Forward-Looking Practices to Improve the Soft Skills of Software Engineers

President Kenneth M. Styron, DBA | Columbia Southern University, Orange Beach, Alabama, USA

Contact: ken@columbiasouthern.edu

Abstract

A four-round modified Delphi project surveyed 25 United States software engineering experts. The study examined software engineering leaders' perceptions of soft-skills importance after a business problem identified a lack of soft-skills as a contributing factor toward the 68% organizational project failure rate in North American. Software project failures lead to reduced organizational performance. An original soft-skills framework guided the data collection and analysis process, which included communication, social, leadership, and thinking practices. A literature review matrix identified 35 potential soft-skill practices included in the Round 1 instrument. The experts winnowed, ranked, remarked on, and added to the practices over three iterative rounds, using contextual rationales and ratings of desirability and feasibility. Six practices were identified as the best ways to improve software engineers' (SE) soft skills, including *SEs must listen to team members and stakeholders, incorporating the information they hear into the conversation; SEs must speak clearly and concisely; SEs must communicate expectations to team members; SEs must synthesize messages from others and consider their perspectives; SEs must employ sound reasoning to make informed and timely decisions; SEs must understand, articulate, and solve complex problems through analytical thinking*. The Round 4 confidence rating resulted in a 100% finding of confidence (45% mostly confident; 55% very confident). Communication, leadership, and thinking skills remained in the final framework; social skills were removed. Leaders should use the findings to guide SE training and coaching to improve their team members' soft skills.

Keywords*:* Soft-Skills, Delphi, Software Engineers, Communication, Thinking, Leadership, Software Project Failure, Collaboration

Introduction

Jim Johnson, the Standish Group founder, stated that over 80% of North America software projects fail to meet stakeholder expectations, deadlines, and budget estimates (Johnson, 2020). Capretz and Ahmed (2018) noted that deficiencies in the soft skills of software engineers (SEs) lead to failed software projects. In a technology-driven world, soft skills provide the personal attributes that enable workers to interact effectively and work harmoniously with stakeholders; leaders must know how to properly use communication, negotiation, conflict resolution, decision-making, and interpersonal relationships to foster productive work environments (Matturro et al., 2019). Engineers traditionally focus on technical aspects of programming (Groeneveld et al., 2019); however, the contemporary global environment requires engineers to collaborate with stakeholders using soft skills to obtain competitive advantages (Dean & East, 2019). This modified Delphi study responded to Capretz and Ahmed's (2018) call for research on improving SE soft skills.

Background

The soft-skill deficiencies of SEs negatively affect business outcomes (Dean & East, 2019). Engineers with high levels of technical abilities often possess meager soft skills, resulting in difficulty working with others; soft skills' criticality mirrors that of technical skills in software engineering (Capretz & Ahmed, 2018). Soft-skill deficits affect business outcomes related to worker behavior, safety, engagement, and productivity (Dean & East, 2019). Customers can be impacted when a worker's soft skills create angst or disappointment, especially those in customer-service roles in technology companies.

Business Problem and Gap in Practice

Sixty-eight percent of organizational projects (and 80% of software projects) fail in North America, resulting in lower performance (Johnson, 2020). Project failures consume valuable human and capital resources yet leave core business requirements unsatisfied (Watt & Abrams, 2019). Large project failures threaten the very existence of organizations (Guidiy et al., 2018). Zaman et al. (2019) found that organizations wasted an average of $97 million for every $1 billion spent on software development; Lauesen (2020) contributed waste to unmet deadlines, budget overruns, and lagging program requirements. The problem led to an identified cause, in the literature, as a deficiency in SE's soft skills (Capretz & Ahmed, 2018), which resulted in a high failure rate in North American software projects (Johnson, 2020) that decreased their organizations' competitive advantages (Dean & East, 2019).

The literature identified multiple practice gaps regarding SEs' soft-skill training and acquisition. First, when leaders do not understand the required soft skills, they cannot coach SEs to develop the skillset. The leaders' gap in knowledge adds to the problem. Next, when SEs cannot leverage soft skills to understand customers, manage expectations, build trust, and resolve problems, their gaps in practice lead

to reduced organizational effectiveness and increased software project failures (Hyder & Iraqi, 2019). Thus, the practice gaps appeared in leaders and their engineers.

Without soft skills, poor communication and misunderstandings lead to expensive and time-consuming project failures (Watt & Abrams, 2019). SEs have limited knowledge about soft skills because these skills have not been a part of the mainstream software engineering curriculum (Capretz & Ahmed, 2018) and, likely, have not been provided in other underlying technical training and education throughout the engineers' lives. Learning new skills is difficult; therefore, understanding which practices enhancing soft skills will help software engineering leaders oversee the design of training programs and guide SEs toward self-development (Giray, 2019).

Need and Justification for the Project

Matturro et al. (2019) stated that further work was necessary to determine what actions industry leaders could take to develop soft skills to enhance software development teams' performance and software projects' outcomes. Dean and East (2019) noted the need to develop and implement strategies to address soft-skill deficits that negatively affect business outcomes. Zorić and Stojanov (2018) directed future research on specific soft skills in the software industry to improve the soft skills of SEs because the significance and need to improve these skills is critical, but industry leaders lack specificity as to what the best practices might be. Limited research and information about achieving the right balance of technical and soft skills prevent engineers from practicing these skills to overcome project failures (Rao, 2018). The importance of soft skills has received more attention from organizational leaders due to increased cultural diversity, globalization, and technological advances (AbuJbara & Worley, 2018).

Literature Review, Theory, and Frameworks

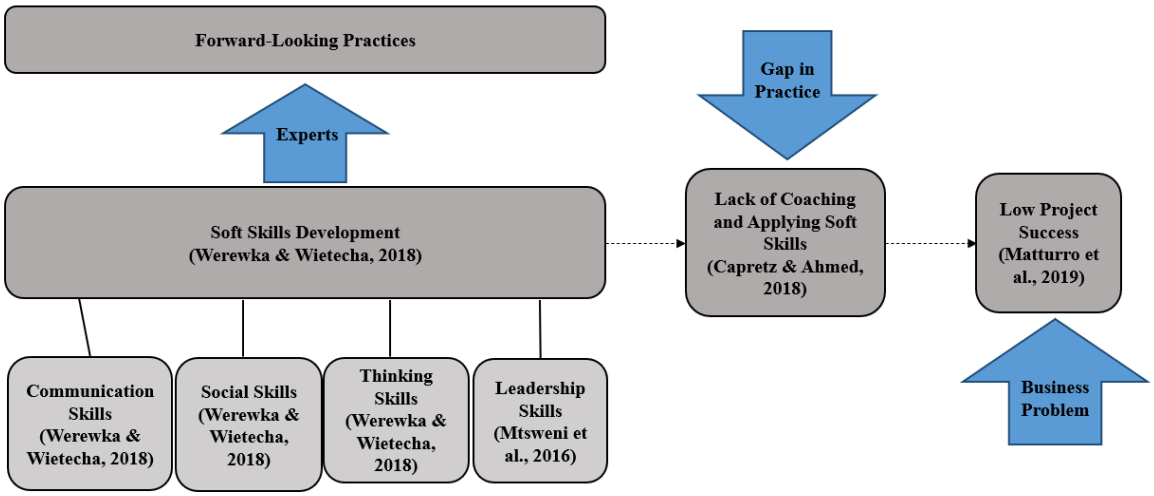
This study used a modified Delphi technique, a unique qualitative method that uses a literature review and matrix to prime the data collection process. While qualitative methods are known for their deductive analysis processes, the modified Delphi approach combines inductive and deductive processes and is closely related to a mixed-methods approach (Linstone & Turoff, 2002). As a result, the literature review becomes part of the data collection process. This literature review explains the literature supporting the applied and soft-skills frameworks, each of which guided the study. A detailed literature review matrix can be accessed through Supplementary Data using the link provided at the end of the study (hereafter cited as Supplementary Data).

The Applied Framework for the Study

Previously used soft-skills frameworks incorporated competency clusters. Four competency skill clusters identified from the literature review included social, thinking, communication, and leadership skills. Clustering competencies in frameworks helps to streamline project design by reducing duplication (Mahasneh & Thabet, 2016). Figure 1 represents the applied framework, which combined the soft-skills framework competencies with the gap in practice, business problem, and goal for the study.

Figure 1

Applied Framework



Review of Conceptual Literature

A focused approach to collecting and analyzing the literature is provided in Table 1, which identifies the keywords and search strings used for the process.

Table 1

Searching Approach

Keyword	Search strings
Soft skills	"soft skills," "nontechnical skills," "personal skills," "people skills," "interpersonal skills," "competencies," "transferable skills," "softskills"
Software engineering	"software engineers," "software engineering," "software development," "software programming," "software projects," "software," "engineers," "programming"
Soft skills and software engineering	"soft skills" and "software engineering," "soft skills" and "software engineers," "soft skills" and "software development," "soft skills" and "software programming," "soft skills" and "software project"

Literature Related to the Business Problem

Software engineers' ineffective soft skill practices have historically led to software project failures, preventing organizations from creating competitive advantages. Failed software projects cost organizations millions of dollars yearly (Zaman et al., 2019) and waste valuable resources (Watt & Abrams, 2019). Researchers have called for identifying effective soft skill practices for SEs to enhance project success (Ahmad et al., 2019; Matturro et al., 2019). Istiyowati et al. (2020) surveyed 66 educators and professionals to obtain their perceptions about the competencies programmers need, finding that a gap in practice persists. SEs' soft skills are critical to the success of organizations. Organizations cannot compete in highly competitive global markets driven by technology because of the current business problem.

Literature Leading to the Soft-Skills Framework

Soft and Hard Skills. S*oft skills* first appeared in the 1972 U.S. Army training manual (Moss & Tilly, 2001). Kechagias (2011) described soft skills as the intra- and interpersonal skills essential for personal development, social participation, and workplace success. Soft skills were widely used in the 1990s (Charoensap-Kelly et al., 2016), but soft skills have received little attention (Ahmed et al., 2015). Technology professionals initially overlooked soft skills, but recognizing soft skills as important has increased over time (Capretz & Ahmed, 2018). In the early stages of mainframe computing, technical skills were valued more than soft skills in the computer industry; however, the current era of personal computers, mobile devices, and social networking emphasizes the importance of soft skills over technical skills (Kappelman et al., 2016).

