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Exploring Individuals' Psychological Factors as Predictors of Workforce Agility in Software Development Teams

Completed Research Paper

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Abstract

In the rapidly evolving automotive sector, software development teams (SDTs) face the challenge of swiftly adapting to unpredictable changes driven by globalization, customer expectations, and innovation. This study delves into the influence of psychological factors — particularly attitudes, emotions, and perceptions — on the workforce agility of employees working in SDTs, crucial for adeptly navigating dynamic shifts. Despite the central role of psychological factors in shaping behavior, existing research overlooks their impact on workforce agility. Through interviews with 27 employees from a leading software company serving the automotive industry, we empirically identified three key factors: agile mindset, psychological empowerment, and agile leadership. Subsequently, drawing upon the literature, we explore the correlations among these factors. By investigating these previously unexplored psychological predictors and their correlations, this study enriches our understanding of workforce agility and provides actionable insights for SDT leaders to nurture desired behaviors.

Keywords: Workforce Agility, Agile Mindset, Psychological Empowerment, Agile Leadership

Introduction

Many industries are shifting towards software-defined solutions, driven by rising customer expectations and rapid innovation. This transformation demands that software development teams (SDTs) swiftly adapt to unpredictable changes (Cankurtaran et al., 2013). Although 70% of SDTs use agile methodologies effectively, nearly one-third of software projects are not delivered on time and with the expected quality (VersionOne, 2018). Agile methodologies like Scrum provide the necessary structure and processes (Schwaber & Sutherland, 2017). However, the success of SDTs also requires employees to embody agile values and principles. Failures in software development often stem from human factors (Eilers et al., 2020; Dikert et al., 2016), as employees in these teams play a central role in anticipating and effectively responding to shifts through proactive, adaptable, and resilient behaviors (Munteanu et al., 2020). These behaviors

exhibited by individual employees are referred to as workforce agility (Petermann & Zacher, 2022). While workforce agility is recognized as significant in both practical and theoretical contexts, various disciplines have so far neglected to examine the role of individuals' psychological factors in predicting workforce agility. More precisely, research has not yet adequately explored which attitudes, feelings, and perceptions of individuals induce workforce agility. Furthermore, the interactions between these factors and their impact on workforce agility remain unclear. Research in social psychology demonstrates the significant influence of psychological factors on individual behavior. For example, this may be an individual's pre-existing attitude towards a situational context in which this individual is performing a behavior (Ajzen & Madden, 1986). Further, humanistic psychology highlights the significance of individuals' inner feelings and motives as drivers of behavior (Deci & Ryan, 1985). These insights imply that such psychological factors may play an important role in explaining and strengthening employees' workforce agility, providing a lever to sustainably promote the desired behavior. Failure to investigate these factors leads to missed opportunities for enhancing workforce agility, resulting in an incomplete understanding and hindering employees' adaptation to rapidly changing environments.

Against this backdrop, this research aims to empirically identify the psychological factors, particularly attitudes, feelings, and perceptions, that evoke workforce agility and reveal their interdependencies. Hence, we address the following research questions (RQs):
RQ1: Which attitudes, feelings, and perceptions evoke workforce agility among individual employees in a software development team?
RQ2: How do these psychological factors interrelate to influence workforce agility?

To answer these questions, we applied an exploratory qualitative research approach to a young automotive software company, which we selected as a unique case. The company has a 5,000-employee base and was recently founded by one of the largest automotive groups. Its primary focus lies in the development of innovative automotive software solutions for the group's automotive products. Within this company, various SDTs operate, each comprised of 5 to 50 employees. We conducted in-depth interviews with 27 employees working in different SDTs at the mentioned software company. All interviewed employees have a high level of workforce agility, self-assessed by the interviewees at the beginning of the interviews. As a result of our empirical-qualitative research, not only do we explain which attitudes, feelings, and perceptions these employees have when working in SDTs (RQ1), but we also propose a theoretical model based on relevant literature findings that explains the correlations between these psychological factors and workforce agility (RQ2). Our research contributes to a deeper understanding of workforce agility in SDTs by examining the psychological factors that drive it. Specifically, we investigate the influences of the agile mindset, psychological empowerment, and agile leadership on employee workforce agility. Additionally, we offer tangible guidance to leaders within SDTs, providing them with clear insights into the key constructs they can harness to fortify and nurture workforce agility among their employees.

Theoretical Framework: Workforce Agility

Workforce agility, also referred to as employee agility (Doeze Jager-van Vliet et al., 2019) and individual agility (Reitz et al., 2020), is defined by various conceptualizations in the current literature. Predominantly, it is characterized as a set of specific behaviors of an individual (Petermann & Zacher, 2022; Salmen & Festing, 2022; Storme et al., 2020; Tessarini & Saltorato, 2021). Sherehiy and Karwowski (2014) define workforce agility as observable performance or behavior at work comprising three distinct dimensions: proactivity, adaptability, and resilience (Petermann & Zacher, 2022; Sherehiy & Karwowski, 2014). Proactivity involves seeking opportunities to contribute to organizational success and taking the lead in pursuing promising prospects (Muduli, 2017; Sherehiy & Karwowski, 2014; Storme et al., 2020). It comprises two sub-dimensions: initiating behavior, which involves initiating activities that lead to solving change-related problems, and anticipatory behavior, which encompasses sensing and anticipating problems (Petermann & Zacher, 2022; Sherehiy & Karwowski, 2014). Adaptability describes an employee's modification of oneself to become a better fit for the environment (Sherehiy & Karwowski, 2014). It consists of four sub-dimensions: learning behaviors, which involve constantly acquiring new knowledge, skills, and procedures; interpersonal adaptability, which refers to the ability to work effectively with individuals from different professions and backgrounds; and professional flexibility, which entails assuming and adapting to different roles as required (Petermann & Zacher, 2022; Sherehiy & Karwowski, 2014). Finally, resilience encompasses an individual's ability to cope in a changing environment (such as new ideas and technology,

tolerance of uncertainty, unexpected situations, and differences in opinions and approaches) and function effectively in stressful situations (Muduli & Pandya, 2018; Patil & Suresh, 2019). This conceptualization of workforce agility has been widely adopted by agility scholars, including Muduli (2017), Qin and Nembhard (2015), and Tamtam and Tourabi (2020). Multiple studies confirm the benefits of workforce agility. For example, workforce agility enables greater performance flexibility, creativity, problem-solving, and effective task management (Alavi et al., 2014). Additionally, it is associated with reduced work-related stress and increased job satisfaction among employees (Alavi et al., 2014; Laanti, 2013).

