TABLE XXXVI
CRITERIA LIST FOR CONTRACTING PROFESSIONALS IN GSD - 1/8

| Code | Criteria | Description | Cited* |
|---|---|---|---|
| C001 | Communication | Communication is the biggest challenge for GSD due to the need for adequate and proper ways of communication in general. In addition, the reduced communication frequency with the project team members became a problem due to the need for more informal or face-to-face contact [31], [44]. | 33 (51%) |
| C002 | English domain | The different language usage among distributed team members. The English language has been widely used as a professional language at national and international platforms [31], [79]. | 19 (29%) |
| C003 | Cultural differences among teams | Each culture has its standards, styles, and moral principles, which can provoke communication-related issues when individuals from different cultural backgrounds communicate with another one [31]. | 27 (42%) |
| C004 | Temporal issues | Temporal issues are related to the time difference between teams that work in several remote locations. Delayed feedback and responses are problematic and restrict the possibility of synchronous interaction, cooperation, and confidential assessment. This criterion is related to the geographic dimension [31], [58]. | 22 (34%) |
| C005 | Fear impact | Fear's impact can manifest itself in numerous ways, including the desire to prevent or limit communication with remote colleagues. In some instances, the objective can be to hinder the work of these remote colleagues directly [77]. | 2 (3%) |
| C006 | Employee Satisfaction | In GSD, the work typically is outsourced or offshore, so it is equally challenging to be motivated, cooperative, and supportive of remote colleagues who are often seen as on the brink of replacing them. These issues negatively impact team members' motivation levels. Thus, this became a human resource problem [77]. | 5 (8%) |
| C007 | Trust building | Personal or impersonal, including cognitive trust, refers to beliefs about others' competence and reliability. This can lead individuals to engage in less self-protective actions and be more likely to take risks [40], [44], [55]. | 28 (43%) |
| C008 | Degree of cooperation | Collaboration among distributed teams. Numerous issues directly mitigate against establishing cooperation in the global team environment. In these circumstances, cooperation between team locations must be developed, established, and effectively managed from the project management perspective to avoid the reluctance to share information [39], [77], [89]. | 14 (22%) |
| C009 | Precise cost estimation | While transferring knowledge from client location to offshore location, the knowledge transfer takes a long time and requires more iterations. It isn't easy to measure how much cost it must invest for knowledge transfer. [38], [39]. | 10 (15%) |
| C010 | Effective leadership | The teams may be formed without planning, lacking the required knowledge and skills. Skilled leadership that has the expertise to assess and analyze the impact of demanded changes and will make the right decision at the right time. Lack of integration planning and lack of management. An effective integration plan is necessary for all Global Software Development projects, especially for large one, to be successful at the integration stage [38], [43]. | 14 (22%) |
| C011 | Project failure risk | There are micro and macro-risk elements. Micro-risks can often be correctly determined, and alternative strategies put in place to mitigate their potential impact. Macro-risks, on the other hand, may not even be considered. It is important to analyze the need and the root cause of change [38], [77]. | 5 (8%) |
| C012 | Defined of roles and responsibilities | Defined roles and responsibilities are essential to assign the proper responsibility and task to the right person and time and should be clearly defined, articulated, and effectively disseminated for all team members [38], [77]. | 16 (25%) |
| C013 | Technical requirements | We must base the selection of global team members on the project's technical requirements. Therefore, the Project Manager needs direct access to information about the academic and technical skills and experiences of potential team members [77]. | 2 (3%) |
| C014 | Effective Partitioning | Effective task partitioning between team members and sites can be modularized, phased, or integrated. The selection often depends on the nature of the work or the physical location of specific tools or skill sets [77]. | 2 (3%) |
| C015 | Team Skills Database | All global team members' technical capability and skill levels must be available to the Project Manager to facilitate effective global team operation. In addition, this information needs to be efficiently maintained, understood, and easily accessible. It is a human resource dimension [77]. | 1 (2%) |
| C016 | Knowledge interchange rate | Knowledge interchange rate is a process of exchange of explicit or tacit knowledge between two agents, during which one agent purposefully receives and uses the knowledge provided by another [31], [55]. | 20 (31%) |
| C017 | Coordination challenges level | Team coordination is defined as activities required to maintain consistency within a work product or to manage dependencies within the workflow. There are many different types of dependencies between task and task holders. These dependencies lead to a need for coordination among stakeholders working on a related set of tasks. When these coordination needs are not satisfied, they will have coordination challenges [31], [77]. | 26 (40%) |