Waychal and Capretz (2018) conducted a qualitative descriptive research study of 136 software engineering students attending classes in Canada, Japan, and India. They found that software engineering had become an all-pervasive discipline, transitioning from traditional process and technology dimensions to more human sciences. Cook (2019) suggested that the software industry had changed due to the increasing demand for software in global markets and the advancement of technology. New socioeconomic and technological challenges are changing the soft skills required in a digitalized world (Chaibate et al., 2019). Soft skill practices are evolving due to software engineering becoming a people-intensive discipline (Capretz & Ahmed, 2018).

Communication Skills and Practices. Hidayati et al. (2020) reported communication skills as one of the top skills required by global software development teams. Effective communication forms a pillar for collaborative activity (Júnior, 2018). Understanding the various stakeholders is essential because meeting their needs and requirements is fundamental for project success (Vanebo & Kjorstad, 2020). Zahid et al. (2018) suggested that software projects' successes and failures are linked directly to SEs' ability to communicate effectively with stakeholders. Inactive, inaccurate, or missing communication contribute to software project failures (Lehtinen et al., 2014).

Stevens and Norman (2016) clustered the concepts of *conveying complex ideas efficiently*, *articulating thoughts clearly*, *fostering open communication*, and *listening* as pivotal communication skills;

Mahasneh and Thabet's (2016) model also included listening, but added *presenting, reading, speaking,* and *writing* as additional and necessary communication skills.

Communication skills are the practices SEs use to convey information so that information is received and understood (Gishin, 2020). Alqaisi (2018) defined communication as a dynamic process where the sender and receiver of information engage interactively by exchanging feedback using verbal, nonverbal, written, and visual communication practices. Johansson (2018) described communication as conveying and sense-making messages and discourse between parties. Effective communicators confidently deliver verbal messages using clear and concise language that they adjust depending on their audience (Barron & Rose, 2021). Using qualitative analysis, Coffelt et al. (2016) surveyed 165 U.S. employers about effective communication skills and identified active listening as a critical element for conversing with others and considering their thoughts. Listening allows communicators to give full attention to the speaker and respond appropriately by synthesizing messages and seeking further clarification (Barron & Rose, 2021). Johnson (2021) suggested that nonverbal cues reinforce communication. Hand gestures, facial expressions, and voice tone influence the delivery of verbal messaging while maintaining eye contact and nodding are essential active listening practices (Johnson, 2021). Active listening and nonverbal cues are critical communication practices that enable people to understand others' messaging.

Ginting et al. (2020) conducted a qualitative study using Kirkpatrick's model to observe the effects of team-building training on soft skills with MBA students in Indonesia. They found that conveying information using visual communication necessitates presenting information in an organized and concise manner. New technological innovations have created new communication channels, including texting, instant video conferencing, and social media platforms that call for different communication skills and practices (McKnight et al., 2019). Effective communication practices include choosing the appropriate technique, channel, and approach when communicating (Galli, 2021). Communication is a critical soft skill necessary for working with team members and stakeholders; however, technological advances are changing SEs' communication practices with each other and stakeholders. Discerning the practices that enable effective communication may enhance SEs' ability to communicate with others.

Understanding the audience is important when communicating. Galli (2021) suggested that communicators consider an audience's intellectual level and understanding to explain complicated ideas clearly by converting concepts into straightforward explanations. Communicators should consider cultural differences when developing messaging (Sekhar, 2019). Conversing with members in the workplace using synchronous communication increases understanding and ensures members comprehend shared information (Brink & Costigan, 2015). Successful communicators steer conversations to arrive at a consensus by delivering ideas effectively and confidently (Sekhar, 2019). Communication is critical to the software development process (DeFranco & Laplante, 2017). Effective communication practices involve the sensible transmission, understanding, and assimilation of information necessary for the success of software projects (Ravindranath, 2016). Sharing information is essential for software development, but understanding others' points of view may be more important. Comprehending others and being understood is critical for communicating with team members and

stakeholders. Identifying the forward-looking practices that effectively improve communication during the software development phase may increase project success.

Communication is a critical component of leadership to accomplish objectives (Cunningham et al., 2020). Badjie (2020) asserted that communication is a manifestation of leadership used to convey a leader's vision to followers. Bolte et al. (2018) conducted a qualitative study that surveyed 72 employees of German companies about digital leadership. Bolte et al. found that open and transparent communication forms strong social relationships with followers. Clear communication encourages followers to provide feedback to improve the workplace environment and solve complex problems (Galli, 2021). Setting a clear vision and explaining the purpose for accomplishing objects is critical for maintaining followership (Promsri, 2019). Influential leaders communicate expectations so that followers clearly understand what is required to be successful (Galli, 2021).

Social Skills and Practices. Social skills refer to how a person interacts with others in social settings (Dubey & Tiwari, 2020). Humans successfully interact when the parties can understand each other by recognizing behavioral cues (Baron-Cohen, 2000). Advanced social skills provide the tools to communicate effectively, work collaboratively in teams, and complete projects successfully (Kerzner, 2017; Werewka & Wietecha, 2018). Mahasneh and Thabet (2016) clustered these skills into categories that referred to recognizing others' feelings and knowing how to use this knowledge to help and influence others, calling the cluster *social-intelligence soft skills*. Werewka and Wietecha (2018) also acknowledged the importance of clustering social skills to identify SEs' soft skill competencies. The social skills construct contributed to the soft-skills framework by exploring the literature on how SEs interact with stakeholders.

Social skills directly relate to the practices used to work with others through social communication and interactions to accomplish goals (Gishin, 2020). Zaman et al. (2019) conducted a qualitative study surveying 242 project managers based in Pakistan to understand the soft side of software projects and reported that the social aspects of complex intensive jobs such as software engineering require reading and reacting to social settings to achieve positive business outcomes. Social skills help people identify underlying feelings, motives, and behaviors (Zaman et al., 2019). Social aspects include interpersonal relationships, personality traits, interaction, and collaboration with others objectively and subjectively (Ahmad et al., 2019). People with strong social skills can accurately understand other people's thoughts and behavior and respond accordingly to accomplish goals (Zaman et al., 2019). Social skills are essential to collaboration**,** where different groups work together to accomplish common goals. The success of software projects depend**s** on SEs' ability to understand others and build relationships that reinforce teamwork.

Social practices include interpersonal skills that build relationships by creating trust, adapting to others when communicating, respecting others' attitudes, behaviors, and beliefs, and being comfortable with oneself (Stevens & Norman, 2016). Establishing and maintaining positive relationships is essential to achieving organizational outcomes in team environments (Lansdell et al., 2020). Working effectively in team environments contributes to achieving desired goals (Gishin, 2020). Teamwork is a vital social skill that requires working with others as team members and team leaders in diverse teams of different ages, genders, races, religions, and political positions (Pieterse & van Eekelen, 2016). Individuals should

appreciate team diversity, showing respect for the values of others by treating people fairly (Gibert et al., 2017). Building relationships beyond existing teams to create networks of valuable partnerships increases the available resources to accomplish tasks (Gibert et al., 2017). Creating and maintaining positive relationships is essential to working with others. Social practices enable SEs to accomplish project goals and objectives effectively with diverse teams and stakeholders.

Teamwork also includes resolving conflicts without degrading relationships (Stevens & Norman, 2016). The ability to understand feelings and emotions is known as emotional intelligence; a critical social skill used when working with people (Almeida & Morais, 2021). Pekaar et al. (2018) conducted a qualitative multilevel path analysis of weekly diaries of third-year students enrolled in higher professional education in the Netherlands. Pekaar et al. (2018) found that understanding emotion increases social effectiveness (Pekaar et al., 2018). Regulating emotion enables people to work together smoothly (Johnson, 2021). Remaining calm and in control even during disappointments, setbacks, or confrontations rather than responding defensively to others is vital to maintain positive relationships (Gibert et al., 2017). Expressing feelings so as not to cause judgment when providing feedback is essential to creating open communication (Almeida & Morais, 2021). Showing empathy for others is an indispensable practice for working with others.

Empathetic leaders can effectively build and maintain relationships, making them assets to the organization (Gentry et al., 2016). Effective social practices maintain project performance by avoiding communication breakdowns, sharing knowledge, building relationships, promoting trust, and aligning project expectations (Kerzner, 2017). Understanding and controlling emotions in social settings are essential social skills to maintain relationships. Identifying the practices that enhance social interactions may help SEs effectively work with team members and stakeholders to increase project success.

Thinking Skills and Practices. A critical responsibility of SEs is solving complex problems (de Campos et al., 2020; Jia et al., 2017) while avoiding frequent software development problems (Zykov & Attakorah, 2020). SEs also must think creatively to produce quality software (Jia et al., 2017). SEs must apply logical thinking to gather and analyze information, design and test solutions, and formulate plans (Ahmed et al., 2015). Werewka and Wietecha (2018) defined thinking skills as the ability to analyze, verify, and assess problems using analytical thinking, systems thinking, and unconventional thinking to find an appropriate solution. Similarly, Mahasneh and Thabet (2016) clustered analytical thinking, conceptual thinking, critical thinking, decision-making, decisiveness, problem-solving, reasoning, and systems thinking skills. Identifying thinking skills related to analytical thinking, critical thinking, and problem-solving may increase SEs' abilities to solve problems using innovative and out-of-the-box thinking.

Cognitive skills include creative thinking, decision-making, and problem-solving (Weber et al., 2010). Hawawsheh (2020) defined the thinking process as understanding the problem, generating ideas, and planning the implementation of solutions. Analytical thinking involves thinking logically to understand, articulate, and solve complex problems based on available information (Gishin, 2020). Deming (2017) suggested that there is no substitute for humans capable of performing open-ended tasks that require flexibility, creativity, and judgment. Technology advancements have increased the complexity of

problems, necessitating the demand for engineers to excel at analytical and problem-solving skills (Waychal & Capretz, 2017). The complexity of software development has increased with technological advancements and a globally connected work environment. Thinking skills are essential in today's complex and competitive environment. Analyzing and processing information is critical for solving complex problems; therefore, understanding the forward-looking practices that positively contribute to problem-solving may increase SEs' ability to find new and innovative solutions.