Predictors of Workforce Agility	**Sources**
External Factors	
Learning and development, subordinate access to direct hierarchical superiors, employee empowerment, enterprise social media, information and communication technologies, job design and new working practices, performance and feedback systems, work safety and security programs, recruitment and testing techniques, teamwork and collaboration, transformational leadership of top management, workplace spirituality	Cai et al., 2018; Cornelis and Febriansyah, 2023; Das et al., 2023; Harsch and Festing, 2019; Liu et al., 2015; Muduli, 2017; Munteanu et al., 2020; Pitafi et al., 2019; Qin and Nembhard, 2015; Saeed et al., 2022; Saputra, 2022; Shern et al., 2022; Sherehiy and Karwowski, 2014; Varshney and Varshney, 2020
Skills and Cognitive Abilities	
Active listening, agility goal setting, ambiguity tolerance, anticipation and planning, cognitive abilities, risk-taking, digital competency, learning from mistakes	Doeze Jager-van Vliet et al., 2019; Qin and Nembhard, 2015; Saputra, 2022; Shern et al., 2022; Storme et al., 2020
Psychological Factors	
Autonomy, job self-efficacy, job-related curiosity, perceived usefulness of digitalization, psychological empowerment	Cornelis and Febriansyah, 2023; Cyfert et al., 2022; Muduli, 2017; Muduli and Pandya, 2018; Munteanu et al., 2020; Sameer, 2022; Sherehiy and Karwowski, 2014; Storme et al., 2020

Table 1. Predictors of Workforce Agility Identified in the Literature

Predictors of workforce agility have been relatively well-researched. In the following, we provide an overview of these predictors, drawing from existing literature including literature reviews by Tessarini and Saltorato (2021) and Salmen and Festing (2022), as well as incorporating additional and more recent findings from our literature review. We started by identifying the specific predictors of workforce agility in the literature and then determined the broader categories under which these predictors could be grouped. Next, we established relationships between the identified predictors and their respective categories. After that, we systematically assigned each predictor to the appropriate category: (1) external factors that lie outside the direct sphere of employee influence, (2) skills and cognitive abilities that are the functional and observable capabilities of an employee, and (3) psychological factors that reflect individual employee's internal perspective. We then checked for any overlap or redundancy to ensure clarity. Finally, we reviewed and refined the structure to ensure it was logical, coherent, and comprehensive. Prior research often focuses on external factors influencing the workforce agility of their employees (Franco & Landini, 2022). External predictors, such as organizational or team leader-installed factors, lie outside the direct sphere of employee influence. A modest body of research examines skills and cognitive abilities, which are the functional and observable capabilities of an employee, as predictors of workforce agility. Only a handful of studies explore the psychological dimension of workforce agility predictors, examining them from the individual employee's internal perspective. Table 1 provides an overview of the identified factors.

Methodology

Research Design and Case Selection

To address our first research question (RQ1), we employed a qualitative approach. Choosing a case study allowed us to delve into the attitudes, feelings, and perceptions of employees within SDTs. This method was chosen due to its numerous advantages, including that case studies (1) are particularly well-suited for the initial exploratory phase of research, allowing for an in-depth exploration of a specific context and the collection of rich data (Yin, 2013); (2) provide insights into inner factors of individuals such as attitudes and motives (Rohrbeck et al., 2015); and (3) are effective in investigating individual behavior (Rohrbeck et al., 2015). The case organization is a young multinational automotive software company and part of one of the world's largest automotive manufacturers. The automotive industry is currently undergoing a major transformation, characterized by a shift towards software-defined cars (Lopis-Albert et al., 2021). In response, the automotive manufacturer strategically consolidated and expanded its software development activities within this new software company, aiming to create innovative software-driven electronics and IT products for their vehicles. The software company has engaged in mergers with several established companies from diverse industries, resulting in the formation of various subsidiaries. This has led to a substantial transfer of workers. At the time of the research, the software company had been in operation for approximately three years, employing over 5,000 employees, and operating in multiple global locations.

Most employees within the company are members of SDTs. These teams encompass a diverse array of topics relevant to the company, including artificial intelligence, UX prototyping, and software testing. Each SDT gathers 5 to 50 employees. All SDTs function autonomously (Stray et al., 2018) and adopt a cross-functional team structure (Lee & Xia, 2010; Hoda et al., 2013). To scale agile practices, principles, and methodologies within the SDTs and align the work of multiple SDTs towards common business goals, the company utilizes the Scaled Agile Framework (SAFe) (Scaled Agile, Inc., 2024). SAFe is designed to address the challenges of scaling agility in large organizations, including managing dependencies and ensuring consistent quality and delivery across teams. The framework is based on the Agile Manifesto (Schwaber & Sutherland, 2024) and principles of Lean thinking (Scaled Agile, Inc., 2024). It provides a comprehensive set of accountabilities and processes for coordinating the work of multiple SDTs. Moreover, it encompasses various levels of planning and coordination, ranging from strategic planning to team-level execution, and emphasizes the importance of continuous delivery, continuous improvement, and customer-centricity (Scaled Agile, Inc., 2024). The organization is delineating operational and organizational structures and has established Solution Trains with multiple Agile Release Trains and numerous agile teams, company-wide cadences with common program increment cycles, agile events, and agile accountabilities. Furthermore, senior managers and team leaders of the SDTs underwent leadership training focused on establishing a clear vision, aligning team goals with the organizational mission, promoting transparency and trust, and delegating decision-making authority within teams. From the outset, the management of the software company recognized the necessity to depart from the previous principles, structures, and processes of traditional car manufacturing. Faced with an incredibly dynamic and uncertain environment, along with numerous dependencies on various stakeholders, and viewing innovation as a constant directive, the company employs individuals who demonstrate proactivity, adaptability, and resilience. Thus, workforce agility is regarded as an essential cornerstone for efficient success. According to Gerring (2007) on case selection in qualitative research, our case represents a classic variant of an extreme case. Extreme cases, in general, are "paradigmatic of some phenomenon of interest" (Gerring, 2007, p. 101) and are therefore useful for generating theory because of their high values on the variables in focus.

