing how" to perform tasks.

> *Respondent 1: "Nor do I need to know the subject itself, as it is structural. That is, if it is clear that structurally there are blind spots, then they need to be opened in any case."*

> *Respondent 7: "Relatively speaking, to complete the task so that everything works well, stably, and so on and so forth. And I have a vision of how it should be, as if, roughly speaking, I can divide it into subtasks."*

> *Respondent 2: "A lot of experience came from the direct operation of the Services, servers, which were in my charge. That is, if something broke somewhere, that is, you could look at*

the error log or something else yourself and immediately, based on this analysis of the data logs, some kind of training was already taking place."

Respondent 3: "I know companies that make it [codebase] publicly available, these companies are cool, they put their solutions in the public repository, you can see them there. That is, for example, I have seen some components from them, I know that it is in public repositories. I'll go and see how it's done, cool done. Why invent a bicycle, I adopt it to myself."

Respondent 1: "Nor do I need to know the subject itself, as it is structural. That is, if it is clear that structurally there are blind spots, then they need to be opened in any case."

Respondent 7: "I think, firstly, from experience, even with each such problem that I solved on the run, tried to solve, I still got some kind of experience. I already tried this somewhere, it didn't work. And just like that, in my head it accumulates by itself. And second, his is probably an observation of colleagues, because in the case company […] from the very beginning there were more senior colleagues, that is, I watched how they do, and I was interested."

Self-efficacy allows respondents to develop knowledge and skills to learn by reviewing the code of peers and/or reading technical documentation and thus adopt successful and efficient patterns in situations when no one inside the case company can consult or guide them. This is how self-efficacy manifests, since simply having a set of skills differs from applying these skills for the successful solutions of workplace tasks (Bandura, 2023). Five out of seven respondents have developed similar patterns of getting knowledge in the situation when they face unfamiliar tasks: initially, they google the domain to familiarize themselves and then ask peers, who already have experience in similar projects or review their codebase in public repositories, such as GitHub.

Respondent 7: "For example, I saw the code of [Person Name] in the public repository, we have all the code in the company visible to each other. I just looked at how it was done there, tried to figure out if I liked it."

Respondent 5: "If these are some functions used in the code of a third-party library, it is obvious that you can look somewhere on the Internet. Or that some kind of structure is like

> *a pattern or something similar, which can also be generally accepted, then I can also look it up on the Internet."*
>
> *Respondent 6: "For me, Golang [language] was new; I never wrote anything about it. But purely based on projects with the help of some tips from colleagues a little bit of Google, well, that's slowly started running."*

Communication and knowledge sharing. The information on who of colleagues has developed which competencies and has experience in the requested technology stack and thus is the right person to ask for advice, is distributed through informal communication by discussion of technologies or previous experience. The role of trust, supported by the previous positive experience was mentioned by one person, as a factor influencing the choice of the right person to ask for advice. Three people mentioned the number of years worked together in the case company as an influencing factor.

> *Respondent 3: "Mainly I ask from those from whom I got used to ask, or with whom we have worked together for years."*
>
> *Respondent 1: "Sometimes when you trust your peers you don't need to spend two days on learning, you just listen to their two-minute lecture on this topic with a summary."*

The academic background or other explicit learning background was mentioned by three respondents as a factor in the successful acquisition of work-related knowledge. And two respondents mention further education as a way to develop work-related competencies.

> *Respondent 7: "I've had a few tasks related to machine learning; I think I have a good university background. I have some kind of background when I know where to look for exact technical information."*
>
> *Respondent 3: "I realized that I have a lot of knowledge from different domains and approaches. And I want to structure it. And I took one course, pretty big. For a year. In February, I took another course, also on the structure of knowledge, specifically for working employees. I want to devote the next year to structuring my knowledge, namely, to bring it to the peak in terms of quality."*

> *Respondent 1: "We work in the field of data structures and processing. I don't want to upset anyone, but since '76, nothing has changed since the release of the book of Knuth. That's just the implementation of the math apparatus has long been known."*

Expertise. Two respondents mention strategies they have developed for the implementation of complicated or containing huge amounts of unknown technological components.

> *Respondent 1: "My actions depend on the type of task. The first option is to search for the average mathematical analog of this operation. That is, to understand what the true essence of the subject is and try to find some kind of analog in some kind of theoretical algorithms or theoretical mathematics. After you find it, you begin to see this task structurally. It takes a little time to either think or google."*

> *Respondent 7: "I will try to reduce the problem first to be understandable to me. That is, if, as you say, she is completely incomprehensible to me. Well, this is not very good, you need to reduce it to something simple first, and then expand this simple. And this is simple, but usually you should already be familiar with how to do it."*

The second respondent also has developed a unique approach toward technologically advanced tasks with major uncertainties:

> *Respondent 7: "To begin with, I will look for how such projects were made by competitors approximately. That is, there you can always see, for example, their vacancies, see a list of technologies that this company requires, and somehow narrow down the spectrum of technologies or future solutions for yourself."*

These two strategies are distinguished from other colleagues' approaches to how they solve unfamiliar tasks or what strategies they chose to succeed in an unfamiliar task. Both respondents are the most experienced team and project leaders, and their strategies comprehend the project, rather task approach. This finding supports the theoretical concept of tacit knowledge in the software development industry – as articulable implicit managerial knowledge on how to perform software projects (Busch et al., 2003), even though the number of respondents is insufficient to state that this knowledge was acquired due to the case company.

Therefore, interview findings confirm that the case company employees possess individual tacit knowledge and one of the respondents described particularly how this knowledge was acquired in the case company.

> *Respondent 7: "I didn't have the habit of trying to simplify it [task] somehow in my head. There was no experience. And as now, for example, and form for yourself some kind of a way to consistently solve the problem. I tried to solve it [task] as is. I was often frustrated that something did not work out."*

Organizational structure. The case company is characterized by low bureaucracy, medium-level formalization and centralization of decision-making; however, each respondent mentions the ability to influence decision-making in the company and the ability to influence project-related aspects of their work. These results partially reflect theoretical findings, that more integrated, complex and formalized (in some research) organizational structures are positively correlated with knowledge management practices development (Chen & Huang, 2007; Liao et al., 2011, pp. 734-735), however, due to the small size of the case company complexity and integration were not studied.

6.3 Process Design Workshop

The direction of the development objective of the present thesis is future-oriented and is headed toward new employees selection and onboarding so that their performance rapidly achieves the level of the current team's performance. 100% retention rate of the current case company team and their performance rate is high enough, according to the case company CTO (Spazhev, 2023), thus, the findings from the present research regarding the current team motivation and tacit knowledge are utilized as guidelines for the new employees selection and onboarding to make their performance rate manageable process.

The development workshop was held in the case company premises on April 18th and lasted 2 hours and 10 minutes. All invited participants agreed to assist in Workshop on elaborating a theoretically grounded approach toward candidate selection, onboarding and performance support. The researcher acted as a facilitator in the process, and two team leaders and the case company CTO acted as speakers. The case

company representatives actively participated in the process, given the fact that the researcher has limited technical qualification and guided the process within the Process design agenda.

The agenda was preliminary forwarded to all participants on the 14th of April and participants were invited to comment and suggest adjustments to the process. The workshop process design draft (appendix 7) explained the main findings from the empirical part, presented the integrated process of motivation and learning and relevant theoretical terms explained, so that each participant could familiarize themselves with the topic and data.

The workshop process followed the agenda and started with the researcher's presentation of the main findings from the empirical part regarding the needs, personal characteristics and background in order to discuss workshop questions.

Q1: How can we design candidates selection process in order to select the candidates, that have the most potential to grow in the case company?

A brief description of the main findings from the theoretical background and empirical part to support the discussion was followed by a question:

Sub question 1: Which of the revealed with data characteristics we should seek when selecting candidates?

All participants shared their opinions, concerns and arguments, which were followed by a list of characteristics, which an ideal candidate is good to have:

- Degree in Math or Computer Science
- Professional experience 2+ years
- Competent communicator

The discussion followed by a question raised by the CTO, who reminded about the culture of life-long learning and “functionality over formalization” culture in the case company and all participants shared their ideas, on why it is important to preserve and what processes it affects. Thus, the discussion moved on to seeking the answer to the question:

Sub question 2: How we can check if the candidates share the case company's culture?

After a lively discussion participants decided to accompany the open positions application process with a 6-question questionnaire:

- What makes good code good?
- What are the benefits of teamwork? What are the benefits of single work?
- What happens when you enter google.com in an address bar of web browser and press enter?
- In which cases you would rewrite existing code and in which cases you would fix the code?
- How do you usually test your application/code before you deliver it?
- What was the last interesting technology you've learned and what made it interesting for you?

An important issue was raised during the workshop, that some candidates can speak well, however, they do not necessarily behave the way they say. Thus, another sub-question arose:

Sub question 3: How can we validate, that a candidate indeed behaves respectfully, communicates professionally and is able to solve practical tasks?

