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Contents

Editorial

At the beginning of this year the successful transformation of the journal *Die Unternehmung* into the Open Access *Swiss Journal of Business* took place. Today, it is a great pleasure for me to present you with the second issue in its new format.
At the same time, I would like to take this opportunity to thank everyone involved in this transformation:

- A big THANK YOU goes to our partners at *Nomos*, for their proactive and supportive role in this transformation process.
- Thank you to the Swiss Academy of Humanities and Social Sciences (SAGW) whose continued financial support will enable us to prevent our authors from any financial burdens regarding article processing charges.
- Thank you also to my Editor's colleagues for supporting me with all their ideas and commitment in this transformation journey.

You have all helped tremendously in opening our journal for an international audience and increasing our academic footprint as well as having a practical impact.
In addition, I would like to warmly welcome *Karsten Hadwich* from the University of Hohenheim as our new Editor with his expertise in Marketing, who will replace *Manfred Bruhn* our long-standing Editor and temporary Managing Editor, to whom I would like to express my heartfelt thanks for his impactful work and his great commitment to our journal. Thankfully, *Manfred Bruhn* will continue to support us as a new member of the Editorial Board.
This issue takes up three current topics in business and management:

- *Vera Betz* and *Milena Zosso* investigate in their qualitative research study the current state and cultural influence of imparting Corporate Social Responsibility and Environmental Social Governance individual competencies with alternative credentials in higher education institutions. Many learners acquire relevant sustainability knowledge, such as Corporate Social Responsibility and Environmental Social Governance practices, by using alternative credentials, short courses, for lifelong up- and reskilling. The authors identify 68 alternative credentials within 179 higher education institutions in the DACH region of Germany, Austria, and Switzerland and analyze their competency domains exploratively with MAXQDA. The results reveal that the most implemented competency is the cognition-oriented domain, focusing on understanding fundamentals. Furthermore, German higher education institutions offer noticeably more reflective course elements within the meta-oriented domain, potentially influenced by cultural differences, such as a more direct approach to feedback and disagreements.
- *Jonas Freibauer, Marc Oliver Rieger,* and *Silja Grawert* examine in their quantitative study the connection between trading app usage and investment behavior. They collected data from 503 participants, which are representative for German Neobroker users, Ex-Neobroker users and Neobroker usage planners and investigated Neobroker users by a number of aspects regarding demography and investment characteristics. In particular, they found out that Neobroker users are significantly more risk tolerant

than the general German population and Ex-Neobroker users. In addition, trading app users tend to invest in more or different products than originally planned. Low trading fees and the low minimum investment amount are the main reasons for the use of trading apps. If investors stop using trading apps, they mostly stop investing all together. Another worrying finding of their study is that in general, the financial literacy of all groups considered in this study is surprisingly low.

- In the third paper of this open issue *Monika Blattmeier* explores in her conceptual article business process patterns that are perceived, analyzed, and visualized as whole entities or Gestalten. The objective of her aesthetic analysis is to sensually understand business processes: Aesthetic business processes are determined by individuals that attribute significant value to the work practices and their outputs. Her analytical perspective emphasizes the human perspective considering the numerous transformations, particularly in matters of sustainability, which also present challenges for business process management. She develops in her contribution a multimodal repertoire that provides texts and images for aesthetic perception using a pattern format. Her article illustrates how a specific business process pattern was visualized in collaboration with companies so that aesthetic experiences are also possible during the reception of the visualizations. The full value of business process patterns, according to her conclusion, is realized when the dynamics of the process flow are recognized, which establishes the link between what is happening in the process and the process structure, time and space, and knowledge of various domains, thereby encouraging innovative thinking.

We hope that this issue will once again provide you with interesting insights into current topics in business and management as well as surprising and revealing "aha" moments for further research. We would like to thank all the authors involved in this issue for their inspiring contributions. A special thanks go to our dedicated reviewers, who have made a significant contribution to the quality of this issue. We hope you enjoy reading this issue of the *Swiss Journal of Business*.

Stefan Güldenberg, Prof. Dr. is Managing Editor of the Swiss Journal of Business, President of the Schweizerische Gesellschaft für Betriebswirtschaft (SGB) and Full Professor as well as Academic Director at the Graduate School of the EHL Hospitality Business School, Lausanne.

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Responsible CSR and ESG Management Competencies: Higher Education Alternative Credentials in the DACH-Region

Vera Betz and Milena Zosso

Summary: Many learners acquire relevant sustainability knowledge, such as Corporate Social Responsibility (CSR) and Environmental Social Governance (ESG) practices, by using alternative credentials (AC), short courses, for lifelong up- and reskilling. This qualitative research study investigates the current state and cultural influence of imparting CSR and ESG individual competencies with AC in higher education institutions (HEI). The authors identify 68 AC within 179 HEI in the DACH region of Germany, Austria, and Switzerland and analyze their competency domains exploratively with MAXQDA. The results reveal that the most implemented competency is the cognition-oriented domain, focusing on understanding fundamentals. Furthermore, German HEI offer noticeably more reflective course elements within the meta-oriented domain, potentially influenced by cultural differences, such as a more direct approach to feedback and disagreements.

Keywords: Sustainability, CSR, ESG, Individual competencies, Upskilling courses, Alternative credentials, Higher education

Verantwortungsvolle CSR- und ESG Managementkompetenzen: Alternative Zertifizierungen von Hochschulen in der DACH-Region

Zusammenfassung: Lernende erwerben relevante Nachhaltigkeitskenntnisse, wie Corporate Social Responsibility (CSR) und Environmental, Social, Governance (ESG) Praktiken, indem sie alternative Zertifizierungen (AC), kurze Kurse, zur lebenslangen Weiterbildung nutzen. Diese qualitative Forschung untersucht den aktuellen Stand und den kulturellen Einfluss der Vermittlung von individuellen CSR- und ESG-Kompetenzen mit AC in Hochschuleinrichtungen (HEI). Die Autoren identifizieren 68 AC innerhalb 179 HEI in der DACH-Region (Deutschland, Österreich und Schweiz) und analysieren Kompetenzbereiche explorativ mit MAXQDA. Die Ergebnisse zeigen, dass die am häufigsten implementierte Kompetenz der kognitionsorientierte Bereich ist, das Grundlagenverständnis. Darüber hinaus bieten deutsche HEI deutlich mehr Reflexionen im metaorientierten Bereich an, was potenziell auf kulturelle Unterschiede wie einen direkteren Feedback- und Meinungsverschiedenheiten-Ansatz zurückzuführen ist.

Stichwörter: Nachhaltigkeit, CSR, ESG, Individuelle Kompetenzen, Weiterbildungskurse, Alternative Zertifizierungen, Hochschulbildung

Legend

AC	Alternative Credential
CSR	Corporate Social Responsibility
DACH	D=Deutschland (Germany), A=Austria (Österreich), CH=Confoederatio Helvetica (Switzerland/Schweiz)
ESG	Environmental Social Governance
HEI	Higher Education Institutions
MOOCs	Massive Open Online Courses

1. Introduction

Is our business world educated and prepared to create a responsible and sustainable future? Higher education institutions (HEI) have been criticized for not preparing managers optimally to engage in responsible decision-making but promoting questionable theories of profit maximization that encourage short-term thinking and a lack of social awareness. As a result, graduates may have contributed to impractical and unsustainable business practices, which can lead to political and corporate scandals and contribute to humanitarian crisis (Amann, 2011; Ghoshal, 2005).

Recognizing these issues, there is a growing consensus that companies should prioritize not only shareholder profits but also environmental and social responsibilities, by reducing carbon emissions and supporting social welfare. Many organizations address these responsibilities through CSR departments and programs (Osagie et al., 2019). CSR is broadly defined as the voluntary integration of social and environmental concerns into business operations (Dahlsrud, 2008; European Commission, 2001). Besides, ESG criteria provide quantifiable metrics to assess CSR performance, making CSR and ESG complementary towards each other (Kaźmierczak, 2022). Recent research emphasizes the importance of Corporate Social Responsibility (CSR) and Environmental, Social, and Governance (ESG) knowledge that professionals and students need to acquire to effectively implement CSR and ESG practices in their business and corporate settings (Marti et al., 2024). At the same time, there is a growing interest in CSR and ESG management by experts from consultancies, financial service providers, nonprofits, public institutions, and multinational companies (García Vaquero et al., 2021; Hesselbarth & Schaltegger, 2014).

Looking at the culturally similar DACH countries (DACH: D=Deutschland (Germany), A=Austria (Österreich), CH=Confoederatio Helvetica (Switzerland/Schweiz), several developments show the importance of upskilling the workforce to keep up with the developments in CSR and ESG. Surveys among employers and employees in the DACH region reveal that companies fear increasing bureaucracy due to governmentally required ESG measures and reporting, and experience difficulties in meeting their sustainability skills demand while employees feel less prepared to change their skill set (PwC Deutschland, 2023; PwC Switzerland, 2023; Wirtschaftskammer Österreich, 2023). In several industries, sustainability efforts are a critical part of a company's strategy, and the efforts in ESG and CSR have become mandatory in the DACH countries, such as the Corporate Sustainability Reporting Directive (CSRD) introduced by the European Commission (Pugnetti, 2024; European Commission, 2024; Abel & Markarian, 2024). Even though Switzerland is not part of the EU, the reporting obligations are aligned with the EU CSRD framework (Darbellay, 2024).

Connected to upskilling, a trend can be noticed that new formats of knowledge acquisition and lifelong learning opportunities have become increasingly important in reaching sustainability goals and standards. Alternative credentials (AC), as a short course format, offer opportunities for students and professionals to acquire new skills and develop their competencies across management and other disciplines, which can help them seek additional recognition on the labor market (Brown et al., 2021; Young et al., 2019). These courses started in the 1990s, for example with IT certifications developed by technology companies as a form of AC, and can link individual economic prosperity and labor market signals (Bean et al., 2023). Moreover, Massive Open Online Courses (MOOCs) on open platforms are AC that offer a broader range of course topics, e.g., teaching intercultural competency and further career development skills (Langseth et al., 2023; Rai et al., 2023). Another form of AC is micro-credentials, which are short-term stackable courses with the same goal of increasing employability and are gaining popularity worldwide (Bideau & Kearns, 2022). Since employers mention that these types of credentials could potentially benefit recruitment, training, lifelong learning, and retention (Brown et al., 2021), HEI started building this type of AC.

Another trend within HEI in the DACH region is a noticeable shift from merely transferring knowledge to teaching competencies (Schmidpeter & Kolb, 2018; Barth et al., 2007). This shift is also evident in the context of CSR education, where the discussion on responsibility has shifted from an organizational to an individual level (Carroll & Laasch, 2019; Wesselink, 2015). Numerous frameworks for individual sustainability and CSR competencies have been proposed (e.g., Barth et al., 2007; Brundiers et al., 2021; De Haan, 2010; Rieckmann, 2012; Wiek et al., 2011), and these competencies are increasingly being integrated into HEI courses (Stalder, 2020). However, this transition in HEI also presents challenges, such as a lack of the necessary skills to teach CSR and ESG-related courses due to a misalignment between faculty skills and institutional strategies (Abdelgaffar, 2021; Beddewela et al., 2017; Podolny, 2009). It remains unclear how individual CSR and ESG competencies are integrated in HEI AC within the DACH region, and this study seeks to address this gap. Therefore, the authors start with a literature review including the concept of individual competency, alternative credentials and the culture within the DACH region. Next, the authors build a CSR and ESG competencies framework and explain the methodology. Lastly, the paper ends with the results, discussion, and conclusion.

2. Literature review

2.1 The Concept of Individual Competency

The broadly discussed concept of individual competency in business research consists of three dominant perspectives: behavioral, generic, and comprehensive (Delamare Le Deist & Winterton, 2005). The behavioral approach defines competencies as a set of simplified observable behaviors or tasks that have to be performed (Neumann, 1979). The behavioral approach is associated with behaviorism, which is part of an approach in psychology that focuses on observable behavior rather than what is happening in the mind (Mulder, 2014; Osagie et al., 2016). In response to criticism that the behavioral approach is too narrowly focused on specific tasks and lacks consideration of broader personal attributes, the generic approach to the concept of competency was put forward (Eraut, 1994; Osagie et al., 2016). The generic approach emphasizes underlying personal characteristics, such as knowledge,

skills, attitudes, and personal traits, that distinguish successful performers from less successful ones and are applicable across various contexts. However, this approach has been criticized for being too general, lacking context-specificity, and thus being difficult to apply effectively in professional practice (Osagie et al., 2016). The most recent perspective is the comprehensive approach (Mulder et al., 2009). This approach moves away from the fragmented focus on specific tasks of the behavioral approach and the broad scope of the generic approach. Instead, it views competencies as an interrelated combination of knowledge, skills, and attitudes, all embedded within the specific context of professional practice (Mulder, 2014; Delamare Le Deist & Winterton, 2005). The authors adopted the understanding of the comprehensive approach in this study.

The individual perspective on competency is relevant in the context of CSR and ESG, where the discussions on responsibility have shifted from an organizational to an individual level (Carroll & Laasch, 2019). Traditionally, literature has focused on institutional and organizational factors driving CSR and ESG performance (Aguinis & Glavas, 2012; Veldhuizen et al., 2013). However, individual change agents are now recognized as key players in response to CSR and ESG challenges, enhancing business flexibility and adaptability. The attributes of change agents are embedded in individual competencies that can be acquired in HEI (Wesselink, 2015) and are increasingly discussed in the educational literature (Wiek, 2011).

With the shift toward individual responsibility and a transition in education from merely transferring knowledge to developing competencies (Schmidpeter & Kolb, 2018; Barth et al., 2007), research on competencies for sustainable development has gained increasing importance (Osagie et al., 2016). Plenty of competency frameworks have been put forward (e.g., Barth et al., 2007; Brundiers et al., 2021; De Haan, 2010; Rieckmann, 2012; Wiek et al., 2011), including the European Commission's GreenComp framework (Bianchi, 2020), which is based on Wiek's (2011) competencies. Each framework emphasizes different aspects of the overarching goal: to equip individuals to participate in socio-political processes and support society's progress toward sustainability (De Haan, 2010; Figueiró & Raufflet, 2015). Individual CSR and ESG competencies are part of these broader sustainability competencies, however, with a more specific focus on the individual competencies needed by CSR/ESG professionals. Several authors have empirically examined these competencies (Osagie et al., 2016, 2019; Wesselink et al., 2015; Lichtenthaler, 2023), providing insights into their relevance and application in professional practice. Furthermore, studies have analyzed competencies within full programs and in bachelor and master courses, for instance in Swiss HEI (Stalder, 2020; WWF Schweiz & econcept, 2024).

2.2 Alternative Credentials

While the CSR and ESG competencies are defined theoretically, there is a gap in the literature regarding whether HEI are implementing these competencies outside of their traditional bachelor and master programs. The upcoming trend of up- and reskilling through AC, which are short courses, is becoming increasingly significant to training executives, professionals, and students outside of regular academic pathways (Bideau et al., 2022; Ward et al., 2023). These courses are shorter than a formal higher education program and can be micro-credentials, academic certificates, or continuing education programs. They link academic education and practical work and add to existing education programs (De Rosa et al., 2024; Kato et al., 2020; Yieng & Haron, 2023). The need for

alternative credentials to foster lifelong learning is urgent to help learners demonstrate their competencies by equipping them with tailored knowledge and competencies, such as critical thinking, to unlock discipline synergies (De Rosa et al., 2024; Kato et al., 2020).

To use the potential of AC, common standards regarding quality, comparability and transparency are necessary and currently discussed worldwide, e.g., by the Malaysian Qualifications Agency (2020) or the New Zealand Qualifications Authority (2023). International and national frameworks define key recommendations, e.g., the ISO 17024, which provides internationally accepted standards to certify individuals (European Commission: European Education and Culture Executive Agency, 2024). Within Europe, several countries established pilot projects, e.g. the Netherlands based on European Standards and Guidelines for Quality Assurance in the European Higher Education Area (ESGs) with transparent standards and registration on their Edubadges platform (European Commission: European Education and Culture Executive Agency et al., 2024). The European approach with the European Union Micro-Credential Agenda aims to provide definitions and guidelines to promote innovative educational programs within EU countries and Switzerland (De Rose et al., 2024).

These upcoming credentials can play an essential role for HEI and employers. One benefit can be an active collaboration to ensure crucial content is taught and used as a recruitment method for potential employees who show employability. Another benefit can be offering quality learning content for existing employees to close skill gaps and improve retention by committing to their professional development (Bell et al., 2022; Brown et al., 2021). It is necessary to focus on accurate content, methods, and competencies to foster desired learning outcomes. Overall, HEI, employers, and learners must adapt to evolving changes to remain relevant.

2.3 Culture within the DACH-Region

Previous studies have highlighted the role of cultural factors in shaping CSR performance (Ringov & Zollo, 2007; Thanetsunthorn, 2015) and how Hofstede's cultural dimensions influence CSR implementation (Tehrani et al., 2021). In the field of education, scholars have primarily studied the effect of cultural factors on students' perceptions of CSR (Thetsane et al., 2024), or applied Hofstede's framework to analyze cultural differences in other areas of HEI, such as entrepreneurship education, and explored how cultural variations shape online management education (Thetsane et al., 2024; Wan Lee et al., 2012). In general, the offered AC must meet the learners' needs while addressing cultural and societal demands (European Commission and Culture Executive Agency, 2024).

Cultural researchers, like Hofstede (1983), Meyer (2022), and Trompenaars (1996), analyzed countries based on different dimensions and developed tools to reveal how social norms in these cultures can be compared to each other. Within the six Hofstede dimensions of power distance, individualism, motivation towards achievement and success, uncertainty avoidance, long-term orientation, and indulgence, the DACH countries differ most regarding long-term orientation and indulgence. The eight dimensions of Meyer's culture map include high context communication, indirect negative feedback, hierarchical leading, top-down deciding, relationship-based trusting, confrontation avoidance, flexible time scheduling, and holistic persuading. Among these, the biggest differences between Germany, Austria, and Switzerland seem to be regarding indirect negative feedback and confrontation avoidance. Trompenaars model includes the eight dimensions univer-

salism/particularism, individualism/communitarianism, specific/diffuse, neutral/affective, achievement/ascription, past/present/future, sequential/synchronic, and internal/external. Within the DACH countries, the biggest differences become apparent between individualism/communitarianism and internal/external. As represented in Figure 1, these three models applied to the context of the DACH region reveal that Germany showcases more long-term orientation (Hofstede), more direct negative feedback, and more confrontational disagreeing (Meyer). Furthermore, Austria is associated with the most balanced orientation between individualistic versus group orientation (Trompenaars), while Switzerland has the highest indulgence (Hofstede) and has a greater orientation towards taking control (Trompenaars).

Cultural Dimensions	Rather low	Rather high	Explanations
Hofstede (2024)			
Long-term orientation			Germany is associated with the highest long-term orientation (e.g., focusing on long-term rewards)
Indulgence			Switzerland is associated with the highest indulgence (e.g., emphasis on quality of life and recreational activities)
Meyer (2024)			
Indirect negative feedback			Germany is associated with the most direct negative feedback (e.g., feedback tends to be unambiguous)
Confrontation avoidance			Germany is associated with being the most confrontational (e.g., direct approach to disagreement)
Trompenaars (2024)			
Individualism/communitarianism			Austria is associated with the most balanced orientation between individualistic versus group orientation (e.g., balance the individual interest with the interest of the community)
Internal/external			Switzerland is associated with the greatest orientation towards taking control (e.g., perceive that they can control their lives and their environment)

Germany Austria Switzerland

Figure 1: Cultural dimensions relevant to the DACH region (based on digital tools of Hofstede, 2024, Meyer, 2024, and Trompenaars, 2024)

Related to the previous literature, there is a research gap in empirically analyzing how culture may impact the integration of CSR and ESG competencies in HEI. Furthermore, limited research exists on the role of HEI in implementing AC for lifelong learning (Lang, 2023). This highlights the relevance of further exploring CSR and ESG competencies

within AC. The potential impact of country-specific cultural factors on AC in HEI holds well in the DACH region, as these countries have comparable education systems. Through the Bologna degree model, the accreditation processes and regulatory frameworks have been standardized (European Education and Culture Executive Agency and Eurydice, 2024). The training structures in Germany, Austria, and Switzerland are characterized by a similar division between vocational education, training and higher education (Graf, 2016). In terms of CSR and ESG, the countries share similar understanding of responsibility and regulatory frameworks, such as the CSRD (Pugnetti, 2024; European Commission, 2024; Abel & Markarian, 2024). Additionally, the DACH region's countries share similar labor market conditions and face intense competition for skilled labor (PwC Deutschland, 2023; PwC Switzerland, 2023; Wirtschaftskammer Österreich, 2023) which is linked to the lifelong learning intention of AC education as individuals should constantly update their knowledge. Given these similarities, it provides an opportunity to compare the HEI through cultural influences based on previously defined cultural factors (Hofstede, 2024; Meyer, 2024; and Trompenaars, 2024).