As part of our case study, we conducted a series of in-depth interviews with employees from the SDTs, who attribute a high degree of workforce agility to themselves, indicating their ability to effectively respond to changes and capitalize on them as opportunities (Petermann & Zacher, 2022) (Table 2). The main reasons for choosing this qualitative research design are as follows: (1) In-depth interviews are considered the best method to gain insight into people's attitudes, beliefs, and motives (Suri, 2011). In general, qualitative methods explore the perspective and meaning of experiences, seek insight, and identify the social structures or processes that explain behavior (Suri, 2011; Rohrbeck et al., 2015; Yin, 2013). (2) Most importantly, qualitative research involves extensive interaction with the people being studied and often allows researchers to uncover unexpected or unanticipated information (Holloway, 2005; Pope & Mays, 1996).

This aligns with our research goal, making our choice of in-depth interviews promising for gaining a clear understanding of the psychological factors inducing workforce agility among employees.

Data Collection and Analysis

To identify psychological factors that lead to workforce agility, we conducted semi-structured interviews with 27 employees engaged in at least one SDT at the automotive software company. To mitigate interviewees' biases, we followed the recommendations of Suri (2011) and constructed a maximum variation sample. Moreover, we selected interviewees who differed regarding their function, position, and age at the selected company. Thus, the interview participants consisted of a diverse group, ranging in age from 27 to 54 years, with an average age of 34. The interviewees worked in various positions (e.g., Release Train Engineer, System Architect, and Agile Coach). The gender distribution among the interview participants was 27% women and 73% men, reflecting the fact that only about one-third of the workforce at the case company is female. Additionally, the interviewees worked in various SDTs (26 in total) that address different topics. This diverse mix of participants brought a wide range of perspectives and experiences, contributing to a rich and inclusive discussion. Overall, all interviewees were asked to freely discuss their personal experiences, beliefs, and views that relate to their daily work in the SDTs. At the beginning of each interview, all interview participants were asked about their previous work experience, particularly their participation in agile teams. Furthermore, they were asked to assess their level of workforce agility through questions aimed at evaluating their level of proactivity, adaptability, and resilience (Sherehiy & Karwowski, 2014; Muduli, 2017) (Table 2). Only participants with an average score greater than or equal to 4 were considered. This helped ensure that only employees with a high level of workforce agility, who could offer valuable insights into its predictors, were chosen. To identify the psychological factors inducing workforce agility among employees working in the related SDTs, participants were asked to elaborate on their associated attitudes, feelings, and perceptions related to their work in the SDTs (Table 2). To allow extensive interaction with the interviewees and uncover unexpected information, we used semi-structured interviews. This way, the interviewees were able to freely explain their thoughts and experiences from their points of view (Osch & Bulgurcu, 2020; Holloway, 2005).

1.1 Experience (*Warm-up*)	Could you please describe your previous work experience, particularly your involvement in agile teams?
2.1 Level of Workforce Agility	**Proactivity:** On a scale of 1 to 5, how would you evaluate your level of active engagement in (1) addressing change-related problems and (2) anticipating potential issues in your everyday work? **Adaptability:** On a scale of 1 to 5, how would you rate your level of (1) actively engaging in acquiring new tasks, skills, and procedures; (2) effectively collaborating with individuals from diverse professions and backgrounds; and (3) smoothly assuming and adapting to different roles as required? **Resilience:** On a scale of 1 to 5, how would you rate your ability to (1) cope in a changing environment, such as tolerating uncertain and unexpected situations, and (2) function effectively in stressful situations?
2.2 Attitudes	Could you please describe the attitudes you associate with your work in your team?
2.3 Feelings	How do you feel about your work, role, and contributions within your team?
2.4 Perceived Working Conditions	How would you describe the conditions of your work or the working environment within your team?

Table 2. Excerpt from the Interview Guide

Each interview lasted about 30 minutes and occurred digitally via Microsoft Teams. We also conducted several informal follow-up interviews via Microsoft Teams with some of the participants to gain further information on issues that arose during our analysis. The interview guide was developed using simple and familiar language, following guidelines from Denzin and Lincoln (2011). All interviews were recorded and transcribed to ensure accuracy during the analysis. The quality criteria for qualitative research, namely confirmability, reliability, dependability, auditability, credibility, authenticity, transferability, and

fittingness according to Miles and Huberman (1994), were taken into account. Following the established approach of Gioia et al. (2013), we conducted a two-phase analysis of our qualitative data. In the first analysis phase, we performed a first-order analysis using an inductive approach, using terms and concepts directly extracted from the transcripts of the interviews. During the open coding phase (Corbin & Strauss, 2015), we identified multiple informant-centric codes, resulting in a high number of terms, codes, and concepts. To establish relationships and similarities between these codes, we consolidated them by linking them to specific concepts, aiming to develop a comprehensive compendium of terms that capture the fundamental properties explaining the phenomenon (Gioia et al., 2013). In the second analysis phase, we organized the first-order concepts into theory-centered second-order themes and distilled them into broader theoretical dimensions. These emerging second-order themes pointed to concepts that could help explain the observed phenomena. We further distilled the second-order themes into aggregated dimensions (Gioia et al., 2013). Throughout the analysis, we continuously iterated between the emergent data, themes, concepts, dimensions, and relevant literature. In summary, by generating the first-order concepts, second-order themes, and aggregated dimensions (Figure 1-3), we established a data structure that describes the process from the raw data to the terms and themes used in the analysis, which is crucial for demonstrating rigor in qualitative research (Goffin et al., 2019; Tracy, 2010).