| C018 | Transparency of roles and responsibilities | It is important to assign the right task and responsibilities to the relevant person. The roles and responsibilities need to be clearly articulated and understood by all the relevant parties [28], [38], [77]. | 6 (9%) |
| C019 | Reporting requirement | Clear software requirements are compulsory for the quality product and it changes till the completion of software development gradually, changes create new challenges to deal with. Requirements must be discussed again and again to achieve a unified interpretation, resulting in optimal designs and software components which can be smoothly integrated [46], [65]. | 10 (15%) |
| C020 | Relevant information disclosure | Information Management is critical due to sharing relevant information between team members. Distance negatively impacts information dissemination. The loss of face-to-face contact and the need to rely on asynchronous communication all impact the level and quality of available and transmitted information between sites [77]. | 4 (6%) |
| C021 | Team issues | Within the global team context, there is a clear need to develop a one-team approach. Teamwork is based on team-member relationships that facilitate the development of mutual respect and trust. This leads to developing a cohesive motivated team that sees itself as a single unit regardless of its members' location [44], [77]. | 19 (29%) |
| C022 | Process Management | A process that directly addresses the specific requirements of the global team environment needs to be developed and implemented. Adequate training on the process operation should be provided to all team members. Shared ownership of the process should be fostered between team members across locations [38], [77]. | 6 (9%) |
| C023 | Software support tools | Tools and technology to facilitate knowledge transfer within the teams. Many organizational practices and technological tools are used during the knowledge transfer process. These tools aim to increase the focal area's knowledge to a high level of knowledge that allows for solving problems and innovation [29], [39], [55], [77]. | 12 (18%) |
| C024 | Technical support | The technical issues comprise all the challenges associated with the technology used to initiate communication among distributed team members. This problem could cause hindrance and misunderstanding [31], [77]. | 3 (5%) |
| C025 | Communication Tools | Quality of communication tools and network speed between sites. A good selection of synchronous and asynchronous communication tools should be provided. An essential aspect of the provision of such tools is to ensure staff are motivated and trained to leverage their capabilities [L26] [L37] [L94] | 6 (9%) |
| C026 | Proficiency in a programming language | Proficiency in a programming language and expertise and knowledge in the application domain. High proficiency in a programming language to build codes with complex instructions. It is a personal technical dimension [48], [90]. | 6 (9%) |
| C027 | Experience in similar projects | Staff experience on similar projects, programming language, and tool experiences [48]. | 4 (6%) |
| C028 | Use of software tools | Evaluating and selecting software packages that meet an organization's requirements is a complex software engineering process. Selection of the wrong software package can be costly and adversely affect business processes [169]. | 1 (2%) |
| C029 | Contribution to team effort | A team's effort contribution is the participation in helping each other, mutual support of team members, suggestions, and contribution of teams on project outcomes [55]. | 3 (5%) |
| C030 | Accomplishment of assigned responsibilities | Demonstrates initiative and responsibility for individual performance to get the job done under direct supervision [170]. | 2 (3%) |
| C031 | Task efficiency | Task efficiency is the completion of assigned or agreed-upon responsibilities is the critical behavior of completing assigned tasks in a timely and efficient manner [170]. | 2 (3%) |
| C032 | Tasks effectiveness | Task effectiveness is significant because the uncertainty on product and technological novelty requires more design and development tasks to be completed on time, avoiding the increasing lead time uncertainty [171]. | 1 (2%) |
| C033 | Independence of thought and action | Independence of thought and action is the person who applies critical thinking work to develop fairness, insight into the personal and public level, humble intellect and postponing the crisis, spiritual courage, integrity, perseverance, self-confidence, and research interest [172]. | 2 (3%) |
| C034 | Creativity in approach to problem-solving | Creativity in problem-solving is capturing and getting inspired by external success stories [64]. | 1 (2%) |
| C035 | Scientific attitude | The scientific attitude is a willingness to change one's theory in the light of new empirical evidence critically. This attitude is a community ethos, not a psychological trait of individual scientists [173]. | 1 (2%) |
| C036 | Determination and effort | The effort reflects the effort exerted by the participant to complete the task, while exertion reflects the overall perception of strain caused by the task. The perceptual sensations represent three dimensions of perceived effort (sensory-discriminative, motivational-affective, and cognitive-evaluative dimensions) [174]. | 1 (2%) |
| C037 | Contributing to discussions | It is common for passive participants to doubt their abilities to contribute to discussions and instead believe they will do more good by remaining silent. On the other hand, individuals will be more likely to transition to posters when they feel sufficiently secure that they will receive positive responses and add value to the group [175]. | 1 (2%) |