Firstly, the authors combine the topics of AC in HEI with CSR and ESG individual competencies in the DACH region. As CSR and ESG individual competencies, along with AC, continue to gain popularity both globally and in the DACH region, it is essential to understand their current status and relationship. This leads to the following exploratory research question:

1. What is the current state of CSR and ESG individual competencies in AC within HEI in the DACH region?

Secondly, due to the research gap in empirically examining how cultural factors influence the integration of CSR and ESG competencies in HEI AC and given that the DACH region shares a relatively uniform HEI system, it provides an opportunity to detect cultural influences aside from other institutional factors. This leads to the following exploratory research question:

2. How does culture influence the way CSR and ESG are implemented in AC within HEI in the DACH region?

3. Framework of CSR and ESG Competencies

To answer the research questions of this study, the authors integrate the individual CSR competencies defined by Osagie et al. (2016) and the Sustainability Management Maturity Model for ESG developed by Lichtenthaler (2023) into one combined framework illustrated in Figure 2. These sources were chosen for their strong practical orientation. The integration of CSR and ESG competencies is important for two reasons. CSR is a dynamic concept that evolves over time. Historically, different aspects of CSR have gained relevance. Between 1983 and 2002, the ethical dimension was more emphasized. From 2003 onwards, sustainability and environmental dimensions became increasingly significant (Sarkar & Searcy, 2016). With reporting becoming increasingly relevant, often facilitated through ESG metrics (Kaźmierczak, 2022), this component must be incorporated into the broader understanding of CSR. In HEI, CSR and ESG are often addressed within the same courses, highlighting the need for a framework that allows for the analysis of both concepts in combination (Chiu & Fong, 2023).

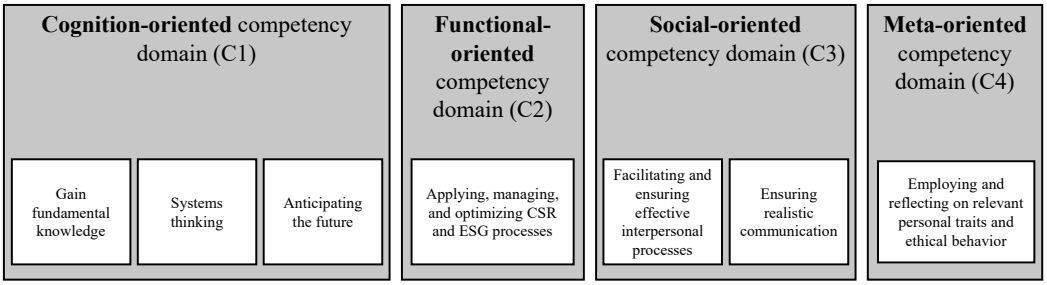

Figure 2: CSR and ESG competencies framework (based on Lichtenthaler, 2023 and Osagie et al., 2016).

Cognition-oriented competency domain (C1): Gain fundamental knowledge, systems thinking, and anticipating future developments. This domain focuses on the conceptual aspects of competencies, such as knowledge and understanding. It involves the fundamental knowledge of CSR/ESG drivers, standards, and regulations (Lichtenthaler, 2023; Osagie et al., 2016). It also includes the ability to identify socio-ecological systems and understand reality as part of broader interconnected contexts rather than merely analyzing individual components in isolation (Osagie et al., 2016 & Bianchi, 2020). Furthermore, systems thinking can also be related to the competency of recognizing business relevance, which means the ability to understand that sustainability must be integrated into all parts of a company rather than treated as a peripheral concern (Lichtenthaler, 2023). Finally, it includes the ability to anticipate future local and global CSR and ESG-related challenges and standards (Lichtenthaler, 2023; Osagie et al., 2016, 2019).

Functional-oriented competency domain (C2): Applying, managing, and optimizing CSR and ESG processes. This domain's focus lies on the operational aspects of competencies. CSR professionals must be capable of managing CSR projects and programs, which includes demonstrating leadership in CSR (e.g., acting as a CSR pioneer). Furthermore, it includes leveraging sustainability for positive business outcomes (Lichtenthaler, 2023) and making a business case for CSR (Osagie et al., 2016). Additionally, it involves the ability to oversee the implementation of CSR strategies, translate them into concrete actions, and utilize available resources more efficiently (Lichtenthaler, 2023).

Social-oriented competency domain (C3): Facilitating and ensuring effective interpersonal processes and communication (internal and external). The Social-oriented domain focuses on competencies related to individual operational effectiveness in interacting with others. These include social, communication, and networking abilities (e.g., to engage with all ecosystem players). A CSR and ESG professional must be able to raise awareness of CSR and ESG initiatives, coach and support others, and promote realistic and transparent internal and external communication regarding CSR and ESG efforts (Berchtold, 2024; Lichtenthaler, 2023; Osagie et al., 2016, 2019).

Meta-oriented competency domain (C4): Employing and reflecting on relevant personal traits and ethical behavior. This domain includes personal conceptual attributes and values. Firstly, it entails the ability to use CSR and ESG-supportive personal characteristics, such as balancing profit and CSR and ESG interests (Lichtenthaler, 2023; Osagie et al., 2016, 2019). And secondly, to recognize and self-evaluate our ideas, habits, and assumptions and to be able to adapt them to internal and external change (Osagie et al., 2016,

2019). This domain also includes ensuring continuous learning and developing resilience for execution (Lichtenthaler, 2023).

In line with the previously presented comprehensive approach, a competency is seen as the interrelation of knowledge, skills, and attitudes, and the integration of these factors within a context (Mulder, 2014). These competency domains can be conceptually divided, however, are most effective when activated together (Osagie et al., 2016, 2019) and may be applied in the context of a professional CSR and ESG manager. The meta-competency domain differs from the first three domains, since it is an overarching competency and has the role of reflecting on other competencies and facilitating their acquisition (Delamare Le Deist & Winterton, 2005).

4. Methodology

The chosen qualitative methodology begins with collecting secondary data about CSR and ESG courses at HEI from university websites. Prior researchers like Wymer and Rundle-Thiele (2017) gained insights on responsibility and sustainability in curricula with this observation method, which avoids potential social desirability biases and nonresponses (Boote & Mathews, 1999). Based on the availability of course information on university websites (Wymer & Rundle-Thiele, 2017), comprehensive data to answer the research questions is gathered in this exploratory analysis. Adapted from Mach and Ebersberger (2024), the authors perform a five-step methodology to identify HEI and courses, structure them with codes, and report the outcomes.

The first step is to select the HEI and gather all course information on the online course catalogs of the selected HEI. This selection includes the 100 largest German HEI based on enrollment numbers (CHE, 2023), all 44 HEI in Austria (Bundesministerium Bildung, Wissenschaft und Forschung, 2024), and all 35 accredited HEI in Switzerland (Swissuniversities, 2024), which offer business education, see also Appendix 1. The authors search for the names of the HEI in combination with the two keywords "Corporate Social Responsibility/CSR" or "Environmental Social Governance/ESG" and the three keywords "Zertifikat/Certificate," "Micro-Credential" or "Weiterbildung/Continuing Education" are performed to identify the AC courses on CSR and ESG. Within the selection criteria, the authors exclude courses that are less than 1 ECTS, which equals 25 to 30 hours of workload, in line with the EU approach to measure (European Commission, 2020), and not more than 59 ECTS, as 60 ECTS can equal a full master's degree. Furthermore, the authors exclude courses that enforce university enrollment as a student to gain the AC, since traditional seminars or modules would have expanded the study. The remaining data include university, country, course title, definition, ECTS, and target group.

The second step is the initial coding based on the first impression (Mach & Ebersberger, 2024). Therefore, each of the two authors codes the competencies of the identified credentials independently in the qualitative software tool MAXQDA (Mach & Ebersberger, 2024). The framework in Figure 2 was used as a first coding scheme with the codes C1= cognition-oriented, C2 = functional-oriented, C3 = social-oriented, and C4 = meta-oriented, since the goal is to reveal the contribution of the different competencies within the credentials.

The third step includes a deeper analysis of the codes based on keywords according to the theory. After the individual coding, the authors discuss the distribution of unmatched codes based on the inter-coder-reliability, which measures the reliability of the coding (Nili

et al., 2020). The inter-coder-reliability in pre-harmonization discussion includes values of 60 % for German coding, 82 % for Austrian coding, and 87 % for Swiss coding, meaning that German coding among the authors differed the most. During that process the authors develop a list of keywords which are presented in Appendix 2 and further discussed in the next step and the results section.

The fourth step is to review the codes and harmonize them to create a common understanding of the competencies and to further work with the data. Based on Nili et al. (2020), the authors discuss code discrepancies to find a consensus within the harmonization process. The authors critically review each unmatched code and discuss which keywords in a code overrule others to develop a comprehensive data set. Since the competencies reach increasingly deeper skills, the "highest" overruling competency is C4, followed by C3 and C2. By going through that process, the authors further define sharp differentiation between the four codes and develop higher-order keywords. Furthermore, competencies divided if two strong keywords appeared or were eliminated if the keywords were not strong enough.

The fifth step is reporting the outcomes and grouping the extracted competencies into four competency domains: C1, C2, C3, and C4.

5. Results

The main objectives of this research study are, first, to understand the current state of implementing CSR and ESG competencies in AC within HEI in the DACH region, and second, to analyze how culture influences curricula. The following section presents the results based on an analysis of the CSR and ESG AC across the three DACH countries by elaborating on the sample and content. Regarding the sample, the authors reviewed 179 higher education institutions in the DACH region during desk research to explore CSR and ESG competencies in AC. Within this screening, the authors discovered 68 courses from 23 universities and 27 universities of applied sciences, see Appendix 1.

	Germany (total all courses)	Germany (average per course)	Austria (total all courses)	Austria (average per course)	Switzerland (total all courses)	Switzerland (average per course)	Total of competencies DACH-Region
Cognition-oriented domain (C1)	126	3.7	68	3.8	62	3.9	256
Functional-oriented domain (C2)	92	2.7	67	3.7	76	4.8	235
Social-oriented domain (C3)	74	2.2	20	1.1	25	1.6	119
Meta-oriented domain (C4)	52	1.5	4	0.2	5	0.3	61

Table 1: Total and per course numbers of extracted CSR and ESG competencies in AC, divided into Germany, Austria, and Switzerland (own elaboration)

Table 1 presents the number of identified competencies grouped by competency domains. The results indicate that educators focus mostly on the cognition-oriented domain (C1), comprising 256 competencies. After that, the functional-oriented domain (C2) follows closely, with 235 identified competencies in all AC courses. The social-oriented domain (C3) appeared in 119 competencies taught in AC courses. Finally, the meta-oriented domain (C4) has the lowest representation, with only 61 competencies in total. Additionally, Table 1 displays the ratio of competencies per course for each country, accounting for the higher number of identified AC courses on CSR and ESG in Germany (34 courses) compared to Austria (18 courses) and Switzerland (16 courses) (see Table 1).

Regarding the content, the authors discover which keywords HEI in the DACH region use for the four competency domains C1, C2, C3, and C4, see also Appendix 2. Keywords within the cognition-oriented (C1) competency domain are learn, understand, become familiar, identify, and anticipate. An example within this category is "Expansion of existing knowledge to include advanced concepts and practices in sustainability and ESG" (Fachhochschule Joanneum (Austria_Coding, pos. 152). The functional-oriented domain (C2) is associated with keywords such as: applying, optimizing, implementation, operational, developing, and evaluating. One example in this domain is "how to implement ESG standards into the investment process" (Universität St. Gallen, Switzerland_Coding, pos. 34). The social-oriented domain (C3) includes representative keywords such as: agents of change, leadership, problem-solving, communication, and facilitation. The following example includes a communication keyword: "how you can systematically and compactly present positive effects with regard to sustainable development for stakeholders" (Leuphana Universität Lüneburg, Germany_Coding, p. 18). Finally, the meta-oriented domain (C4) was related to keywords such as: discuss, reflection, ethics, self-examination and resilience. This domain is created based on examples such as "Our CSR training will guide you through developing your own Code of Ethics" (Freie Universität Berlin, Germany_Coding, p. 13).

Figure 3 illustrates the average number of competencies per AC course for each DACH country. All the countries in the DACH region put more emphasis on cognition and on the functional competency domain. For the cognition-oriented domain (C1), HEI in the three countries display relatively similar numbers of competencies with Germany at 3,7 competencies, Austria at 3,8 competencies, and Switzerland at 3,9 competencies. However, there is a divergence in the functional-oriented domain (C2). Germany's CSR and ESG AC courses allocate less emphasis, with 2,7 competencies, compared to Austria at 3,7 and Switzerland at 4,8. Within the sample, the focus is on the cognition and function-oriented competencies, which aligns with previous research, revealing that obtaining cognition-oriented competencies is prevalent (Osagie et al., 2016). By offering these cognition-oriented competencies, HEI can show that they are a trustworthy partner that includes scientific basic understanding and helps students and professionals to gain a solid foundation. The function-oriented domain is more practice-oriented, and since all companies must include CSR and ESG in their sustainability reporting, this domain is crucial for the business world (Abel & Markarian, 2024).

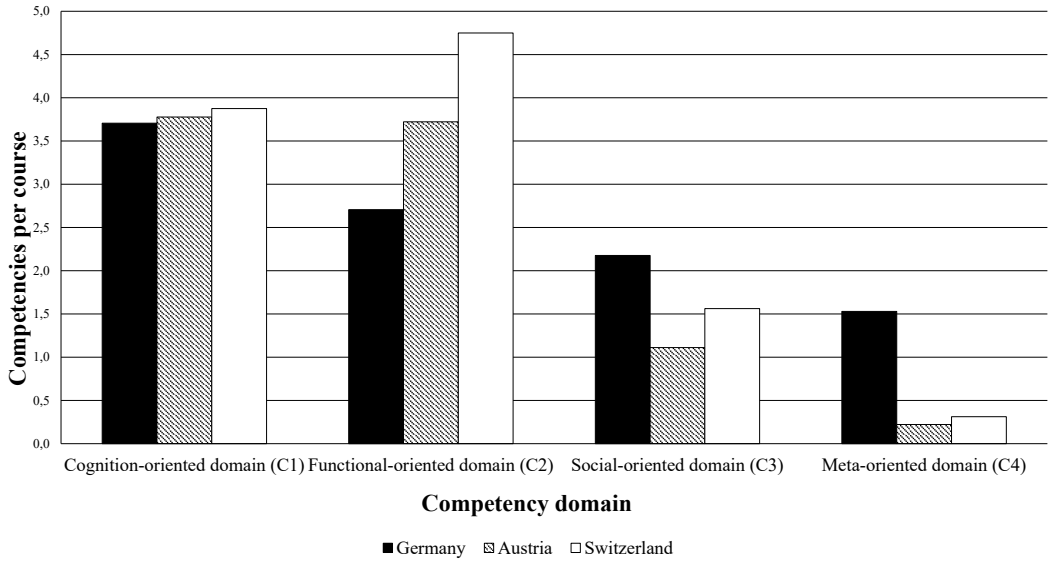

Figure 3: Relative numbers of extracted CSR and ESG competencies in AC, divided into Germany, Austria, and Switzerland (own elaboration)

The social-oriented domain (C3) shows moderate differences among the countries. German AC programs include 2,2 competencies on average per course, whereas Austria and Switzerland place slightly less emphasis, with 1,1 and 1,6. A notable difference is the stronger emphasis German educators place in their AC courses on the meta-oriented domain (C4), with 1,5 competencies per course, compared to only 0,2 in Austria and 0,3 in Switzerland. Overall, the social and meta-oriented domains are less present than the previous two domains in all three countries. Once a basic understanding of cognition-oriented and functional-oriented is established, social-oriented competencies connected to change management and leadership are essential to drive new processes. These social-oriented competencies, like implementing the change of CSRD in companies, are underrepresented in AC. Lastly, the meta-oriented domain is the least taught competency. There might be limited time for self-reflection or ethical behavior education within the course structure of AC if the focus is on cognition- and function-oriented domains, even though these competencies play an important role in embracing the complexity and envisioning a sustainable future (Bianchi, 2020). From these results, it can be deduced that not every educator includes and facilitates all the necessary CSR competencies in their AC (Abdelgaffar, 2021; Beddewela et al., 2017; Podolny, 2009).

Analyzing the cultural aspect, all three DACH regions are similar with minor differences in worldwide comparison. Within Germany, with a gradual decrease in proportion from the cognition- to the meta-oriented domain, the meta-oriented competencies are more often taught than in Austria and Switzerland. With an average of 1,5 included competencies per course, Germany features 7.5 times more meta-oriented CSR competencies than Austria and 5 times more than Switzerland within the sample. From a cultural perspective, this aligns with Germany's high score in long-term orientation in Hofstede's dimensions, underlining the relevance of meta-oriented competencies. Traits like self-reflection and eth-

ical behavior are thus valued as essential tools for considering long-term impact. Furthermore, Germany holds the most direct approach to negative feedback and confrontation, based on Meyer (2022), which leads to a more open confrontation regarding needed change.

Within Austrian AC, the cognition- and function-oriented domains are essential, with a notable drop to the other social- and meta-oriented domains, which are nearly unavailable. Based on Trompenaars` dimensions, Austria is the most likely country to balance individualistic and group orientation within the DACH region. The need to have the same basic understanding and "how to" know-how on all levels within a company can be reflected by this contribution.

Among the different domains, only Switzerland focuses predominantly on the function-oriented domain. Swiss culture is associated with Hofstede's high levels of indulgence and Trompenaars orientation towards internal control, meaning the drive to increase the quality of life with a hands-on mentality.

6. Discussion and Conclusion

As CSR and ESG competencies become increasingly important in the business world, HEI have integrated them into AC to support the development of these competencies among students and professionals. Despite the shared CSR and ESG objectives, differences become apparent by collecting and coding AC competency data from German, Austrian, and Swiss HEI and matching them with cultural dimensions.

One of the key findings of this study regarding the current state of CSR and ESG competencies is that Germany places a stronger emphasis on the meta-competency domain within its AC compared to Switzerland and Austria. Cultural differences may influence this discrepancy, as Germany exhibits the highest long-term orientation score and tends to adopt a more direct approach to feedback and disagreement (Hofstede, 1983; Meyer, 2022). As a result, competencies such as self-reflection and ethical behavior are more prominently emphasized in CSR and ESG AC in German HEI. This would align with a cultural inclination toward considering individual future impacts and fostering open discussions on necessary changes and ethics. However, there are also similarities among the results of the countries as all three focus on implementing the cognition- and functional-oriented competencies. Based on Trompenaars (1996), Germany, Switzerland, and Austria lean more towards internal control in international comparison, which leads to a focus on planning and knowing all the information to act accordingly.

In conclusion, this study contributes to the literature on CSR education and AC education in the following ways. Firstly, it introduces a novel CSR and ESG competencies framework that enhances the understanding of CSR competencies by integrating ESG into CSR, as discussed, reflecting the growing prominence of CSR reporting. Secondly, it sheds light on the current distribution of CSR and ESG competencies, highlighting that not all competencies are systematically embedded within the AC in the DACH region. Particularly, the integration of social and meta-competencies into AC within HEIs still appears to be challenging, although literature emphasizes the importance of incorporating all competency domains. Thirdly, the lack of certain competency domains might point to operational or institutional issues in CSR and AC education within higher education institutions. In the context of AC, time constraints may limit the inclusion of meta-competencies, which require reflection on other competencies and support their acquisition

(Delamare Le Deist & Winterton, 2005). It might also indicate that the educators in HEIs lacks the necessary support structures and training to implement and facilitate the required CSR and ESG competencies in their AC.

One limitation of this study is that some AC could possibly not be identified due to restricted external websites. Additionally, it is difficult to generalize Europe-wide by focusing on three culturally similar countries. Within Switzerland, the study does not account for regional linguistic and cultural differences. Furthermore, course catalogs may list certain competencies, but there is no guarantee of actual inclusion or emphasis in classroom instruction. Based on the results, future research could further analyze the distribution of CSR and ESG competency domains within each AC in the DACH region. Moreover, an in-depth investigation into the reasons behind the less frequent inclusion of certain competencies, beyond cultural differences, would be valuable. For instance, investigating the challenges faced by the CSR and ESG educators, as well as the competency development of faculty and educators in HEI, would be necessary. Additionally, future research paths include further examination of the AC functions within the system of implementing these new education innovations into different HEI systems by focusing on relevant sustainability topics such as CSR and ESG. Hence, measuring the long-term impact of these CSR and ESG AC and the impact of the pedagogical way the competencies are taught are potential future research paths.