Findings

In this section, we present the findings of our qualitative analysis, outlining the psychological factors of employees working in SDTs that induce their workforce agility (RQ1). To present our results rigorously and comprehensively, we rely on a tandem procedure, highlighting them through the voices of the interview participants (Gioia et al., 2013; Goffin et al., 2019).

Employees' Attitudes

In our interviews, we observed different dimensions regarding the attitudes of the interviewed individuals toward their work in SDTs: The first dimension, which we describe as 'openness toward learning', can be broadly characterized as being open to continuously expanding knowledge. One indicator of this is that many interviewees describe their positive attitude toward learning from the experiences of others. For example, this is exemplified by the following statement from an interview participant (I20): "*You want to connect with the right person, you want to learn from the experiences and things that others find valuable and share*". Another indicator is that the interview participants are open to learning from the mistakes made by others or themselves, as an interviewee (I19) emphasized: "*This confession of 'yes, this is where I failed once'. So it kind of, it didn't work out, I learned from it, and I can share that with you [the other team members]*". Further, we identify the openness to taking in new knowledge as an additional indicator of interviewees' positive attitude toward learning, as another interview participant (I2) reported: "*Given our substantial team size, the impact of knowledge-sharing is significant. It's almost inherent that we share knowledge, as there's an incredible amount to learn from our colleagues*". As a second dimension, we identified 'open towards teamwork' which broadly can be described as open to working with others. For example, one interviewee (I17) explained that "*in general, communication and exchange are the key purposes in our team*". The teamwork dimension is indicated through three aspects: (1) interviewees are willing to provide feedback on the contributions of team members; (2) they are open to sharing their ideas and contributions with others. For instance, one interviewee expressed (I21): "*You really exchange ideas openly*"; and (3) interviewees reported that they are willing to help their team members when support or guidance is requested, or when questions arise. For example, an employee (I1), who leads a SDT, told us: "*We are convinced to help each other, to support each other. Many questions are shared, […] problems are addressed, and we help each other. […] There is very honest, transparent collaboration*". In our interviews, we found evidence of a third dimension, which we describe as 'open to self-organization'. This means that the interviewees are open to working in a self-organized manner. It can be illustrated by an interviewed team member's (I14) statement: "*All people are minded to take responsibility. […] We are all on the same level. And yes, well, we need to organize ourselves. So sometimes we need one or two people to give the orders. But I personally think things stay free, so no hierarchy. No, I don't want that at all. In one way or another, everyone can bring a topic with them and then these people can lead, so to say*". Indicators for this self-organization dimension are the following: (1) interviewees reported that they are open to keeping in mind what to do to reach the team goal. Regarding this, a team member (I8) explained the team members' attitude: "*An open space approach that we use there, in the sense that we create our*

own agenda […]. We all contribute to it. Nothing is pre-declared. Exactly not". (2) Interviewed members of the SDT said that they are willing to reflect on their own doing and results. (3) They are open to taking over responsibility and making decisions, as confirmed by another team member (I14): "*But all people are definitely open to taking responsibility*".

The dimensions we identified as the attitudes of individuals working in SDTs align with those of a construct discussed in the literature known as an agile mindset. An agile mindset can be characterized as a positive attitude of an employee towards the organization's adoption of agile practices (Miler & Gaida, 2019; Mordi & Schoop, 2020). Scholars depict the agile mindset as a multi-dimensional construct. Regarding learning, several authors emphasize its importance as a part of the agile mindset, which pertains to an individual's positive attitude toward acquiring new knowledge and insights to effectively respond to change (Eilers et al., 2022; Gannod et al., 2018; Miler & Gaida, 2019; Mordi & Schoop, 2020; Ozkan et al., 2020). This closely aligns with our dimension of 'openness towards learning'. Furthermore, teamwork is highlighted as an integral part of the agile mindset, encompassing a positive attitude toward sharing knowledge, providing feedback, and collaborating with other team members for problem-solving (Eilers et al., 2022; Gannod et al., 2018). This mirrors our identified dimension of 'openness towards teamwork'. Similarly, the aspect of self-organization is emphasized in the definition of the agile mindset, reflecting an individual's positive attitude towards reflecting on their work processes, making decisions, and taking responsibility for their tasks (Eilers et al., 2022; Miler & Gaida, 2019; Mordi & Schoop, 2020; Ozkan et al., 2020), aligning with our dimension of 'openness towards self-organizing'. Based on these observations, it can be concluded that the attitude of employees with a high level of workforce agility working in SDTs can be interpreted as an agile mindset. Figure 1 summarizes the findings of this section.