De Campos et al. (2020) revealed that critical thinking, the aptitude to make informed decisions by using appropriate questioning with the ability to act independently and wisely, is a crucial component of problem-solving. Individuals must be able to self-direct, discipline, regulate, and correct (Almeida & Morais, 2021) to proactively modify behavior to deal with changes (Barron & Rose, 2021) and become more effective (Gupta & Gouttam, 2017).

Practical problem-solving includes generating, evaluating, and implementing numerous possible solutions to resolve issues (Pallathadka, 2020). Problem solvers evaluate and assimilate information from multiple sources (Barron & Rose, 2021). Gibert et al. (2017) suggested that creative thinking is essential to problem-solving. Creative thinkers consider the bigger picture, long-term implications, and wide-ranging possibilities when developing solutions. Existing practices or methods do not limit potential solutions; problem solvers are open to new ideas and adapt to changing environments (Gibert et al., 2017). Decision-making is the most critical component of problem-solving (de Campos et al., 2020). When problem-solvers identify solutions, they make effective decisions founded on sound reasoning (Barron & Rose, 2021).

Weber et al. (2009) conducted a qualitative Delphi study to assess the soft-skill competencies of entry-level managers in the United States. Weber's findings indicated that creative thinking, making sound decisions, and solving complex problems were important soft skills.

Leadership Skills and Practices. Successful leadership requires soft skills that influence the innovation and performance of others to achieve a common goal (Northouse, 2018). The changing nature of leadership has shifted from authoritarian- to relationship-based styles, requiring leaders to build and maintain relationships through person-focused skills (Gentry et al., 2016). SE leaders must lead and run projects, take ownership and responsibility for their actions, and support what they consider important and correct (de Campos et al., 2020). Jena and Satpathy (2017) argued that leadership is a critical soft skill because leaders play a more important role in situations where others do not directly manage individuals. Leadership in the workplace boosts productivity (de Campos et al., 2020) and contributes to project success (Zhang et al., 2013). While Mahasneh and Thabet (2016) and Werewka and Wietecha (2018) failed to include leadership as a primary construct, Dubey and Tiwari (2020) and Ballesteros-Sánchez et al. (2019), and Weber et al. indicated that leadership is a vital soft skill for SEs.

Leadership is influencing people to achieve common goals (Northouse, 2018). Most importantly, leadership is available to everyone (Shuck & Herd, 2012). Jena and Satpathy (2017) argued that leadership is more important when others do not directly manage individuals. Dubey and Tiwari (2020) conducted a quantitative analysis of the soft skills gap with novice information and communication technology professionals in India and found that leadership is one of the most critical soft skills in the IT

sector, including software engineering. Leadership skills enable leaders to handle difficult situations resiliently (AbuJbara & Worley, 2018). Professional leadership practices are also necessary when negotiating with others, creating collaborative environments, and resolving conflicts (Weber et al., 2010). Successful leaders practice good leadership and lead by example (Galli, 2021). Effective leadership results in excellent teamwork and collaboration, which improves organizational performance (Ravindranath, 2016). Software engineering requires engineers to take leadership roles during different stages of software development; therefore, identifying effective leadership practices is essential for enhancing SEs' ability to lead.

Gibert et al. (2017) recommended that leaders inspire a strong desire for followers to succeed by steering members toward successful goals and task completion. Leaders should help individuals to improve the skills and abilities necessary to achieve success by providing constructive feedback (Gibert et al., 2017). Evaluating, analyzing, and providing criticism on employees' behaviors and abilities inspires employees by helping them to improve through self-development (Ginting et al., 2020). Developing employees using coaching and mentoring unleashes their full potential and abilities (Srivastava & Jain, 2017). Because communication with team members and stakeholders is critical for project success, determining which leadership practices increase communication and followership may help SEs lead and communicate more effectively with team members.

Leadership influences innovation as well (Sopa et al., 2020). Innovative behavior that generates, promotes, and helps employees realize new ideas in the workplace has become a critical leadership practice that drives innovation (da Silva et al., 2016). According to Edison et al. (2018), innovation is critical for SEs to create and sustain competitive advantages. Innovative behavior generates effective solutions for complex problems (de Campos et al., 2020). Successful leaders create supportive environments for innovation (Rybakova et al., 2019). One way of doing this is empowering employees to take risks and even fail when exploring new opportunities, which is critical for innovation (Promsri, 2019). Bolte et al. (2018) suggested that leaders must accept mistakes to enable innovation. Kuratko et al. (2014) explained that tomorrow's competitive advantages are grounded in today's innovation; therefore, taking risks and exploring new ideas are essential. Klein (2020) argued that leaders must have a vision for the future and be innovative.

Findings from Soft-Skills Literature

Researchers attempted to address software projects' failure by investigating the soft-skill practices influencing projects' success. The findings of nine studies from 2014 to 2021 indicated soft skill practices critical to SEs and project success (Table 2). Practitioners have yet to address the underlying factors that cause catastrophic project failures as software projects fail (Zaman et al., 2019).

Table 1

Software Engineering Soft Skill Studies

Reference	Method	Findings
(Ahmed et al., 2015).	Qualitative exploratory mapping study	Communication, team player, problem-solving, and interpersonal skills were in high demand for SEs.
(Bailey, 2014).	Qualitative case study	The most important skill for software developers was problem-solving, followed by adaptability, accepting constructive criticism, listening, teamwork, time management, idea generation, exhibiting a customer mentality, investigating using interpersonal skills, communicating in inter-team environments, transferring knowledge and verbal communication.
(Matturro et al., 2019).	Qualitative systematic mapping study.	The most mentioned skills were communication, teamwork, analytical, organizational, interpersonal, leadership, and problem-solving.
(Mtsweni et al., 2016).	Quantitative analysis of industry experts' opinions.	The study reported that team player, personal integrity, group work, time management, open communication, listening skills, problem-solving, critical thinking, trustworthiness, and ability to work under pressure as the most in-demand skills and attributes.
(Groeneveld et al., 2019).	Qualitative systematic literature review of software engineering.	Identified communication, teamwork, self-reflection, conflict resolution, mentoring, and leadership as important soft skills for SEs.
(Iriarte & Orè, 2017).	Qualitative systematic literature review of IT project success.	The most mentioned soft skills for IT project managers were communication, leadership, conflict management, thinking, innovativeness, change orientation, negotiation, motivation, and problem-solving.
Reference	Method	Findings
(de Campos et al., 2020)	Qualitative systematic literature review of employability soft skills of engineers.	The literature review revealed the most employable soft skills of problem-solving, critical thinking, creative thinking, communication, teamwork, ethics, and emotional intelligence.

(Zykov & Attakorah, 2020)	Qualitative case study of human factors.	Researchers found that communication, experience, team composition, motivation, teamwork, management, conflict resolution, and problem-solving soft skills increased project success.
(Burbekova, 2021)	Quantitative and qualitative data analysis.	The researcher found that creativity, persuasion, collaboration, adaptability, and emotional intelligence ranked highest among those soft skills in demand for 2020.

Note. A complete literature matrix used to create the Round 1 instrument can be accessed through Appendix A in the Supplementary Data file (see **References**).

Working with people, guaranteeing customer satisfaction, and developing favorable atmospheres that promote collaboration are essential to complete projects successfully on time and within budget (Ravindranath, 2016). Internal conflict and dysfunctional group dynamics can hinder team effectiveness, which is critical for creating competitive advantages (Komla et al., 2018). Soft skills help people overcome interpersonal challenges by equipping individuals with empathy and communication skills to lead more effectively, which increases performance and productivity (Rao, 2018). Researchers have identified over 30 soft skills that may improve SEs' soft skill deficiencies; however, agreement on which soft skill practices are most important varied among researchers. The extensive list of soft skill practices may confuse SEs as to which practices are most effective.

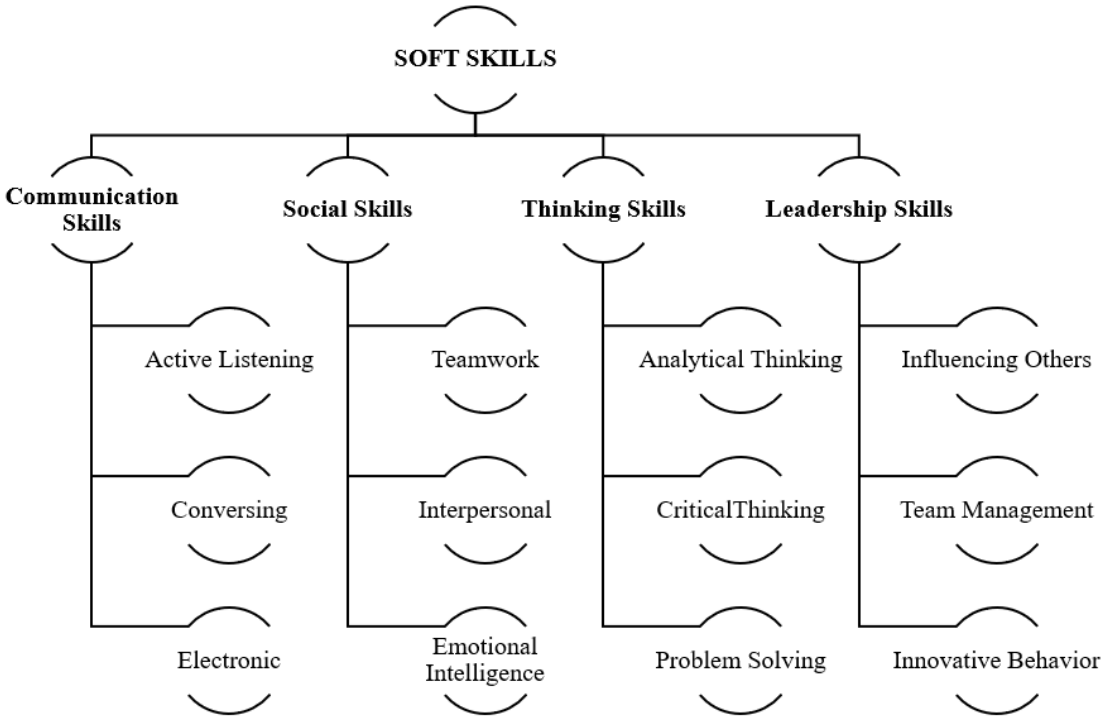
Researchers disagree on which soft skills are more important, creating conflicting results as to which soft skill practices are beneficial for improving the soft skills of SEs. Societal and technological innovations such as the internet, social media, artificial intelligence, and the Internet of Things are changing how people interact and work together (Golay, 2020). Current and historical practices identified in the literature review may help leaders address SEs' soft skill deficiencies. Leaders would benefit from new knowledge about the soft skill practices that may improve the soft skills of SEs. Improving the soft skill practices of SEs may increase project success, allowing organizations to develop the competitive advantages necessary to compete in a technologically driven world.