In order to handle this situation, participants agreed to arrange a technological debate with different opinions with candidates during the interview in order to observe how candidates communicate, articulate arguments and handle often occurring in the case company situations of technological debates. For the purpose of discovering candidates' cultural fit and hands-on experience participants decided to arrange a two-level test assignment with a small basic task and subsequent comments with a request to fix some minor issues in code.

Participants agreed that this process of candidate selection has the potential to cover motivational, personality, skills, cultural and communication factors and can be adjusted in an iterative manner. Participants confirmed that all their considerations are covered, and the candidate selection process shall be held according to the discussed procedure.

After the 10-minute break participants met to discuss the second major question.

Q2: How can we improve our onboarding and performance support practices to foster performance?

Participants agreed and it is also supported by theoretical findings, that a new person's onboarding to the already existing project takes time, despite the candidate level, and in order to boost this process, the case company managers need to adjust and finetune processes iteratively. Thus, the managerial task for the case company is to create conditions for personal and professional natural growth and development. Participants prior agreed to adjust candidate selection processes to heighten the chances of the "right" candidate selection.

For the purpose of developing favorable professional conditions in the workplace the participants agreed to arrange a process of onboarding and further development of new team members, which starts on gradual project immersion with isolated clear tasks (task identity, JCT) with a maximum delivery time of one week (knowledge of the results of work, JCT and goal setting theory) for a period of one month. After the first "onboarding" month larger operational tasks are assigned with comments on these tasks' significance.

Team leaders agreed about the importance of regular feedback to support new team members' technical competency and self-efficacy and the researcher is responsible for supporting team leaders in the process and remind them about feedback and task significance explanations until these new practices become natural for team leaders.

For the purpose to support the performance of the case company's current employees, participants of the workshop decided to arrange monthly workshops/brainstorming for all team members with preliminary agreed agenda. The purpose of the workshop is to address various important internal topics in a semi-structured manner and serve as a space for informal communication about new technologies, the case company's new releases and progress on current projects, answer the employees' questions and report about the current state of business and to discuss failures and lessons learned. Workshop participants agreed to arrange the first monthly workshop in three weeks when a new product is released.

One of the team leaders suggested making a process of "first-level comments" company-wide best practice. First-level comments suggest that all relevant information regarding the project on how to run the code is stored nearby the code in a readme file. Thus, a new to the project engineer would be able to run the code, find other relevant information regarding the project and its infrastructure in the case

company's inner Confluence documents and use Jira to follow tasks logic and assignees to seek for important details on the project.

Workshop participants agreed that for the current state of the case company's processes and scope suggested improvements are a way to start and agreed to proceed on processes improvements in an iterative manner. Participants agreed to revise the processes once a year and the next workshop on candidate selection and onboarding is held in April 2024.

The researcher read back the action plan and the participants agreed to start with the actions collaboratively developed during the workshop. The researcher thanked all the participants for their time, commitment and active and diligent collaboration. The workshop was announced closed.

6.4 Summary of key findings

In this chapter quantitative data collected with anonymous questionnaires and qualitative data collected with semi-structured interviews were presented in order to find answers to the research questions:

1. Which factors contribute to the case company employees' motivation?
2. Which factors contribute to tacit knowledge acquisition?

Regarding RQ1, with the questionnaire on employee motivation quantitative data were collected to serve as a benchmark for measuring the case company employee motivation. A motivated employee considers quitting the job and working somewhere else "a couple of times", their overall work satisfaction scores 8,00 points and the number of "sick leave" days within a calendar year is 4,00.

Among the factors, affecting employee motivation personal characteristics, set of needs, job characteristics, peer motivation and intrinsic motivators were identified.

Personal characteristics of the case company employees include: autonomy, technical competency, growth orientation, creativity, curiosity. Respondents have normal level of cognitive abilities for tech-professionals measured by math performance; respondents might have advanced level of implicit learning abilities; respondents have from 0,00 to 40,00 years of professional experience, with six people having over 6 years of experience and average 12,11 years of professional experience which is normal for

obtaining domain expertise. State of the profession was not proven to moderate motivation, but rather moderate the effect of monetary reward, while innate abilities and curiosity, knowledge and skills do.

Set of needs discovered to drive the case company employees support McClelland's theory – need for affiliation (4 respondents), need for achievement (5 respondents) and growth need (6 respondents). The monetary reward was discovered to motivate more experienced respondents and serve as a hygiene factor for less experienced respondents.

Job characteristics, which motivate the case company employees partly support theoretical findings of job characteristics theory. Task identity (5 respondents) and task significance (3 respondents) report as valuable and important factors. Autonomy is valued by all 7 respondents and feedback was mentioned by 4 people, however mainly in the context of getting aware of the results of their work and perceiving themselves (technically) competent, which in the studied case is comprehended in the cognitive context of learning and acquiring tacit knowledge and is embedded in the concept of self-efficacy.

Peer (de)motivation. 6 respondents reported noticing if a peer is not motivated by their distracted and task avoiding behavior, is not engaged and poorly communicates, while a motivated colleague is focused, engaged, proactive and competent in communication. 5 respondents are motivated by their colleagues' motivated behavior.

Regarding RQ2 Results obtained with DLOQ can be utilized to observe the tendency and serve as benchmark for further data collection in the case company. DLOQ was designed to primarily assess the overall pattern of mean results within all domains and the data show that the case company has a tendency toward learning organization. The lowest mean result of the case company is ranked in “Systems to Capture Learning” (Table 8). “Systems to capture learning” dimension is the only predictor of the organization’s knowledge performance, which is an organizational ability to utilize knowledge to innovate, improve processes and create new knowledge (Kyoungshin, 2016). Other domains scored less in DLOQ – Empower People, Connect the Organization, Collaboration and Team Learning and Continuous learning are the field of potential growth for the case company.

Background data did not reveal any anomalies in explicit learning abilities of the case company employees, rather than revealed that employees represent a “normal” level of general intelligence for software engineers, measured by math performance, thus, data has not revealed predictors of fast acquiring job-

relevant skills and knowledge. Results of TTKM questionnaire didn't confirm, that the case company produces tacit knowledge about the performance of software projects.

Nor the interview analysis could confirm, that the case company employees possess domain tacit knowledge, because only two respondents with experience in managing software projects volunteered to participate in the interview part of the research out of four such engineers in the case company, which is also insufficient for qualitative research (Baker & Edwards, 2012; Eriksson & Kovalainen, 2015, Chapter 7). One of the two respondents has already had substantial previous managerial experience in the domain, and the second respondent has gained managerial knowledge within the case company. Interview of only one respondent, who gained tacit managerial knowledge in the case company is not sufficient because no similar patterns or other factors, allowing to suggest, that this tacit knowledge was developed due to experience in the case company. The researcher in qualitative research can subjectively decide on which sample size is sufficient to reveal the whole picture of the research topic and uncover the richness of factors constituting the rare phenomenon (Baker & Edwards, 2012, pp. 8-9; Eriksson & Kovalainen, 2015, Chapter 7).

Tacit knowledge. Nonetheless, during the interview process, similar patterns in the respondents' approach to acquire knowledge and their approach toward code analysis and performing tasks were uncovered, which allows to suggest, that individual tacit knowledge, supposedly confirmed by DLOQ questionnaire is produced by the case company. Thus, for the purpose of the present research tacit knowledge is re-conceptualized as "knowing how", i.e. as knowledge acquired through personal experience, is procedural, i.e. has practical implication toward solving real-life tasks, influences behavior since it is relevant to personal goals (Ryan, 2005) and is studied with qualitative data collected and analyzed further.

Self-efficacy was discovered to be the factor that allows the case company employees to develop knowledge and skills to learn by reviewing the code of peers and/or reading technical documentation and thus develop task-relevant skills and successfully perform the tasks. This successful performance induces a sense of competence and enhances motivation in accordance with goal setting theory and reinforces self-efficacy.

Explicit learning. Access to the code databases and public repositories, such as GitHub and academic background/university degrees in mathematics or computer science were discovered to contribute to tacit knowledge acquisition in the case company. The time of team formation, which is the number of

years team members have been working together (Marsicano et al., 2017, p. 237) is involved in tacit knowledge acquisition.

During the development workshop, held in the case company premises with three participants, managing software projects and the researcher as a facilitator, an action plan on how to boost the performance of newly selected and onboarded software engineers, backed with theoretical and empirical findings, was elaborated. The action plan covers two themes: candidate selection and onboarding and performance support during the 1st year in the case company and is iteratively revised yearly.

Action plan of the case company's new candidate selection and onboarding, aimed at boosting the performance of software engineers.