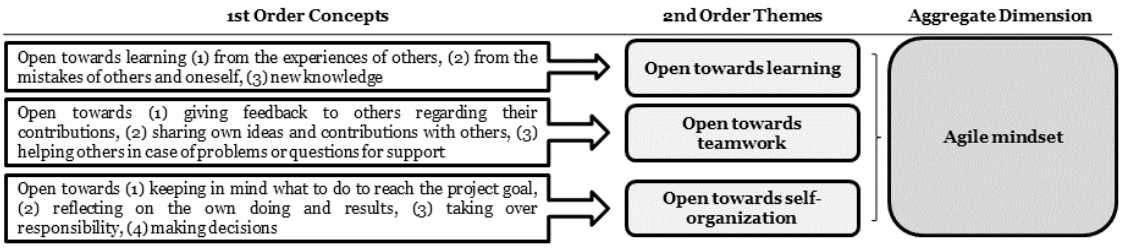

Figure 1. Attitudes of Employees with a High Level of Workforce Agility

Employees' Feelings

Concerning feelings, we identified four dimensions. The first dimension, which we describe as 'importance', pertains to the belief of team members that their daily work in the SDTs aligns with their values. This is supported by the observation that many interviewees expressed that their work in the SDTs matches their values and ideals. This insight is evidenced by the following statement from an interviewee: "*Being part of this team feels meaningful […], I appreciate my work here because I perceive it as adding value. Because it aligns with my own personal values*" (I22). Moreover, interviewees associate their work in the SDTs with a meaningful purpose, as noted by one team member (I8): "*The work here […] really gives people something that they really appreciate the time they put in there*". The importance dimension is also indicated by the fact that interviewees perceive their work in SDTs as grounded in their interests, experience, and knowledge. As a second dimension, we identified 'autonomy', which broadly represents a high degree of freedom in carrying out their work within the SDTs. One indicator of this is that the interviewed employees perceive a freedom to decide when and how they engage in the team's activities. As reported by an interviewee (I17): "*There is no hierarchy. That is why people feel comfortable taking action […] and take initiative without feeling constrained*". Furthermore, another team member (I21) shared: "*And so you don't feel guilty if you don't get involved […]. And when topics that are relevant to you come up again and you have a little more time, you can participate again […]. And I think this kind of flexibility makes that team just so valuable*". Another indicator of autonomy is employees' perception of freedom in decision-making. In our analysis, we explored a third dimension which we labeled as 'self-confidence in own competence'. We could find evidence of this through the following indicator: Several interview

participants reported having self-confidence regarding their competencies for undertaking the work in the SDTs. As a team member (I8) expressed: "*The people who come together there are precisely the ones suited to discuss this topic*". Another interview participant (I22) shared: "*I'm actually also an anxious person and always try to open my mouth only when I think I know what I'm saying. And the work in my team has at least caused me to believe that my experiences and knowledge are needed here*". The fourth dimension is what we refer to as the 'influence of work'. This is evidenced by employees' belief that their work positively impacts the team's success. As one interviewee (I8) articulated: "*I try to make it clear (…) that every team member, regardless of their role, does their part as best they can*". Additionally, another interviewee (I20) stated that his contributions have a broader impact on the organization: "*These are overarching issues that we aim to address, matters that affect everyone involved*".

The dimensions we examined in our data align with those of psychological empowerment outlined in the literature. Psychological empowerment, in essence, is the process of enhancing an individual's self-efficacy and confidence (Conger & Kanungo, 1988), thus representing a mental state of an employee (Amundsen & Martinsen, 2014). Psychologists define this construct as "intrinsic task motivation reflecting a sense of self-control in relation to one's work and an active involvement with one's work role" (Seibert et al., 2011, p. 981). The construct consists of four dimensions: meaning, self-determination, competence, and impact, which reflect the individual's perception of her or his work role. Meaning encompasses the correspondence between an individual's work role and their personal beliefs, values, and standards (Oyen et al., 2001, p. 981). This aligns with our dimension of 'importance'. Self-determination is an individual's feeling of independence and control concerning the initiation or regulation of their actions (Oyen et al., 2001, p. 981). This strongly corresponds to what we characterize as 'autonomy'. Competence entails the belief in one's ability to successfully perform job-related tasks (Oyen et al., 2001, p. 981), which constitutes a perfect mirroring of our dimension of 'self-confidence in own competence'. Finally, impact is the conviction that an individual can effect change within the managerial process, influencing operational outcomes within the work unit (Oyen et al., 2001, p. 981). This goes along with our dimension of 'influence of work'. Overall, these findings suggest that members of SDTs experience psychological empowerment. Figure 2 provides an overview of the findings presented in this section.

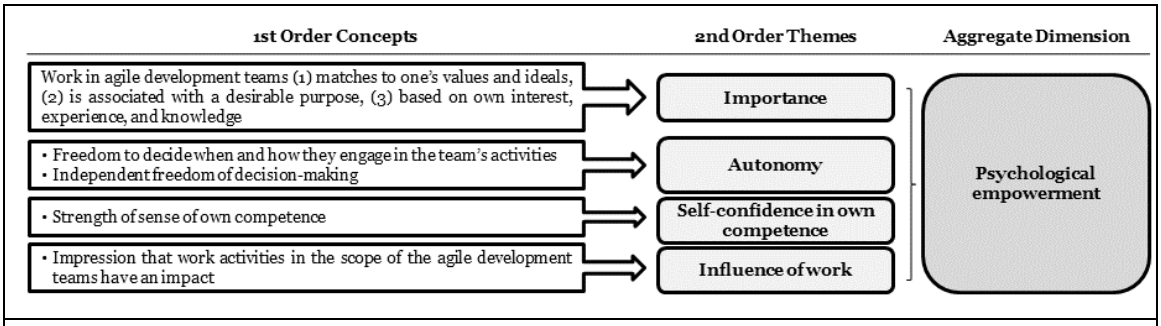

Figure 2. Feelings of Employees with a High Level of Workforce Agility

Employees' Perceptions

Through our interviews, we noted three dimensions regarding the interviewees' perception of the working conditions within their SDTs. The first dimension, termed 'perceived error culture', refers to the interviewees' perception that past mistakes are not punished but rather seen as opportunities for improvement. This is exemplified by the following statement of an interviewee: "*We act open, honest, and transparent (…) and we are not shy to ask questions and share mistakes so that everybody can learn from it*" (I5). Furthermore, we identified a second dimension, described as the 'perceived possibility for self-organization'. This was supported by multiple interview participants who reported perceiving the possibility to self-organize their work and take responsibility for their contributions to their SDTs. As one team member emphasized: "*Every team member, no matter the role, makes his or her contribution as best as they can"* (I23). As a third dimension, we identified 'perceived trust', indicating that the interviewees perceive high levels of trust from both, their team leaders and team members regarding their contributions

and decisions in the SDT context. For example, one interviewee explained: "*You also really talk openly. You dare to say anything*" (I25).