The Soft-Skills Competency Framework

A pre-study soft-skills competencies framework (Figure 2) was created from the literature review and contributed to guiding the instrumentation for Round 1 of the study. The study tested the framework using the modified Delphi process.

Figure 2

Soft Skills Competencies Framework



Note. This competency framework identifies clusters of soft skills, which was transformed by Styron (2021) from Werewka and Wietecha (2018) and Mahasneh and Thabet (2016).

Research Technique

A modified Delphi technique identified forward-looking practices to improve the soft skills of SEs as viewed by a nationwide panel of software engineering leaders with soft skills acumen. The study determined the extent to which consensus was achieved regarding the practices' desirability and feasibility, and included the following research questions:

> **RQ1**: What are the forward-looking practices that successful software engineering leaders perceive could improve the soft skills of software engineers?

RQ2: To what extent is there consensus among a panel of soft-skilled, expert software engineering leaders as to desirable, feasible, and forward-looking practices which could improve the soft skills of SEs?

Sampling and Recruitment

Panelists for this project consisted of expert leaders with soft skills and the acumen of software development teams. The project experts were required to have the following characteristics:

- Led software development teams in the United States for at least 5 years;
- Their teams exhibited excellent team dynamics and high project completion rates;
- Possessed soft skills acumen.

Software development included internal and external software solutions.

A third-party service, User Interviews, recruited participants for the project. This proprietary service gives researchers access to over 400,000 vetted members of the company's community (User Interviews, n.d.). The recruitment announcement included a description of the project, inclusion criteria, survey format, potential benefits, participant expectations, and time commitment, as recommended by Skulmoski et al. (2007).

Experts were told to expect four rounds of online surveys during a 4-to-6-week period, each requiring between 15 and 30 minutes to complete. User Interviews compiled a list of qualified members interested in participating in the project. I vetted the final list of participants using their self-reported work experience and knowledge of software development and by manually reviewing their LinkedIn profiles.

The panel size of industry experts is also essential to produce quality output results (Skulmoski et al., 2007). While Vernon (2009) claimed that panel size did not correlate to a study's effectiveness, Skulmoski et al. claimed larger groups may produce more convincing results but require more effort, recommending sizes of 15 to 20 members. Bardecki (1984) warned against panels smaller than 10 members and advised that Delphi studies have a 20% to 30% dropout range. Therefore, 25 participants were recruited to allow for attrition.

Data Collection and Analysis

The instruments used for each round are pivotal to a successful modified Delphi study. The literature review guided the creation of the Round 1 instrument; each subsequent round emerged from the previous round's results.

Participants

Table 3 provides the participants in the study and their backgrounds, expertise, and experiences. I reviewed the backgrounds of 46 expert applicants. Of those, 19 were rejected due to not having the required

experience (i.e., 13 had less than 5 years of experience, seven had worked on less than 5 projects, and 16 had led less than 3 projects). Twenty-seven experts were invited to participate; twenty-five accepted the invitation.

Table 3

Participant Demographics

P#	Occupation	Locality	Employees	Race	Gender
P1	Senior SE	Northeast U.S.	51-200	A	F
P2	IT Consultant / SE	Northeast U.S.	201-1000	BoAA	M
P3	Computer SE	Southwest U.S.	10,001+	W	M
P4	Senior Web Application Developer	Midwest U.S.	2-10	W	F
P5	Senior Front-End Developer	Midwest U.S.	10,001+	W	M
P6	Senior SE and Manager	Northwest U.S.	51-200	U	M
P7	SE	Northeast U.S.	10,001+	BoAA	M
P8	Software Engineering Manager	Northeast U.S.	11-50	HoL	M
P9	Chief Software Architect	Midwest U.S.	1001-5000	W	M
P10	Android SE	Northwest U.S.	1001-5000	A	M
P11	SE	Midwest U.S.	201-1000	BoAA	M
P12	SE	Northwest U.S.	51-200	W	F
P13	Lead SE	Northwest U.S.	51-200	U	M
P14	Sr. Software Development Consultant	Northeast U.S.	11-50	W	M
P15	Computer SE	Northeast U.S.	10,001+	A	M
P16	Engineering Program Manager	Northeast U.S.	10,001+	A	F
P17	SE / Software Architect	Northwest U.S.	11-50	W	M
P18	Business Owner / SE	Southeast U.S.	11-50	W	M
P19	Computer SE	Northeast U.S.	201-1000	W	M
P20	Director of Technology	Northwest U.S.	1001-5000	BoAA	M
P21	SE	Southwest U.S.	10,001+	W	M
P22	Software Engineering Manager	Northeast U.S.	10,001+	W	M
P23	SE	Northeast U.S.	1001-5000	BoAA	M
P24	Associate Director of IT	Southeast U.S.	1001-5000	W	M
P25	Senior Customer Engineer	Northwest U.S.	10,001+	W	M

Note. Of the 25 participants, 12 had academic degrees or certifications, 22 were considered experts in their organizations, and 8 were recognized as experts in software engineering. Abbreviations used are United States (U.S.), Female (F), Male (M), Asian (A), Black or African American (BoAA), Hispanic or Latino (HoL), Unknown (U), and White (W).

Data Collection

Following a strict timeline reduced attrition. A test run of Round 1 occurred on October 14, 2021, and the pilot ran smoothly. Participants received the Round 1 survey via Survey Monkey on October 18, 2021. The rounds and their response rates and dates are in Table 4.

Table 4

Data Collection Timeline and Survey Response Rates

Round	Start date	End date	Participants	Completed	Response rate
1	October 18, 2021	October 23, 2021	25	24	96%
2	October 25, 2021	October 29, 2021	24	23	96%
3	November 1, 2021	November 3, 2021	23	23	100%
4	November 4, 2021	November 10, 2021	23	23	100%

Data Analysis and Preliminary Findings

This modified Delphi project consisted of four rounds of survey analysis. The iterative process of the modified Delphi project requires analysis and findings between rounds because the results of each round inform the next rounds' survey instrument (Day & Bobeva, 2005).

Round 1

Round 1 began using the instrument created from the literature matrix, which was loaded into Survey Monkey and sent to the 25 participants who had accepted the invitation. That instrument contained 45 items (35 practices and 10 additional questions and comments). The instrument, literature matrix, and Round 1 response tables can be accessed through files found in the Supplementary Data. Instrument wording appears in Appendix B of the tables' titles for Tables B1 to B45 (see Supplementary Data). Participants were encouraged to agree or disagree with each item, provide feedback for their choices, and provide additional items with rationale. Table 5 shows how the items changed between rounds 1 and 2 based on participant feedback.

More than 50% of the participants agreed with the 35 practices. However, 44% of the participants disagreed with SE*s must use nonverbal postures, hand gestures, facial expressions, and voice tone to reinforce the intended message,* which was the practice receiving the most negative feedback and agreement level.

A total of 11 practices were revised using the participants' comments to increase clarity or capture the intended context of the original statement (Table 5). For example, I revised that *SEs must be willing to take and accept risks that may result in failure to explore new opportunities* because 29% of the experts provided the rationale for avoiding failure.

Table 5

Soft Skill Practice Revisions

Original Statement	Type of Practices	Revised Statement
	Communication	
Software engineers must speak clearly and concisely with confidence.		Software engineers must speak clearly and concisely.
Software engineers must synthesize messages from others considering their perspectives.		Software engineers must synthesize messages from others and consider their perspectives.
Software engineers must communicate with the appropriate technique, channel, and approach.		Software engineers must consider the context and setting when choosing communication methods.
Software engineers must consider the intellectual level and understanding of the-audience to explain complicated ideas clearly.		Software engineers must consider the background of the audience and be able to break down complicated ideas into concepts that can be simply understood by those who are not technical.
	Social	
Software engineers must establish and maintain positive relationships inside and outside an organization.		Software engineers must establish and maintain positive relationships with coworkers, clients, and vendors**.**
Software engineers must consider the diversity of other team members.		Software engineers must consider the many different perspectives of team members.
	Thinking	
Software engineers must identify and fill gaps in information required to solve problems.		Software engineers must identify and fill gaps in information required to solve problems.
	Leadership	
Software engineers must influence others to take action(s) otherwise not considered.		Software engineers must lead others to take action(s) otherwise not considered.
Software engineers must lead by example.		Software engineers must lead by example following rules, so as not to be hypocritical.

Software engineers must inspire a strong desire to succeed among team members by steering others towards successful goals and task completion.	Software engineers must inspire a strong desire to succeed among team members by encouraging others towards successful goals and task completion.
Software engineers must be willing to take and accept risks that may result in failure to explore new opportunities.	Software engineers must be willing to take and accept risks to explore new opportunities.

Note. See Appendix B in Supplementary Data for full list of participant comments leading to the changed items.

Recommendations were categorized into the four soft-skill categories, providing eight new communication practices, 10 new social practices, eight new thinking practices, and nine new leadership practices. Common themes identified from the comments that were not part of the original list of practices included written communication, empathy, health and wellness, and time management. Suggestions such as health and wellness were excluded from Round 2 because they are not soft skills. Table 6 provides the new instrument created from Round 1 results for Round 2.