1. Candidate selection process.
    - Prescreening. CV and 6-question questionnaire revised by CEO and CTO.
    - 1st interview. Held by the CEO, CTO and Team-leader in order to assess culture fit, communication competency and technical level for test assignment
    - Test assignment. Two-level test assignment of little complexity, but with minor fixes iteration
    - Job-offer negotiations. Held by CEO and CTO
2. Onboarding and performance support of candidates during 1st year.
    - Introduce a process of “first-level comments” as a company-wide best practice. First-level comments suggest that all relevant information regarding the project is stored nearby the code in a readme file.
    - Onboarding begins with gradual project immersion with isolated clear tasks delivered within one week for an onboarding period of one month. After the first onboarding month larger tasks are assigned with comments on these tasks’ significance.
    - Adopt a practice of regular feedback on team performance given by the team leader. Upon completion of a sprint input of team members is recognized.

- Conduct monthly workshops where report about current projects progress, discuss new technologies, “fancy” project solutions and mistakes and lessons learned.

Thus, by selecting relevant candidates and by adjusting onboarding processes, the case company is capable of creating favorable conditions for natural activity, intrinsic motivation and supporting the existing environment in the workplace. In the next chapter the integrated empirical concept of motivation and learning for the case company is presented and the main findings in relationship with the theoretical framework are discussed.

7 Discussion

The aim of the present research was to identify which factors contributed to the commissioner's software development team performance and retention. Answers to research questions were found and discussed further in the present section:

RQ1: Which factors contribute to the case company employees' motivation?

Individual factors. The case company employees represent a relatively homogenous group of people with university degree in math or computer science, with an innate leaning toward computers and technical abilities, discovered in their early years. The research did not reveal advanced intellectual abilities, measured by math performance, while implicit learning abilities, measured by academic performance and foreign language skills might be advanced in part of the team. Employees demonstrate a high level of autonomy, creativity and curiosity and are driven by the need for affiliation, growth need and need for achievement.

These findings partly support the discoveries from a systematic Literature Review (Beecham et al., 2007, p. 12; Sharp et al., 2009, p. 7) regarding the personality of software engineers, excluding introversion, which was only once explicitly articulated by a respondent. Similar limited support of a set of needs that drive the case company employees was discovered, however, due to the small number of respondents (seven people participated in interviews) these limited support can be explained.

Monetary reward. The role of monetary reward on motivation contradicts the findings of Hall and colleagues (Hall et al., 2008, p. 93) since in the case company it is a moderator which contributes to the motivation of more mature developers (unlike more junior developers as stated by Hall and colleagues) who pay house loans and are breadwinners in the families and therefore are motivated with monetary reward, while for younger and more junior engineers monetary reward is a hygiene factor.

Such contradiction might probably stem from cultural and organizational contexts. According to the respondents, software engineers are a distinct occupational group, and, as stated by Starceva (2016), in Russia they have access to certain financial resources, in form of high financial compensation, which differs in Finland and even though if Finland software engineers are paid well, the gap between the monetary reward of other occupational groups and software engineers is less substantial, than compared

to Russia and is further regulated by progressive personal income taxation system. Therefore, after the relocation of the case company software team in 2022, monetary reward for seasoned software engineers become a motivator, because their wealth naturally decreased.

Job characteristics. Motivation factors of job characteristics in the case company partly support theoretical findings of job characteristics theory, developed by Hackman and Oldham (1976). Among job characteristics task identity (5 respondents), task significance (3 respondents), autonomy (7 respondents) and feedback were mentioned in the context of motivation.

However, the new content motivation theory of software engineers (TMS-SE presented in Figure 7) was developed by Franca (2014), which is more relevant to the findings of interviews, however, alone cannot comprehend the findings of the studied case. Thus, task identity is replaced with well-defined work, task significance is replaced with social impact and acquisition of useful knowledge, skill variety is interpreted as work variety and autonomy is perceived as creative work.

Table 37 - Job Characteristics Theory in comparison to the results of the present research

Job Characteristics Theory	Results from the present research
Task Characteristics	
Task Identity	Well defined work
Task Significance	Social Impact Acquisition of useful knowledge
Skill Variety	Work variety
Autonomy	Creative work
Feedback	-
Context	
-	Cognitive workload
Agents	
-	Engagement of co-workers
The Self	
-	Technical confidence

Figure 7. TMS-SE motivation theory (França, 2014, p.114)

JCT better describes the case company employees' motivation with such job characteristics as task identity, task significance and autonomy. Task significance is mentioned in the context of its role and value

for the team and company, rather than the more universal concept of social impact, suggested by Franca (2014). Work variety characteristic of Franca's is supported by the empirical results of the present research, however mainly as avoidance of mundane routine tasks. Both autonomy of JCT and creative work from Franca's were found to be valuable for the case company employees. Task identity factor influence was supported by the empirical results in a broader perspective than JCT theory describes, rather than what was presented by Hall and colleagues in SLR (Hall et al., 2008, p. 93)– "clear goals, personal interest, knowing task's purpose etc".

Cognitive dimension in motivation. All respondents are most motivated in the situations when they feel themselves competent and successful. For more novice respondents most pleasant job is associated with acquiring new knowledge and creativity along with cognitive workload. For more experienced respondents satisfaction arises with completing the tasks or getting tasks done, along with individual "valence" factors (Vroom, 1964) as cited in (Miner, 2015, Chapter 7), such as finding a "fancy" solution, taking responsibility for the solution, solving tasks with one "universal" solution, mobilize cognitive functions. Expectancy theory is also supported by the role of monetary reward for the case company seasoned employees, who believe they need to put in more effort, to receive the salient reward, i.e. monetary compensation (Vroom, 1964) as cited in (Armstrong, 2020, Chapter 24). Satisfaction occurs when there is an evident for respondent correlation between their effort and outcome.

With such successful experience respondents are capable to develop task performance strategies, supporting goal setting theory (Locke & Latham, 2013). However, in the present case respondents less base themselves on outer feedback, but rather on their subjective perception of the successful completion of a task. Thus, feedback in the present research is understood according to JCT as "knowledge of the results of work". Several respondents in their goal choices operate with an individual perception of a goal measure, that would allow them to feel competent. Thus, one respondent chooses a task (goal) that can be accomplished within 1-2 days, two others mention small goals, which can be accomplished either "fast" or "20 tasks within a day". Thus, the term specific is treated as "achievable with a clear timeframe".

RQ2: Which factors contribute to tacit knowledge acquisition?

The case company employees demonstrate normal level of cognitive abilities for engineering university students, measured by math performance and might have advanced implicit learning abilities. All respondents have university degree in mathemaatics or computer science. They acquire tacit knowledge individually by screening for codebase of their peers from previous or current projects, seeking optimal

ways to perform tasks. They also take to public repositories, google and read documentation seeking ways to solve unfamiliar tasks. In the last turn they ask for peer's advice and guidance. In essence, respondents acquire tacit knowledge by self-learning.

The role of informal communication between respondents is in exchanging opinions about new technologies and exchange their experience with previous projects, thus sharing knowledge about who is the best candidate to seek professional advice within the team. The role of trust in exchanging knowledge was explicitly mentioned by one respondent and implied by two others, who mentioned the number of years worked "hand-by-hand" with peers. Factors of "time of team formation" was revealed by Marsicano and colleagues (2017, p. 237), in their study of team maturity in software engineering teams, however, no clear agreement about the time needed was achieved, thus, it is still questionable, how many years of working together is needed for a team, to achieve maturity and thus, benefit from learning maturity, technical maturity and relational maturity (Marsicano et al., 2017, p. 237).

DLOQ and TTKM did not provide statistically valid results due to the small sample size and only the tendency can be estimated. However, the organizational construct does not require statistical representativity in sample size, but rather a careful selection of respondents pool, who are possessing the right knowledge (Wagner et al., 2010, p. 610). The design of DLOQ allows to estimate the tendency toward learning organization or the organization which enables employees to acquire tacit knowledge and share it.

TTKM questionnaire didn't confirm, that the case company produces tacit knowledge about the performance of software projects and the qualitative data collected with interviews were not sufficient for qualitative analysis, because only two volunteered respondents have managerial experience. Thus, with the present research no confirmation of tacit knowledge in the software engineering domain conceptualized as articulable implicit managerial knowledge on how to perform software projects (Busch et al., 2003) is achieved. Nonetheless, 4 out of 7 respondents demonstrate similar patterns in their approach toward new tasks or tasks with substantial uncertainties. Thus, for the purpose of the present research tacit knowledge is re-conceptualized as "knowing how", i.e. as knowledge acquired through personal experience, is procedural, i.e. has practical implication toward solving real-life tasks, influences behavior since it is relevant to personal goals (Ryan, 2005). This process cannot be separated from the motivation theme, because individuals receive positive reinforcement when they utilize tacitly acquired

knowledge to perform work-related tasks, which prompts feeling of professional growth and advancement, which in turn is one of the needs of the respondents.