The three dimensions of perceived working conditions that we explored in our data align with the characteristics of an agile leadership style as delineated in existing studies. Agile leadership is defined as a type of leadership style derived from software development. It aims to implement and foster agility, enabling successful adaptation to constant changes in a dynamic business environment (Geffers et al., 2024). This leadership style is not only implemented by executives with managerial authority but also by team members (Geffers et al., 2024). One of the primary objectives of agile leadership is to emphasize the promotion of learning and facilitate the exchange of knowledge. This is achieved by cultivating a constructive environment that encourages open discussion about impediments and mistakes. In this way, errors are not stigmatized or viewed negatively, but rather seen as valuable learning opportunities (Geffers et al., 2024; Malik et al., 2021; Petermann & Zacher, 2021). This corresponds with our dimension of 'perceived error culture'. Additionally, employees practicing agile leadership take on responsibility and act independently, organizing themselves within a certain framework. They decide how to fulfill tasks and achieve goals (Chow & Cao, 2008; Moe & Dingsøyr, 2008), which corresponds with our characterization of 'perceived possibility for self-organization'. Moreover, agile leadership aims to cultivate a culture of trust (Geffers et al., 2014), creating an environment where all employees feel secure expressing their ideas, concerns, and opinions without fear of judgment. This promotes open communication, collaboration, and a sense of collective responsibility, reflected in our dimension of 'perceived trust'. In essence, these findings suggest that the members of the SDTs experience agile leadership. Figure 3 provides a summary of the results presented in this section.

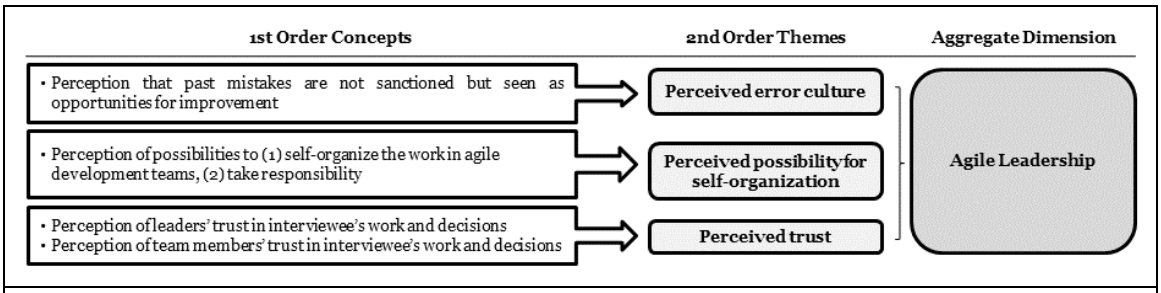

Figure 3. Perceived Working Conditions of Employees with a High Level of Workforce Agility

Theoretical Model

In this section, we propose a theoretical model revealing the relationships between the previously identified constructs and their relationships with workforce agility (RQ2). We derived the propositions underlying our model from the literature.

Relationship between Agile Mindset and Workforce Agility

We propose that the agile mindset of employees induces their workforce agility. In the first instance, dealing with the postulation of this proposed relationship involves contextualizing the agile mindset as an 'attitude'. The term mindset originates from research in cognitive psychology. Most global mindset scholars conceptualize mindset in terms of the sense-making presuppositions inherent to an individual or, in other words, as a general framework of epistemology (French, 2016). Demonstrative of this, Rhinesmith's (1992, p 63) work describes mindset „as a predisposition to see the world in a particular way … a filter through which we look at the world … a predisposition to perceive and reason in certain ways … a means of simplifying the environment and bringing to each new experience or even a pre-established frame of reference for understanding it". So, mindset refers to the perspective on how the individual sees the world (French, 2016). This perspective interprets mindset as an individual's belief or worldview, sometimes even viewing it as an all-encompassing facet of identity (French, 2016). In this way, it is closely related to the psychological construct of attitude. In psychology, attitude is a mental and emotional entity that inheres in

or characterizes a person (Perloff, 2016). The term is described as an individual's predisposed state of mind regarding a value. It is precipitated through a responsive expression towards oneself, a person, place, thing, or event, which is called the attitude object (Perloff, 2016). In terms of their psychological categorization, attitudes are more concrete than mindsets because an attitude is focused on an object or certain behavior, including the individual's degree of favour or disfavour for it (Eagly & Chaiken, 1993). Therefore, an attitude can be a positive or negative evaluation of the attitude object (Perloff, 2016).

All of the extant work that attempts to conceptualize the agile mindset until today have in common that they take the psychological attitude construct as a basis for conceptualizing the agile mindset. A case in point is the work by Miler and Gaida (2019) who describe the agile mindset as a positive attitude of an individual employee towards the organization's endeavors of working agile. In other words, the agile mindset is seen as an attitude with a thematic focus on agility as its attitude object. This implies that similar to an attitude, the agile mindset can be a positive or negative evaluation of agility by an individual. Eagly and Chaiken (1993) describe the agile mindset in this vein as "a psychological tendency that is expressed by evaluating a particular entity with some degree of favour or disfavour" (p. 1). We base the derivation of our proposition on this perspective. In general, psychology scholars recognize a link between an individual's attitude and behavior, describing attitude as a trigger for an individual's behavior (Perloff, 2016). This insight traces its roots back to the early attempts to define the construct of attitude in the 1930s. At this time, it was observed that attitudes provided the dynamic element in human behavior and served as reliable indicators of behavioral tendencies. For instance, according to Droba (1933), "an attitude is the foreshadowing of what the individual will likely be doing with respect to the object in question" (p. 447). Further, Allport (1935) claimed that by understanding attitudes, we gain insight into a process that determines an individual's real or possible activities. So, it was generally considered logical and consistent for a person who holds a favorable attitude towards an object to perform favorable behaviors and not to perform unfavorable behaviors concerning the object (Ajzen & Fishbein, 1977).