| C038 | Accepting criticism gracefully (personality dimensions) | Instill the values of good human relations and the need to work cooperatively, accept criticism gracefully, be courteous and enthusiastic, and maintain friendly relationships. It is related to personality dimensions [176]. | 1 (2%) |
| C039 | Communicate clearly with team | Communicate clearly with team members when speaking and writing. Understand the direction of the team [177]. | 1 (2%) |
| C040 | Communicate civility with team | In a team context, civility is acting with empathy, compassion, and kindness in every interaction and treating everyone connected online with dignity and respect [178]. | 1 (2%) |
| C041 | Communicate clearly with stakeholders | Communicate clearly with stakeholders when speaking and writing. Understand the direction of the stakeholders [177]. | 1 (2%) |
| C042 | Communicate civility with stakeholders | In a stakeholders context, civility is acting with empathy, compassion, and kindness in every interaction and treating everyone connected online with dignity and respect [178]. | 1 (2%) |
| C043 | Collaborative work friendly | Collaborative work friendly is the ability to function on multidisciplinary teams. In today's multicultural world, this outcome also implies an ability to collaborate with people from different cultures, abilities, and backgrounds [177]. | 2 (3%) |

*The last column represents the times and percentage that the criteria were cited. To see all the clusters click in Fig. 17.

TABLE XXXVII
CRITERIA LIST FOR CONTRACTING PROFESSIONALS IN GSD - 2/8

| Code | Criteria | Description | Cited* |
|---|---|---|---|
| C044 | Culture of leadership | Employees desire good error management, forms of participation, and a culture of leadership that includes support and the establishment of common mindsets, stability, and reliability of corporate values [29], [92]. | 9 (14%) |
| C045 | Comprehension ability | Comprehension ability in a project context depends on information about the trustee's roles and type of experience with technology use. Therefore, the personal profile also provides more data about skills and knowledge, such as previous work experience and academic studies. This information will allow the trustor to perceive a trustee's capabilities rapidly and explicitly [41]. | 2 (3%) |
| C046 | Assignment of roles and responsibilities | Clear assignment of roles and responsibilities. The roles and responsibilities of the team members must be clearly defined, which is vital for controlling and managing misconceptions during the implementation of process activities [37], [89]. | 3 (5%) |
| C047 | Transparency of Vision and goal | Vision and mission of demanded changes, knowing the scope and purpose of change management is important for the successful implementation of the requested changes [37], [55], [89]. | 8 (12%) |
| C048 | Team training and monitoring | Types of training: Induction Program, Training on Application Functionality, On the job Training, Trainee ramp-up. The education and support of distributed team members are essential in GSD [38], [49]. | 7 (11%) |
| C049 | Geographically distributed CCB (change control block) | Tracking, monitoring, and controlling the Requirements change management activities in the offshore software development environment. We should establish a geographically distributed CCB (change control block) to verify and determine the reasoning behind the requested changes [37], [38]. | 2 (3%) |
| C050 | Resistance management of changing | The political environment influences the management effect of organizations on the requirements to change the management process because some organizations are hesitant to change the requirements. However, resistance management is essential in eliciting the desired requirements and effectively [37]. | 1 (2%) |
| C051 | Strong team relationship | The arduous relationship among team members (global service climate). The relationships of overseas team members should be formalized to share and accommodate secret requirements and build trust [29], [37]. | 7 (11%) |
| C052 | Skilled human resources | Skilled human resources are the skills or expertise of individuals available. Skilled human resources is a team core consideration in the agile software development paradigm and are essential for successfully implementing requested requirements. Thus, this is the knowledge, skills, and attitudes of a human resource department [37]. | 5 (8%) |
| C053 | Response/ feedback online | The delay in getting a response can expand the time needed to resolve the issues. It is perceived as difficult and annoying for the teams working remotely in different time zones. It might also be a major issue in globally distributed development because team members are unable to analyze the overall project procedure due to delay in response or feedback [31]. | 4 (6%) |
| C054 | Requirement and data traceability | Traceability of data is a key issue Working in a heterogeneous data environment. Traceability can only be assessed by checking the quality and quantity of links among related data resources from different software tools [91]. | 9 (14%) |
| C055 | Process awareness | The organizational management must provide training and certification opportunities to Requirements change management team members. It is much important to held workshops and seminars to motivate the team members to participate in process awareness [38]. | 6 (9%) |
| C056 | Formal standard and procedures | The practitioner should adopt formal standards and procedures for success. The team members should use formal processes, frameworks, and best practices. The standards and procedures guide the practitioners about "what to do" and "how to do it." [38], [89]. | 4 (6%) |