Table 6

Additional Practices Moved to Round 2

Communication Practices
Software engineers must learn and practice public speaking.
Software engineers must listen to team members and stakeholders, incorporating the information they hear into the conversation.
Software engineers must use written communication to explain ideas clearly.
Software engineers must be open to receiving feedback and constructive criticism from supervisors, managers, and team members.
Software engineers must be able to write reports that provide details explanations about processes and objectives and describe design choices and products.
Software engineers must be able to use storying telling to convey complex ideas and keep others engaged in discussion.
Software engineers must have good presentation skills.
Software engineers must control the conversation, keeping the conversation open but within the scope of the conversation, so the main idea does not get lost.
Social Practices
Software engineers must realize when team members need help and reach out to them.
Software engineers must have humility and know when to say, “I don’t know.”
Software engineers must use empathy to understand and relate to problems others may share.
Software engineers must be able to improve their skills by teaching others.
Software engineers must set boundaries to avoid unhealthy relationships.
Software engineers must ask for help when the need arises.

Software engineers must play devil's advocate in a respectful manner.
Software engineers must cooperate with others by working alongside team members to achieve the goals of the organization.
Software engineers must ask team members what they can help with rather than asking if they need help.
Software engineers must speak up when they see something inappropriate that makes them or others uncomfortable.
Thinking Practices
Software engineers must be able to change priorities according to demands.
Software engineers must reflect on events to avoid problems in the future.
Software engineers must be aware of implicit biases and work on combating them.
Software engineers must be able to consider that their perspectives are wrong and adjust their approach to solving a problem.
Software engineers must be able to use design thinking to adapt ideas to new places.
Software engineers must be aware of time while developing new ideas and find solutions with real timelines.
Software engineers must balance practical and ideal solutions because the ideal solution could take unlimited time or resources.
Software engineers must be life-long learners.
Leadership Practices
Software engineers must be able to lead and manage teams efficiently.
Software engineers must make sure everyone has everything they need to be successful.
Software engineers must share goals publicly.
Software engineers must motivate employees by giving them new responsibilities to increase their investment in the organization.
Software engineers must give team members the opportunity take new challenges.
Software engineers must know when and how to delegate tasks.
Software engineers must give team members the opportunity to learn new skills.
Software engineers must look for opportunities to mentor team members.
Software engineers must empower team members.

Round 2

In Round 2, the experts rated the desirability and feasibility of the forward-looking practices using specially worded Likert-type scales for the desirability and feasibility ratings created by Linstone and Turoff (2002) for this type of Delphi study. The scale consisted of the following ratings: 1 = *very undesirable*, 2 = *undesirable*, 3 = *neither desirable nor undesirable*, 4 = *desirable*, and 5 = *very desirable*. The feasibility scale mirrored the desirability scale, changing *desirable* to *feasible.*

Delphi studies use a predetermined cutoff point to determine initial consensus, typically from 70% to 80%. While 27 practices earned > 80% for desirability, they were < 80% for feasibility, requiring omission from Round 3. For example, the experts rated *SEs must be open to receiving feedback and*

constructive criticism from supervisors, managers, and team members at 100%; however, the participants reported a 70% feasibility for the practice.

Participants were asked for rationales for ratings of 1 or 5. An example of an item receiving mixed feedback was that *SEs must have good presentation skills.* P12 said it was not required for the job (giving a 3 rating), while P19 gave a 5 rating, saying, "Presentation is a key aspect in delivering information to a group of people." Using the 80% cutoff point, 15 practices moved from Round 2 to Round 3 (Table 7).

Table 7

Round 3 Practices by Category

Communication
Software engineers must speak clearly and concisely.
Software engineers must synthesize messages from others and consider their perspectives.
Software engineers must actively listen to speakers, giving full attention to the speaker.
Software engineers must listen to team members and stakeholders, incorporating the information they hear into the conversation.
Social
Software engineers must collaborate with and support team members by sharing resources, ideas, and encouragement to achieve desired goals.
Software engineers must ask for help when the need arises.
Software engineers must cooperate with others by working alongside team members to achieve the goals of the organization.
Thinking
Software engineers must understand, articulate, and solve complex problems through analytical thinking.
Software engineers must learn and seek to fill gaps in information required to solve problems.
Software engineers must be adaptable and receptive to new ideas.
Software engineers must employ sound reasoning to make informed and timely decisions.
Software engineers must balance practical and ideal solutions because the ideal solution could take unlimited time or resources.
Software engineers must be life-long learners.
Leadership
Software engineers must clearly communicate expectations to team members.
Software engineers must communicate a clear vision and purpose to team members and stakeholders.

Round 3

The process for Round 3 included the experts' weight-ranking the remaining 15 practices. The rankings were A (*highest = 4*) to D (*lowest = 1*). Only practices with A or B were calculated into the final frequency rate, and an agreement level of 80% was used to rank the practices. Table 8 provides the final six practices for Round 3, ranked in order. This list answered the study's first research question: *What are the forward-looking practices that successful software engineering leaders perceive could improve the soft skills of software engineers?*

Table 8

Top-Ranked and Ordered Practices with Categories

Rank	Practice	Soft skill category
1	Software engineers must listen to team members and stake-holders, incorporating the information they hear into the conversation.	Communication
2	Software engineers must speak clearly and concisely.	Communication
3	Software engineers must clearly communicate expectations to team members.	Leadership
4	Software engineers must synthesize messages from others and consider their perspectives.	Communication
5	Software engineers must employ sound reasoning to make informed and timely decisions.	Thinking
6	Software engineers must understand, articulate, and solve complex problems through analytical thinking.	Thinking

Round 4

Confidence levels for the final listed practices resulted from the Round 4 iteration from the experts. Table 9 items were sent to 24 participants, and 23 responded; they were asked to rate each item on a 5-point Likert scale regarding confidence, where 1 = *not confident at all*, 2 = *somewhat unconfident*, 3 = *neither confident nor unconfident*, 4 = *mostly confident*, 5 = *very confident*. Every participant ranked the items as either *mostly confident* (45%) or *very confident* (55%) and provided feedback rationalizing their scores. Table 9 organizes their comments among confidence levels. Because all of the remaining practices received ratings of 4 or 5, they all comprise the study's final findings, answering Research Question 2: *To what extent is there consensus among a panel of soft-skilled, expert software engineering*

leaders as to desirable and feasible, forward-looking practices which could improve the soft skills of SEs?

Table 9

Final Confidence Ratings of Participants

P	Mostly Confident
P1	This captures the majority of the role of software engineers. Software engineer must also have good organizational skills
P5	I think this is a perfect group of practices software engineers must have for soft skills. Having these 6 critical skills together will make them good team players, good thinkers and thus keep them on track for any project.
P6	I think the 6 practices identified are the most important soft skills that a software engineer must have. I would also add that Software Engineers must be able to identify, evaluate and provide solutions that align to current timelines, budget, and the reality of the project.
P7	I feel that grouping this six skills together is good and proper because they all work hand in hand.
P10	Most of the choices are focused on clear communication and rational decisions and I believe that those are central to improving soft skills. The more engineers communicate effectively the better off the projects they work in will be as well as their relationships with teammates. Considering others' perspectives is crucial towards getting to the best solution as well by getting a wide range of inputs and opinions.
P12	I think it is a very solid list of soft skills for software engineers. The above-mentioned attributes strongly develop and make them successful in their workplaces and even beyond.
P15	I know I'm confident in this six practices we have been talking about.
P17	Sometimes get mixed feedback from the team. Some say everything is very clear and others say things can be more clear when I propose something
P18	Though being able to code, think analytically, and find solutions is very important, in the current work environment, being able to communicate effectively is what separates the great developers from the rest. You can find plenty of people who can sling code, but finding someone who can understand the problem from all perspectives, and work in tandem with other arms of the business to find solutions is truly valuable. I feel that

	working on increasing the skills of software engineers in the soft skill area helps make developers that understand the whole problem, the purpose of the exercise, and come up with timely and effective solutions. In my experience I have seen more projects fail because of poor communication on expectations and reasons for the project than I ever have from technical issues. With Agile and other formats taking hold in all areas, the ability to understand the larger picture and communicate it is going to be the linchpin of any good organization.
P23	I like that it emphasizes clarity of communication, which I think is a huge bottleneck to technical communication
	Very Confident
P8	This is a very good list, however, I did feel there were some other skills that were equally if not more important than some listed above
P9	I feel mostly confident that I have these skills, but probably all of them still have room for improvement.
P11	These skills seems to group around communication and problem solving, which are all critical skills for being an effective software engineer
P13	This looks like it aligns mostly if not completely with my rankings from the previous session. I agree with all of these statements and I think these are the most important items out of the sets that were included in the previous sessions. In addition to being able to solve problems and create sound designs & implementations (which is really the core task of being an engineer), engineers need to be able to listen and communicate well, which is the core of most of the statements above.
P16	Going through those skills again, makes me even realize how more they are important and how they are going to skyrocket the improvements of soft skills of software engineers, because they all work together.
P19	I respond affirmatively to each of these statements without reservation.
P20	I feel like success is contingent on the individual's willingness to embrace soft skills, that being a software engineer is more than being smart. If an individual is willing, then I'm mostly confident that these skills will work.
P21	Yeah, it was worth it
P22	I remember that these are ones that I thought were the most important, so I'm happy to see that other people felt that way also.