Self-efficacy. Self-efficacy, which wasn't properly explored in the theoretical framework and thus its influence in acquiring tacit knowledge and motivation remained only partly covered with interviews, however, it revealed that among the case company employees are those, who are less capable of developing more practically successful work strategies. The role of self-efficacy was discovered during seeking evidence and answers for both research questions in an attempt to understand, why some respondents with relevant skills and experience and operating in the same organizational structure and context of the case company were less practically successful than their peers. Mere possession of skills does not predict their successful application to practical solution of tasks (Bandura, 2023, pp. 53-56). The role of self-efficacy in development of successful practical strategies might be an important factor for fostering the performance of software engineers in the case company.

The integrated concept of motivation for the case company employees, developed by the researcher, is presented in Figure 8 and explained further in the text. It is built by connecting the theoretical framework, presented in Figure 3, and the empirical results of interviews. The initial theoretical framework is adjusted according to the empirical findings and aim of the present research, namely identify key motivation and knowledge management factors, which contributed to the case company's software development team's consistent results of projects delivery, as well as research questions:

1. Which factors contribute to the case company employees' motivation?

2. Which factors contribute to tacit knowledge acquisition?

According to the revealed data, outcomes of motivated software developers are retention and performance. There are two set of factors, contributing to the motivation of the case company employees. One sets of factors is content or static set of factors, which are employees personality and workplace/job characteristics. Set of personality traits and needs along with job characteristics of the case company orientate employees toward certain goal choices. Individuals' growth need drives them to acquire tacit knowledge in order to perform work tasks.

In the theoretical framework goal orientation and elaboration by individuals successful goal strategies are covered by process theories, which are in essence cognitive. In the present case cognitive nature of

process theories consists of the acquisition of tacit knowledge due to the knowledge-based and intellectually advanced nature of work. Positive orientation of employees toward such goal as obtaining knowledge for the purpose of solving advanced workplace task and emerging after this satisfaction reinforces motivation due to the dominant growth need of the case company employees.

Employees acquire knowledge through individual learning via peers' codebase studying in public repositories and with explicit learning method – technical documentation reading and, as a last resort, with the peer advice. Once an individual can perform a challenging task with acquired knowledge or in a "fancy" manner, a sense of competence and satisfaction prompts. Self-efficacy is involved in the success of an individual's ability to utilize the acquired knowledge, decide about effort and task strategies they utilize to achieve a goal; however, the mechanism of this influence was not studied in the present research. Motivated colleagues enhance and contribute to the motivation of the case company respondents. Outcomes of learning integrated into daily tasks, satisfaction and motivation reinforce each other and drive respondents to set and achieve new workplace goals.

The case company structure in its current condition is not optimal for knowledge management practices, due to its strong centralization, however, no recommendations about restructuring are made, since the current results of the case company performance are satisfactory for the company's management. While during the present research no confirmation of the case company's employees' tacit knowledge in the software development domain was revealed, the initial aim to identify key motivation and knowledge management factors, which contributed to the case company's software development team's consistent results of projects delivery remained partly unresolved in the knowledge domain. However, individual tacit knowledge acquisition can be influenced by adjustments by the case company candidate selection and onboarding processes, which were discussed during the collaborative workshop. During the collaborative development workshop the case company team leaders drafted an action plan to improve existing candidate selection and onboarding processes to support employees' natural activity and intrinsic motivation.

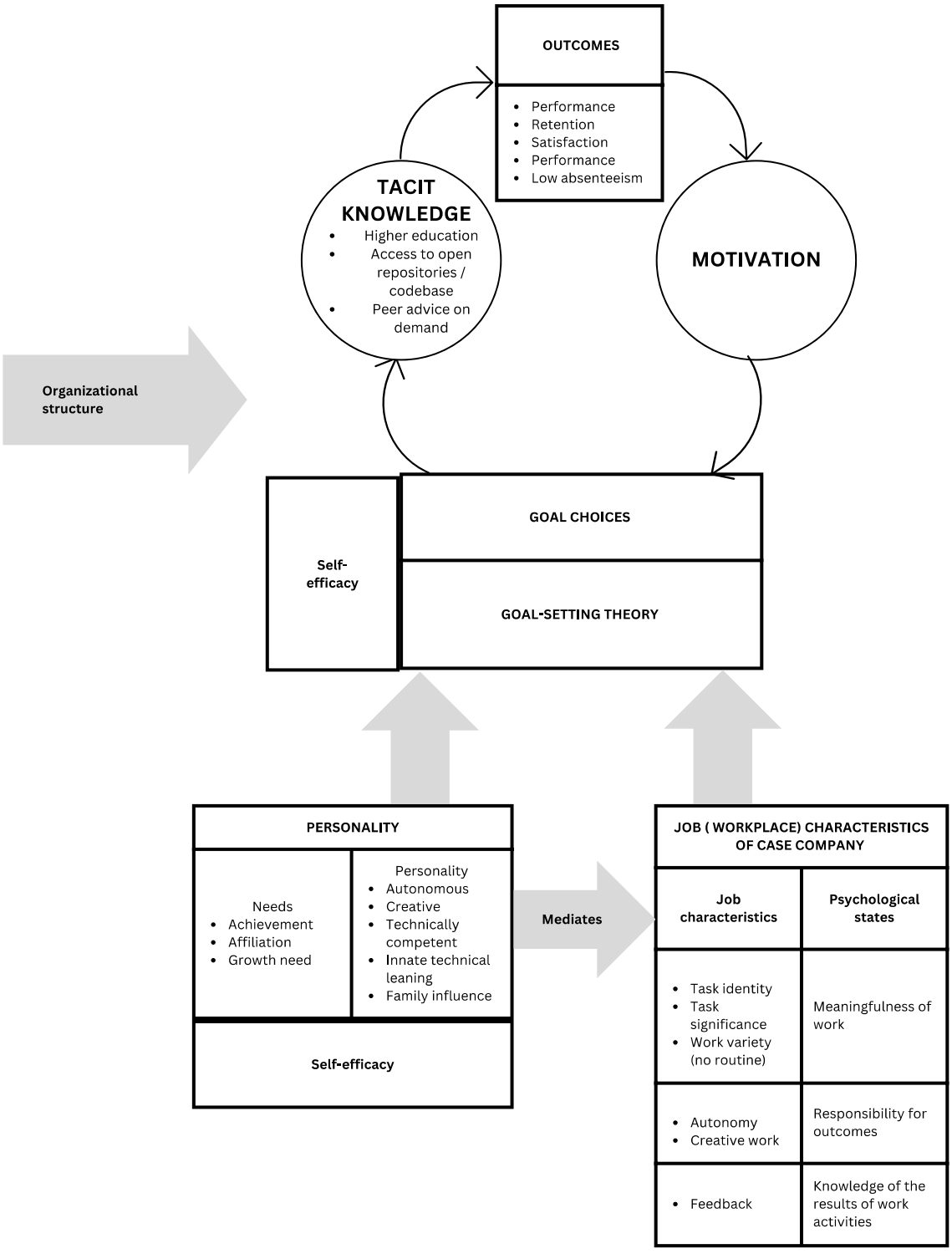

Figure 8. Integrated concept of learning and motivation for the case company

8 Conclusion

8.1 Reliability, validity and ethics

The research was conducted within the ethical and scientific guidelines of the Finnish National Board on Research Integrity TENK (*Responsible Conduct of Research and Procedures for Handling Allegations of Misconduct in Finland*, 2013), which the researcher familiarized herself to prior to the begging of the research process.

The choice of research strategy and methods are well grounded, justified and conducted with the principles of scientific research. Data was collected from primary sources within the guidelines of TENK (*Responsible Conduct of Research and Procedures for Handling Allegations of Misconduct in Finland*, 2013), openly presented, the contribution of the previous research on the topic was properly acknowledged. The researcher has familiarized herself with the scientific topic and accumulated vast knowledge on the topic, proven with the literature review, all sources are properly cited.

For the case study research strategy qualitative data collected with interviews is triangulated with quantitative data collected with questionnaires, sample size comprises nine to ten respondents, which is sufficient to ensure credible results for qualitative research, but not sufficient for statistical analysis, thus quantitative data is analyzed with descriptive statistics. Findings of the research correspond to the purpose of the research, answer the research question are linked to the theoretical framework and the previous research; thus, the research results are credible. For the purpose of organizational construct elaboration, instead of statistically representative results, the criterion of possessing the right knowledge prevails (Wagner et al., 2010, pp. 610-611). Credibility was challenged across the research process, due to the researcher's position and her involvement in processes. Since credibility in qualitative research can be estimated by the findings, which might not support the researcher's expectations (Saunders et al., 2009, p. 206), what is revealed by a failure to support the fact, that the case company generates domain-specific tacit knowledge, the present research is credible.