Overall, this study is a unique contribution to the current CSR and ESG competencies teaching landscape in combination with the upcoming concept of AC, which has become increasingly important for students and professionals to prove their employability regarding sustainability competencies. By focusing on the DACH region with a similar education system, this study benefits decision-makers in HEI as practical guidance in developing and refining their CSR and ESG AC offerings. The HEI can benefit from each other's concepts, such as the German effort for the meta-oriented domain or the Swiss dedication on function-oriented competencies, and, therefore, can develop and expand their AC portfolio. Moreover, this study lays the groundwork for enhancing faculty training in HEI in the DACH region, an area currently lacking a strong research foundation. By equipping educators in HEI with effective teaching strategies to develop all competency domains, including cognition, function, social, and meta-competencies, this study contributes to preparing learners for the evolving demands of CSR and ESG practice.

Appendix

Appendix 1: Descriptives – number of courses (own elaboration)

	Germany (D)	Austria (A)	Switzerland (CH)	overall
Number of checked HEIs	100, based on CHE (2023)	44, based on Bundesministerium Bildung Wissenschaft und Forschung (2024)	35, based on Swissuniversities (2024)	179
Number of courses	34	18	16	68
Number of universities	15	5	3	23
Number of universities of applied sciences	11	9	7	27

	Germany (D)	Austria (A)	Switzerland (CH)	overall
Number of universities per location: D=West, A=West, Ch=French region	7 (Hochschule RheinMain, Hochschule Bonn-Rhein-Sieg, RWTH Aachen, Universität Münster, Johann Wolfgang Goethe-Universität Frankfurt am Main, Hochschule Fresenius, FOM Hochschule für Oekonomie & Management)	3 (Fachhochschule Kufstein Tirol Bildungs GmbH, MCI Management Center Innsbruck, Fachhochschule Kärnten)	3 (Université de Genève, HES-SO Haute école spécialisée de Suisse occidentale, International Institute for Management Development)	
Number of universities per location: D=North, A=Central, Ch=German region	6 (Universität Hamburg, Hamburger Fern-Hochschule, Europäische Fernhochschule Hamburg, Carl von Ossietzky Universität Oldenburg, Leuphana Universität Lüneburg, Ostfalia Hochschule für angewandte Wissenschaften)	1 (Johannes Kepler Universität Linz)	6 (Universität Zürich, Universität St. Gallen, Zürcher Hochschule für Angewandte Wissenschaften, Hochschule Luzern, Fachhochschule Nordwestschweiz, Berner Fachhochschule)	
Number of universities per location: D=East, A=East	5 (Friedrich-Schiller-Universität Jena, Universität Rostock, Freie Universität Berlin, Technische Universität Chemnitz, IU Internationale Hochschule)	6 (Fachhochschule des bfi Wien GmbH, Wirtschaftsuniversität Wien, Fachhochschule Wiener Neustadt GmbH, Fachhochschule Burgenland GmbH, Universität für Weiterbildung Krems, FHW Fachhochschul-Studiengänge der Wiener Wirtschaft GmbH)		
Number of universities per location: D=South, A=South, Ch=Italian region	8 (Universität Augsburg, Hochschule München, Technische Hochschule Nürnberg Georg Simon Ohm, Universität Passau, Technische Hochschule Deggendorf, Technische Universität München, Friedrich-Alexander-Universität Erlangen-Nürnberg, Universität Bayreuth)	4 (Fachhochschule Joanneum GmbH, Technische Universität Graz, Montanuniversität Leoben, CAMPUS 02 Fachhochschule der Wirtschaft GmbH)	1 (Scuola universitaria professionale della Svizzera italiana)	

Appendix 2: Coding Keywords and Harmonization (own elaboration)

Keywords C4 (overruling C3, C2, C1)	Keywords C3 (overruling C2, C1)	Keywords C2 (overruling C1)	Keywords C1
reflection	leadership	realize	(become) familiar
ethics	promoting participants	implement	encounter
dealing with issues as a person	cultural components	create	look at
philosophical questions	tailor-made	evaluate	acquire
high self-standard	employee-oriented	compare	insights

Keywords C4 (overruling C3, C2, C1)	Keywords C3 (overruling C2, C1)	Keywords C2 (overruling C1)	Keywords C1
work-life-balance concept	(further development of sustainability) reporting	design	overview
assessment	management tools	develop	frame
evaluation	managing	determine	core competencies
resilient	leader of tomorrow	operational	learn
discuss	communication	define criteria	understanding
	lead	control	
	key functions	assess	
	stakeholder		
	agents of change		
	problem-solving and moderation techniques		

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The Role of Trading Apps in Shaping Investment Behavior

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Summary: We study the connection between trading app usage and investment behavior. To this aim, we collect data from 503 participants, which are representative for German Neobroker users, Ex-Neobroker users and Neobroker usage planners. We investigate Neobroker users by a number of aspects regarding demography and investment characteristics, in particular we find that Neobroker users are significantly more risk tolerant than the general German population and Ex-Neobroker users. Trading app users have a tendency to invest in more or different products than originally planned. Low trading fees and the low minimum investment amount are the main reasons for the use of trading apps. We observe that investors who stop using trading apps mostly stop investing all together. Another worrying result is that financial literacy among all groups is low and most Neobroker users have wrong conceptions about how trading apps earn money. In general, the financial literacy of all groups considered in this study is surprisingly low.

Keywords: Neobroker, financial risk-taking, investment behavior, fintech, trading app, financial literacy

Die Rolle von Trading Apps bei der Gestaltung des Investitionsverhaltens

Zusammenfassung: Diese Studie untersucht die Verbindung zwischen der Nutzung von Trading Apps und dem Investitionsverhalten. Zu diesem Zweck wurden Daten von 503 Teilnehmenden, die repräsentativ für deutsche Neobroker Nutzer, Ex-Neobroker Nutzer und Neobroker-Nutzungsplaner sind, erhoben. Wir untersuchen Neobroker Nutzer nach einer Reihe von Aspekten hinsichtlich Demographie und Anlagecharakteristika. Insbesondere stellen wir fest, dass Neobroker Nutzer signifikant risikotoleranter sind als die deutsche Bevölkerung und Ex-Neobroker Nutzer. Trading App Nutzer weisen eine Tendenz auf, in andere oder mehr Produkte zu investieren als ursprünglich geplant. Niedrige Handelsgebühren und der geringe Mindestanlagebetrag sind die Hauptgründe für die Nutzung von Trading Apps. Neobroker Nutzer, die ihre Trading App Nutzung stoppen, hören meist ganz auf zu investieren. Ein weiteres besorgniserregendes Ergebnis ist, dass das Finanzwissen in allen Gruppen gering ist und die meisten Neobroker Nutzer keine Kenntnis über das

Geschäftsmodell von Neobrokern haben. Generell ist das Finanzwissen aller in dieser Studie betrachteten Gruppen überraschend niedrig.

Stichwörter: Neobroker, finanzielles Risiko, Investitionsverhalten, Fintech, Trading App, Finanzbildung

1. Introduction

While stock market investments used to be complex for laymen and involved high learning and transaction costs, the availability of broadly diversified exchange-traded funds, internet brokers, and robo-advisors has changed both significantly. The low or in some cases even non-existing trading fees of these providers, as well as order placement and securities account management on the individual smartphone, reduce entrance barriers and make it easy for people with low income or low wealth to start investing in the stock market. This study investigates how trading apps, particularly Neobrokers, have lowered these barriers, providing a detailed analysis of user demographics and investment characteristics. Even low trading costs have a negative impact on the stock market participation of low or moderate wealthy households (Vissing-Jørgensen, 2002). For this reason, it is surprising that in many highly developed countries the proportion of people investing in stocks (the stock market participation) is still quite low, as the entry costs to participate in the stock market are now potentially set down. Stock market investments contribute to an efficient allocation of capital (Wurgler, 2000). They also offer an investment opportunity that has much better expected returns over the long-term than fixed interest investments (Campbell & Viceira, 2005; Leibowitz & Krasker, 1988). Therefore, capital market investments are pivotal for retirement saving. The lack of willingness to invest in equities could possibly lead to huge losses in retirement savings. There is a lot of academic research on trying to understand this situation and come up with ideas on how to improve it (e.g. (Farhi & Panageas, 2007; Mckenzie & Liersch, 2019)).

Recently, companies such as Robinhood, Scalable Capital and Trade Republic have been offering trading apps that may, to a large extent, be designed to appeal to people who have not yet invested in equities. Our study finds that Neobroker users are significantly more risk tolerant than the German population and Ex-Neobroker users, a behavior potentially amplified by the gamification methods and attention triggers inherent in these apps, thus echoing findings by Arnold et al. (2022) on the impact of digital stimuli.

These apps provide users with a simple and playful way of investing via smartphone. They offer trading of financial products at low prices or without trading fees. The executing trading venue is usually predetermined and is related to the cost structure of trading apps. This is because trading apps are not primarily financed by the fees charged for an order execution but by refunds from the executing trading venue. These refunds are also called payment-for-orderflow. Trade Republic, for example, receives a payment-for-orderflow, of up to 3 EUR per customer trade they place with their cooperating executing market maker (Trade Republic Bank GmbH). Furthermore, 81 % of the revenue of Robinhood, the largest Neobroker in the U.S., was order-based income in the first quarter of 2021 (SCE, 2021).

In analyzing the demographic and behavioral aspects of Neobroker users, we contribute to the literature on financial engagement facilitated by digital platforms. This includes identifying that a notable portion of users cease investing altogether after discontinuing

app use, highlighting potential risks in user engagement strategies. Trading apps may appeal especially to novice investors because of their simplicity. They use gamification methods to give the user the impression of a real-time investment game. For this purpose, the apps use a variety of different psychological methods to reward the client in different situations. An example is a virtual shower of confetti on the Robinhood app when a new user has completed the first transaction (Tierney, 2022). On the one hand, this might have a positive effect and be especially appealing for novice investors, as they feel to get a reward for their first investment, which can help to get over initial insecurities with investing. On the other hand, gamified investing can lead to investments in financial products in which one would otherwise not invest. Furthermore, gamified investment apps, as the ones mentioned above, use psychological methods to lead their users to trade more often (Langvardt & Tierney, 2022), which results in higher earnings for the app providers (Tierney, 2022). There is already empirical evidence that the design of a trading app has an impact on the trading behavior of the users. The changes in investment behavior are, in this case, positive for the trading app provider and negative for the user (Tierney, 2022). This study seeks to investigate these dynamics further, particularly focusing on the balance between accessibility and the encouragement of potentially detrimental trading behaviors.

Therefore, it is important to investigate the long-term impact on wealth development of trading app users and the connection between trading apps and their investment behavior, also in the context of potential regulatory purposes. Trading apps have become very popular during the Corona crisis in which especially young people, who had to stay at home and had more spare time, started to speculate on the stock market with trading apps (Osipovich, 2020). Coupled with feedback loops on social media, which may primarily be used by young investors as a source of information about the capital market and investment opportunities, this has already led to at least one major bubble event, related to the GameStop stock (Lawrence, 2021). The GameStop event and the effects of smartphone investing on trading behavior especially after the GameStop event have already been analysed in detail (Welch, 2022; Kalda, Loos, Previtero, & Hackethal, 2021).

Trading apps, also known as Neobrokers, receive both very positive and negative reactions: On the one hand, they are seen as a modern and cost-efficient way to attract new investors to the stock markets. On the other hand, they are seen to induce overtrading and speculation rather than reasonable long-term investing. In combination with hidden costs, these factors might lead to losses for investors. In addition, Neobroker users (in this case Robinhood users) have been found to be affected by attention-driven trading and as a result of that tend to herd more than regular investors (Barber, Huang, Odean, & Schwarz, 2022). The increase in herd behavior underlines the assumption of more speculative, more frequent, and less reasonable trading. Periods of intensive buying of Robinhood users are followed by negative returns (Barber, Huang, Odean, & Schwarz, 2022). In line with the assumption that trading app users often pursue short-term and less reasonable investment goals, trading app users in China trade more frequently, possibly due to overconfidence. Furthermore, trading app users are significantly affected by trading apps in the way they react to short-term signals (Cen, 2023). After the GameStop event, trading apps have been described as a danger to the stability of stock markets, although other work has shown that it were institutional investors who tended to exacerbate the Covid-19 crash through fire-selling, whereas retail investors served as liquidity providers.

This means that retail investors prevented the stock markets from losing even more during the Corona crisis.

It is already clear that trading apps have led to increased participation in the stock market (Barber, Huang, Odean, & Schwarz, 2022). The question is therefore, whether this effect will be sustainable in the long-term. In the best scenario, many novice investors who started investing through a Neobroker will learn and end up with reasonable long-term stock market investments. Furthermore, these investors should avoid overtrading and underdiversification in the best-case scenario. Conversely, the worst-case scenario would lead investors to risky investments, which can result in accumulating losses and a final drop out of the stock market. In consequence, a whole generation of potential investors, who have just started investing, would be lost for the stock market, with dire consequences for the society, for example, regarding the pension gap in the German pension system.

While Neobrokers provide an accessible and often cost-effective entry point into the stock market, it is crucial for investors to have a comprehensive understanding of their cost structures. Studies have shown that the apparent low trading fees may obscure certain hidden costs that affect overall investment returns. For instance, Garvey and Wu (2010) discussed the implications of hidden transaction costs in electronic trading environments, which can erode investment returns more significantly than anticipated. In the context of Neobrokers, the concept of payment-for-order-flow, while reducing direct fees, may introduce implicit costs that affect best execution practices, as detailed by Angel et al. (2011). Understanding these dynamics is an essential component of financial literacy, particularly for novice investors engaging with Neobroker platforms.

Therefore, integrating discussions on potential hidden costs into financial literacy education could enhance investors' ability to make informed decisions. Increased awareness of these aspects may mitigate the risk of misunderstanding the true cost of transactions and promote more sustainable investment behaviors.

Additionally, Barber et al. (2009) highlighted that investor education on the intricacies of trading costs and market mechanics can contribute to more informed trading practices and improved financial outcomes. As such, introducing educational initiatives aimed at improving understanding of Neobrokers' business models and associated trading costs may lead to better investment decision-making, reinforcing long-term participation in stock markets.

In sum, this research not only confirms prior concerns surrounding trading apps, but also emphasizes the urgent need for regulatory strategies to address these challenges. Our findings underscore the critical need for financial literacy programs that can better equip investors to understand the complex cost structures of Neobrokers and mitigate potential financial risks.

2. Hypothesis development

As a result of trading apps being a recent and relatively new phenomenon, the academic literature is still scarce. Especially, there is virtually no study with representative data from users of several different Neobrokers investigating the association of trading apps with the investment behavior of Neobroker users. In this paper, we examine who uses trading apps and whether trading app usage is connected to specific risk attitudes, investment goals, levels of financial literacy and trading and app usage frequency. Secondly, we show why former trading app users stopped the use.

2.1 Trading frequency

The trading frequency describes how many trades an investor places per month on average. Cai and Lu (2019) showed that the frequency of opening financial mobile applications is positively correlated with increased trading activity. Investors who frequently use mobile applications for financial information tend to trade more actively, even after accounting for other market factors like investor sentiment and market volatility (Cai & Lu, 2019). In addition, the introduction of trading apps has been shown to increase investor attention and trading volume. Retail investors who adopt these apps tend to trade more frequently and respond more to short-term market changes, which can lead to an increased trading frequency (Cen, 2023). The rise of stock trading apps has notably changed the behavior of millennial investors, who now rely more on digital platforms for trading decisions (Kritikos, Handrich, Gorgels, Priem, & Morales, 2022). This demographic shift towards app-based trading has contributed to an increase in trading frequency as millennials engage more actively with the stock market through these apps (Sumant, Bhavsar, Sinha, & Bhatt, 2022). With the easy portfolio access through a trading app on the own smartphone and the associated permanent availability of trading, the trading frequency could consequently increase. Thus, we expect a positive relationship between the frequency of opening a trading app and the trading frequency.

Hypothesis 1: The frequency of opening a trading app is positively related to the trading frequency of Neobroker users.

2.2 Risk tolerance

The risk tolerance shows how much risk investors are willing to take when investing. The risk tolerance can affect an investor in several regards, e.g. which investment products are bought or the respective investment goals. Arnold et al. (2022) argued that the influence of external stimuli on risk taking in everyday situations, as shown, for example, by Weber et al. (2004), Galvan et al. (2006) and Figner et al. (2009), had not been considered in the previous literature on the risk behavior of investors. They precisely investigated the impact of external stimuli on risk-taking of investors and showed that financial attention stimuli increase financial risk-taking (Arnold, Pelster, & Subrahmanyam, 2022). In addition, Freibauer et al. (2024) showed that the risk tolerance of Neobroker users is higher than that of general investors. This shows that trading apps can possibly affect the risk tolerance of their users, using gamification methods and leading the users to invest not in line with their risk tolerance and their potential investment plan. Lower risk tolerance could also be a reason to stop using a Neobroker. The influence of attention triggers, combined with the greater risk tolerance among Neobroker users relative to general online investors, suggests that the digital stimuli offered by trading applications, such as push notifications, may contribute to an increased risk tolerance among Neobroker users compared to the German population and Ex-Neobroker users.

Hypothesis 2: Neobroker users have a higher risk tolerance than the German population.

Hypothesis 3: Neobroker users have a higher risk tolerance than Ex-Neobroker users.

2.3 Business model of Neobrokers

Since the trading app providers receive a payment-for-order-flow for each customer order, they have an increased interest in customers trading frequently. Trading app users may not realize the connection between the number of trades and the amount of income of the trading app provider. Providers advertise low or no fees for trading securities. However, at the same time, trading apps contain hidden costs that most trading app users are probably unaware of. The hidden fees appear, for example, in the form of worse execution prices. These may be associated with challenges in long-term performance, particularly for smaller investment amounts. The low or, in some cases, non-existent trading fees can give the impression of free trading for trading app users. We expect that the majority of trading app users do not know how Neobrokers are financed.

Hypothesis 4: The majority of Neobroker users do not know how Neobrokers are financed.

2.4 Investment behavior

Recent research has identified that the dynamic presentation of information within trading apps can influence user decision-making processes (Frydman & Wang, 2020). In addition, Tahler and Sunstein (2008) have highlighted the profound influence platform designs can have on consumer behavior. Neobrokers, with their user-friendly interfaces, have the potential to affect trading behaviors, potentially leading to an increase in the number of financial transactions completed. The dynamic presentation of information, as noted in recent studies, can significantly influence user decision-making processes (Frydman & Wang, 2020). Features such as real-time alerts, push notifications, and the ability to view and mimic peer trading activities are embedded within trading apps, could encourage increased interaction and potentially leading to the purchase of more financial products than initially planned. Moreover, psychological factors could play a critical role, as the accessible and sometimes gamified experience offered by Neobrokers could tap into cognitive biases such as overconfidence and impulsivity, prompting users to engage in different transactions (Dhar & Zhu, 2006).

Hypothesis 5: The use of Neobrokers is associated with a tendency to purchase more financial products than initially planned by users.

2.5 Risk behavior

The proliferation of Neobrokers could possibly also introduced a shift in how users perceive and engage with risk. Risk behavior, a vital component of financial decision-making, typically involves the willingness to engage in investments with uncertain outcomes (Kahneman & Tversky, 1979). Thus, similar to the investment behavior, changes in the risk behavior of Neobroker users could also be connected to Neobroker use. This aligns with the literature suggesting that digital platforms with dynamic content could lead users to contemplate and execute more varied investment decisions than initially intended (Frydman & Wang, 2020). Neobrokers frequently incorporate interface designs that could promote risk-taking behavior among users. These platforms often emphasize riskier investment opportunities, through prominent placements or the availability of leveraged

products (Frydman & Wang, 2020). Furthermore, the social trading features inherent in many Neobrokers allow users to trace and emulate the actions of successful peers, which might inadvertently promote riskier investment choices.

This leads us to assume that the Neobroker use could be connected to a changing risk behavior of Neobroker users.

Hypothesis 6: The use of Neobrokers is associated with a tendency to change the risk behavior of their users.

The paper proceeds as follows. Section 3 presents a detailed description of our dataset. Section 4 provides the results of our study, divided into four sub-sections. Section 4.1 shows what characterizes a typical Neobroker user. Section 4.2 answers the question why Neobroker users use a trading app. Section 4.3 analyses the investment behavior of Neobrokers and the association between the trading app use and the investment goals and behavior of their users. Section 4.4 shows why former Neobroker users stopped using trading apps. Section 5 concludes and is followed by Section 6 with a discussion.