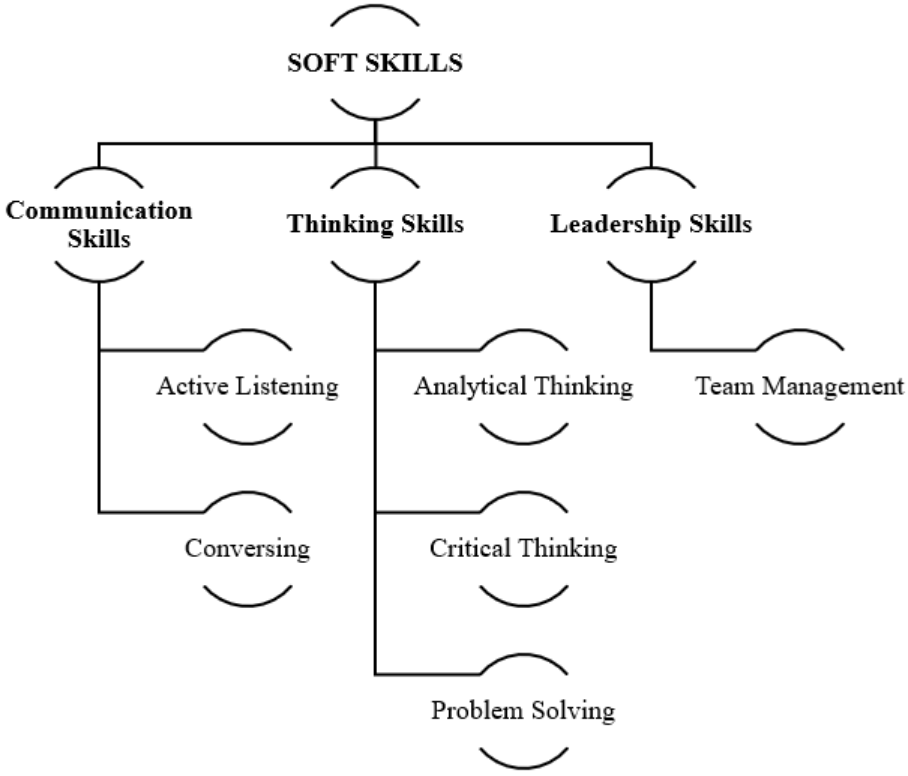
Note. Comments are provided verbatim.

Discussion and Implications

In the pre-study applied framework (Figure 1), the stated study goals were to identify the forward-looking practices that experts recommended, by consensus, as desirable and feasible soft-skills practices of software engineers. The pre-study soft-skills framework (Figure 2) included four categories and 12 competencies. The study experts agreed that of those original categories and competencies, three categories and six competencies (Table 8) were applicable. Social skills did not appear as one of the final categories, with leadership, communication, and thinking skills remaining as categories and contributing to the final framework. The final soft-skills competency framework is shown in Figure 3.

Figure 3

Styron Soft-Skills Competency Framework



Application to the Literature

The project's findings align with scholarly and practitioner literature emphasizing soft skills' importance. This project extended the research of Matturro et al. (2019). Industry experts' identification and evaluation of current, historical, and forward-looking practices produced a list of desirable and feasible top-ranked practices, adding to the literature concerning soft skills and software engineering.

This project confirmed the research of Hidayati et al. (2020) and Júnior (2018), who reported communication as one of the top skills required by software development teams. Alqaisi's (2018) study explained that communication is a dynamic process where the sender and receiver interchange interactively, exchanging feedback with each other to communicate emerged out of the six remaining practices. Gishin (2020) explained that communication, in the form of understandable information conveyance, was the most critical soft skill. Sekhar (2019) stated that software engineers must consider cultural differences when developing messaging. Each of this study's findings supported these previous research studies.

Cunningham et al. (2020) stated that communication is a critical component of leadership used to accomplish goals. The forward-looking practice of "SEs must communicate expectations to team members" supported the research of Galli (2021), who offered that leaders must communicate expectations so that followers clearly understand what is required to be successful. The leadership practice emphasizes the importance noted by Galli (20201) that the foundation of effective leadership is rooted in communication.

The forward-looking practices related to the category of thinking soft skills accentuated the importance of analytical thinking and problem-solving by SEs, as noted by Gishin (2020) and Waychal and Capretz (2017). The practice of "SEs must employ sound reasoning to make informed and timely decisions" confirmed the research of Barron and Rose (2021), who found that making effective decisions requires sound reasoning based on the evaluation and assimilation of information from multiple sources. The thinking practice of "SEs must understand, articulate, and solve complex problems through analytical thinking" reinforced the research of Werewka and Wietecha (2018). These two thinking practices stress the importance of SEs' analysis, verification, and assessment of problems to create viable solutions.

This project contributed to practitioner knowledge by narrowing the knowledge gap for applying practices to improve SEs' soft skills. The literature review of historical and current practices identified 35 soft skills practices, and the expert panel suggested an additional 35 practices that may increase the soft skills of SEs. Seventy practices identified in this project may assist leaders with developing SEs' soft skills. Fifteen practices were deemed desirable and feasible by the panel of experts at 80% agreement; however, 27 were rated desirable and feasible at 70% agreement, providing practitioners with additional practices that may be beneficial for improving soft skills.

The final results present the six top-ranked practices that may be the most important to practitioners. The results of this project contribute to practitioner knowledge by providing these practices from industry leaders. The insight gained from this project may help solve the specific business problem noted by Capretz and Ahmed (2018) that SEs' soft skill deficiencies result in high software project failure rates. Improving SEs' soft skills may increase project success.

Project Application and Recommendations

The findings of this project may be applied to the business need for strategies to address the SEs' soft skills deficits that affect project outcomes, as noted by Dean and East (2019). The continued growth of the software industry has increased the demand for leaders to develop the abilities of SEs to increase project success (Capretz & Ahmed, 2018). Organizational leaders attempt to meet this demand by investing in interactive training and workshops to help engineers build soft skills (Hyder & Iraqi, 2019). P18 stated,

> I feel that working on increasing the skills of SEs in the soft skill area helps make developers that understand the whole problem, the purpose of the exercise, and come up with timely and effective solutions. In my experience I have seen more projects fail because of poor communication on expectations and reasons for the project than I ever have from technical issues.

The results of this project may assist leaders with developing training programs that highlight the importance and application of practices to improve SEs' soft skills. I recommend that software engineering leaders use the six top-ranked practices identified by the experts in this project to form the basis for training programs to improve the SEs' soft skills. The confidence of the expert panel indicates that these practices may improve soft skills for SEs and other professionals.

Ibrahim et al. (2017) proposed role-playing and game activities for soft skills development. I recommend that leaders use gamification techniques to assist SEs with *understanding, articulating, and solving complex problems using analytical thinking*. Gamification may increase the transfer of soft skills that, according to Charoensap-Kelly et al. (2016), are more difficult than hard skills because soft skills are more challenging to measure. SEs should embrace leadership by *clearly communicating expectations to team members*. Leadership workshops would help engineers build the soft skills necessary to meet the demands of their organization.

Recommendations for future research include evaluating the feasibility of specific soft skills identified in this project and comparing the soft skill practices used by SEs with software engineering leaders. How do the soft skills necessary for success differ between these two roles? Future research may contribute to software engineering and add to the body of knowledge concerning soft skills.

Conclusion

This study emphasized the importance of soft skills for SEs to communicate with others, work in teams, problem-solve, and lead projects. P1 summed it best by stating, "Soft skills are about the human connection. We're not just machines even though we interact with them a lot." Soft skills enable SEs to work with people and accomplish the organization's goals (Capretz & Ahmed, 2018). This project intended to and did provide industry leaders with real-world practices to improve the soft skills of SEs.

References

AbuJbara, N. A. K., & Worley, J. A. (2018). Leading toward new horizons with soft skills. *On the Horizon-The Strategic Planning Resource for Education Professionals*, *26*(3), 247–259. https://doi.org/10.1108/oth-10-2017-0085

Ahmad, M., Butt, W. H., & Ahmad, A. (2019, October 18–20). *Advance recommendation system for the formation of more prolific and dynamic software project teams*. IEEE 10th International Conference on Software Engineering and Service Science, Beijing, China. https://doi.org/10.1109/icsess47205.2019.9040791

Ahmed, F., Campbell, P., Beg, A., & Capretz, L. F. (2015). *What soft skills software architect should have? A reflection from software industry.* International Conference on Computer Communication and Management, Sydney, Australia. https://ui.adsabs.harvard.edu/abs/2015arXiv150807283A

Almeida, F., & Morais, J. (2021, May 23). Strategies for developing soft skills among higher engineering courses. *Journal of Education*. https://doi.org/10.1177/00220574211016417

Alqaisi, F. (2018, May). The effects of stakeholder's engagement and communication management on projects success. *MATEC Web of Conferences*, *162*, Article 02037. https://doi.org/10.1051/matecconf/201816202037

Badjie, G. (2020). Leadership should or should not delegate communication? (A systematic literature review: The art of delegation). *Eksis: Jurnal Riset Ekonomi dan Bisnis*, *15*(2), 67–78. https://ejournal.stiedewantara.ac.id/index.php/001/issue/view/753

Bailey, J. (2014). Nontechnical skills for success in a technical world. *International Journal of Business and Social Science, 5*(4), 1–10. http://ijbssnet.com/journals/Vol_5_No_4_Special_Issue_March_2014/1.pdf

Ballesteros-Sánchez, L., Ortiz-Marcos, I., & Rodríguez-Rivero, R. (2019). The impact of executive coaching on project managers' personal competencies. *Project Management Journal*, *50*(3), 306–321. https://doi.org/10.1177/8756972819832191

Bardecki, M. J. (1984). Participants' response to the Delphi method: An attitudinal perspective. *Technological Forecasting and Social Change, 25*(3), 281–292. https://doi.org/10.1016/0040-1625(84)90006-4

Baron-Cohen, S. (2000). Theory of mind and autism: A fifteen-year review. *Understanding Other Minds: Perspectives from Developmental Cognitive Neuroscience* (pp. 3–20). Oxford University Press. https://docs.autismresearchcentre.com/papers/2000_SBC_Theory-of-mind-and-autism-review.pdf

Barron, L. G., & Rose, M. R. (2021). Malleability of soft-skill competencies. *Journal of Military Learning, 5*(1), 1–85. https://www.armyupress.army.mil/Journals/Journal-of-Military-Learning/Journal-of-Military-Learning-Archives/April-2021/Barron-Rose-Soft-Skill/

Bolte, S., Dehmer, J., & Niemann, J. (2018). Digital leadership 4.0. *ACTA Technica Napocensis-Series: Applied Mathematics, Mechanics, and Engineering*, *61*(4), 637–646. https://atna-mam.utcluj.ro/index.php/Acta/article/view/1102