Under the assumption that the agile mindset can be interpreted as an attitude, one consequently could assume that higher levels of an agile mindset in employees working in SDTs lead to higher levels of workforce agility in these persons. Besides the arguments for a correlation between attitude and behavior, the psychological literature engages in an ongoing debate regarding the moderators that impact this correlation. More recent work has established a consensus that there are certain conditions under which this relationship is stronger or weaker. One example of such a condition is what psychological scholars refer to as 'perceived behavioral control'. It "is defined as one's perception of how easy or difficult it is to perform the behavior" (Eagly & Chaiken, 1993, pp. 186-187). High perceptions of behavioral control create a relatively favorable condition under which "anyone could do it if they wanted to" (Wallace et al., 2005, p. 2016), and attitudes have a better chance of predicting behavior. On the contrary, low perceived behavioral control creates an unfavorable condition under which individuals are more influenced by the perceived lack of resources and opportunities to perform the behavior than by their attitudes (Wallace et al., 2005). In other words, when behavior is difficult to enact, few people can overcome situational obstacles, so one would not expect attitudes to predict behavior very effectively (Wallace et al., 2005). These insights can be applied to our context as follows: We assume that SDT members' perceived working conditions, which include higher degrees of perceived error culture, possibilities for self-organization, and trust, represent a high level of behavioral control. Under this condition, one could expect attitudes to predict behavior very effectively. This implies that the perceived working conditions within the SDT strengthen the relationship between an agile mindset and workforce agility. Thus, we postulate:

Proposition 1: Employees with a strong agile mindset have higher levels of workforce agility.

Proposition 2: Employees' perceived error culture strengthens the relationship between agile mindset and workforce agility.

Proposition 3: Employees' perceived possibility for self-organization strengthens the relationship between agile mindset and workforce agility.

Proposition 4: Employees' perceived trust strengthens the relationship between agile mindset and workforce agility.

Relationship between Psychological Empowerment and Workforce Agility

We further postulate that psychological empowerment has an impact on workforce agility. Our arguments are grounded in insights from psychology, particularly concerning the relationship between human motivation and behavior. Research in this well-established field seeks to explain why people initiate,

continue, or terminate a certain behavior at a particular time (Deci & Ryan, 1985; Mario, 2019). Generally, motivation is understood as the energization and direction of behavior. Energy describes an individual's inherent motive that, once activated by a situational context, relates that energization to behavior (Deci & Ryan, 1985). An individual's motive may be an expected reward (Schacter et al., 2011). These fundamental psychological insights into predicting human behavior from an individual's motives are the basis for the well-known self-determination theory. This theory seeks to understand the reasons behind an individual's behavior. In concrete, it focuses on the degree to which this behavior is self-motivated and self-determined, meaning without any external reward (Ryan & Deci, 2017). The self-determination theory assumes a human's self-determination, which means that human beings are seen as active, growth-oriented organisms naturally inclined towards integrating their psychic elements into a unified sense of self (Deci & Ryan, 2000). Moreover, the theory proposes three main intrinsic needs involved in this self-determination, motivating self-initiated behavior (Deci & Ryan, 1995). These needs are autonomy, competence, and relatedness (Deci & Ryan, 2000). For our context, autonomy, and competence are particularly relevant. Autonomy entails the need to be a causal agent in one's own life and act in harmony with one's integrated self (Assche et al., 2018). This does not certainly mean being completely independent of others but rather constitutes a feeling of overall psychological liberty and freedom of internal will (Assche et al., 2018). On the other hand, competence, in terms of self-determination theory's basic human need, refers to an individual's ability to perform a task or work proficiently well (White, 1959). Environments or contextual situations that support an individual's feelings of autonomy and competence, according to the self-determination theory, are argued to foster intrinsic motivation for pro-active and persistent behavior in that individual. Conversely, the theory posits that the degree to which any of these psychological needs are unsupported within a social context will have a robust detrimental impact (Deci & Ryan, 2000).

In our interviews, we investigate that employees working in SDTs feel psychological empowerment, with autonomy and self-confidence in their competencies emerging as two significant dimensions. Following the logic of the self-determination theory, these two dimensions serve as important drivers for interviewees' motivation towards pro-active and resilient work behavior. This corresponds with the SDT's persistent dimension. More broadly, interviewees' experience of autonomy and competence may intrinsically motivate them towards agile work behavior, resulting in higher levels of workforce agility. In addition to the self-determination theory, previous research results in the area of job autonomy (a dimension of psychological empowerment) support our arguments. The literature has confirmed that providing employees with autonomy in their work settings impacts how they behave. Specifically, studies spanning several decades have provided empirical evidence linking employees' autonomy to behaviors such as proactivity and learning, both of which represent dimensions and sub-dimensions of workforce agility. In terms of proactivity, Wall and Martin (1987), Ohly et al. (2006), Parker et al. (1997), as well as Sherehiy and Karwowski (2014) have found that higher autonomy at work allows workers to respond d more swiftly to problems and develop more flexible solutions to problems during the operation process. Having the opportunity to independently address minor operational issues, rather than relying on supervisors or colleagues, enhances the employees' comprehension of problems, tasks, or work processes. This knowledge can then be utilized to proactively mitigate or foresee challenges (Sherehiy & Karwowski, 2014). In terms of learning (a sub-dimension of workforce agility's dimension of adaptability), Brousseau (1983) and Kohn and Schooler (1978) discovered through their empirical investigations that employees with greater autonomy enhance their knowledge and skills by regularly dealing with new, unexpected, and diverse tasks. This implies that these employees improve their learning of new behavioral patterns. We posit that these empirical findings from previous studies regarding the positive influence of autonomy on proactivity and learning can be applied to our case, as our study addresses precisely the same variables. Therefore, we hypothesize that interviewees experiencing autonomy in our study exhibit agile work behavior, signifying that psychologically empowered employees demonstrate higher levels of workforce agility. Against this backdrop, we postulate (Figure 4):

Proposition 5: Employees experiencing higher levels of psychological empowerment have higher levels of workforce agility.