3. Data and methodology

This section provides a description of the dataset, which we collected for this study, which represents the German population regarding their current, former, or intended use of Neobrokers. The data was collected on our behalf by a company conducting representative surveys in Germany. To ensure that random and incorrect answers to the questionnaire are not included in our datasets, a test question is included in the questionnaire. Participants with a wrong answer to this question were excluded from the survey. The logic of data collection is shown in Figure 1. The three groups were filled with participants until the specified number of participants per group was reached. The survey should be completed after at least 250 Neobroker users, 125 Neobroker usage planners, and 110 Ex-Neobroker users have completed the survey. The filters shown in Figure 1 were as follows: Filter 1: "Do you currently use a trading app?"; Filter 2: "Have you used a trading app in the past and now stopped using it?"; Filter 3: "Are you currently planning to use a trading

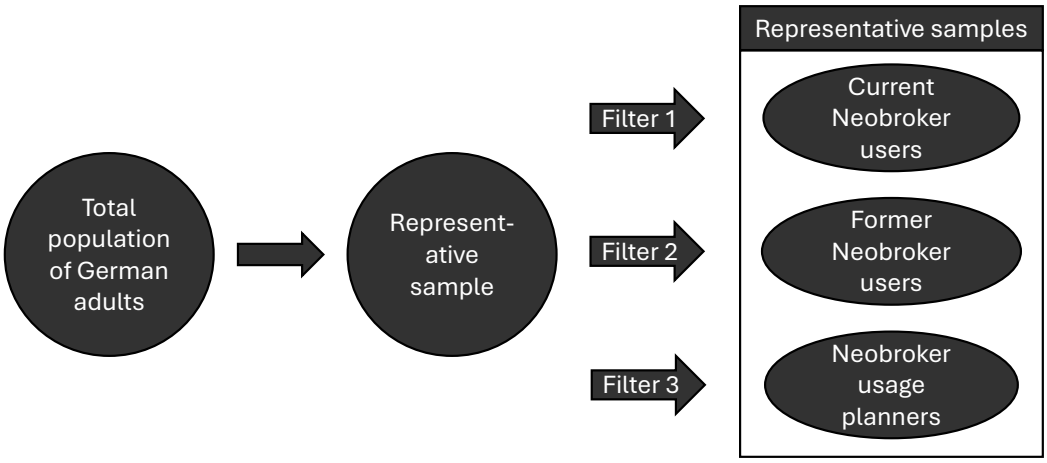

Figure 1: Logic of the data collection.

app in the future?". In total, the sample consists of 503 adults, all living in Germany. Half of the sample (51.1 %: 257 participants) were selected as current Neobroker users, and approximately one quarter each considered using them (26.2 %: 132 participants) or had previously used them (22.7 %: 114 participants).

The data was collected in the period of 08 December 2022 to 21 December 2022. The dataset collected is unique, as currently no other representative dataset exists, that reflects Neobroker usage in general, which means across several different Neobrokers. This gives the possibility of getting an insight into the characteristics and behavior of a broader group of Neobroker users. Previously, representative data from one specific Neobroker (for example, Robinhood or Trade Republic) was used to analyse the influence of Neobrokers or smartphone investing on retail investor behavior (Barber, Huang, Odean, & Schwarz, 2022; Kritikos, Handrich, Gorgels, Priem, & Morales, 2022). This might result in a sample bias, while our data reflect the users of various Neobrokers.

Table 9 summarizes the composition of our dataset regarding gender, age, school education, and professional qualification and can be found in Section 7 (Appendix).

4. Results

We analysed the data of the 257 Neobroker users, to understand who uses Neobrokers and in which way Neobroker users display specific risk attitudes, characteristics, and behavior. The data on Ex-Neobroker users can inform us about the reasons for stopping the use of trading apps and about subsequent investment behavior. Therefore, we study whether former Neobroker users continue to invest through other brokers after the termination of Neobroker usage.

4.1 Who uses trading apps? – The distribution of Neobroker users

In the first part of our analysis, we identify typical attributes of Neobroker users: Neobroker users are predominantly male (66.5 %), which can be explained by the fact that more men than women generally invest in the stock market. Surprisingly, Neobroker users come from all age clusters. Moreover, Neobroker users are not mainly from the lower wealth distribution, as the study by Kritikos et al. (2022) suggested. Detailed personal information of Neobroker users can be found in Table 1.

Interestingly, 36.6 % of the Neobroker users have completed a vocational training for their professional qualification. The majority of Neobroker users (53.7 %) have a bachelor or master degree (or equal), meaning that the majority of Neobroker users can be considered educated. This is confirmed when comparing this result with the education of the German population. In 2019 17.3 % of the German population had a university degree[1]. The proportion of Neobroker users with a university degree (Bachelor or Master degree (or equal)) differs significantly from the proportion of the German population who have such a degree (t-test: $t(256) = 11.679$, $p<.001$). This shows that Neobroker users can be considered more educated in general than the German population. Furthermore,

1 A bachelor's degree, a master's degree and the diploma degree were counted as university degrees. For more information, please refer to https://www.destatis.de/DE/Themen/Gesellschaft-Umwelt/Bildung-Forschung-Kultur/Bildungsstand/Publikationen/Downloads-Bildungsstand/bildungsstand-bevoelkerung-5210002197004.pdf?__blob=publicationFile (Educational level of the German population – Results of the 2019 microcensus).

Table 1: Personal information of the Neobroker users (N = 257)

Variables	Groups	Number of participants (%)
Gender	Male	171 (66.5)
	Female	86 (33.5)
	Diverse	0 (0.0)
Age	18–26	23 (9.0)
	27–34	74 (28.8)
	35–48	97 (37.7)
	49–64	52 (20.2)
	> 64	11 (4.3)
School education	Hauptschule / Realschule diploma	64 (24.9)
	High school diploma (or equal)	193 (75.1)
Professional qualification	No education	6 (2.3)
	Vocational training	94 (36.6)
	Business administration	18 (7.0)
	Bachelor degree	68 (26.5)
	Master degree (or equal)*	70 (27.2)
	PhD	1 (0.4)

* The numbers are high since until around 2010 in Germany there was no bachelor degree, but only a degree equivalent to a master degree.

it should be mentioned that 136 Neobroker users (52.9 %) currently use a Neobroker exclusively, and 121 Neobroker users (47.1 %) currently use a Neobroker and another broker at the same time.

4.1.1 Age distribution of Neobroker users

The average age of Neobroker users in our data is 40.3. Table 2 shows the age distribution for five age clusters of Neobroker users of our study. Neobroker users are, in general, older than in a previous study (Kritikos, Handrich, Gorgels, Priem, & Morales, 2022). The age distribution might have changed because trading apps attract new groups of investors and thus also new age clusters. We compared the age distribution of Neobroker users with that of the German population[2]. We expect Neobroker users to be younger than the German population when comparing the age clusters shown in Table 2.

2 We used data of 2022 of the German Federal Statistical Office (https://www-genesis.destatis.de/genesis/online) for the age distribution of the German population. Individuals aged 0–17 were excluded.

Table 2: Comparison of the age clusters of Neobroker users (N = 257) and the German population older than 17 years in %.

Groups	18–25	26–34	35–48	49–64	>64
Neobroker users (N = 257)	7.0	30.7	37.7	20.2	4.3
German population	8.5	11.4	17.5	23.7	22.1

The proportion of the respective age clusters "26–34" (t-test: $t(256) = 6.709$, $p<.001$), "35–48" (t-test: $t(256) = 6.682$, $p<.001$), and "> 64 (t-test: $t(256) = -14.086$, $p<.001$)" of Neobroker users differ significantly from those of the German population. Since the clusters "26–34" and "35–48" combined represent more than half of the Neobroker users (68.4 %) and the German population is older regarding the clusters "49–64" and "> 64", the expectation that Neobroker users are younger than the German population is confirmed.

4.1.2 Education

75.1 % of the Neobroker users have an Abitur degree (or equal), which is the German university entrance qualification. In 2019 only 33.5 % of all Germans had this degree[3]. Neobroker users have a higher school education than the German population (t-test: $t(256) = 15.39$, $p<.001$). This is contrary to the assumption that Neobrokers would address uneducated people to a large extent. In fact, most Neobroker users (54.1 %) have a university degree (Bachelor, Master or PhD, compare Table 1).

4.1.3 Financial Literacy

The financial literacy of the three groups in our survey was measured by analyzing three fundamental questions about financial literacy and Neobroker usage that were asked in our survey. These three questions are:

1. What is meant by the bid-ask spread?
2. How do Neobrokers earn money?
3. How does the value of a fixed-rate bond change when interest rates rise?

These questions cover various aspects of financial literacy: the knowledge of stock market trading, the knowledge of the business model of Neobrokers and the knowledge of the impact of changing market conditions on financial products. Questions 1 and 3 are standard measurement questions for financial literacy. Question 2 was asked to include the knowledge of the participants about the business model of Neobrokers in the financial literacy measurement. Question 3 was adapted in modified form from the 2009 SAVE survey[4]. We analysed whether the answer to the respective question was correct. For each correct answer, the participant got one point. The score is therefore based on numbers

3 For more information, please refer to the https://www.destatis.de/DE/Themen/Gesellschaft-Umwelt/Bildung-Forschung-Kultur/Bildungsstand/Publikationen/Downloads-Bildungsstand/bildungsstand-bevoelkerung-5210002197004.pdf?__blob=publicationFile (Educational level of the German population – Results of the 2019 microcensus).

4 SAVE is a representative survey on the saving behavior of private households in Germany, which was repeatedly conducted between 2001 and 2013.

between 0–3, where 0 means "not financial literate at all" and 3 means "very financial literate". The score was then used as a proxy for financial literacy. Table 3 shows the level of financial literacy of the three groups in our survey based on the three fundamental questions[5].

Table 3: Financial literacy of the three groups compared in this study.

Groups	Classification	Number of participants (%)	Average
Neobroker users	0	93 (36.2)	0.91
	1	103 (40.1)	
	2	51 (19.8)	
	3	10 (3.9)	
Ex-Neobroker users	0	47 (41.2)	0.80
	1	45 (39.5)	
	2	20 (17.5)	
	3	2 (1.8)	
Planners	0	48 (36.4)	0.80
	1	63 (47.7)	
	2	20 (15.2)	
	3	1 (0.8)	

As the average of all three groups lies between 0 and 1, all groups tend to have low financial literacy. This could lead to a higher probability to incur a loss.

In particular, the result of one of the three fundamental questions on financial education stands out. This is the question about knowledge of how Neobrokers earn money. For this question a participant was classified as correct if it was exclusively stated that Neobrokers earn money through a commission from the executing trading venue (payment-for-order-flow) and through the partially existing order fees. We expect the majority of Neobroker users not to know how Neobrokers earn money. The surprising insight is that nearly nobody of the respondents, not even the Neobroker users (7.0 %), knows how Neobrokers make money. Therefore, all groups are potentially unaware of the hidden costs of trading apps. We compared the expected 50 % with the result of the Neobroker users. The difference is statistically significant (t-test: $t(256) = -26.955$, $p<.001$, std. deviation = 0.256), which confirms Hypothesis 4.

4.1.4 Financial assets distribution

Regarding financial assets (including cash, investments in the stock market, and investments in open-end and closed-end funds, but excluding real estate assets), there is a large variation (Table 4). The majority of Neobroker users (57.9 %), can be assigned to the financial asset clusters between 5,001 – 100,000 EUR. The average financial assets of German households amounted to 77,900 EUR in 2021 (Deutsche Bundesbank). Neobroker users seem to come from all financial strata.

5 For more details about the answer options, evaluation and result of each financial literacy question, please refer to Appendix B.

Table 4: Clusters of the financial assets of Neobroker users (N = 257) of our study.

Wealth cluster (€)	Proportion (%)
0 – 5,000	9.7
5,001 – 25,000	21.4
25,001 – 50,000	16.3
50,001 – 100,000	20.2
100,001 – 250,000	12.8
250,001 – 1,000,000	8.6
1,000,001 – 10,000,000	0.4
no answer	10.5

4.1.5 First-time investors

In 2020 Robinhood released a statement that 50 % of their users are novice investors[6]. Furthermore, 47 % of the Trade Republic users surveyed for the DIW study were novice investors (Kritikos, Handrich, Gorgels, Priem, & Morales, 2022). For our data, we expect that 50 % or more of the Neobroker users are novice investors. 133 of 257 Neobroker users (51.8 %) are novice investors. Therefore, our data is consistent with previous findings and not statistically different (t-test: $t(256) = 0.561$, $p = 0.576$) from our expectations based on the previous studies mentioned above.

We further investigated which determinants are connected to a Neobroker user being a novice investor. For the following analysis, we used the data of Neobroker users (N = 257) and created a logistic regression model with the dependent variable "novice investor". This variable is coded 1 for "novice investor" and 0 for "experienced investor". The model is statistically significant (chi-square(1) = 19.865, $p<.001$). The independent variable "age" (Wald(1) = 17.933, $p<.001$) shows a negative connection. The lower the age of Neobroker users, the higher the probability that they are first-time investors. The reason for this could be that older individuals have already had more time to start investing than younger people. The following variables have also been analysed in this regression analysis but have no significant association with Neobroker users to be novice investors: gender, school education, professional qualification, invested capital, financial assets. Nevertheless, the "age" remains significant in every model in combination with the respective variables listed above and therefore the connection is robust.

4.1.6 Investment performance

80.9 % of the Neobroker users stated that they had made a profit with their investments at a Neobroker on average, leaving 19.1 % who reported making a loss. This finding can be compared with other investment contexts. For instance, research on investment funds found that approximately 32 % of the analyzed funds reported a loss, indicating a higher percentage

6 See https://blog.robinhood.com/news/2020/5/4/robinhood-raises-280-million-in-series-f-funding-led-by-sequoia.https://blog.robinhood.com/news/2020/5/4/robinhood-raises-280-million-in-series-f-funding-led-by-sequoia.

of losses compared to Neobroker users (Atkinson, Riani, & Corbellini, 2020). Additionally, while comprehensive statistics on individual investor losses are scarce, a study on Taiwanese investors highlighted significant aggregate losses, even though a direct percentage of individual losses was not specified (Barber, Lee, Liu, & Odean, 2009). Another study focusing on mutual fund retail investors in China showed a notable incidence of major losses impacted by financial literacy, suggesting that a substantial proportion of such investors also experience losses (Jiang, Liao, Wang, & Xiang, 2020).

A reason for the high percentage of profits could be the underreporting of losses due to social expectations. The relatively lower percentage of Neobroker users reporting losses could be attributed to underreporting due to social expectations, or the favorable market conditions since the popularity of Neobrokers surged with the launch of Trade Republic in Germany in 2019. Since 2019 the stock market has been steadily moving in a positive direction for long-term investments. This trend was only interrupted by the Covid-19 crash in March 2020, which may have provided Neobroker users who started to invest during the pandemic with advantageous entry points, potentially contributing to their average profit outcomes.

4.2 Why do investors use trading apps?

We focus on the reasons for investors to choose a Neobroker and to invest in general. Moreover, we answer the question why Neobrokers gained increasing popularity in recent years and whether Neobroker usage is connected to individual investment activities, behavior and risk assessment.

4.2.1 Reasons for using a Neobroker

According to our results (Figure 2), Neobrokers are mostly used because of low or in some cases non-existing trading fees (25.0 %). With 17.2 % the intuitive operation of Neobrokers was also frequently cited as a reason for using a Neobroker. This shows that Neobrokers attract their users, among other aspects, by being easy to log in and operate on the individual smartphone.

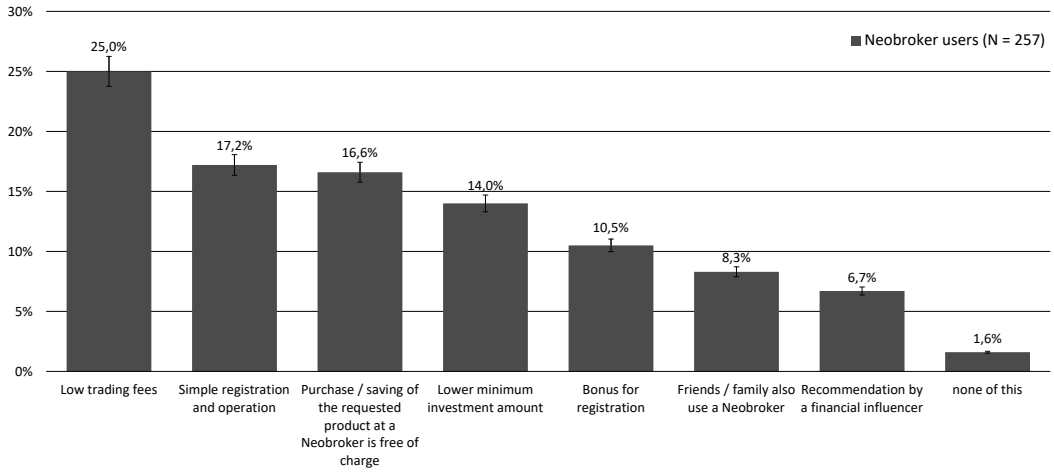

Figure 2: Reasons for using a Neobroker by Neobroker users (N = 257)

Reason 1, "low trading fees" refers to the general transactional costs incurred when buying any financial product through the app, such as a standard fee per order. In contrast, Reason 3, "purchase/saving of the requested product at a Neobroker is free of charge" highlights specific instances where certain products, like saving plans for particular ETFs, are available without traditional trading fees.

When combining the reasons "low trading fees", "purchase / saving of the requested product at a Neobroker is free of charge" and "lower minimum investment amount" to the aspect of financial fees, it is the most mentioned (55.6 %) and therefore primary reason for Neobroker users to invest through Neobrokers. This shows that Neobroker users prefer brokers with low fees and a low entry barrier for investments, represented by a lower minimum investment amount than other brokers. Thus, the results suggest that the main reasons for the Neobroker usage are related to the unique design of Neobrokers regarding their financial fee system.

4.2.2 Goal with investments in individual stocks

Next, we analysed what products Neobroker users invest in. When a Neobroker user indicated to invest in individual stocks, we asked for the respective reasons (multiple answers possible). 211 of the 257 Neobroker users (82.1 %) trade with individual stocks. The results of the question on the reasons for investing in individual stocks are shown below, divided into the five response options provided in the questionnaire. The percentages refer to the number of Neobroker users who invest in individual stocks (N = 211) and do not sum up to 100 % because multiple answers were possible.

- 57.8 % own individual stocks to earn the dividend (std. error of mean = 0.034).
- 53.1 % own individual stocks, because they are convinced of the respective company (std. error of mean = 0.034).
- 37.4 % want to build a market portfolio of individual stocks that outperforms the broad market (std. error of mean = 0.033).
- 29.9 % buy individual stocks on recommendation (std. error of mean = 0.032).
- 0.9 % have other reasons (std. error of mean = 0.007).

At first glance, the most reasonable motive to hold individual stocks is to build a market portfolio that outperforms the broad market. However, literature on retail investor performance suggests that this is on average not successful (Barber & Odean, 2000; Fjesme, 2020). On the other hand, the argument of holding individual stocks to receive the dividend is questionable, as some ETFs also pay a dividend and other ETFs reinvest the dividend. Neobroker users may not be sufficiently informed about ETFs, which is in line with our result of a low financial literacy of Neobroker users.

4.3 Investment behavior of Neobroker users

4.3.1 Changes in investment and risk behavior

According to the self-assessment of the participants (Table 5), our results show a tendency to buy more or different products than originally planned, when assuming that the traded products would not have changed without the Neobroker use. This supports Hypothesis 5. The differences between the number of answers to the four answer options regarding

the change in investment behavior are statistically significant (Friedman-test: chi-square(3) = 8.38, p = 0.039, n = 257).

Table 5: Changes in the investment behavior of Neobroker users (N = 257) in %.

Answers	I buy more products than planned (%)	I buy less products than planned (%)	I buy different products than planned (%)	Traded products have not changed (%)
mentioned	23.0	16.0	26.1	18.7

The number of percentages in Table 5 and Table 6 respectively do not amount to 100 % because multiple answers were possible.

Table 6: Changes in the risk behavior of Neobroker users (N = 257) in %.

Answers	I take more risk (%)	I take less risk (%)	My risk behavior has not changed (%)
mentioned	25.7	12.4	31.9

The same applies to taking on more risk when making investments (Table 6). Our results indicate that using Neobrokers leads to a shift towards more risk taking (Friedman-test: chi-square(2) = 23.425, p<.001, n = 257), when referring to the assumption that risk behavior would not have changed without the Neobroker use. This result supports Hypothesis 6.

Trading apps display information about stock prices or provide lists of the most traded stocks and ETFs that change daily. This information could be one of several reasons for the tendency towards the connection between trading apps and investment and risk behavior of their users. This result is further confirmed by previous work that has shown that the presentation of information affects investment behavior (Frydman & Wang, 2020).

4.3.2 Frequency of the Neobroker use

Neobrokers could entice their users to use their trading app more often, by, for example, notifications and the easy portfolio access via the app. The frequent opening of the trading app could possibly affect users in trading more often. 17.1 % of Neobroker users (N = 257) log into their Neobroker several times per day, 21.4 % one-time per day, 31.5 % several time per week and the rest less often. The frequency of depot opening is coded 1–6, where 1 means “several times a day” and 6 means “rarely or never”.