Brink, K. E., & Costigan, R. D. (2015). Oral communication skills: Are the priorities of the workplace and AACSB-accredited business programs aligned? *Academy of Management Learning & Education*, *14*(2), 205–221. http://doi.org/10.5465/amle.2013.0044

Burbekova, S. (2021, April 28-30). *Soft skills as the most in-demand skills of future IT specialists*. 2021 IEEE International Conference on Smart Information Systems and Technologies, Nur-Sultan, Kazakhstan. https://doi.org/10.1109/SIST50301.2021.9465935

Capretz, L. F., & Ahmed, F. (2018). A call to promote soft skills in software engineering [Editorial]. *Psychology and Cognitive Sciences, 4*(1), e1–e3. https://doi.org/10.17140/PCSOJ-4-e011

Chaibate, H., Hadek, A., Ajana, S., Bakkali, S., & Faraj, K. (2019). A comparative study of the engineering soft skills required by Moroccan job market. *International Journal of Higher Education, 9*(1), 142. https://doi.org/10.5430/ijhe.v9n1p142

Charoensap-Kelly, P., Broussard, L., Lindsly, M., & Troy, M. (2016). Evaluation of a soft skills training program. *Business and Professional Communication Quarterly, 79*(2), 154–179. https://doi.org/10.1177/2329490615602090

Coffelt, T. A., Baker, M. J., & Corey, R. C. (2016). Business communication practices from employers' perspectives. *Business and Professional Communication Quarterly*, *79*(3), 300–316. https://doi.org/10.1177/232949061664

Cook, D. (2019, July). *IBISWorld industry report 51121. Software publishing in the US.* https://www.ibisworld.com/united-states/market-research-reports/software-publishing-industry/

Cunningham, C. M., Hazel, M., & Hayes, T. J. (2020). Communication and leadership 2020: Intersectional, mindful, and digital. *Communication Research Trends*, *39*(1), 4–31. https://www.thefreelibrary.com/Communication+and+Leadership+2020%3A+Intersectional%2C+Mindful%2C+and...-a0621691480

da Silva, F. Q., Monteiro, C. V., dos Santos, I. E., & Capretz, L. F. (2016). How software development group leaders influence team members' innovative behavior. *IEEE Software*, *33*(5), 106–109. https://doi.org/10.1109/MS.2016.120

Day, J., & Bobeva, M. (2005). A generic toolkit for the successful management of Delphi studies. *The Electronic Journal of Business Research Methodology*, *3*(2), 103–116. https://doi.org/10.1.1.126.426

Dean, S. A., & East, J. I. (2019). Soft skills needed for the 21st-century workforce. *International Journal of Applied Management and Technology, 18*(1), 17–32. https://doi.org/10.5590/ijamt.2019.18.1.02

de Campos, D. B., de Resende, L. M. M., & Fagundes, A. B. (2020). The importance of soft skills for the engineering. *Creative Education*, *11*(08), 1504. https://doi.org/10.4236/ce.2020.118109

DeFranco, J. F., & Laplante, P. A. (2017). Review and analysis of software development team communication research. *IEEE Transactions on Professional Communication, 60*(2), 165–182. https://doi.org/10.1109/TPC.2017.2656626

Deming, D. J. (2017). The growing importance of social skills in the labor market. *The Quarterly Journal of Economics, 132*(4), 1593–1640. https://doi.org/10.1093/qje/qjx022

Dubey, R. S., & Tiwari, V. (2020). Operationalisation of soft skill attributes and determining the existing gap in novice ICT professionals. *International Journal of Information Management*, *50*, 375–386. https://doi.org/10.1016/j.ijinfomgt.2019.09.006

Edison, H., Wang, X., Jabangwe, R., & Abrahamsson, P. (2018). Innovation initiatives in large software companies: A systematic mapping study. *Information and Software Technology, 95*, 1–14. https://doi.org/10.1016/j.infsof.2017.12.007

Galli, B. J. (2021). The relationship and impact of communication on leadership: A research note. *International Journal of Applied Management Sciences and Engineering*, *8*(1), 1–11. https://doi.org/10.4018/IJAMSE.2021010101

Gentry, W. A., Weber, T. J., & Sadri, G. (2016). *Empathy in the workplace: A tool for effective leadership.* [White Paper]. Center for Creative Leadership. https://doi.org/10.35613/ccl.2016.1070

Gibert, A., Tozer, W. C., & Westoby, M. (2017). Teamwork, soft skills, and research training. *Trends in Ecology & Evolution*, *32*(2), 81–84. https://doi.org/10.1016/j.tree.2016.11.004

Ginting, H., Mahiranissa, A., Bekti, R., & Febriansyah, H. (2020). The effect of outing team building training on soft skills among MBA students. *The International Journal of Management Education*, *18*(3), 100423. https://doi.org/10.1016/j.ijme.2020.100423

Giray, G. (2019, September). *An analysis of desired skills for software development jobs in Turkey using text mining*. Turkish National Software Engineering Symposium, Izmir, Turkey. https://www.researchgate.net/publication/335234799_An_Analysis_of_Desired_Skills_for_Software_Development_Jobs_in_Turkey_Using_Text_Mining

Gishin, D. (2020). The role of soft skills and competencies for a successful career in the IT sector. *Journal of Informatics and Innovative Technologies (JIIT), 4*(2), 45–58. https://journal.iiit.bg/wp-content/uploads/2020/04/br4_2019.pdf

Golay, D. (2020). Technology and societal changes: A complex story with many possible endings. *XRDS, 27*(2), 5–6. https://doi.org/10.1145/3433116

Groeneveld, W., Vennekens, J., & Aerts, K. (2019). Software engineering education beyond the technical: A systematic literature review *arXiv.org e-Print Archive*. https://arxiv.org/ftp/arxiv/papers/1910/1910.09865.pdf

Guidiy, T. L., Halligan, B. B., & Peters, C. (2018). Strategies for handling failures in development of information systems. *Journal of Managerial Issues*, *30*(3), 363–377. https://www.scribd.com/document/436578773/Strategies-for-Handling-Failures-in-Development-of-Is

Gupta, S., & Gouttam, D. (2017). *Towards changing the paradigm of software development in software industries: An emergence of agile software development.* 2017 IEEE International Conference on Smart Technologies and Management for Computing, Communication, Controls, Energy and Materials (ICSTM), Chennai, India. https://doi.org/10.1109/icstm.2017.8089120

Hawawsheh, B. A. (2020). The impact of project managers' soft skills on project management performance in Jordan: A literature review. *Noble International Journal of Business and Management Research, 4*(3), 20–25. https://ideas.repec.org/a/nap/nijbmr/2020p20-25.html

Hidayati, A., Budiardjo, E. K., & Purwandari, B. (2020, January). Hard and soft skills for scrum global software development teams. *Proceedings of the 3rd International Conference on Software Engineering and Information Management*, Sydney, NSW, Australia. https://doi.org/10.1145/3378936.3378966

Hyder, M., & Iraqi, K. M. (2019). Paradigm shift of leadership: Leaders in information technology. *The Islamic Culture* (41), 166–175. http://theislamicculture.com/index.php/tis/article/view/600

Ibrahim, R., Boerhannoeddin, A., & Bakare, K. K. (2017). The effect of soft skills and training methodology on employee performance. *European Journal of Training and Development, 41*(4), 388–406. https://doi.org/10.1108/ejtd-08-2016-0066

Iriarte, C., & Orè, S. B. (2017). Soft skills for IT project success: A systematic literature review. *Trends and Applications in Software Development*, (pp. 147–158) Springer. https://doi.org/10.1007/978-3-319-69341-5_14

Istiyowati, L. S., Syahrial, Z., & Muslim, S. (2020). Programmer's competencies between industry and education. *Universal Journal of Educational Research*, *8*(9A), 10–15. https://doi.org/10.13189/ujer.2020.082002

Jena, A., & Satpathy, S. S. (2017). Importance of soft skills in project management. *International Journal of Scientific Research and Management*, *5*(7), 6173–6180. https://doi.org/10.18535/ijsrm/v5i7.45

Jia, J., Chen, Z., & Du, X. (2017, July 21–24). *Understanding soft skills requirements for mobile applications developers.* 2017 IEEE International Conference on Computational Science and Engineering (CSE) and IEEE International Conference on Embedded and Ubiquitous Computing (EUC), Guangzhou, China. https://doi.org/10.1109/cse-euc.2017.29

Johansson, C. (2018). Leadership communication. *The International Encyclopedia of Strategic Communication* (pp. 1–16). https://doi.org/10.1002/9781119010722.iesc0099

Johnson, B. (2021). Soft skills-essential for success. *BMH Medical Journal*, *8*(3), 99–102. https://babymhospital.org/BMH_MJ/index.php/BMHMJ/article/view/311

Johnson, J. (2020). *CHAOS 2020: Beyond infinity*. The Standish Group.