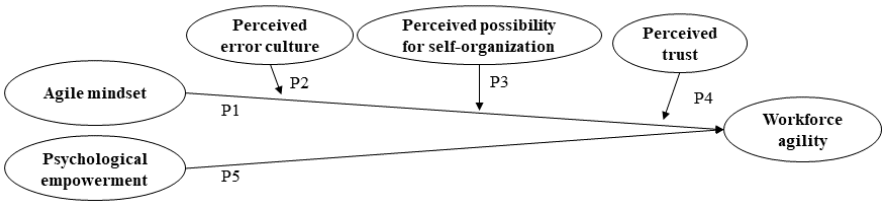

Figure 4. Proposed Theoretical Model

Contributions

Theoretical contributions: Our findings contribute to research efforts focused on exploring predictors of workforce agility, particularly within software development teams (SDTs). Existing studies have predominantly emphasized external factors implemented by organizations to influence employees' agility, such as job rotation and cross-training. Other studies have highlighted the significance of employees' skills and cognitive abilities, such as risk-taking and digital competency, in predicting workforce agility. However, the existing literature offers an incomplete understanding of potential psychological factors among employees that predict workforce agility. Individual behavior is greatly influenced by psychological factors (Ajzen & Madden, 1986; Deci & Ryan, 1985), which may explain and enhance workforce agility, promoting desired behavior sustainably. Thus, neglecting these factors leads to missed significant opportunities to leverage these factors for promoting workforce agility. Our research addresses this gap by examining these factors, contributing to the theoretical field in three primary ways:
(1) For the first time, we were able to provide evidence that the agile mindset, which, from a psychological view, constitutes an individual's attitude, impacts the workforce agility of employees.
(2) We also investigate that employees' perceived working conditions play a crucial role in fostering workforce agility. In particular, our research revealed that when employees perceive an error culture, the possibility of self-organization, and leaders' trust in employees, it reinforces the relationship between the agile mindset and workforce agility.
The identification of the agile mindset, along with the employees' perceptions of an error culture, possibility for self-organization, and trust, constitute completely new insights into the research area of psychological predictors of workforce agility and, thus, expanding the extant body of knowledge.
(3) Our research also uncovered that psychological empowerment is a predictor of workforce agility. As mentioned, scholars like Muduli (2017), Muduli and Pandya (2018), Cyfert et al. (2022), and Cornelis and Febriansyah (2023) have provided evidence in their prior studies that psychological empowerment influences employees' workforce agility. These studies primarily employ quantitative methods for data collection, especially standardized surveys. However, surveys typically do not allow for extensive interaction with study subjects (Holloway, 2005). This limited interaction can result in a surface-level understanding and may not capture a rich contextual understanding and the depth of individual perceptions (Rohrbeck et al., 2015). Hence, with our qualitative approach, we were able to acknowledge and validate prior insights.

Practical contributions: To enhance workforce agility in SDTs, it is crucial to consider the attitudes, feelings, and perceptions of those involved. Managers of SDTs gain a valuable capability by comprehending the elements that enhance employees' workforce agility. This enables them to cultivate this desired behavior through long-term programs, leading to benefits like heightened innovation performance, increased employee satisfaction, organizational growth, and elevated productivity as documented by various studies (Petermann & Zacher, 2022; Tripp et al., 2016). Our study findings provide leaders from SDTs with a clear direction on which constructs they can build on to strengthen workforce agility:
(1) The agile mindset, which we identified in our data, is an important attitude construct. It tends to be relatively stable for individuals, but it is not entirely resistant to change. Based on this, concrete measures can be taken to make the agile mindset of those affected discussable and developable. Measurement tools such as those developed by Eilers et al. (2022) can be helpful here. To offer framework conditions for successful agile mindset development, measures from three areas can be helpful: 1) measures for knowledge transfer, such as training, coaching, and exchange with other teams or companies, 2) an appropriate work

design, which, for example, allows regular reflection or direct work with stakeholders, as well as 3) leadership concepts, which allow the team to come to the fore and enable productive handling of errors (Eilers et al., 2022; Peters et al., 2019).
(2) Psychological empowerment has emerged as the second success construct for workforce agility in SDTs. Here, too, leaders can take appropriate measures to promote psychological empowerment. While the status quo can be assessed with measurement tools such as those developed by Spreitzer (1995) for individuals, psychological empowerment can be addressed through structural empowerment measures. These include measures that transfer power and control from the manager to the employees concerned.
(3) Working conditions have been identified as another factor contributing to workforce agility in SDTs. Managers and team leaders play a critical role in implementing those conditions which are based on the establishment and strengthening of an error culture, self-organization, and trust. To implement an error culture, managers and leaders need to proactively address errors. This involves quick error detection, open communication about mistakes, coordination of their handling, and implementation of measures to minimize any potential damage (Dyck et al., 2005). Furthermore, managers and team leaders can foster self-organization and encourage team members to take on responsibilities by distributing commitment and decision-making authority among team members (Malik et al., 2021; Petermann & Zacher, 2021) and improving cooperation, communication, and mutual support within the team (McHugh et al., 2011). In addition, managers and team leaders can take measures to show their team members that they trust them and have confidence in their work and decisions. This can be specifically implemented by relational behaviors like openness and support (Carmeli et al., 2012) and by fostering a collective sense of purpose among team members (Joshi et al., 2009).
These insights can enhance organizations' adaptability and overall long-term success, empowering managers to navigate the dynamic landscape of SDTs. Our findings hold particular significance for sizable enterprises and those with a diverse, varied workforce, especially those stemming from mergers or swift growth.

Limitations & Future Research

While insightful, our study has limitations that present future research opportunities:
(1) Our study's methodological approach was a qualitative case study, focused on a European automotive software company. While this selection was suitable for initial data collection, it does constrain the generalizability of our findings (Yin, 2013). Future research should aim to validate and expand upon these results by comparing them with cases from different enterprises and contexts, including diverse sectors and company types such as start-ups or SMEs, to enhance the robustness of the findings (Walsham, 2006).
(2) Our findings are based on qualitative data collected through interviews with employees working in software development teams. Future research could benefit from adopting a mixed-methods approach, combining both quantitative and qualitative elements from various sources, offering a more comprehensive understanding of the psychological factors that promote workforce agility in software development teams (Eisenhardt & Graebner, 2007; Venkatesh et al., 2016).
(3) Based on previous research, we developed a novel theoretical model (Gioia et al., 2013), which explains the interconnections between the investigated factors - agile mindset, psychological empowerment, working conditions - and workforce agility. To further validate our theoretical model, future studies should undertake quantitative research to empirically test the proposed factors and relationships outlined in our model (Collins et al., 2006).

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