The evolution in the research process in conceptualizing tacit knowledge produced by the case company, in other words, dependability is another criterion of quality and value of qualitative research which replaces reliability for qualitative research (Saunders et al., 2009, p. 206). The results of the research are

not intended to be generalized or replicated outside of the case company, due to the small sample size and stemming from this limited external validity, however, findings from the present research might contribute to the generalizability of other research in similar contexts.

The researcher presented full and profound description of the context, data collection and analysis techniques and procedures, findings of the research, analysis process and interpretations, allowing the reader to decide upon the research transferability (Saunders et al., 2009, p. 206) of the study into other contexts, thus ensuring transferability off the research, which is another criterion of the present research quality.

Observer bias is addressed with the deductively held data collection and analysis process. Conflict of interest due to the researcher's position is addressed by avoiding factors under the direct responsibility of a researcher in the case company, such as leadership, values and culture. National culture aspects with large power distance causing the researcher's perception as a powerful person for the respondents, is taken into consideration with interview protocol question design and remote interviewing. The cultural context might affect findings of the research; however, cultural context alone does not invalidate the results of the research.

The research ethic is acknowledged during the data collection, analysis and storage processes, confidentiality is considered during the process of data analysis process. Questionnaires were conducted anonymously; data is stored on the researcher's laptop anonymously. The recordings of the interviews were made with the respondent's prior consent are deleted after transcribing, and transcriptions are read and analyzed by a researcher alone. Any personal information was deleted from the transcripts after the analysis and the transcripts are stored on the researcher's laptop.

8.2 Suggestions for further research

Several theoretical concepts, which manifested during the qualitative data analysis stage were not properly studied in the theoretical framework section, which are self-efficacy and self-determination theory. Concepts developed by Ryan and Deci with their Self-Determination theory (1985; 2000) appeared of greater importance for the studied case, than the researcher anticipated, due to the personalities of the case company employees and their innate leaning toward technology and engineering.

The role of self-efficacy in obtaining work-related skills and professional growth is worth proper scrutiny in the software development context. Due to the rapid development of technologies, the introduction of ChatGPT and Co-pilot AI-based tools, the capability to develop task strategies and adapt workplace practices might become crucial in performance and well-being. It is also worth studying with an in-depth approach the mechanisms of how self-efficacy, goal setting and Expectancy theory affect the acquisition of work-related knowledge and affect the motivation of software engineers.

Team Maturity in software engineering, developed by Pereira and Marsicano with colleagues (2017, pp. 235-240) and which can be utilized as a description of the case company is also worth further development and empirical testing. Processes happening in mature teams might contribute to the theoretical framework of organizational culture and learning organizations.

The final notice relates to the role of the researcher and her affiliation with the studied case, which limited the scope of the study and lead to the exclusion of leadership and culture, which are of great interest in a team of professionals with high intrinsic motivation and a high level of competence. Studying the leadership styles which contribute to the high level of professionals' retention might be beneficial in practical and academic domains.

8.3 Personal learning experience

The present research has been a great challenge, partly because of the workload that the researcher was to handle along with personal and professional activities, but also due to the failures and obstacles along the way. Given the situation when after two months of work the Word document with part of the literature review section disappeared from the laptop in the mid-cross-border business trip and the whole work has to be started from the beginning, also when the number of respondents revealed insufficient for qualitative research of articulable implicit managerial knowledge on how to perform software projects.

Along with challenges, the present research has become a great opportunity to develop, and practice set of important skills, as discipline, ability to pursue long-term goals, resilience, self-efficacy and adaptability. Consistency with the thesis schedule and the ability to resist the temptation to lay on a couch after a long day instead of proceeding the work was supported by a sincere interest in the studied topic.

Learning and researching skills evidently progressed along the journey. At the beginning of this path, the myriad of relevant theoretical topics seemed overwhelming, but with advancing in studying the scientific articles and previous research and with the skill to find relevant reliable sources, the skill to prioritize and select theories that would be most beneficial for the theoretical framework developed.

On this last page of the thesis the researcher realizes that her interest in the topic of research is even bigger than at the beginning of this journey, due to many interesting discoveries and the revealing of even more interesting topics, which remained uncovered. The overall experience is very satisfying and the support from my supervisor PhD Päivi Karhu was professional, timely and insightful. It is also very important to recognize the commitment and active participation of the case company employees along the process. It was a great journey, and what's even better, is where it has brought the researcher to.

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Dimension of Learning Organisation

☐ Mandatory questions are marked with a star (*)

In this questionnaire, you are asked to think about how your organization supports and uses learning at an individual, team, and organizational level. Please respond to each of the following items.
For each item, determine the degree to which this is something that is or is not true of your organization.
If the item refers to a practice that rarely or never occurs, score it a one [1]. If it is almost always true of your department or work group, score the item as six [6].
Fill in your response by marking the appropriate number on the answer sheet provided.

1. How long have you worked in organization *

If less than a year put zero, in other cases put completed years _____

2. In my organization, people openly discuss mistakes in order to learn from them *

Individual level

3. In my organization people identify skills they need for future work tasks *

Individual level

4. In my organization people help each other learn *

Individual level

5. In my organization people can get money and other resources to support their learning *

Individual level

6. In my organization people are given time to support learning *

Individual level

7. In my organization people view problems in their work as an opportunity to learn *

Individual level

8. In my organization people are rewarded for learning *

Individual level

9. In my organization people give open and honest feedback to each other *

Individual level

10. In my organization people listen to others' views before speaking *

Individual level

11. In my organization people are encouraged to ask "why" regardless of rank *

Individual level

12. In my organization whenever people state their view, they also ask what other think *

Individual level

13. In my organization people treat each other with respect *

Individual level

14. In my organization people spend time building trust with each other *

Individual level

15. In my organization, teams/groups have the freedom to adapt their goals as needed *

Team/Group Level

16. In my organization, teams/groups treat members as equals, regardless of rank, culture, or other differences *

Team/Group Level

17. In my organization, teams/groups focus both on the group's task and on how well the group is working *

Team/Group Level

18. In my organization, teams/groups revise their thinking as a result of group discussions or information collected *

Team/Group Level

19. In my organization, teams/groups are rewarded for their achievements as a team/group *

Team/Group Level

20. In my organization, teams/groups are confident that the organization will act on their recommendations *

Team/Group Level

21. My organization uses two-way communication on a regular basis, such as suggestion systems, electronic bulletin boards, or town hall/open meetings *

Organizational level

22. My organization enables people to get needed information at any time quickly and easily *

Organizational level

23. My organization maintains an up-to-date database of employee skills *

Organizational level

24. My organization creates systems to measure gaps between current and expected performance *

Organizational level

25. My organization makes its lessons learned available to all employees *

Organizational level

26. My organization measures the results of the time and resources spent on training *

Organizational level

27. My organization recognizes people for taking initiative *

Organizational level

28. My organization gives people choices in their work assignments *

Organizational level

29. My organization invites people to contribute to the organization's vision *

Organizational level

30. My organization gives people control over the resources they need to accomplish their work *

Organizational level

31. My organization supports employees who take calculated risks *

Organizational level

32. My organization builds alignment of visions across different levels and work groups *

Organizational level

33. My organization helps employees balance work and family *

Organizational level

34. My organization encourages people to think from a global perspective *

Organizational level

35. My organization encourages everyone to bring the customers' views into the decision making process *

Organizational level

36. My organization considers the impact of decisions on employee morale *

Organizational level

37. My organization works together with the outside community to meet mutual needs *

Organizational level

38. My organization encourages people to get answers from across the organization when solving problems *

Organizational level

39. In my organization, leaders generally support requests for learning opportunities and training *

Organizational level

40. In my organization, leaders share up-to-date information with employees about competitors, industry trends, and organizational directions *

Organizational level

41. In my organization, leaders empower others to help carry out the organization's vision *

Organizational level

42. In my organization, leaders mentor and coach those they lead *

Organizational level

43. In my organization, leaders continually look for opportunities to learn *

Organizational level

44. In my organization, leaders ensure that the organization's actions are consistent with its values *

Organizational level

Team performance on successful projects

☐ Mandatory questions are marked with a star (*)

Please, select the degree to which you feel each factor affects team performance on successful software development projects on a 5-point scale. The constructs are rated by selecting closest to the statement pole that best describes the factors that influence team performance on successful projects. There are no right or wrong answers on this questionnaire, just personal version of factors that affect team performance on successful projects.

1. *

2. *

3. *

4. *

5. *


Innovative project
1
5
Mundane/Everyday type project

6. *


1
Experienced team
1
5
inexperienced team

7. *


1
Adequate resources
1
5
Inadequate resources

8. *


1
Diverse team members
1
5
Uniform team members

9. *


1
Small project
1
5
Extensive project

10. *


1
Strict deadlines
1
5
Widely variable deadlines

11. *


1
Big Team
1
5
Small Team

12. *

13. *

14. *

15. What's your age *

This section collects background data to present descriptive statistic information on respondents.