| C057 | Change acceptability | The identification of change is the key activity, which indicates why, how, and when change is needed. The "change acceptability" refers to the quality of a software project dependent upon the satisfaction of the customers' needs and expectations. However, the acceptance of requirement changes during software development is a positive mark towards the satisfaction of customers [38], [46], [89]. | 10 (15%) |
| C058 | Continuous organizational support | An organizational commitment can be triggered by a combination of three conditions: desire, compulsion, and obligation to work for the focal organization. Commitment provides a foundation for employees to engage in behaviors that support the organization [179]. | 4 (6%) |
| C059 | Frequency of social events | Social events include but are not limited to telling people what to do, spending time with sharp and witty people, giving speeches, attending parties, laughing without reservation, voicing strong personal values and opinions in a group, telling jokes, criticizing someone, and asking for help or advice [180]. | 2 (3%) |
| C060 | Task synchronization | Reduced opportunities for synchronous communication were also significant risk factors in GSD. Due to the temporal distance, the use of synchronous communication becomes less. Using asynchrony communication tools for communication and collaboration practices can be unsafe. There might be a probability of an unnoticed or lost email, so an individual has confusion which increases the likelihood of misunderstanding [31]. | 6 (9%) |
| C061 | Software testing methods | Components are delivered untested due to pressure caused by time constraints on the development teams. They should be properly unit tested before integrating them into the final system as they are developed for some specific use cases. In almost 80% of the projects, the integrator finds defects during integration due to improper unit testing [43], [65]. | 9 (14%) |
| C062 | Geographical dimension | Geographical distance is geographic dispersion between team members in remote sites. Communication risk increases whenever geographic distance increases. Therefore, this criterion is related to the geographic dimension [31], [58]. | 16 (25%) |
| C063 | Organizational dispersion | Overseas site's response. In GSD, the development sites are located across several geographical locations in different time zones. The difference in team identity. The difference in organizational objective and strategy. Information misinterpretation due to repeatedly readjusting to a variety of methods. Frequently readjusting to alternative methods of their business units. Loss of tacit knowledge due to the replacement of onshore with offshore staff. Delay due to staff changes [L06, L09, L69]. | 7 (11%) |
| C064 | Turnover (team/staff) | The high rate of skilled employee turnover or staff changes leads to the organization's loss of tacit knowledge. These changes result in additional delays and conflicts in the development process. In addition, change in staff will create gaps in the knowledge transfer process and leave developers to work independently [39]. | 2 (3%) |
| C065 | Degree of novelty | Degree of the novelty of the product for involved persons. Novelty increases the difficulties in a project. When the requirement is changed or is new, team members might be unaware of new requirements, or team members might not understand the requirements completely. If the higher the novelty of project knowledge, the more difficult it is to transfer knowledge [39], [48]. | 6 (9%) |
| C066 | New vendor relationship | The client's knowledge loss becomes a problem of knowledge transfer when the company moves from an old vendor relationship to a new vendor relationship, as the client no longer holds all the information that the new vendor critically needs to involve in services with the client [39]. | 1 (2%) |
| C067 | Updated Knowledge transfer documents | When the knowledge's codifiability is higher, the knowledge can be easily transferred to knowledge recipients, and in some cases, employees need help finding updated knowledge transfer documents in their project repository, leading to delays in project delivery [39]. | 1 (0%) |
| C068 | Knowledge Codifiability | Knowledge codifiability in an organizational project repository happens when complex knowledge is not codified in a high-level manner and is not straightforward to understand [39]. | 1 (2%) |
| C069 | Proper documentation | The root cause of most integration problems is inadequate documentation. Many project documentation is hard for the client organization because most of the knowledge concentrates and remains hidden in the vendor organization. In some cases, even if the documentation exists, it is obsolete and plays no role other than introducing new people to the coarse grain [43]. | 6 (9%) |
| C070 | Compatibility of data | Lack of compatibility. The GSD teams may use diverse platforms and tools for the development of software components or subsystems. These components/subsystems raise compatibility problems during integration. Data integration, this request for integration implies that all the development artifacts in software processing are constantly accessible, even if they reside across different development tools [43], [91]. | 6 (9%) |