To assess the trading frequency of Neobroker users, we requested participants to indicate the average number of trades they perform manually each month, excluding the automatic execution of saving plans. In this study, the trading frequency refers to the average number of trades manually executed per month by the participants. The variable “trading frequency” is surveyed on a scale from 1 to 10, with 1 representing “0 trades” and 10 representing “>100”.

The frequency of opening the trading app correlates significantly with the trading frequency (r_s = -.362, p<.001, n = 257). More frequent opening of the trading app is connected to more frequent trading, which confirms hypothesis 1. The given correlation is negative due to the mentioned coding of the two variables, but still implies a positive

connection. A possible reason for the connection could be that Neobroker users who trade more frequently log into their trading app more often to execute trades.

4.3.3 Trading frequency

Currently, Neobroker users make on average between 3–4 trades per month. This means 3–4 manually executed transactions, without automatically executed saving plans. Regarding the distribution of the trading frequency of Neobroker users, one would assume that zero trades and a lot of trades are rare. This is confirmed by our data. Zero trades were made by 3.1 % and a lot of trades (>20 trades) by 6.6 % of the Neobroker users, which tend to trade more frequently than users of other brokers. This is already confirmed by data from Robinhood investors, who traded nine times as many shares as users of other e-brokers in the first quarter of 2020 (Barber, Huang, Odean, & Schwarz, 2022). This further shows that investment behavior, just like the risk tolerance of Neobroker users, is connected to the use of trading apps. Increasing trading frequency does not necessarily have to be negative, but trading fees could have a negative impact on long-term investment performance (Barber, Lee, Liu, & Odean, 2009). More frequent trading also entails a higher probability of losses (Busse, Lin, Qing, & Zhe, 2018) and thus might lead to myopic loss aversion and make stock market investments seem less attractive in the long run.

4.3.4 Risk tolerance

In our study, risk tolerance has been elicited on a scale from 0 to 10, with 0 representing "not at all willing to take risks" and 10 representing "very willing to take risks". With regard to the risk tolerance of Neobroker users for financial investments, which is shown in Table 7, there is a tendency towards a higher risk tolerance. This can be seen in the mean value of the risk tolerance of Neobroker users of 6.8.

We compared the risk tolerance distribution of Neobroker users with the respective distribution of the German population, which is represented by the SOEP[7] in our study. Table 7 shows the number of responses from the two samples regarding the risk tolerance in percentage terms.

Table 7: Comparison of the number of answers to the risk tolerance of Neobroker users (N = 257) and the SOEP data (N = 30,334).

In %	0	1	2	3	4	5	6	7	8	9	10
Neobroker users	0.4	1.2	4.7	8.2	6.6	26.8	14.8	17.5	11.7	2.3	5.8
SOEP data	8.1	4.1	8.7	10.7	8.6	17.8	12.0	13.5	10.3	3.4	2.8

Please note: 0 = no risk tolerance at all. 10 = high risk tolerance.

Based on our results, Neobroker users show a higher willingness to take risk when investing (mean of 6.8) than the general German population (SOEP data with a mean of 5.84) (Mann-Whitney U Test: U = 3,130,262, p<.001). This confirms hypothesis 2.

7 "German Socio-Economic Panel", for more information please refer to: https://www.diw.de/soephttps://www.diw.de/soep. We used SOEP data from 2020.

The respective differences between the risk tolerances 0 and 10 of the two samples are particularly striking (Table 7). 8.1 % of the SOEP respondents indicated a risk tolerance of 0, while only 0.4 % of the Neobroker users did so. The situation is the opposite for the highest risk tolerance of 10, which was indicated by 5.8 % of the Neobroker users, considerably more than the SOEP participants with 2.8 %. The higher risk tolerance of Neobroker users can moreover be caused by an initial higher risk tolerance or the impact of the trading app use on the risk tolerance. Please note that a causal relationship regarding one of the two mentioned possible reasons for the higher risk tolerance cannot be drawn with our data.

These results can be further understood through the lens of the existing literature on risk-taking behavior. Arnold et al. (2022) explore how attention triggers can influence financial risk-taking, suggesting that digital platforms can increase investor attention and subsequently increase their willingness to take risks. They found that exogenous attention triggers, such as notifications or alerts, lead to an increase in investor leverage, similar to the higher risk appetite observed among Neobroker users. This aligns with our findings, indicating that Neobrokers might indeed earn more as users engage in riskier financial behavior, potentially driven by the digital and interactive nature of their platforms, which actively captures the attention of the users.

Barber and Odean (Barber & Odean, 2001) highlight how overconfidence can lead to increased trading activity and risk-taking among individual investors. This aligns with our findings, suggesting that Neobroker users, who are typically more engaged with digital platforms, may have a higher sense of confidence in their investment decisions. Similarly, sensation-seeking behavior, as documented by Grinblatt and Keloharju (2009) might further explain the propensity to riskier trades among this group.

Arnold et al. (2022) emphasize the power of attention triggers, such as push notifications, in directing investor behavior. Although Gargano and Rossi (2018) do not explicitly focus on digital stimuli, they provide compelling evidence that increased investor attention, as measured by online account activity, is positively correlated with better investment performance. This finding is particularly relevant for users of trading apps and Neobroker platforms, where ease of access and frequent account engagement might lead to increased investor attention. Our study adds to this narrative by demonstrating how the interactive and user-friendly nature of Neobroker platforms may facilitate more engaged and potentially more informed decision-making among their users.

The dual-process theory, as discussed by Kahneman (2013) and Evans and Stanovich (2013), provides a framework to understand how exogenous stimuli, like push notifications, can trigger affective processes, leading to immediate, emotion-driven decisions. This rapid decision-making process could be a reason why Neobroker users may exhibit a higher tolerance for risk.

As Neobrokers leverage advanced technology to present information interactively and engagingly, investors may be drawn into a continuous loop of engagement. Technological advances through trading apps may transform financial markets, potentially increasing investor risk appetites by providing more immediate and dynamic market interactions.

4.4 Why do investors stop using trading apps?

This section provides information about the reasons why Ex-Neobroker users stopped using trading apps. It is thereby important to differentiate between reasons for someone

who invested with a Neobroker for the first time and someone who has already been investing before the Neobroker use. Most Ex-Neobroker users have invested before their trading app use.

4.4.1 The Ex-Neobroker users

The personal information of the Ex-Neobroker users can be found in Table 8.

Table 8: Personal information of the Ex-Neobroker users (N = 114).

Variables	Groups	Number of participants (%)
Gender	Male	72 (63.2)
	Female	41 (36.0)
	Diverse	1 (0.9)
Age	17–26	7 (6.1)
	27–34	16 (14.0)
	35–48	33 (29.0)
	49–64	48 (42.1)
	>64	10 (8.8)
School education	Hauptschule / Realschule diploma	48 (42.1)
	High school diploma (or equal)	66 (57.9)
Professional qualification	No education	3 (2.6)
	Vocational training	56 (49.1)
	Business administrator	10 (8.8)
	Bachelor degree	20 (17.5)
	Master degree (or equal)	22 (19.3)
	PhD	3 (2.6)

Surprisingly, the distribution of the professional qualification compared to those of Neobroker users changed. 49.1 %, which means that nearly the majority of the Ex-Neobroker users have done a vocational training (Neobroker users: 36.6 %). In addition to this result, 36.8 % hold a university degree. This makes Ex-Neobroker users less educated in form of their professional qualifications than Neobroker users (52.7 % hold a university degree) (Mann-Whitney U test: U = 12,449, p = 0.012.). 62.3 % of Ex-Neobroker users have financial assets up to and including 50,000 EUR (Neobroker users: 47.5 %). Regarding the reasons for investing in general, less Ex-Neobroker users (42 %) than Neobroker users (57 %) invest or have invested to improve their own retirement provision (Mann-Whitney U test: U = 12,495, p = 0.009). Interestingly, compared to Neobroker users, less participants (Ex-Neobroker users: 29 %, Neobroker users: 47 %) indicated to enjoy the thrill of investing (Mann-Whitney U test: U = 12,049.5, p = 0.001). We find that 72 Ex-Neobroker users stopped investing completely and 42 continued to invest through another broker. This suggests that 72 Ex-Neobroker users have stopped investing

completely as a result of their Neobroker use. Nevertheless, it cannot be flatly stated that Neobrokers were the only reason for the stop of investment activities of these Ex-users.

4.4.2 Ex-Neobroker users split into novice and experienced investors.

We divided Ex-Neobroker users into 23 (20.2 %) novice investors and 91 (79.8 %) experienced investors who had already invested through other brokers before starting to use a Neobroker. Overall, among all Neobroker users, 133 out of 257 (51.8 %) are novice investors, indicating that experienced investors are less prevalent in the general user base. However, this observation should not be interpreted as a definitive causation without considering the broader context of user demographics. This nuanced interpretation ensures that our analysis accounts for both the observed statistical difference and the larger demographic trends within the Neobroker user base. This broader context reveals that experienced investors are comparatively overrepresented among Ex-Neobroker users, suggesting that the likelihood of ceasing Neobroker usage might be higher for those with prior investment experience. It is crucial to interpret these results in light of this demographic distribution. The number of Ex-Neobroker users who were novice investors and those who were experienced investors differs significantly (Mann-Whitney U test: $U = 1{,}257$, $p = 0.031$). Therefore, the higher proportion of experienced investors among those who terminate Neobroker usage could reflect their increased propensity to evaluate and discontinue services that do not meet their expectations or match their more advanced investment needs.

4.4.3 Investment activity after Neobroker usage stopped.

25.4 % of Ex-Neobroker users still invest using other brokers after stopping the Neobroker use. 82.8 % of those currently still investing Ex-Neobroker users have already been invested through other brokers before their Neobroker use. We also compared novice and experienced Ex-Neobroker users regarding their investment activity after the termination of Neobroker usage. 17.4 % of Ex-Neobroker users who were novice investors and 48.8 % of the experienced Ex-Neobroker users still invest through other brokers. The difference is statistically significant (Mann-Whitney U test: $U = 791.5$, $p = 0.031$). Novice Neobroker users are more likely to stop investing altogether than experienced Neobroker users. As a result, the original idea that novice investors find an entry point and start investing in the stock market through trading apps and then switch to another, more classic brokers does not exist.

4.4.4 Risk tolerance of Ex-Neobroker users

We compared the risk tolerance of Ex-users and Neobroker users, which is represented by the same scale from 0 to 10, as mentioned for Neobroker users. The risk tolerance of Ex-users differs from that of Neobroker users. The difference between the two distributions is statistically significant, according to the results of the Mann-Whitney U Test ($U = 10{,}271$, $p<.001$). This proves that Ex-users show a lower willingness to take risks (mean of 5.38), than Neobroker users (mean of 6.80), which confirms Hypothesis 3. The result is also reflected in the percentage of Ex-users who are more often represented in the four lowest risk classes than Neobroker users. This is an indication that, among other factors, the lower risk tolerance of Ex-users contributes to the termination of Neobroker use.

We find that some Ex-users indicated a high willingness to take risks, while others indicated a very low risk tolerance. This results in 13 responses for not willing to take risks at all. All of these investors have completely stopped their investment activities.

Moreover, it is also conceivable that the two groups of Ex-Neobroker users (Ex-investors and investors) may have a different attitude towards risk. We therefore expect Ex-investors to have a lower willingness to take risks than investors. The respective distribution is shown in Figure 3. The Ex-investors are surprisingly high in the risk tolerance groups 8 and 9. Nevertheless, the Ex-investors show less willingness to take risk in general (mean of 4.96) than Ex-users who are still investors (mean of 6.10). The result of a Mann-Whitney U Test ($U = 1{,}130.5$, $p < 0.05$) proves that the difference between the risk tolerance of the two groups of Ex-users is statistically significant.

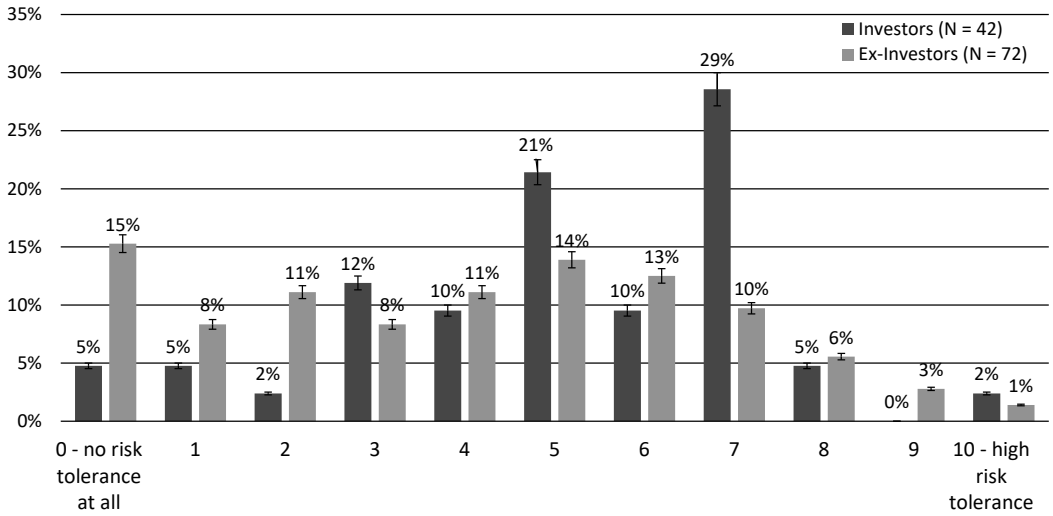

Figure 3: Risk tolerance of the two groups of Ex-Neobroker users (Investors: N = 42, Ex-Investors: N = 72).

4.4.5 Investment performance via Neobrokers

We assume that negative returns could cause the termination of Neobroker use. Thus, we expect that more Ex-Neobroker users have suffered losses with their investments at a Neobroker than Neobroker users. In total, 57 Ex-Neobroker users (50 %) stated that they had made a profit and 57 Ex-Neobroker users (50 %) stated that they had made a loss with their investments at a Neobroker. In comparison, more Neobroker users (80.9 %) indicated to have made a profit with their investments through a Neobroker. The difference between the percentages of losses is statistically significant (Mann-Whitney U test: $U = 10{,}117.5$, $p<.001$) and could be caused by the potential underreporting of losses by Neobroker users.

While analysing the investment performance of Ex-Neobroker users, we once again split the Ex-users into investors and Ex-investors. We expect Ex-investors to have experienced more losses with their investments at a Neobroker, compared to the Ex-users who continued investing. In line with the expectations, 56.9 % of the Ex-investors and 38.1 % of the

Ex-users who still invest have suffered predominantly losses with their investments at a Neobroker. The difference is statistically significant (Mann-Whitney U test: U = 1,227, p = 0.053), which confirms our expectation. We, therefore, found an indication that losses have been a reason to drop out of the stock market completely and to stop using a Neobroker for Ex-users who are now Ex-investors.

We further analyzed whether experiencing predominantly wins or losses with investments at a Neobroker is connected to the risk tolerance of Ex-users. In our analysis, the variable was coded as 1 for predominantly wins and 0 for predominantly losses. Correlation analysis revealed that gaining predominantly wins correlates significantly with the risk tolerance of Ex-users (r_s =.199, p =.034, n = 114). To control this result, we performed a linear regression with the dependent variable "risk tolerance" and the independent variable "experienced predominantly wins or losses", using data of Ex-users (N = 114). This variable is coded 1 for predominantly wins and 0 for predominantly losses. The model was statistically significant (F(1, 112) = 4.620, p = 0.034, adjusted R^2 = 0.031). Experiencing predominately wins by Ex-users is positively connected to a higher risk tolerance of Ex-users (standardized β = 0.199, p = 0.034).

This suggests that Ex-users who experienced mostly positive outcomes with their investments tended to exhibit higher levels of risk tolerance. In contrast, those who experienced predominantly losses showed lower risk tolerance. The correlation implies that past losses might contribute to the lower risk tolerance observed among Ex-users. These results are consistent with behavioral finance theories, such as loss aversion, which suggest that negative investment experiences can lead to more risk-averse behavior in the future (Kahneman & Tversky, 1979).

4.4.6 Reasons for the termination of the Neobroker use.

Ex-investors and investors within the Ex-Neobroker user group pursue different investment goals. This is confirmed by our data and results (Figure 4), especially when referring to the reasons for the termination of the Neobroker use. These reasons are to a large extent reasonable and in line with the expectations.

The three most frequently mentioned reasons by those who stopped their investments altogether were:

1. Too little knowledge of the stock market (33.3 %).
2. Invested capital was needed elsewhere (27.8 %).
3. Experienced mostly losses (26.4 %).

These three reasons can be categorized into the cluster of negative investment experiences and investment hurdles. Interestingly, Ex-investors stated more often (33.3 %) that they stopped using a Neobroker due to a lack of stock market knowledge than the investors (14.3 %) (Mann-Whitney U test: U = 1,224, p = 0.027). The lack of stock market knowledge could be a reason for Neobroker users to stop investing altogether. The reason that the invested capital was needed elsewhere was indicated by 27.8 % of the Ex-investors and therefore much higher than by the investors with 9.5 % (Mann-Whitney U test: U = 1,236, p = 0.022). Investors still invest, so the capital they invested through a Neobroker is now probably invested with another broker. In addition, the third most mentioned reason by the Ex-investors is to have mainly achieved losses (26.4 %).

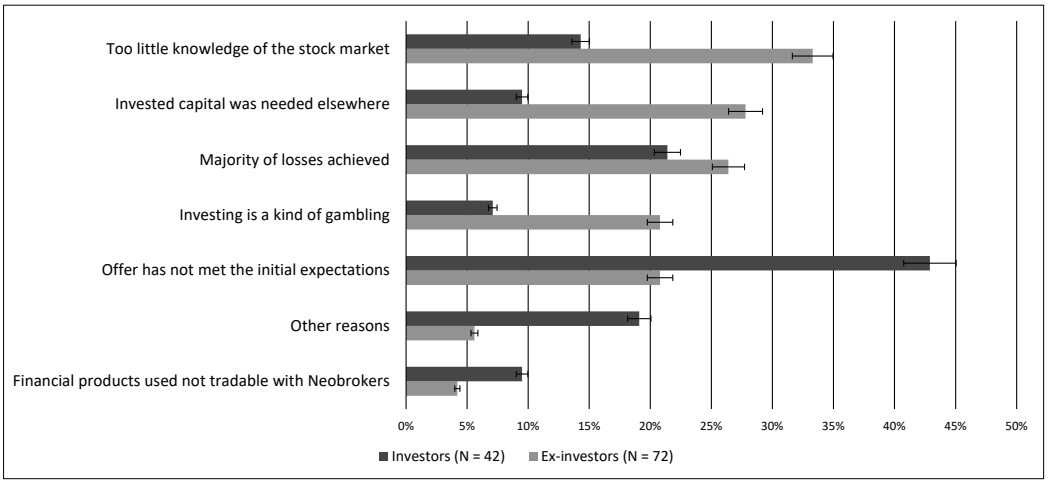

Figure 4: Reasons for dropping out of the Neobroker use of the Ex-users divided into investors (N = 42) and Ex-investors (N = 72).

The three most mentioned reasons by those who stopped their Neobroker use, but still invested elsewhere were:

1. Offer has not met the initial expectations (42.9 %).
2. Experienced mostly losses (21.4 %).
3. Other reasons (19.1 %).

The reason most mentioned by investors (42.9 %) is that Neobrokers do not meet their expectations. Since they simply switched brokers or, if they used a Neobroker and another broker at the same time, gave up using a Neobroker and continued to invest, this reasons seem logical. This is primarily a reason tailored to the specific offers of Neobrokers with their function as a broker. The second most mentioned point (21.4 %) is having mostly achieved losses with their Neobroker investments. This point is mentioned less often than by the Ex-investors (26.4 %) and does not differ significantly (Mann-Whitney U test: U = 1,437, p = 0.555). Surprisingly, they have continued to invest, although they have predominantly suffered losses with their investments at a Neobroker. One possible reason could be that investors make their respective Neobroker responsible for the majority of the losses incurred, maybe because they felt their trading decision being influenced or because of hidden trading costs and therefore continue to invest through another broker.