Júnior, N. L. (2018, May). Toward a theory of communication in distributed software development teams: *ICGSE '18: Proceedings of the 13th International Conference on Global Software Engineering*, (pp. 140–143). IEEE. https://doi.org/10.1145/3196369.3196384

Kappelman, L. A., Jones, M. C., Johnson, V., & McLean, E. R. (2016). Skills for success at different stages of an IT professional's career. *Communications of the ACM, 59*, 64–70. https://doi.org/10.1145/2888391

Kechagias, K. (Ed.). (2011). *Teaching and assessing soft skills*. 1st Second Chance School of Thessaloniki. http://research.education.nmsu.edu/files/2014/01/396_MASS-wp4-final-report-part-1.pdf

Kerzner, H. (2017). *Project management: A systems approach to planning, scheduling, and controlling*. Wiley. https://doi.org/10.3280/pm2010-003015

Klein, M. (2020). Leadership characteristics in the era of digital transformation. *Business & Management Studies: An International Journal*, *8*(1), 883–902. https://doi.org/10.15295/bmij.v8i1.1441

Komla, T., Lui, S. M., Marion, H., Pryce, J., Li, Y., & Sharee, B. (2018). Developing soft skills: Exploring the feasibility of an Australian well-being program for health managers and leaders in Timor-Leste. *SAGE, 8*(4), 1–13. https://doi.org/10.1177/2158244018811404

Kuratko, D. F., Covin, J. G., & Hornsby, J. S. (2014). Why implementing corporate innovation is so difficult. *Business Horizons, 57*(5), 647–655. https://doi.org/10.1016/j.bushor.2014.05.007

Lansdell, P. A., Mohammadali-Haji, A., & Marx, B. (2020). University accounting programmes and the development of industry 4.0 soft skills. *Journal of Economic and Financial Sciences*, *13*(1), 1–17. https://doi.org/10.4102/jef.v13i1.470

Lauesen, S. (2020). IT project failures, causes and cures. *IEEE Access,* 8, 72059-72067. https://doi.org/10.1109/access.2020.2986545

Lehtinen, T. O. A., Mäntylä, M. V., Vanhanen, J., Itkonen, J., & Lassenius, C. (2014). Perceived causes of software project failures – An analysis of their relationships. *Information and Software Technology, 56*(6), 623–643. https://doi.org/10.1016/j.infsof.2014.01.015

Linstone, H. A., & Turoff, M. (Eds.). (2002). *The Delphi method: Techniques and applications*. Addison-Wesley. https://web.njit.edu/~turoff/pubs/delphibook/delphibook.pdf

Mahasneh, J. K., & Thabet, W. (2016). *Rethinking construction curriculum: Towards a standard soft skills taxonomy*. 52nd ASC Annual International Conference, Associated Schools of Construction, Provo, UT, United States. http://ascpro0.ascweb.org/archives/cd/2016/paper/CERT137002016.pdf

Matturro, G., Raschetti, F., & Fontán, C. (2019). A systematic mapping study on soft skills in software engineering. *Journal of Universal Computer Science, 25*(1), 16–41. http://www.jucs.org/jucs_25_1/a_systematic_mapping_study/jucs_25_01_0016_0041_matturo.pdf

McKnight, S. T., Maniam, B., & Robertson, J. (2019). Effects of technology innovations on business. *Journal of Business and Behavioral Sciences, 31*(1), 84–101. http://asbbs.org/files/2019/JBBS_31.1_Spring_2019.pdf

Moss, P., & Tilly, C. (2001). *Stories employers tell: Race, skill, and hiring in America*. Russell Sage Foundation.

Mtsweni, E. S., Hörne, T., & van der Poll, J. A. (2016). Soft skills for software project team members. *International Journal of Computer Theory and Engineering*, *8*(2), 150–155. https://doi.org/10.7763/ijcte.2016.v8.1035

Northouse, P. G. (2018). *Leadership: Theory and practice*. Sage. https://scholar.google.com/scholar?q=Northouse,+P.+G.+(2018).+Leadership:+Theory+and+practice.+Sage+publications.&hl=en&as_sdt=0&as_vis=1&oi=scholart

Pallathadka, H. (2020). Inculcating soft skills: A significant need of the hour in 21st century workforce. *European Journal of Molecular & Clinical Medicine*, *7*(9), 3809–3815.

Pekaar, K. A., Bakker, A. B., van der Linden, D., Born, M. P., & Sirén, H. J. (2018). Managing own and others' emotions: A weekly diary study on the enactment of emotional intelligence. *Journal of Vocational Behavior, 109*, 137-151. https://doi.org/10.1016/j.jvb.2018.10.004

Pieterse, V., & van Eekelen, M. (2016, July). Which are harder? Soft skills or hard skills? *ICT Education,* 160–167. https://doi.org/10.1007/978-3-319-47680-3_15

Promsri, C. (2019). The developing model of digital leadership for a successful digital transformation. *GPH-International Journal of Business Management (IJBM)*, *2*(8), 1–8. http://www.gphjournal.org/index.php/bm

Rao, M. S. (2018). Soft skills: Toward a sanctimonious discipline. *On the Horizon, 26*(3), 215–224. https://doi.org/10.1108/OTH-06-2017-0034

Ravindranath, S. (2016). Soft skills in project management: A review. *IUP Journal of Soft Skills, 10*(4), 16–25. https://www.iupindia.in/1703/Soft%20Skills/Networking_and_Career_Development.html

Rybakova, A., Vinogradova, M., & Sizikova, V. (2019, September 28–29). *Advancing leadership careers with leadership competences.* 5th International Conference on Social, Economic, and Academic Leadership (ICSEALV 2019), Prague, Czech Republic. https://dx.doi.org/10.2991/assehr.k.191221.181

Sekhar, G. R. (2019). Teaching soft skills: A necessity in modern era. *Research Journal of English Language and Literature*, *7*(1), 109–117. https://doi.org/10.33329/rjelal.7119.109

Shuck, B., & Herd, A. M. (2012). Employee engagement and leadership: Exploring the convergence of two frameworks and implications for leadership development in HRD. *Human Resources Development Review*, *11*(2), 156–181. https://doi.org/10.1177/1534484312438211

Skulmoski, G., Hartman, F., & Krahn, J. (2007). The Delphi method for graduate research. *Journal of Information Technology Education, 6,* 1–21. https://doi.org/10.28945/199

Sopa, A., Asbari, M., Purwanto, A., Santoso, P. B., Ramdan, M., Primahendra, R., Mustofa, D. H., Hutagalung, D., Maesaroh, S., & Pembangunan, S. I. (2020). Hard skills versus soft skills: Which are more important for Indonesian employees' innovation capability. *International Journal of Control and Automation*, *13*(2), 156–175. https://www.researchgate.net/publication/340412466

Srivastava, P., & Jain, S. (2017). A leadership framework for distributed self-organized scrum teams. *Team Performance Management: An International Journal, 23*(5), 293–314. https://doi.org/10.1108/TPM-06-2016-0033

Stevens, M., & Norman, R. (2016). *Industry expectations of soft skills in IT graduates: a regional survey*. Proceedings of the Australasian Computer Science Week Multiconference, Canberra, Australia. https://doi.org/10.1145/2843043.2843068

User Interviews. (n.d.). User Interviews: Recruit participants for UX research. https://www.userinterviews.com/recruit-our-participants

Vanebo, R. B., & Kjorstad, M. (2020, July). An interactive tool for collaboration and knowledge sharing of customer needs in the conceptual phase. *INCOSE International Symposium,* 30(1), 902–919. https://doi.org/10.1002/j.2334-5837.2020.00762.x

Vernon, W. (2009). The Delphi technique: A review. *International Journal of Therapy and Rehabilitation, 16*(2), 69–76. https://doi.org/10.12968/ijtr.2009.16.2.38892

Watt, G., & Abrams, H. (2019). *Lean entrepreneurship: Innovation in the modern enterprise.* Apress. https://doi.org/10.1007/978-1-4842-3942-1_2

Waychal, P., & Capretz, L. F. (2017). *Need for a soft dimension*. 3rd International Conference on Software Engineering, Geneva, Switzerland. https://doi.org/10.5121/csit.2017.70414

Waychal, P., & Capretz, L. F. (2018). Universality of egoless behavior of software engineering students. *International Journal of Technology and Human Interaction*, *14*(1), 99–112. https://doi.org/10.4018/ijthi.2018010106

Weber, M. R., Crawford, A., Rivera, D., Jr., & Finley, D. A. (2010). Using Delphi panels to assess soft skill competencies in entry level managers. *Journal of Tourism Insights*, *1*(1), 12. https://doi.org/10.9707/2328-0824.1011

Weber, M. R., Finley, D. A., Crawford, A., & Rivera, D., Jr. (2009). An exploratory study identifying soft skill competencies in entry-level managers. *Tourism & Hospitality Research*, *9*(4), 353–361. https://doi.org/10.1057/thr.2009.22

Werewka, J., & Wietecha, M. (2018). Sustainable soft competences development of software developers by communication skills training. *Scientific Papers of Silesian University of Technology. Organization and Management Series, 116(1995)*, 189–220. http://doi.org/10.29119/1641-3466.2018.116.14

Zahid, A. H. A., Haider, M. W., Farooq, M. S., Abid, A., & Ali, A. (2018). A critical analysis of software failure causes from project management perspectives. *VFAST Transactions on Software Engineering*, *6*(1), 62–68. https://doi.org/10.21015/vtse.v13i3.512

Zaman, U., Jabbar, Z., Nawaz, S., & Abbas, M. (2019). Understanding the soft side of software projects: An empirical study on the interactive effects of social skills and political skills on complexity – performance relationship. *International Journal of Project Management, 37*(3), 444–460. https://doi.org/10.1016/j.ijproman.2019.01.015

Zhang, F., Zuo, J., & Zillante, G. (2013). Identification and evaluation of the key social competencies for Chinese construction project managers. *International Journal of Project Management*, *31*(5), 748–759. https://doi.org/10.1016/j.ijproman.2012.10.011

Zorić, T., & Stojanov, Ž. (2018). Software developers' perceptions of soft skills in software requirements engineering. *Journal of Engineering Management and Competitiveness, 8*(1), 54–64. https://doi.org/10.5937/jemc1801054z

Zykov, S. V., & Attakorah, J. A. (2020). Survey of human factors in crisis responsive software development. *arXiv.org e-Print Archive*. https://arxiv.org/abs/2007.12019

Appendices A and B to the study are located in the Supplementary Data file found here: https://drive.google.com/file/d/1XFH_I3aGV7YvJ7X7_D_48UTdqxk_M4Xd/view?usp=sharing

Business Management Research and Applications: A Cross-Disciplinary Journal (BMRA) (ISSN 2769-4666) is an open-access (CC BY-ND 4.0), peer-reviewed journal that publishes original research as well as works that explore the applied implications of others' research, conceptual papers, and case studies (including teaching notes for review) that have a business administration and management slant. *BMRA* welcomes original submissions from researchers, practitioners, and Master's/doctoral students from the following disciplines: business management, occupational safety, cybersecurity, finance, marketing, entrepreneurship, public administration, health services, fire safety, human resources, project management, healthcare management, and information technology. Master's degree-level student authors must be co-authors with faculty or professional researchers in the field. *BMRA* is a participant with the LOCKSS archival system, **Alabama Digital Preservation Network | ADPNet**.

Register and submit your work to

Business Management Research and Applications: A Cross-Disciplinary Journal (columbiasouthern.edu)