16. What's your gender *

- [ ] Male
- [ ] Female
- [ ] Prefer not to tell

This section collects background data to present descriptive statistic information on respondents.

17. How many years of IT experience you have *

18. How many years you have worked in the company *

if less that a year - put 0
in other cases put completed years _____

19. Your highest education degree *

- [ ] Secondary school
- [ ] University Bachelor Degree
- [ ] University Master Degree
- [ ] University Specialist
- [ ] Other

20. Your score on state math exam (ЕГЭ). In case you didn't have one - put your grade on math from your school diploma *

Scores _____

Grade * _____

21. Your score on state foreign language exam (ЕГЭ). In case you didn't have one - put your grade on math from your school diploma *

Scores _____

Grade * _____

22. Year of graduation from school *

_____

23. Have you graduated with honours from *

- [ ] School
- [ ] University
- [ ] None

Motivation

☐ Mandatory questions are marked with a star (*)

The purpose of this servey is to measure general level of motivation among employees. It consists of four questions. For each question, pick the closest option according to your perception. In numeric questions, put numbers in the box.

1. How long have you worked in organization *

Put the number. If less that a year put zero, in other cases put completed years _____

2. I've seriously considered to quit and work elsewhere *

- ◯ Never
- ◯ Couple of times
- ◯ From time to time
- ◯ Often
- ◯ Right now

3. My overall work satisfaction is *

4. How many days have you approximately been absent in 2022 due to health reasons? Reespond in case you worked full 2022

_____

Semi-structured interview protocol.

1. Background questions

Name
Position
Education
When did you start in a company
How would you assess your professional level when you started in the company
How do you asses your professional level now

2. Structure of the company

Do you know who is the decision making authority in the company and how can you influence the decisions?
How would you estimate the level of bureaucracy in the company
How would you estimate the level of formalization or when decisions are guided by prescribed rules, procedures and policies.

3. Motivation

How did you choose the profession/work area?
How do you feel currently working as a software engineer? More/less stressful, enjoyable, hard, meaningful, etc.
Is software engineers a distinct social/occupational group? What are their characteristics, what distinguishes them from others?
Why you choose the commissioner company to work for?
How would you describe a behavior of a motivated software engineer?
Among your daily activities, what are those you like most? Why?
What other activities would you like to do, but currently don't do? how do you feel about it? Among your day-to-day activities, which do you hate the most? Why?
Besides your day-to-day activities, what other activities would you never want to do?
How would you describe a clearly demotivated colleague?
How are the tasks assigned to you? How does the task division work? Describe your teamwork dynamics, and your specific role.
In which way do you think that it can affect the teamwork?
What else could the organization do (but currently does not) to deal with the motivation of the software engineers?
Talking about your future career expectations: what activities would you like to be doing in 5 years?

4. Learning

How fast you learn work-related skills, self-assessment?
How do you most effectively learn on the workplace, describe the process
How would you actually prefer to learn? What is the most effective way for you to get new information?
Do you feel yourself belonging to the team/community
Who are the people you address in case of workplace difficulties?
Who are the people who request your help most often
How do you feel, when someone asks for your help/advise?

Would you like to add any extra information or observation that we have not asked, but you think can be relevant for us?

Codebook

Name	Examples of units coded	Files	References
background		5	6
Context		5	9
Higher education		7	7
Monetary reward	2: “when I chose a profession, I didn’t think at all that some profession would bring more money or less. That is, I did not go into the profession for money.” 3: “And so it happened. That I chose such a specialty, but I did not think about money. Didn't recognize.” 6: “Thinking about salary. But to be honest, not in the first place. I mean, well, it's just kind of self-evident. That is, if there is professional growth, then the salary will come”	7	13
Motivation	6: “the very process of developing some interesting algorithms It gives me pleasure” 4: “I like it because I've never come across such a job before... And, perhaps, this component, the English language, is the most interesting” 5: “I am driven by something at the junction, when you didn’t know how to do something, found out about it.”	7	30
absence of motivation	2: “On the contrary, he is distracted.” “Well, yes, it is somewhat annoying or something like that? Well, yes, I notice it. Noticed. It annoyed me.” 3: “he does not listen, not taking into account the results of some past discussions.” 1: “The second story is systematic non-compliance with deadlines and silent non-compliance with deadlines.”	6	13
Goal setting theory		6	29
Goal choices		1	1
difficult		1	1
specific		0	0
Goal moderators		5	13

Name	Examples of units coded	Files	References
Commitment		2	2
Feedback		4	7
Skills, ability		2	3
Task complexity		1	1
mechanisms of influence on outcomes		1	6
direction		0	0
effort		1	2
persistence		0	0
task strategies		1	4
Intrinsic motivation	2: “I want to do something cool” 3: “I'm there all the time, maybe I took apart my computers, assembled new ones from spare parts. That is, there was interest at this level.” 1: “My whole family soldered. I constantly saw these oscilloscopes, a soldering iron. And I was curious.” 7: “I sometimes have a fixed idea in my head that you need to somehow try to do it all in one way in such a universal way, so that it is just wow, cool and kind of. I'm trying to do this, it's interesting to me. I'm happy when I succeed, I'm upset when I don't.”	6	20
Job characteristics theory		7	33
Job characteristics		6	23
autonomy	2: “I am 80% autonomous Well, I guess I set my own deadlines.” 1: “On average, I assign the task to myself, of course.” 3: “In general, I think I'm pretty autonomous now.” 7: “Right now, in this period, I am assigned tasks, I can influence. For example, if I think that a task is impossible or should be done as part of another task, I will inform about that.”	4	6
feedback	3: “I do it and see results immediately. Actually, that's why I'm still in the frontend, because I like to see right away.”	4	7

Name	Examples of units coded	Files	References
	1: “And I liked this process and the result is visible. The main thing in the end, you need to understand that, taking into account poverty, the lack of appliances and toys, I soldered toys myself, I soldered myself appliances that I later used, made a musical player, and listened to music on it, because there was no money for it.” 4: “I actually developed several such programs in the customs office, which helped to solve problems. And they were so successful that they spread throughout our northwestern region and it was very interesting.”		
skill variety		1	2
task identity	5: “On the tasks that we take, we discussed them before taking on. Therefore, most likely, yes, I was just satisfied with these surrenders, and I wanted to take them. Therefore, I did not try to refuse to surrender for the deadlines.” 7: “For example, such a task, or, if the task is so abstract, then, of course, it’s more likely already, if I manage the project there, then the mistake is precisely in compiling the task by me.”	5	6
task significance	2: “The main factor of motivation is the desire to perform, so that your task is completed both beautifully and beneficially.” 4: “I actually developed several such programs in the customs office, which helped to solve problems. And they were so successful that they spread throughout our northwestern region and it was very interesting.”	3	4
psychological state		4	10
knowledge of the results of work		4	6
meaningfulness of work		1	1
responsibility for outcomes		2	3
mediators		5	17
managerial leaning		2	5

Name	Examples of units coded	Files	References
state of profession		4	7
technological leaning		4	5
Moderators		6	10
career stage		0	0
family influence		6	8
national culture		1	2
Needs		3	7
High-order needs (motivators)		3	5
Low-order needs (hygiene)		1	2
Performance and outcomes		1	2
Personality		7	85
Achievement		5	10
affiliation		4	4
autonomous		4	7
creative		4	7
growth oriented	3: “Well, it's a full stack. That is, I have had a frontend for many years, right? Now pull up the backend. And now to implement cloud technologies. Well, along the way, of course, to manage some projects related to these areas, that is, to manage and, so to speak, a playing coach. Be a player coach. That is, to practice. But at the same time make decisions. I would like that.” 6: “Experts in the field Definitely would like to become, as I said the motivation to grow, it is huge. That is, I do not want to stand still, I want to develop.” 7: “Leading. Yes, because I like to communicate my vision. I like to do something with someone else's hands, I like to organize something. That is. I even see some such meta-programming in this. That is, when you are programming code, you write, and then you set a task in the timeline and try to build some kind of project algorithm.”	6	13

Name	Examples of units coded	Files	References
innate technological lean		7	30
introverted		1	1
need for power		2	4
technically competent		5	9
repetitive mundane tasks		3	5
Self-efficacy	2: “To be honest, the tasks that I don't like to start doing lately are long-term tasks related to learning. Because every time I start making them, I don't finish them. This is terribly infuriating and annoying.” (lack of S-E) 3: “I had one conversation with [person name]. I told him that I will spend a few days on this. But then it will pay off, thereby speeding up the process.” 1: “There was a big problem that a lot of people don't understandwhen advice is needed because they don't understand that advice is needed. From here I go and listen to who is discussing what. When I feel that there is no depth and potential problem, I begin to give advice myself or point out what is missing in the study.” 7: “Then, after some iterations, I was able to transform this idea into an implementation with the help of the team. It was very cool.” 6: “before you run away, distract a colleague from work, you must first try to think something yourself. For example, you can, for example, already implement some piece.”	7	34
separate professional entity		7	11
VIE theory, Goal-Choice predictors		1	1
expectations		0	0
instrumentality		0	0
valence		0	0
Organizational structure		6	22
Bureaucracy		6	6
Centralization		6	9