5. Conclusion

Based on unique representative data of German Neobroker users, Ex-Neobroker users, and potential future users, this work provides important insights into the investment motives and reasons to use a trading app. Additionally, this paper answers the questions of whether the use of trading apps is associated with specific user characteristics, risk attitudes, and behavior of the users. Our findings indicate that Neobrokers are associated with both positive and negative aspects of the investment behavior of Neobroker users. With our data, we can confirm all of the following hypotheses:

- Hypothesis 1: *The frequency of opening a trading app is positively related to the trading frequency of Neobroker users.*
- Hypothesis 2: *Neobroker users have a higher risk tolerance than the German population.*
- Hypothesis 3: *Neobroker users have a higher risk tolerance than Ex-Neobroker users.*
- Hypothesis 4: *The majority of Neobroker users do not know how Neobrokers are financed.*
- Hypothesis 5: *The use of Neobrokers is associated with a tendency to purchase more financial products than initially planned by users.*
- Hypothesis 6: *The use of Neobrokers is associated with a tendency to change the risk behavior of their users.*

First, we found that Neobrokers are used by all age, education, and financial classes. Neobrokers contribute to increasing stock market participation, as over half of Neobroker users are novice investors (51.8 %), which is consistent with previous research findings. Those Neobroker users who stop using them are mostly already experienced investors, as these correspond to 79.8 % of the Ex-Neobroker users.

Second, our results show that Neobroker users have low financial education and most of them do not understand the business model of Neobrokers. The use of trading apps is associated with a tendency to buy more or different products and a tendency to take more risk than originally planned. Moreover, we found that Neobroker users are more risk tolerant than the German population and Ex-Neobroker users. Individuals with a higher risk tolerance are therefore more likely to continue using a Neobroker. The more frequent opening of a trading app is associated with a higher trading frequency. In case novice investors stop using Neobrokers, they usually stop investing in the stock market altogether. Accordingly, Neobrokers do not serve as an entry platform for novice investors who then subsequently switch to other traditional brokers.

6. Discussion: Risk tolerance of Neobroker users

The findings of this study indicate that Neobroker users exhibit a higher risk tolerance compared to the general German population and Ex-Neobroker users. In the context of the revenue of Neobrokers, a higher risk tolerance of the users could be beneficial for Neobrokers, as they may indeed earn more when their users take on higher risks. Several factors could explain this phenomenon: First, Neobrokers often generate revenue through transaction fees. Higher trading frequency, driven by increased risk-taking behavior, could result in more transactions and, consequently, higher fee- and PFOF-income for the Neobrokers. Second, in the context of interest and margin accounts, many Neobrokers offer margin trading, allowing users to borrow funds to invest. Users with higher risk tolerance might be more likely to utilize margin accounts, leading to increased interest income for Neobrokers. Third, currently the revenue of Neobrokers is positively correlated with the amount of transactions of their costumers due to the PFOF. Higher trading frequency, driven by increased risk-taking behavior, might result in more transactions and, consequently, higher income from the PFOF for Neobrokers. Fourth, as highlighted by Arnold et al. (2022), attention-driven trades often involve higher leverage, amplifying potential returns and losses. Neobrokers benefit from increased trading activity and the associated fees and interest from leveraged positions. These factors underscore the importance of

understanding the economic incentives behind the Neobroker business model and their connection to the investment behavior of their users. By fostering an environment that encouraged higher risk-taking, Neobrokers can potentially enhance their profitability. However, this also raises questions about the risk to investors and the broader financial system, which warrants further investigation and regulatory scrutiny.

It may also be beneficial to explore cross-cultural influences on risk tolerance. Hofstede's cultural dimensions studies (e.g. Kahneman (2013)) on cross-cultural financial behaviors can provide insights into how cultural factors might moderate risk-taking propensity, particularly in a globalized investment environment.

7. Appendix

A Total participants

Table 9: Personal information of the participants of our trading app survey.

Variables	Groups	Number of participants (%)
Gender	Male	315 (62.6)
	Female	187 (37.2)
	Diverse	1 (0.2)
Age	18–26	42 (8.3)
	27–34	110 (21.9)
	35–48	162 (32.2)
	49–64	155 (30.8)
	>64	34 (6.8)
School education	Hauptschule / Realschule diploma	162 (32.2)
	High school diploma (or equal)	341 (67.8)
	No education	21 (4.2)
Professional qualification	Vocational training	216 (42.9)
	Business administrator	37 (7.4)
	Bachelor degree	103 (20.5)
	Master degree (or equal)*	121 (24.0)
	PhD	5 (1.0)

* The numbers are high since until around 2010 in Germany there was no bachelor degree, but only a degree equivalent to a master degree.

B Financial Literacy

To determine the financial literacy of the participants, three fundamental questions related to financial literacy and Neobroker usage were asked in our survey. The three questions and how we analysed the answers to those questions in order to divide the participants into four groups in terms of their financial education, will be shown below. The logic of analysing the financial literacy was adapted from (Freibauer, Grawert, & Rieger, 2024).

1. "What is meant by the bid-ask spread?"

For this question, participants could choose between four response options, where only one could be selected. The answer option that the bid-ask spread describes the spread between the buying and selling price is correct. If this answer was given, the participant was categorized as correct. The overall result and the results of the individual groups are shown in Table 10.

The answer options given for Question 1 were:

- □ The term "bid-ask-spread" describes the difference between the purchase price and the selling price offered on the stock exchange.
- □ The term "bid-ask-spread" describes the difference between the purchase price of a share and the value of the share at the beginning of the following trading day.
- □ The term "bid-ask-spread" describes the trading fee that has to be paid at some brokers for the purchase of a security.
- □ The term "bid-ask-spread" describes the amount of profit or loss an investor makes when selling a security.

Table 10: Number of correct answers to the first question on financial literacy divided into the three groups considered.

Groups	Answers	Number of participants (%)
Neobroker users (N = 257)	Correct	117 (45.5)
	Incorrect	140 (54.5)
Ex-Neobroker users (N = 114)	Correct	51 (44.7)
	Incorrect	63 (55.3)
Planners (N = 132)	Correct	68 (51.5)
	Incorrect	64 (48.2)
Total (N = 503)	Correct	236 (46.9)
	Incorrect	267 (53.1)

2. "How do Neobrokers earn money?"

For this question, participants could choose between five answer options, with multiple answers possible. We assume that the main sources of income for Neobrokers are the payment-for-order-flow in combination with the order fees charged by some brokers. According to this assumption a participant was considered as correct if only the two mentioned options (payment-for-order-flow and the order fees) were given. The results can be seen in Table 11.

The answer options given for Question 2 (multiple answers possible) were:

- □ Through a commission/refund from the executing trading venue.
- □ With the low order fees.
- □ In case of a dividend payment, the Neobroker receives a certain percentage of the dividend.

- If a share is sold through a Neobroker and a profit is made, the Neobroker receives a certain percentage of the profit.
- With advertisements displayed in the app.

Table 11: Number of correct answers to the second question on financial literacy divided into the three groups considered.

Groups	Groups	Number of participants (%)
Neobroker users (N = 257)	Correct	18 (7.0)
	Incorrect	239 (93.0)
Ex-Neobroker users (N = 114)	Correct	3 (2.6)
	Incorrect	111 (97.4)
Planners (N = 132)	Correct	4 (3.0)
	Incorrect	128 (97.0)
Total (N = 503)	Correct	25 (5.0)
	Incorrect	478 (95.0)

3. "How does the value of a fixed-rate bond change when interest rates rise?"

The third question addresses general financial knowledge, in relation to changing conditions on the interest rates. For this, it was possible to choose between the price of the bond increases, the price of the bond decreases and the price of the bond does not change. Only single choice was possible. If a participant stated that increasing interest rates lead to a decrease of the bond price, the participant is correct. The results can be seen in Table 12.

Table 12: Number of correct answers to the third question on financial literacy divided into the three groups considered.

Groups	Groups	Number of participants (%)
Neobroker users (N = 257)	Correct	100 (38.9)
	Incorrect	157 (61.1)
Ex-Neobroker users (N = 114)	Correct	37 (32.5)
	Incorrect	77 (67.5)
Planners (N = 132)	Correct	34 (25.8)
	Incorrect	98 (74.2)
Total (N = 503)	Correct	171 (34.0)
	Incorrect	332 (66.0)

The answer options given for Question 3 were:

- The price of the bond increases.
- The price of the bond decreases.
- The price of the bond does not change.

Combined financial literacy

A financial literacy score was created with a scale from 0 to 3, to compare the financial literacy of different groups. The meaning of the scale is shown below. Based on the responses of the participants to the three financial literacy classification questions, they were assigned a financial literacy score, using the following logic.

1. "not financial educated" = 0: the answers to all three questions are wrong.
2. "little financial educated" = 1: one of the three questions is answered correctly.
3. "medium financial educated" = 2: two of the three questions are answered correctly.
4. "highly financial educated" = 3: all three questions are answered correctly.

The result of this classification logic can be found in Table 3.

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In humans, the flow of business processes: an aesthetic perspective using business process patterns

Monika Blattmeier

Summary: "Life is form, and form is the modality of life," declared the art historian H. Focillon, celebrating the various forms in our universe. This conceptual article explores business process patterns that are perceived, analyzed, and visualized as whole entities or Gestalten. Sensually understanding business processes – specifically, the collective routines, the implicit knowledge that is expressed therein, and, lastly, their uniqueness – is the objective of aesthetic analysis. Aesthetic business processes are determined by individuals that attribute significant value to the work practices and their outputs. This analytical perspective emphasizes the human factor, the unusual, and the power of imagination in light of the numerous transformations, particularly in matters of sustainability, which also present challenges for business process management. A multimodal repertoire that provides texts and images for aesthetic perception is being developed through the use of a pattern format. To figure out the inherent quality of a business process pattern, one must engage with both the problem-solution scheme and its dynamic characteristics inside the process flow. The article illustrates how a specific business process pattern was visualized in collaboration with companies so that aesthetic experiences are also possible during the reception of the visualizations. The value of business process patterns is realized when the dynamics of the process flow are recognized, which establishes the link between what is happening in the process and the process structure, time and space, and knowledge of various domains, thereby encouraging innovative thinking.

Keywords: Business processes, aesthetics, organizational patterns, pattern language, knowledge management, process visualization, organizational transformation, business innovation

In Menschen, der Fluss von Geschäftsprozessen: Eine ästhetische Perspektive mittels Geschäftsprozessmustern

Zusammenfassung: „Leben ist Form, und Form ist die Art und Weise, wie sich Leben abspielt", meinte der Kunsthistoriker H. Focillon und feierte die Formen in unserer Welt. In diesem konzeptionellen Artikel geht es um die Form von Geschäftsprozessmustern, die als Ganzheiten oder Gestalten wahrgenommen, analysisiert und visualisiert werden. Ziel der ästhetischen Analyse ist es, Geschäftsprozesse sinnlich zu verstehen, insbesondere die kollektiv durchgeführten Routinen, das implizite Wissen, das darin zum Ausdruck gebracht wird, und schließlich deren Einzigartigkeit. Ästhetische Geschäftsprozesse zeichnen sich durch die Menschen aus, die der Arbeitspraktik und dem, was darin hergestellt wird, einen besonderen Wert verleihen. Vor dem Hintergrund diverser Transformationen

insbesondere in Richtung Nachhaltigkeit, von der auch das Geschäftsprozessmanagement herausgefordert wird, möchte diese analytische Perspektive dem Menschlichen, dem Ungewöhnlichen, der Vorstellungskraft mehr Aufmerksamkeit schenken. Mit dem Format eines Patterns entwickeln wir ein multimodales Repertoire, das Texte und Bilder für die ästhetische Wahrnehmung anbietet. Um die Inhärente eines Business Process Patterns zu erfassen, ist es von Bedeutung, nicht nur die Problem-Lösungs-Struktur, sondern auch deren dynamischen Charakter im Prozessfluss zu erleben. Der Artikel zeigt am Beispiel eines konkreten Business Process Patterns, wie dieses gemeinsam mit Unternehmen visualisiert wurde, so dass auch in einem rezeptiven Umgang mit dokumentierten Patterns ästhetische Erfahrungen möglich werden. Der Wert von Business Processs Patterns entsteht, wenn die Dynamik eines Prozessflusses erlebt wird, der die Handlungen mit der Prozessstruktur, die Zeit mit dem Raum, das Wissen verschiedener Domänen verbindet und so zu einem neuen Denken anregt.

Stichwörter: Geschäftsprozesse, Ästhetik, organisatorische Muster, Mustersprache, Wissensmanagement, Prozessvisualisierung, organisatorischer Wandel, unternehmerische Innovation

1. Introduction

A business process is typically defined as a sequence of operations that starts with a customer-oriented idea and delivers services to the customer (Schmelzer & Sesselmann, 2020; Suter et al., 2019). In contrast to normal processes, business processes primarily seek to address the functional division of labor created by the organizational structure. Business processes facilitate the organization of internal and external interfaces, hence enabling the design of value creation to be particularly effective and efficient (Suter et al., 2019; Wagner & Patzak, 2020). Secondly, business processes only exist with information technologies, perhaps specifically since 1969 when P. Drucker recognized the information industry as one of the new industries: "Electricity is the cheapest, most plentiful, and most versatile energy for mechanical work. But information is energy for mind work" (Drucker, 2016, p. 43). Within all of this, business processes ensure networked business architectures, which are the basis of H. Österle & R. Winter's (2003) vision and version of business engineering. In business processes, making use of information generates knowledge that is not necessarily articulable. This knowledge, which is deeply embedded in the company, associated with humans and challenging to describe, empowers companies to achieve exceptional performance when integrated with the infrastructure of business processes. Thirdly, business processes constitute the core competences of a company that ensure competitive advantages and cannot be transferred or purchased (Barney, 2013; Schmelzer & Sesselmann, 2020). This paper focuses on this implicit knowledge that flows through humans inside a business process (Bititci, 2016; Dumas et al., 2021).

The objective of business process management is to enhance the effectiveness and efficiency of the organization (Davenport, 1993; Schmelzer & Sesselmann, 2020). Numerous factors influence the efficacy of business process management, including strategic orientation, control, methodologies, information technology, employees, and organizational culture (Rosemann & de Bruin, 2005; Kerpedzhiev et al., 2021). The human factor differentiates a "Business-BPM" from an "IT-BPM", since it seeks to understand business processes through the lens of the consumer. "The need for a holistic approach" (Valiris &

Glykas, 1990) arises mostly from the desire to approach business processes from multiple perspectives and to emphasize "Business-BPM" in both research and practice (Sesselmann & Schmelzer, 2020). The digital transformation and the transition to sustainability both present challenges for organizational management, which is why people and culture are becoming increasingly significant as determining factors. The "triple bottom line" approach integrates economic, ecological, and social values. New Work, a concept that F. Bergmann developed in the 1970s, has attracted new attention in light of this (Foelsing & Schmitz, 2021). The needs of employees have become a priority for companies, job advertisements remind us of "perfect images of work" in which professional self-realization occurs, and new social living and working spaces may arise (Lemberg, 2023). Organizations emphasize the needs of their workforce and employment possibilities. This refers to a social environment where subjects and things are interconnected on an emotional level.

Business processes, as systems of action (Weick, 1985) wherein humans collaboratively execute tasks, are relevant to the ongoing exploration of concepts for future successful employment. Understanding affectivity in business processes – particularly when it leads to practices based on positive moods in relationships – is the goal of this study. We seek to visualize implicit knowledge that, in conjunction with habitus and the corresponding process structures, frequently results in particular rules for problem-solving (Mutch, 2003; Bourdieu, 1992; Wenger et al., 2002). Consistent with organizational aesthetics, we assume that implicit knowledge emerges from sensory perception. This conceptual article aims to find a format for a business process pattern that facilitates the visualization of implicit knowledge. Visualized business process patterns direct attention to unusual aspects. Those who perceive find themselves elevated beyond their ordinary perception. They recognize novel influences, the present moment, and what is unique. Alongside empathizing and stimulating the senses, comprehending sensory experiences derived from business process patterns indicates the generation of new knowledge. The findings are categorized into three sections that build on each other: Firstly, we show the potential of an aesthetic perspective on process flows, and, secondly, in a descriptive section, we determine the format of a business process pattern. We present a repertoire for its visualization, which includes the format as a compass to guide the visualizations and their perception. A third section will utilize an example from an ongoing research project to illustrate how a business process pattern might be visualized, experienced, and aesthetically understood.

2. Conceptional foundation: patterns in business process management

To find a format for a pattern that allows an aesthetic perspective on behaviors inside business processes, we will first examine the application of patterns in business process management thus far. We want to know what features of patterns are described as well as how and why they are used. Within the fields of business models and business process models, patterns serve as reusable structures for problem-solving, analogous to their interpretation in software development just as defined by architect C. Alexander. "The pattern concept is an inspiring format that is a good way of exchanging fragmentary, atomic ideas about programming," C. Alexander (1999) admitted in his keynote speech at the ACM Conference on Object-Oriented Programs Systems, Languages, and Applications (OOPSLA). He additionally pointed out, "Indeed, as I understand it, that part is working very well. But these other two dimensions, (1) the moral capacity to produce a living structure and (2) the generativity of the thing, its capability of producing coherent wholes

– I haven't seen very much evidence of those two things in software pattern theory." In keeping with C. Alexander, we continue by outlining how we apply a business process pattern to expand the logical connection between the problem and its solution, so generating new perspectives on human-centered business processes.

2.1. Patterns for business models

Patterns for business models are defined, described, and employed for innovations in business models. Business model patterns comprise foundational elements that are prevalent throughout different business models, exhibiting similarities, and can be reconfigured to create new business models. Due to the fact that a business model "describes the rationale of how an organization creates, delivers, and captures value" (Osterwalder & Pigneur, 2010, p. 18), it can be used to specify the customers, the promising delivery, its value chain, and the question of which mechanism is used to implement the value (Gassmann et al., 2015). Business models can be looked at with Osterwalder's Business Model Canvas, which includes nine components: groups of customers, value propositions, channels, customer relationships, revenue streams, key resources, key activities, key partners, and cost structure. The canvas should serve as the foundation for collaborative modeling, enabling the development of business models that expose a profound empathy for the consumer. Patterns are employed to develop new business models through imitation, recombination, and adaptation. Gassmann et al. (2015) outline a pattern adaptation based on the similarity principle, which reflects an evolutionary approach, whereas the confrontation principle involves interaction with entirely unfamiliar patterns. Business models constitute the foundation of business strategy: they facilitate the establishment of objectives, the identification of business processes and models, and the cultivation of core competencies. Core competencies are a company's competitive advantage, arising from its unique infrastructure, engagement in business processes, and expertise that is fundamentally embedded inside the organization. In this regard, business capabilities should be perceived as assets rather than core competencies, as they are activated by "by people or systems through processes utilizing technologies and other resources to deliver the organization's ability to perform" (Hanschke, 2024, p. 226). These are business entities, which encompass business objects, business functions, and IT services. Patterns that inspire business models may integrate individual knowledge as a resource inside the business plan, facilitating the development of core competencies (Barney, 2013) through organizational learning, for instance.

2.2. Patterns for business process models

The business models discussed in the previous section relate to business processes: Business processes are influenced by the business strategy outlined in the business model, and they also originate from the business model. With the maxim "structure follows process and process follows strategy," companies have the opportunity to overcome challenges in a particularly agile way. In business process management, patterns are mostly used for modeling, which involves creating as realistic process objects as possible. These objects are made up of a series of sub-processes that are automated via workflows. In business engineering, a "method- and model-based design theory for companies in the information age" (Österle & Winter, 2003, p. 7) integrates business processes and business strategy

with information and communication technologies to ease the execution of the business model. Workflows enhance business operations by articulating instructions with such precision that they can also be executed by information systems. Although workflow management systems, or more specifically, business process management systems, are designed to automate processes, business process modeling provides the advantage of ensuring that operational processes are transparent, communicated, and documented (Aldin & de Cesare, 2011). Modeling becomes more efficient and effective through the provision of modeling instructions by patterns (Van der Aalst et al., 2003). A definition of object-oriented programming referred to by Van der Aalst et al (2003) states that patterns are understood as reusable conceptual artefacts, which are "the abstraction from a concrete form which keeps recurring in specific nonarbitrary contexts." The three-part rule, which provides "a solution to a recurring problem in a particular context," is once again emphasized by Fellmann et al. (2019). Notations enable the description and modeling of various process perspectives. Each view is a representation of a distinct aspect of the process, including process activities, process outcomes, organizational entities and roles, resources, data, information, documents, business rules, and control flows. Fellmann et al. (2019) argue that patterns should also be employed for process design, addressing the differences, similarities, and innovations of other categories of business process model patterns. Expanding the business and IT language with business process patterns that also convey core competencies could be beneficial in this regard.