| C071 | Appropriate architecture | The development, maintenance, and evolution of software architecture appear to be crucial, especially concerning the definition of interfaces. Lack of continuous and active management of the architectures, including change control with a representation of all parties involved, is likely to lead to major problems, which appear to be detected only during the integration stage of the project [43], [46]. | 6 (9%) |
| C072 | Similar programming languages | In GSD, many software components are not properly integrated due to the heterogeneity of software programming languages, operating systems, and communication tools. In addition, a common infrastructure is not shared between sites, making integrating components developed on these sites complex [43], [91]. | 3 (5%) |
| C073 | Product selection and customization (off the shelf) | Due to time and budget constraints, selecting a proper component and customization from a large pool of components is challenging. Furthermore, in the case of open-source software (OSS), there are problems in the selection, maintenance, integration, and licensing of OTS(off-the-shelf) components [43]. | 1 (2%) |
| C074 | Availability of human resources | Lack of human resources, knowledge, and skills. Lack of suitable infrastructure for integration and the nonavailability of skilled human resources to solve integration issues in time hinder the integration process. This criterion is related to a human resources department issue [43], [65], [92]. | 14 (22%) |
| C075 | Proper component interfaces | Lack of proper component interfaces is the interface through which a component requests services or provides services. Inconsistencies between components/modules create problems during the integration stage [43]. | 1 (2%) |
| C076 | Relationship between persons at different sites | Lack of employee respect issues. Has the team met or talked personally? This event grows the relationship between people at different sites, increasing the efficient outsourcing relationships in organizational management [47], [48], [76]. | 4 (6%) |
| C077 | Common working experience | The common work experience is the site's experience working together; or the number of hours worked together by each team, depending on the project program objective [48], [76]. | 2 (3%) |
| C078 | Criticality of the task | Criticality is the importance of getting the task done correctly in terms of its adverse effects should problems occur, and a critical task is one where a failure impacts the life of a human [181]. | 1 (2%) |
| C079 | Complexity of the task | Complexity is a function of the number of interconnected variables in the task, and the most challenging tasks are those in which there is a constraint on decomposition into simpler subtasks [182]. | 1 (2%) |
| C080 | Degree of Task formality description | The degree of task formality description is the role of methodology (techniques, graphs, formulas) to perform or explain professional services. Also, formality controls workplace relationships between professionals within organizations, allowing greater or lesser professional self-sufficiency [183] | 1 (2%) |
| C081 | Process phase (lifecycle) | The process phase (lifecycle) comprises the development, distribution, acquisition, deployment, use, maintenance, deactivation, and disposal phases [184]. | 1 (2%) |
| C082 | Degree of collaborative task coupling | Collaborative coupling, in broad terms, signifies the intensity of user-user interaction to accomplish a task. Collaborative task coupling is categorized into loosely coupled, and tightly coupled [185]. | 2 (3%) |

*The last column represents the times and percentage that the criteria were cited. To see all the clusters click in Fig. 17.

TABLE XXXVIII
CRITERIA LIST FOR CONTRACTING PROFESSIONALS IN GSD - 3/8

| Code | Criteria | Description | Cited* |
|---|---|---|---|
| C083 | Degree of Business Process maturity | If there are no stable requirements and requirement changes, this change has to be communicated. This is not easily possible if there is no maturity or no good communication infrastructure between sites [42], [48], [51]. | 5 (8%) |
| C084 | Product size | The product size to be developed comprise program code, an integral component of the software; architectural design size: components, their functions, and their interactions (interfaces); and specification size like the Unified Modeling Language [186]. | 3 (5%) |
| C085 | Stable requirements | The high degree of requirements changes during the project may provoke significant delays, with a good chance of introducing errors and misunderstandings. The impact of unstable requirements is generally high for any software development project [46], [48]. | 7 (11%) |
| C086 | Number of involved sites | In global software development, it is necessary to observe the number of involved sites that needs to collaborate on a project [48]. | 1 (2%) |
| C087 | Time pressure | Pressure on people working on the project [48] results in developers attempting to find shortcuts and adopt different approaches to complete software development to accomplish the given deadline [65]. | 4 (6%) |
| C088 | Learning curve | Learning to work together, master the domain, and understand mutual sub-domains may take years. This fact may result in underestimating the learning curve in multi-site software development. It is a personal technical dimension [46]. | 2 (3%) |
| C089 | Integration plan | A clear integration plan is necessary to ensure efficiency and without extra complexity when finally putting the system together. Thus, integration asks for a centrally controlled approach [46]. | 4 (6%) |
| C090 | Vision for the end product | Distributed members must be aware of the rules and regulations they must observe during the project, and a shared vision for the project can align team members toward shared goals [187]. | 1 (0%) |