Name	Examples of units coded	Files	References
Complexity		0	0
Formalization		6	6
Integration		0	0
Tacit knowledge		7	131
open repositories and digital tools	6: “Read documentation, see usage examples often for libraries. They are published online, where you can clearly see how it works.”	5	13
role of context		2	3
tacit knowledge acquisition	2: “a lot of experience came from the direct operation of the Services, servers that were in my charge. That is, if something broke somewhere, that is, it was possible to look at the error log or something else and immediately, based on this analysis of the data logs, some kind of training was already taking place that it was impossible to do this and that there, then provided that it was done,then this, then that. That is, this is also such an experience, it is to say that it is direct learning something, but it is rather an experience.”	7	42
explicit learning	6: “Read documentation, see usage examples often for libraries. They are published online, where you can clearly see how it works.” 2: ”there were already specialized advanced training courses directly, there were some kind of guides that higher organizations went down to the branches there on how to do this or that…. Well, against the background of these materials, it turned out to somehow develop.” 3: ” Last summer, I realized that I have a lot of knowledge from different domains and approaches. And I want to structure it, how to structure it. And I took one course so pretty big. For a year.”	6	11
implicit learning		0	0
role of expert		4	4
tacit knowledge transfer		7	36
altruism	2: “I am always ready to help.”	6	7

Name	Examples of units coded	Files	References
	3: “I am generally super happy when they ask me something.”		
barriers		2	2
informal communication		4	8
trust	7: “We have been working together for a very long time, we sat in the same office a lot. And one way or another, they always told each other who did what approximately.” 1: “That is, sometimes sometimes, if you trust your colleagues, then you can not spend two days studying, but listen to a two-minute lecture on this topic already with conclusions.”	4	5
time		4	9

Respondents background data frequency tables and descriptive statistics

Gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	male	6	66,7%	66,7%	66,7%
	female	1	11,1%	11,1%	77,8%
	prefer not to tell	2	22,2%	22,2%	100,0%
Total		9	100,0%		

How many years of IT experience you have

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	,00	2	22,2%	22,2%	22,2%
	3,00	1	11,1%	11,1%	33,3%
	6,00	1	11,1%	11,1%	44,4%
	10,00	1	11,1%	11,1%	55,6%
	15,00	2	22,2%	22,2%	77,8%
	20,00	1	11,1%	11,1%	88,9%
	40,00	1	11,1%	11,1%	100,0%
Total		9	100,0%		

How many years you have worked in the company

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	,00	3	33,3%	33,3%	33,3%
	1,00	1	11,1%	11,1%	44,4%
	4,00	2	22,2%	22,2%	66,7%
	6,00	2	22,2%	22,2%	88,9%
	7,00	1	11,1%	11,1%	100,0%
Total		9	100,0%		

Your highest education degre

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	University Bachelor Degree	3	33,3%	33,3%	33,3%
	University Master Degree	3	33,3%	33,3%	66,7%
	University Specialist	3	33,3%	33,3%	100,0%
Total		9	100,0%		

Score on state math exam

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	64,00	1	11,1%	25,0%	25,0%
	74,00	1	11,1%	25,0%	50,0%
	80,00	1	11,1%	25,0%	75,0%
	92,00	1	11,1%	25,0%	100,0%
Missing	.	5	55,6%		
Total		9	100,0%		

Your grade on math when you graduated from school

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	5,00	9	100,0%	100,0%	100,0%
Total		9	100,0%		

Score on state foreign language exam

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	75,00	1	11,1%	100,0%	100,0%
Missing	.	8	88,9%		
Total		9	100,0%		

Your grade on foreign language when you graduated from school

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	4,00	4	44,4%	44,4%	44,4%
	5,00	5	55,6%	55,6%	100,0%
Total		9	100,0%		

Year of graduation from school

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1975	1	11,1%	11,1%	11,1%
	2001	1	11,1%	11,1%	22,2%
	2002	3	33,3%	33,3%	55,6%
	2011	1	11,1%	11,1%	66,7%
	2014	1	11,1%	11,1%	77,8%
	2015	1	11,1%	11,1%	88,9%
	2017	1	11,1%	11,1%	100,0%
Total		9	100,0%		

Have you graduated with honours

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	University	3	33,3%	33,3%	33,3%
	None	4	44,4%	44,4%	77,8%
	Both	2	22,2%	22,2%	100,0%
Total		9	100,0%		

	How many years of IT experience you have	How many years you have worked in the company	Your highest education degre	Score on state math exam	Your grade on math when you graduated from school	Score on state foreign language exam	Your grade on foreign language when you graduated from school	Year of graduation from school	Have you graduated with honours	Gender
N Valid	9	9	9	4	9	1	9	9	9	9
Missing	0	0	0	5	0	8	0	0	0	0
Mean	12,11	3,11	3,00	77,50	5,00	75,00	4,56	2004,33	2,89	1.56
Median	10,00	4,00	2,00	77,00	5,00	75,00	5,00	2002,00	None	male
Mode	.	,00	.	.	5,00	75,00	5,00	2002	None	male
Std Dev	12,62	2,89	,87	11,70	,00	NaN	,53	12,75	,78	,88
Variance	159,36	8,36	,75	137,00	,00	.	,28	162,50	,61	,78
Kurtosis	2,39	-2,00	-1,71	,28	.	.	-2,57	3,44	-1,04	-,45
Skewness	1,41	,06	,00	,23	.	.	-,27	-1,62	,22	1,19
Range	40,00	7,00	2,00	28,00	,00	,00	1,00	42,00	2,00	2,00
Minimum	,00	,00	University Bachelor Degree	64,00	5,00	75,00	4,00	1975	University	male
Maximum	40,00	7,00	University Specialist	92,00	5,00	75,00	5,00	2017	Both	prefer not to tell

Workshop on candidate selection and onboarding processes improvements

Helsinki, Kumpulantie 3, meeting room Kallio
Tue, 18th April, 10:00-12:00
Present: Dmitrii S, Nikolai L, Aleksander Ob, Kristina V

Agenda: elaboration of a theoretically grounded approach toward candidate selection and onboarding and professional development of employees, based on qualitative data and aligned with the company's strategy.

Step 1. Process terms of reference

1.1. Situation • Context • Rationale • Key events • Client(s) • Main challenge • Potential benefits	• CodeLine OY, est. 2018, 11 employees • Cherry-pick talents on competitive market • Move toward company strategic goals • Candidate onboarding and 1-2 years professional development • CodeLine and its customers • Volunteer turnover of key people, brain leak •
1.2. Focus • Purpose • Objectives • Outputs • Short-term outcomes • Medium-term outcomes • Long-term outcomes	• Investigate research findings • Elaborate grounded approach toward candidate selection and professional development aligned with the commissioner's strategy • 100% employee retention • Cope with economy recession • Preserve tacit knowledge • Achieve competitive advantage
1.3. Stakeholders • Categories and perspectives • Types of power • Give-get analysis • Commitment • Implementation	• All present persons, employees and future candidates • Discussed and agreed on opening session
1.4. Core assumptions • Project scope • Values, ethics • Key issues • Policies, guidelines • Levels of evidence • Decision making • Reports	Presented further in Figure 1. • Future onboarding and selection processes for the company, not transferable results • Create pleasant workplace with learning culture and ethical and mature workplace for all stakeholders • Scientific qualitative research supports the process • Collaborative decision making • CEO reports annually to employees in December
1.5. Key considerations • Risks and opportunities • Related initiatives • Pressures • Data, evidence and trends • Relationships • Time frames • Implementation challenges	 • Potential additional workload on team leaders • Potential high performance and low volunteer turnaround of employees • Global recession and financial resources shortage • Qualitative data collected within the scientific research process • • 2023-2025, annually reviewed • Additional workload that is difficult to handle and embed into existing routines
1.6. Work Plan • Phases • Timing • Action items • Deliverables • Responsibilities • Resources	 • April 2023, design process improvements/adjustments • Pilot test the new process when hiring resumes • Test the employee journey on existing employees and collect their feedback on December 2023 • to be decided

1.7. Governance • Leadership • Management • Committee structure • Logistical support • Resources • Contracts	• to be decided
1.8. Essential documents • Glossary • Acronyms • Fact sheets • Stakeholder coordinates • Supportive information • Additional sources	• Action plan • Written procedures • Employee skills grid • Company's project registry • to be decided

Step 2. Agenda set up by email, confirmations from participants received.

Workshop arranged on Tuesday 18th of April in office premises from 10:00 a.m. to 12:00 or further if needed. Handout materials sent to participants on Friday 14th of April.