2.3. Patterns for implicit knowledge in business processes

Through business process patterns, we aim to utilize patterns for designing business processes where capital optimization is no longer the primary focus (De Geus, 1997). A pattern-based business process structure should, firstly, allow everyone to contribute to a company's originality, secondly, make the beauty of work tangible, and thirdly, provide people's expertise and knowledge a high value as a consequence. In contrast to Japanese success concepts, the emphasis lies not on simplicity, but on subtlety. In light of this, business process patterns act as ***models*** for companies, encouraging them to replicate the true invariance of these patterns or important components. Companies draw similarities between effective practices enclosed in a pattern and their potential implementations inside their business operations. If a pattern functions as a model, it must possess "as many analogies as spines from the body of a porcupine" (Daston, 2022, p. 20). Working with business process patterns prevents us from using strategies and tactics without taking the relevant context into account. Thus, cultures establish their own patterns based on shared fundamental concepts since they have been successful in resolving their issues. A business process pattern is an ***instrument*** for analyzing, reflecting, and improving the understanding of other contexts and, eventually, one's own context. When a pattern is well-suited to the business context, a business process that distinguishes and makes the organization competitive emerges. C. Alexander asserts that the process of differentiation always consists of two components, as illustrated by the following example: A Guatemalan farmer builds terraces in a field, while simultaneously, a broader process combines the individual activities of this farmer and maybe his coworkers, resulting in the formation of the terrace on the hill (Alexander, 2002, p. 205). Finally, a business process pattern enables us to assess the quality of the process itself. A pattern teaches us how to solve problems while also providing us with ***experience***. A business process can thus be perceived as a progression

away from a problem rather than towards an objective. This perspective liberates actors in the business process from rigid, perhaps unrealistic objectives, enabling the evolution of visions and emotions inside the process. A problem-solving business process is thus more suitable for complex circumstances where the final outcomes are difficult to manage. In summary, as reusable problem-solution structures, patterns support business process management, allowing companies to create value effectively, efficiently, and agilely, particularly in modeling business strategy, business processes, and workflows. Patterns outline logical linkages, are described within the framework of a modeling language, and are utilized primarily by business analysts. From an aesthetic perspective, we hope to broaden the use of patterns by allowing them unfold in generative sequences rather than putting them together as "mental tool boxes" in a pattern language. C. Alexander illustrates "the process of creating life" by describing his friend's progressive development of beautiful meadows in the hills of Berkeley: „He clears the land of that scrub which makes the land too vulnerable to fire. He opens it, concentrates its beauty. Under the hand of this embellishment, each part becomes better; its uniqueness is preserved, its character intensified" (Alexander, 2002, p. 4). How can we utilize business process patterns to stimulate a perception of the unconventional and distinctive elements of business processes that establish a connection between perceiving people and the present moment? This question forms the foundation for the following parts.

3. About a format for the aesthetic dimensions of business process patterns

This section clarifies a format for the description and visualization of business process patterns using text as well as images. We want to enhance the current understanding of a pattern in business process management to establish a foundation for aesthetic business processes. Therefore, we are interested in the following: what constitutes an aesthetic experience (cf. section 3.1)? How does an aesthetic perspective impact business processes (cf. section 3.2)? What does it mean to implement aesthetic practices in business processes (cf. section 3.3)? The format and form of a pattern for aesthetic business processes should ideally help to reflect a business process pattern as a Gestalt (Blattmeier, 2023a, 2023b, 2023c), in Alexander's words as something whole. To assist with this aesthetic experience as a process of visualization, knowledge creation, and reflection, we offer a multimodal repertoire, which will be demonstrated in practice in a further part of our contribution.

3.1. Business process patterns as a Gestalt

In aesthetic business processes, business process patterns take on a certain form – a Gestalt – that we perceive as a whole, which, according to Gestalt theory, is "more" or "different" than the sum of its parts. The Gestalt of business processes can be perceived through three distinct qualities: Firstly, according to G. Böhme (2013), "aesthetic work" creates an ***atmosphere*** that we can perceive when, for example, we are put in a cheerful mood by of a spring morning or feel the tension in a meeting. The prerequisite for this is that we are emotionally affected. The atmosphere is the foremost element of perception, preceding the Gestalt, individuals, objects, their interactions, or relationships. Secondly, these elements of business processes allow us to link actions in time to the process ***structure*** in space. As an architect, C. Alexander wanted to understand why people feel particularly alive in certain cities and buildings. He noticed that these places were characterized by a special quality, which he was unable to

name and even less able to describe with words. As "alive" was not enough, he often used terms such as "whole," "comfortable," "free," "exact," "egoless," and "eternal" (Alexander, 1979, p. 30). In the end, he worked with patterns to reconstruct a structure containing two fields: the field of geometric relations (space) and the field of human behaviors (action). He explained that a sidewalk in Bombay exhibits a distinct pattern compared to a sidewalk in New York, because people in Bombay often sleep on the sidewalk, whereas in New York, it is primarily utilized for walking (Alexander, 1979, p. 73). A pattern is consequently deeply connected to a cultural context. C. Alexander was able to finally grasp the quality without a name by allowing patterns to overlap (Alexander, 1965; Alexander et al., 1977). He stated, "The more living patterns there are in a place – a room, a building, or a town – the more it comes to live as an entirety, the more it glowes, the more it has that self-maintaining fire which is the quality without a name" (Alexander, 1979, p. x). We cannot think of a business process pattern as "an element in an erector set" if we permit this overlap or any other unfolding. In "The Nature of Order," C. Alexander described how he and his architectural colleagues suggested theoretical systems to replicate the style of traditional societies. These systems, called pattern language, allowed for the definition of patterns or generic units that could be employed successively in design (Iba, 2016; Finidori et al., 2021). He expanded this approach with artificial languages: "We discovered that it is possible to create pattern-language-like systems, artificially" (Alexander, 2002, p. 344). However, these artificial languages can only be accepted if they create something holistic. Thirdly, we can also perceive the Gestalt of business processes as patterns progressively unfold in business processes based on the context, leading to the emergence of ***unique characteristics***.

3.2. A business process pattern has forms and a format

The Gestalt of a pattern for aesthetic business processes can take on a variety of forms, which we aim to describe using a format (cf. Figure 1). Initially, a business process pattern is a ***three-part rule*** that "expresses a relationship between a certain context, a problem, and a solution," similar to other patterns that are typically attributed to C. Alexander (1979, p. 247). This type of rule is commonly followed in business processes, usually unintentionally. Process participants have implicitly acknowledged the rule. Because the rule has demonstrated its usefulness in solving problems it has been kept as knowledge in the company's memory. It may even have become indispensable. A pattern is not merely a simple rule; rather, it is a rule that evolves within a specific environment. C. Coplien & N. B. Harrison (2004) identified a "short and necessarily incomplete" definition that best describes a pattern of aesthetic business processes: „A recurring structural configuration that solves a problem in a context, contributing to the wholeness of some whole, or system, that reflects some aesthetic or culutural value." A pattern appears in the form of a ***process culture*** that has been studied, interpreted, and defined from a variety of perspectives. We adhere to E. H. Schein's definition, which characterizes culture "as a pattern of shared basic assumptions that was learned by a group as it solved its problems of external adaptation and internal integration, that has worked well enough to be considered valid and, therefore, to be taught to new members as the correct way to perceive, think, and feel in relation to those problems" (Schein, 2004, p. 17). This definition is grounded in a model with three "Levels of Culture", which clarifies the content and interrelations of various business process patterns. Analogously, we put together a three-level model for identifying business process patterns in aesthetic business processes, shown on the

left-hand side of Figure 1: Initially, E. H. Schein describes the fundamental assumptions that unconsciously influence the perceptions and behaviors of individuals within a culture, thereby establishing patterns as ***rules***. This leads to the development of values that are shared, accepted, and lived by all members, whether consciously or unconsciously. When the values that are lived in companies are expressed in specific contexts, we attribute patterns to this level as part of the process culture. Furthermore, E. H. Schein integrates explicit artifacts that consist of technical systems, documents, stories, or individuals in business process patterns. At this level, we can perceive a pattern in the form of ***common practices*** in a business process that contribute to the competitiveness, uniqueness, and ultimately, the success of a company (Rummler & Ramias, 2015; Suter et al., 2019; Schmelzer & Sesselmann, 2020). It is important to note that the business process pattern is not described as a distinct process unit. Similar to the arts and crafts (Daston, 2022), the expertise embodied by a business process pattern is passed on through experience. At this level, we identify business process patterns that generate unique value through standardized or routine work practices. G. Böhme describes this as "all human activities that lend to things, people and ensembles that more which goes beyond their handiness and objective presence" (Böhme, 2016, p. 27). In presenting business process patterns, we adhere to C. Alexander's format, which initially introduces the pattern with a picture and a context description. He addresses the problem and its associated tensions, outlines the solution using a diagram, and ultimately articulates the consequences that connect the pattern to other patterns (Alexander et al., 1977, p. x). The right-hand side of Figure 1 gives a symbolic representation that helps with the production and reception of pattern visualizations.

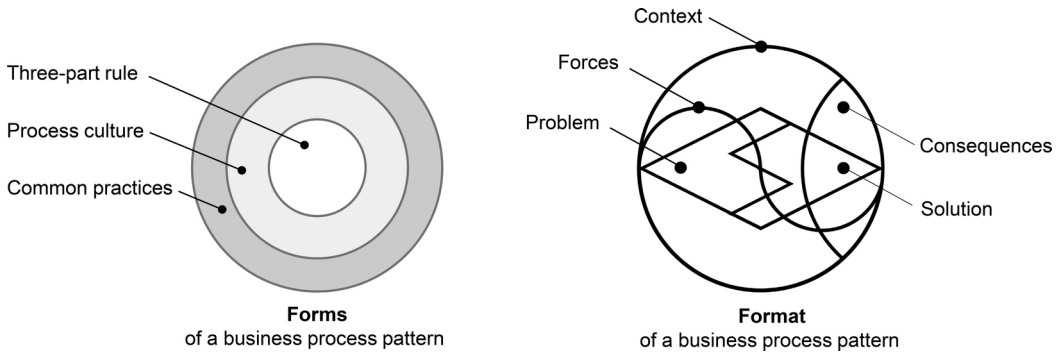

Figure 1: One format to reconstruct, describe and visualize business process patterns which can be applied in several forms (author: Blattmeier; graphic elements: Wolters-Schaer)

3.3. A repertoire for the aesthetic experience of business process patterns

In order to configure, specify, and standardize business process patterns in texts and images, C. Alexander's format is a valuable tool. C. Alexander pointed out that the format is important for him, firstly, to recommend patterns in connection with other patterns and, secondly, to present the problem and solution in such a way that the essence of a pattern is never lost, regardless of how the pattern is used. He therefore refers to descriptions in which the elements are presented in a specific order (Alexander et al., 1977). In an attempt to provoke an aesthetic understanding of business process patterns, we intend to multimodally weave language, image, and text using the repertoire. Analysis, interpreta-

tion, and combination are necessary for the various modalities of communication. Because sensuous, physical, holistic, and implicit knowledge is communicated, the ultimate goal is to experience business process patterns aesthetically (Strati & Montoux, 2002). Figure 2 provides an overview of the information gathered in the repertoire, particularly its complexity of information (The essence – Gestalt) and its communication characteristics (Textual – Visual). The format of Figure 1 determines the organization of the reconstructed information in Figure 2, helps searching for it, and verifies the completeness of the information presented. The horizontal line separates textual from visual information, while the vertical line distinguishes the essence of the business process pattern from its Gestalt on both areas. Four fields are set up as follows: The first field provides a ***short description*** containing a pattern name, the problem-solution scheme (VanLehn, 1990) and the keywords. In general, the purpose of the brief description, which is referred to as a patlet, is to assist users in rapidly identifying a pattern for a problem in their own context (Coplien & Harrison, 2004). The second field of the text area describes the three-part structure of context-problem-solution as a ***story*** comprising exposition, complication, and resolution. Through a narrative, we aim to articulate the forces operating inside a pattern as pairs of oppositions that determine aesthetic perspectives (Blattmeier, 2024).

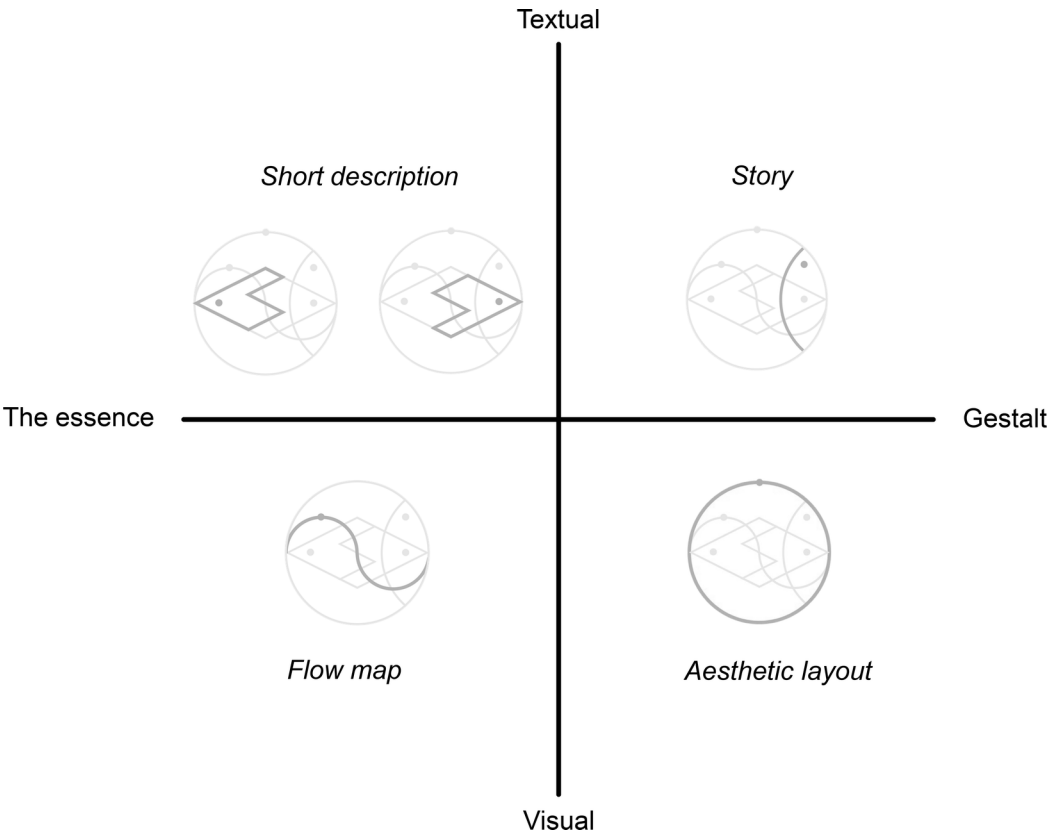

Figure 2: The repertoire that contains multimodal information that is represented as an image or text, reduced to its essence, or as a complex Gestalt, using the pattern format (author: Blattmeier; graphic elements: Wolters-Schaer)

The objective of this field is for recipients to grasp the meaning on their own thereby becoming aware of the consequences linked to the solution of a pattern. The ***flow map*** in the third field emphasizes the process flow generated by actions happening in patterns: Problems are solved or tasks are accomplished to balance the forces within an overall structure of action. Human behaviors establish a process structure, which subsequently affects those behaviors. Consequently, in the fourth field, we seek to avoid differentiating between the process flow and the structure. We perceive business process patterns as spatiotemporal phenomena within an ***aesthetic layout***, existing merely to the degree that they are utilized in or arise from relationships. In the aesthetic layout, we differentiate between process flows that generate or sustain a sphere spanning the problem-solution (***space***), that evolve things incrementally, in relation to time, with ups and downs (***direction***), and that are related to frequency, which is infinite and cyclical (***continuum***). Thus, the form dynamically arises from the corresponding force system, similar to a drop of water that forms itself from its own forces and is capable of compensating for disturbances from its own forces. Process flows also influenced by the presence of individuals who follow visions. Values and norms support maintaining the integrity of the process structure. At some point business process patterns in the aesthetic layout are characterized by moments of sensory experience. Ultimately, the moment of experience provides opportunities for the self-referentiality and, as a result, the uniqueness of an individual (Dewey, 1934).

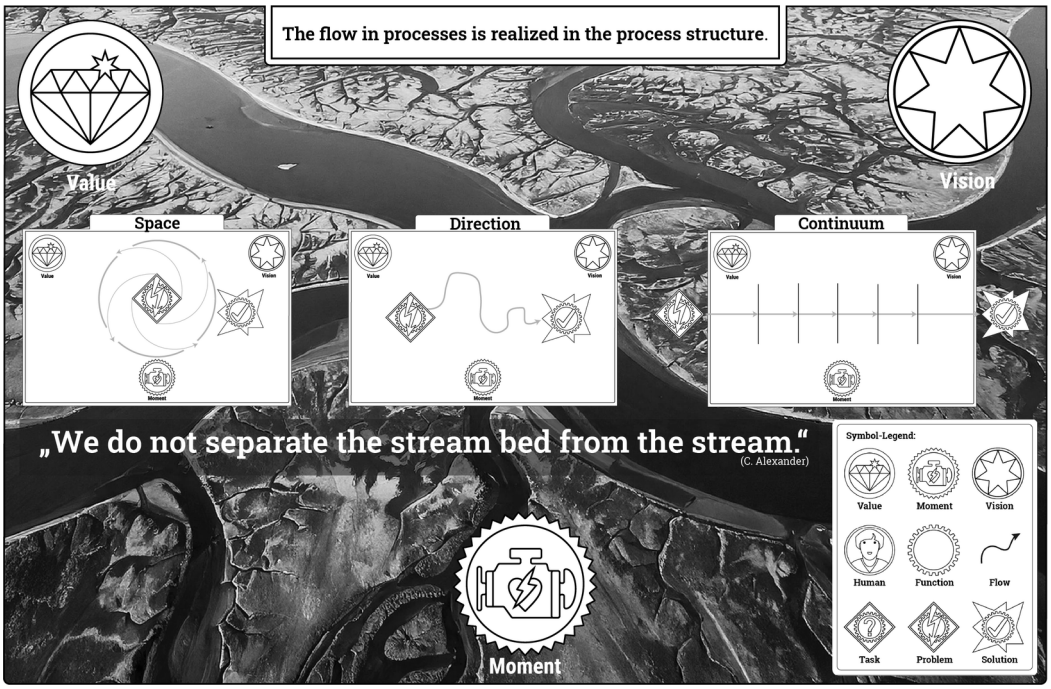

Figure 3: An aesthetic layout that can be used to experience the Gestalt of a business process pattern (graphic: Wolters-Schaer; concept/lyrics: Blattmeier)

The repertoire lacks any kind of hierarchy, has no back and front, and contains no steps. The repertoire should be applied to initiate, assist, and enhance an aesthetic experience, or

alternatively, a multimodal discussion in the context of learning. The production process in which we incorporated C. Alexander's format in text and image will be detailed in the subsequent section. Consequently, we aim to provide managers, consultants, and process participants with information on how to integrate the multimedia content of texts and images into the reception. This should allow them to experience business process patterns aesthetically, gain insights, and learn within their organizations.

4. Illustration: Aesthetic experiencing of a business process pattern

This section uses the example of a business process pattern to illustrate our aesthetic experiences with it in business processes. We are referring to the process of producing texts and images in which we follow the format outlined in section 3.2 to complete the repertoire of section 3.3. In doing so, we aim to communicate how the repertoire, its content, and ultimately the format of a business process pattern can be used in a reception, such as when business processes or their business process models are to be adapted, redesigned, or understood using business process patterns. Here, "aesthetic experience" refers to the sensual understanding of business process routines. We are examining perceptions with positive connotations, through which we discover something unusual or acquire knowledge in general. The illustration stems from our approach in the current research project "Process Design for Living Organizations (ProlOg)," wherein we perceived business processes aesthetically through making implicit knowledge explicit in the form of a pattern. Knowledge that has been described and visualized is made available for documentation, reflection, and application in a knowledge management system, which is a pattern pool for aesthetic business processes. The objective of the project is to create a knowledge management concept that activates knowledge and, consequently, business processes. The project is funded by NBank, the investment and development bank of Lower Saxony, and the European Union's "Social Innovation" program through the European Social Fund Plus (ESF Plus). Considering the lack of trained labor in the East Frisia region, small and medium-sized businesses in particular tend to profit from creating an inclusive and diverse workplace culture. In collaboration with seven firms from various industries participating in the project, we have collected 30 business process patterns to date. The illustration displays the business process pattern "Breathing in and out in a network of personal relationships," identified in the car body shop of the VW plant in Emden. Following pattern mining, we proceed to the pattern visualization and subsequently demonstrate how the pattern was reflected in the learning community of the project. The pattern's problem-solution was recognized in pattern mining (cf. section 4.1), while its interpretation of a Gestalt was the focus of pattern visualization (cf. section 4.2). Subsequently, the repertoire's multiple information were the subject of pattern reflection (cf. section 4.3). This process is illustrated in Figure 4.

4.1 Recognizing the business process pattern (pattern mining)

The visualization process began with a short description we developed following the identification of the pattern during the pattern mining phase with the participants in the body shop. The term pattern mining is associated with digging for gold, because it is about recognizing the essence of a pattern. This short description served as the foundation for both the aesthetic layout and the flow map.

Pattern name: "*Breathing in and out in a network of personal relationships*"

Short description: *To compensate for unforeseen events that affect your process, you organize your own communication channels in the network of relationships, search for new relationships and thus further develop process structures.*

Keywords: *Relationship, individuality, self-organization*

This is a distillation of our common experience, which we consciously picked to find a specific approach to the routine in car body production: For example, the body shop at the VW plant in Emden has a hierarchically organized value-added structure in which teams take on responsibility, interfaces are clearly defined, and function transfers happen at the interfaces. If the teams are confronted with a situation for which they have no solution, such as a system failure, they will work independently to discover a solution inside their team or network. The prerequisite for this is that decision-making authority has been agreed with the management. Self-organizing teams breathe in when they acquire ideas from collaborations inside their own network and exhale when they can share solutions in return. In the background of pattern mining, we carried out interviews, participant observations, and workshops to comprehensively capture the circumstances of employees participating in the relevant business process. The initial goal was to remind those involved in the process of their roles, responsibilities, and knowledge. We also sought to gain a deeper understanding of the problem-solving strategies, competencies, and standards. Finally, we clarified the shared values inside the lived process culture. Throughout our interactions with the organizations, we employed the principles of ethnography (Silverman, 2006; Herrmann, 2012; Schultze, 2020): At first, it was essential to understand daily organizational life through the eyes of the participants in the process. Rather than presenting ourselves as "tourists" in search of freshness, we intended to be perceived as students actively ***engaging with the experiences of individuals*** involved in the process. A second principle was derived from P. Bourdieu, particularly from his note: "it is because subjects, strictly speaking, do not know what they are doing that what they do has more meaning than they know" (Bourdieu, 1977, p. 79). By asking about the purpose, we hoped to learn how and why something is done. Nonetheless, it became evident that ***understanding the conditions***, or the needs that are driving the behaviors of those involved in the process, is sometimes more important than focusing on their stated thoughts and emotions. Thirdly, we concentrated on ***being attentive*** to the stories of people, even though they might not have directly addressed our questions. This open approach assumed that the interviewees had been briefed by the management with whom we initially spoke and had provided their approval. We also left it to the managers as "gatekeepers" to determine the respective business process, the roles in the business process and the people who held these roles for the interviews. A questionnaire that asked about problem-solving techniques, problem analysis, and business process culture served as the basis for the interviews. From the beginning, we made an effort to record people's true words, including exact quotes and straightforward descriptions. "*With head, hand and heart to the doer mentality to master the daily challenges; information and ideas are obtained from other departments; the store must run.*" These are the phrases from the business process pattern "*Breathing in and out in a network of personal relationships*."

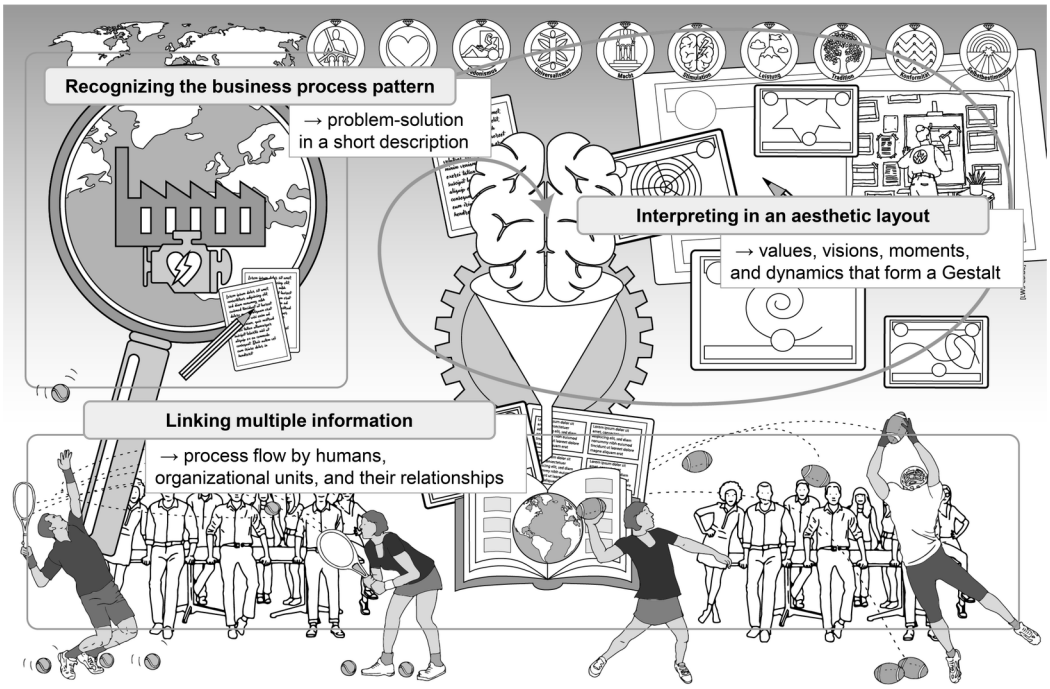

Figure 4: The aesthetic experience is a process that includes visualization used to fill the fields of the multimodal repertoire (cf. Figure 2). Visualization refers to the phases of pattern mining, pattern writing/visualizing, and pattern reflecting. (text addition: Blattmeier; graphic: Wolters-Schaer)

4.2 Interpreting in an aesthetic layout

The problem-solution structure outlined in the short description was converted into an aesthetic layout following pattern mining, which was refined during the visualization processes of the 30 patterns. The objective of the aesthetic layout is to comprehend business process patterns as Gestalten. Aesthetics serves as an analytical perspective, as we examine elements from the full spectrum of experience, resulting in the perception of a Gestalt. Our analytical-aesthetic approach focuses on values, visions, experiential moments, and the dynamics of problem-solving that we perceive sensually. We represented the elements of the pattern "*Breathing in and out in a network of personal relationships*" as follows (cf. Figure 5):

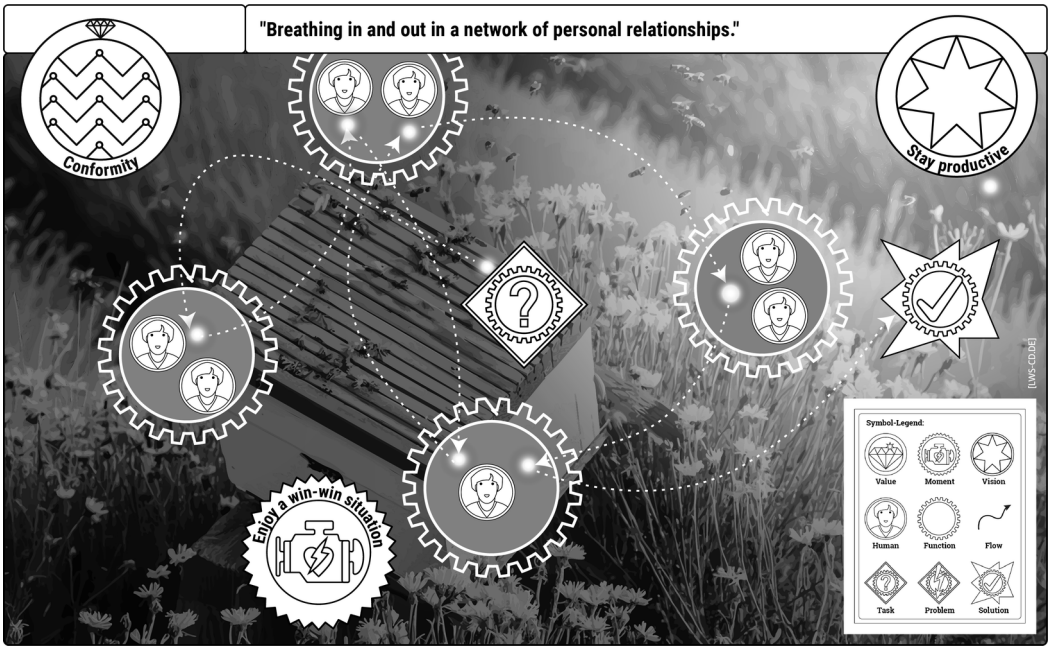

Figure 5: The aesthetic layout for the business process pattern "Breathing in and out in a network of personal relationships" (Pattern discovery and description: Blattmeier; graphic: Wolters-Schaer)

The visualization's leading ***value*** in the VW plant's production system is conformity, which is indicated in the upper left corner. This value has been espoused as behaviors in the production process are directed by politeness, obedience, and self-discipline. The process participants gained experience with this value, cultivated it into a shared fundamental nature, and assert that this value defines their work. It has become an accepted assumption that they neglect. *Conformity* is a value described by social psychologist S. H. Schwartz (Bardi & Schwartz, 2003), alongside power, achievement, hedonism, stimulation, self-determination, universalism, benevolence, spirituality, tradition, and security. Each business process pattern has been categorized according to its motivating value type. The ***vision*** in the upper right-hand corner is tied to the value. People who are engaged in the process of "*breathing in and out of a network of personal relationships*" have a clear vision of *staying productive*. They prioritize fulfilling the duties assigned to them by the body shop. Vision and values are somewhat associated with the purpose of an organization. A company's purpose demonstrates the value it aims to provide to its employees and society (Fink & Moeller, 2018). Nevertheless, the purpose of an organization does not necessarily provide an answer to the concerns that employees have regarding the meaning of their work. Meaning, according to V. Frankl, is the personal fulfillment of values in a concrete situation (Von Devivere, 2021). Meaning develops in a business process pattern because it provides a concrete vision for individuals. In every business process pattern, there are also ***moments*** when someone feels something. The term "feeling" is suitable for at least two categories of "feeling events" in German: We experience a physical sensation, such as stomach pain, and a mental experience, such as the sensation that arises when we recall

and subsequently experience it (Stalfort, 2010). The individuals engaged in the body shop at the VW production plant in Emden expressed satisfaction when they successfully established a *win-win situation* with interface partners within the production system. Through sensory experiences in visualization, we aim for companies to aesthetically understand the patterns of business processes. It should be possible for companies that are unfamiliar with the business process pattern "*Breathing in and out in a network of personal relationships*" to emotionally engage with it in order to perhaps remember and learn from it. The visual representation of a business process pattern aims to clarify the core of the problem-solution. Consequently, the aesthetic layout shows how the pattern influences the dynamics of the problem-solving process. The visualization explores a process flow that starts with a time-based initiation, which is the problem or task, and concludes with the solution of the problem. Each process flow indicates an "ensemble" of activities in space and time that can be assigned to three space-time paths in accordance with Figure 4. During a visualization workshop, the car body shop employees analogized their workflow to that of a beehive. They highlighted the distinctive relationships within a bee colony structure, wherein some bees depart while others tend to the honey. Consequently, we have employed this metaphor to explain the problem-solution inside a natural framework. Business process patterns are metapatterns that have a transdisciplinary influence. T. Volk identified metapatterns "throughout the spectrum of reality: in clouds, rivers, and planets; in cells, organisms, and ecosystems, art, architecture, and politics" (Volk, 1995, p. viii). His metapatterns inspired us to focus on the diverse process dynamics of business process patterns.

4.3 Linking multiple information

During the collaborative visualization processes, a learning community has been established among the companies involved in the ProlOg project. The companies, similar to a community of practice, have a common interest in acquiring a fresh perspective on processes through the use of visualizations. Their objective is to acquire, implement, and maintain expertise in a field that is significant to their organization, specifically process management. In order to establish a shared understanding, the short descriptions were arranged in accordance with the aesthetic layout, both within and between the companies. A variety of multimedia content, including text and images, as well as logical and aesthetic information regarding the problem-solution structure and design, had to be combined. We recognized the necessity of making the essence of a business process pattern more accessible to companies who want to combine it with their own business process patterns. Consequently, we have created a flow map (cf. Figure 6) that distills the variable context to the invariant of a business process pattern, particularly focusing on the dynamics of the problem-solving process that arises from and balances a system of forces. The flow map for the pattern "*Breathing in and out in a network of personal relationships*" concentrates more specifically on the ***flow*** of relationships between inside and outside, across boundaries, and in two directions within a whole. In addition to the sequence and interaction of activities, the flow map references ***humans***, their ***responsibilities*** and ***organizational units***, as well as sub-goals, beginnings, and endings. The flow map has been compared to the present flow maps at the sub-process level in the production system. The purpose of these flow maps, which are equivalent to swimlane diagrams, is to demonstrate the way in which the processes in a quality management system meet the requirements specified in

ISO 9001, chapter 4.4. As shown in Figure 7, the surface correction procedure starts with a complaint from body shop production or quality assurance and ends when the message "No complaint" is proved. It clarifies the interplay among body shop production, single part procuction, the planning department, quality assurance, and a centralized IT-system. The quality assurance staff charged with conceptualizing this diagram prioritized an accessible and clear representation that workers could easily comprehend and regularly follow. Our aesthetic analysis's multimodality really made process participants from production and quality assurance, whose work was symbolized using the swimlane diagram, more conscious of the significance of the process, their role, and the steps themselves. They collectively concluded: "Novel representations inspire me to think differently."

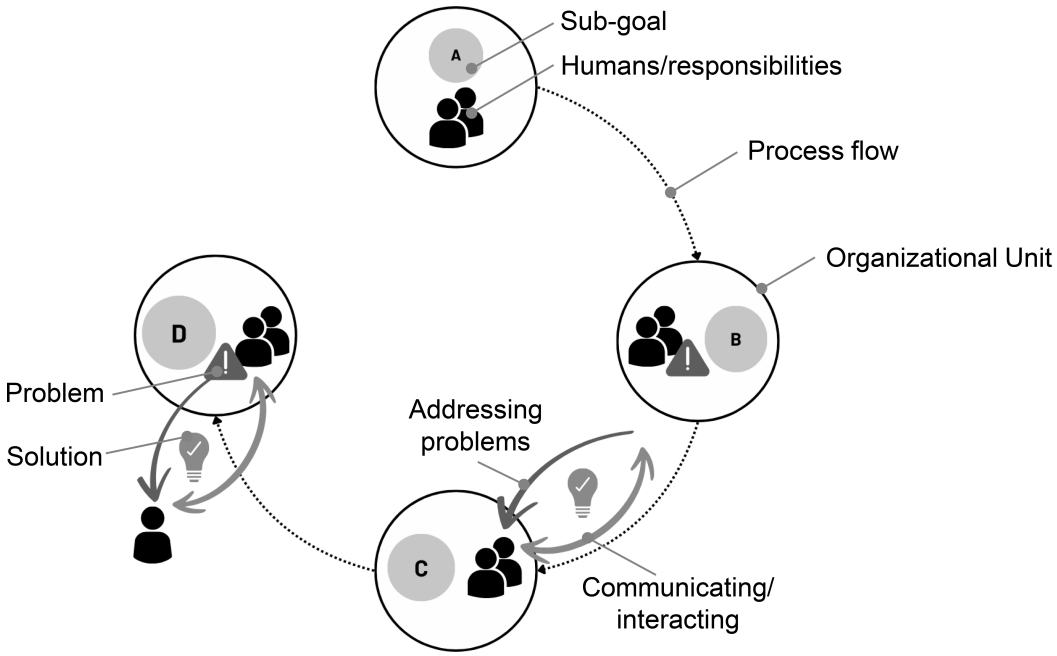

Figure 6: The flow map for the business process pattern "Breathing in and out in a network of personal relationships" (author: Blattmeier; design: Herrmann)

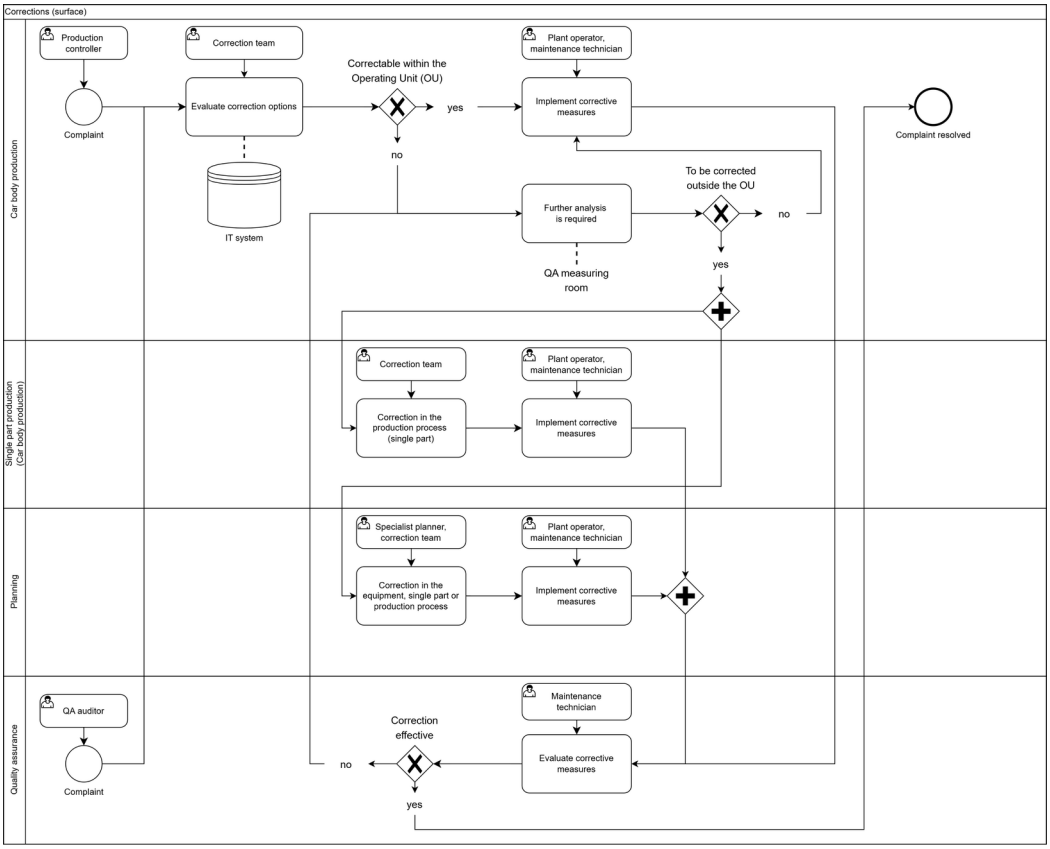

Figure 7: The sub-process of surface correction in a car body shop modeled as a swimlane diagram with BPMN (Business Process Model and Notification)

5. Conclusion of the aesthetic analysis

This article explores the knowledge within business processes from an aesthetic perspective, particularly focusing on the implicit knowledge embedded in humans (Polanyi, 1962), their activities, and the underlying structures. It relates to aesthetic experiences, which provide sensual insights that indicate the existence of something novel, unique, and extraordinary. Values, visions, and moments of self-experience for those involved in business processes should be made visible. The article follows the format of a business process pattern to visualize the spectrum of sensory experiences. The format contributes to the development of a multimodal repertoire that enables us to not only rationally comprehend the problem-solution structure but also perceive the business process pattern as a whole (Gestalt). This expands the possibilities for disseminating knowledge through business process patterns in business process management. The traditional problem-solution scheme in business process modeling has predominantly been conceptualized in the context of software development; in our view, business process patterns can also emphasize the dynamic and sensory aspects of the process flow through which problems are addressed. The aesthetics of business processes can be perceived when they create

unique value because they express a company's core competencies. In aesthetic business processes, individuals are emotionally engaged in their tasks, experience them sensually, and learn how significant they are. Aesthetic business processes are characterized by their receptiveness to the unconventional, diversity, and creative approaches. Because of this, business process patterns must have an opportunity to evolve generatively allowing for dynamic and self-organizing process structures (Gestalten). A pattern language designed for aesthetic business processes is less beneficial to problem-solving by iteratively assembling patterns as basic building blocks of a language. C. Alexander's later work, "The Nature of Order," outlines a pattern language that, dependent upon the specifics of the project, may be either newly developed or a fusion of existing languages. This language serves as a bridge between multiple domains of knowledge, particularly in the context of aesthetic business processes. Although this article's aesthetic analysis attempts to increase awareness of, characterize, and visualize aesthetic behavior in business processes, it is insufficient on its own to offer thorough recommendations for economic action. The visualization in the article, which utilized a particular business process pattern as an illustration, stimulated the senses of those involved in the process, promoting self-observation and intuition, as well as the development of knowledge and creativity. This was achieved by companies learning collaboratively, as they gained a better understanding of their own processes and those of other companies. The value of visualizations for business process management, however, is only realized when they are looked at in detail. The repertoire of texts and images requires that managers, consultants, and process participants engage with diverse, often conflicting, realities. It is not always possible to explain some circumstances; instead, one must engage with them through an interplay of emotion and rationality. In business process management, business process patterns as Gestalten can guide perception towards distinctive and unforeseen elements that link the perceiver to the present moment.

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