Step 3. Agenda flow

10:00-10:10 – small talk, discussion of the process workflow and the agenda, adjust expectations
10:10-10:20 – Kristina presents key findings from the research and data analysis, Q&A
10:20-10:50 – discussion of the current candidate selection process and potential improvements based on the research findings
10:50-11:00 – finalizing and summing up candidate selection process updates
11:00-11:10 – break, coffee
11:10-11:50 – discussion on the improvements on employees' journey in the company for 1-2 years, that will support their learning processes, self-efficacy and growth need
11:50-12:00 – summarizing the discussion key takeaways and deciding on closing session or proceeding after lunch break
12:00-12:30 – lunch break
12:30-13:20 – discussion employees' professional journey in the company
13:20-13:30 – closing words

Step 4. Preliminary design of a workshop discussion sessions – Brainstorming

1. Environment. Kallio meeting room booked on Tuesday 10:00-12:00.
2. Problem 1. Current candidate selection process and potential improvements based on the research findings
   Problem 2. improvements on employees' journey in the company for 1-2 years, that will support their learning processes, self-efficacy and growth need
3. Generate and share ideas. Ideas are collected on whiteboard
4. Collaborate on narrowing down the list of ideas

5. Make an action plan. Write down the list of action

Step 5. Check the draft design. Collect feedback and adjust the design

Preliminary draft of the workshop design was sent out by email to all the participants on Friday 14th evening. Feedback is requested.

Step 6. Complete the design

Key terms
Motivation – occurs before the action
Satisfaction – occurs after the action
Goal – object or aim of an action
Tacit knowledge – "knowing how", i.e. as knowledge acquired through personal experience, is procedural, i.e. has practical implication toward solving real-life tasks, influences behavior since it is relevant to personal goals
Absenteeism – the practice of regularly staying away from work without good reason
Self-efficacy – subjective
judgments of what one can do in a current or prospective situation, not statements of intentions of what one will do
Need for achievement – need for competitive success
Need for affiliation – need for friendly relationship with others
Valence – Значимость цели. function of an individual's origin of motivation, such as needs, goals and values
Instrumentality – is the perception of an individual, that certain level of performance will lead to the desired reward
Expectations – is the individual's perception of the likelihood, that a certain set of actions will assure the performance sufficient for achieving desired reward
Task significance – is the degree to which the work has a substantial impact on the project or for a company/customer
Task identity – clear goals, personal interest, knowing task's purpose
Meaningfulness of work – The degree to which the employee experiences the work as inherently meaningful, as something that "counts" in his or her own system of values
To mediate – to connect two variables, to show how an independent variable affects dependent variable through a certain mechanism

The concept

There are two pillars of the case company employees' motivation outcomes, as performance and retention, which are employee personality and workplace/job characteristics. Set of personality traits and needs along with job characteristics of the case company influence goal choices. Individuals' growth need drives them to acquire tacit knowledge in order to perform work tasks. Employees acquire knowledge through individual learning via peers' codebase studying in public repositories and

with explicit learning method – technical documentation reading and with peer advice. Once an individual can perform a challenging task with acquired knowledge or in a "fancy" manner, sense of competence and satisfaction prompts. Self-efficacy is involved in the success of an individual's ability to utilize the acquired knowledge, effort and task strategies; however, the mechanism of this influence was not studied in the present research. Outcomes of learning integrated into daily tasks, satisfaction and motivation reinforce each other and the process to set and achieve new workplace goals.

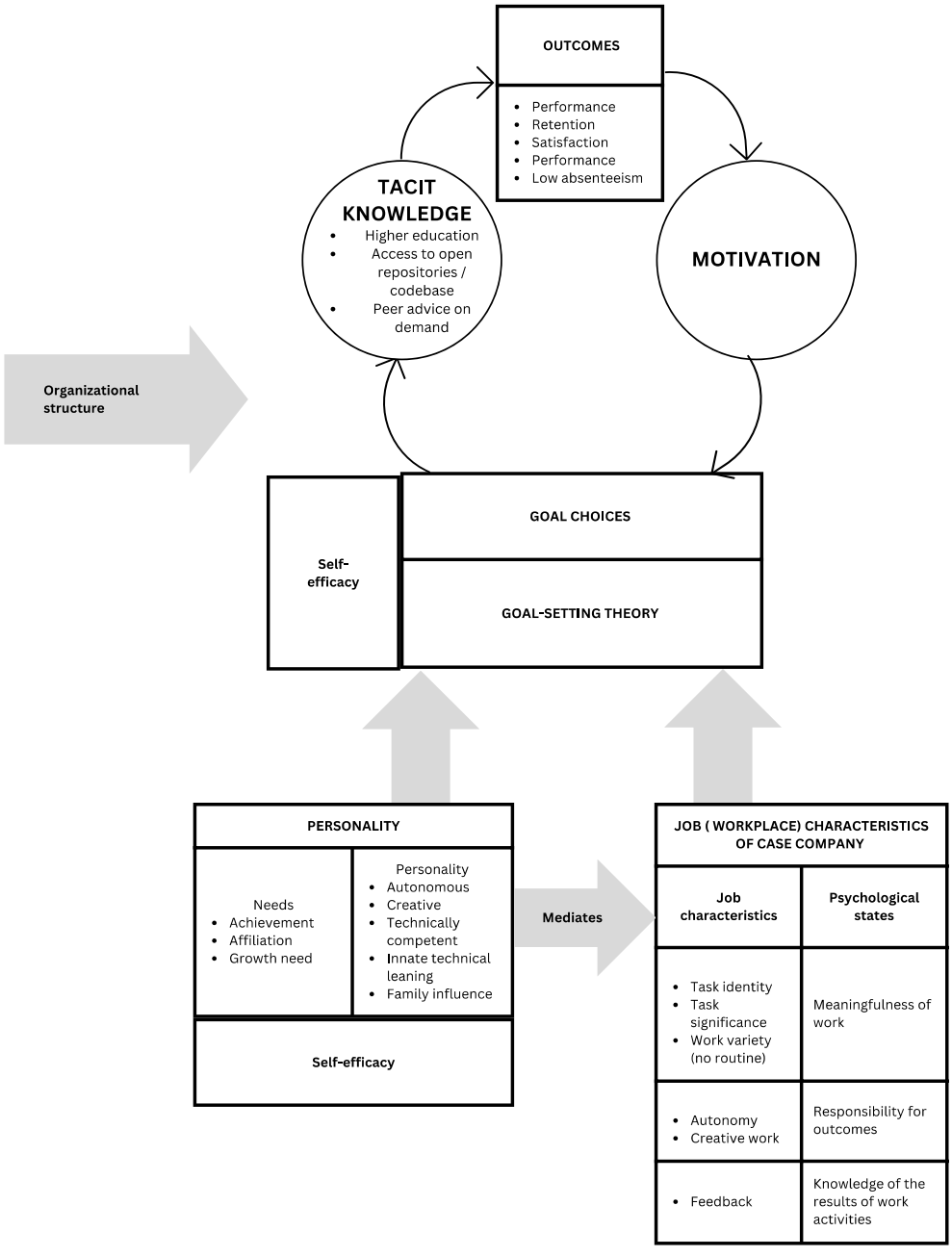

Figure 1. An integrated schema of motivation for the case company software developers

Thesis material management plan

Attached to thesis plan

1. **General description of the material**

What type of research material (e.g. interview, survey, observation) is collected or used in thesis?

Seven interviews conducted orally, recorded and transcribed

Three questionnaires conducted with Webropol tool and data exported to Excel and PSPP

2. **Documentation and quality of the material**

How is the research data documented, for example, what kind of identification information is used? How is the quality of the material and its documentation ensured?

Questionnaires are conducted anonymously, respondents are distinguished by numbers, respondents' personality is unknown

Interviews are conducted remotely via Teams and recorder with teams; respondents are identified by names. Recording are deleted from Researcher Teams account

3. **Storage and backup**

How is the material saved? How is data security ensured (e.g. access to the material) during thesis process? Who can access the material?

The interviews were uploaded to Sonix.ai platform for transcribing, word documents containing transcribed material is downloaded to the researcher's laptop. All material was deleted from Sonix.ai platform after transcription is done.

Interview transcriptions were uploaded to NVivo used to assist with qualitative data analysis during thesis process and on completion of the process, project and all material was deleted from NVivo.

NVivo project, interview transcripts and audio recordings and quantitative anonymous data collected with Webropol is stored on the Researcher's laptop. Laptop is owned by the Commissioner.

4. **Ethical and legal issues related to storage**

How are any possible ethical issues related to the material storage considered (e.g. sensitive personal information, access by others)? How are the ownership and user rights of the material managed?

The material does not include any sensitive information. The commissioner owns the material

5. **Opening the material and long-term storage**

Would it be possible to use the material later? How is any further use of the material enabled?

The material is used only for developing practices of the case company's candidates selection, onboarding and performance support processes.