| C091 | Overloading of key personnel | Because various initiatives compete for the same employees, a possible lack of resources appears (such as overloading of crucial personnel, unavailability of experts, and unavailability of the necessary training), which may lead to failure in the project not going according to the plan [188]. | 1 (2%) |
| C092 | Consistent data | The software development team must know the data's status before using it in the deployment phase to make data more consistent since continuous deployment leads all importance towards the development of the process, which causes errors and inconsistency in data [91]. | 1 (0%) |
| C093 | Misspelling in data entry | The development and operation teams working together in a DevOps environment may adopt best practices to resolve data entry issues avoiding misspellings in data entry. Thus, to validate the performance of product efficiency, data must counter checked to resolve such issues [91]. | 1 (0%) |
| C094 | Missing information | The critical challenge in the DevOps environment is missing information and other invalid data due to integrating different sites in a software organization. This hindrance can be resolved by automated data validation processes or by adopting lean in the development, and operational environment [91]. | 1 (0%) |
| C095 | Data Harmonization | The increasing demand to integrate sizeable open data sets, ongoing updates, visualization, and analysis while addressing privacy and security concerns are common problems. Hence, to support data harmonization, developing end-to-end automated processes will result in low-quality data products [L44]. | 2 (3%) |
| C096 | Data visualization tools | Visualization of data it can be claimed that, without suitable visualization and understanding of large integrated data sets in a heterogeneous data environment, it is critical day by day to understand the purpose of data [91]. | 1 (0%) |
| C097 | Data aggregation | Data Aggregation is one of the critical challenges in the mining process; data searched, reported, and presented from a different source is vital to gain specific business objectives. Therefore, a consistent approach is required to present and aggregate data [31], [55], [91]. | 3 (5%) |
| C098 | Measuring provenance of data | Data provenance means the location of specific data and when and where that data was generated. Data comes from multiple sources, causing reliability challenges in heterogeneous data environments. Therefore, integrity and authenticity must be assessed when analyzing data [91]. | 1 (0%) |
| C099 | Storage of transition logs | Storage of transition logs while considering data validity and security, storage of transition logs is a challenge in a DevOps environment [91]. | 1 (2%) |
| C100 | Analyze Data in Real Time | Data generated in real-time, i.e., online development systems, must check data assessment while sharing data in a continuous environment of DevOps during production [91], and proper tools are required to maintain continuous scalability and performance measures for better release [103]. | 3 (5%) |
| C101 | New visualization techniques and their assessments | New visualization techniques and their assessments to implement or integrate new techniques with the existing system must follow all privacy guidelines suggested by developers. Thus, if appropriately implemented with whole team discussion, such tools may help reduce time, and cost [91]. | 1 (2%) |
| C102 | Contract management | A contract is an agreement that creates obligations for the parties. Contract management involves building a good working relationship between client and contractor. It involves proactively anticipating future needs and reacting to situations or risks that may arise during the contract execution [189], [190]. | 3 (5%) |
| C103 | Task updating | Managers are confronted with their entire teams working from different locations. Also, it has to agree on individual working patterns and work schedules with employees to accommodate their care responsibilities by effectively communicating realistic expectations and setting achievable deadlines considering the highly unusual context in which teleworking currently takes place while ensuring business continuity and the required level of performance [191]. | 4 (6%) |
| C104 | Quality assurance procedure | Lack of detailed requirements specification documentation for global teams. Evaluating the project quality concerning the service [53], [55]. | 7 (11%) |
| C105 | Incremental integration | In incremental integration, pieces of software are integrated into increments to avoid extensive integration. Thus, if we set an initial stage for the integration of components, while some components may still be in the development stage, it may be more valuable and save precious time during later stages of integration [192]. | 2 (3%) |
| C106 | Regular deliveries | Agile software development brings its own set of novel challenges that must be addressed to satisfy the customer through the early and continuous delivery of valuable software [193]. | 4 (6%) |
| C107 | Use of modular approach | In an Agile software project, the modularization approach segregates the code base into domain modules, identifies well-defined interfaces to these modules, and restricts the inter-module interactions through these interfaces [194]. | 3 (5%) |
| C108 | Cross-functional teams | Each team member, representing a different knowledge specialty, comes to a team with a different thought world so that each member understands the problem, critical elements, and steps in solving the problem differently from each other. These differences create a lack of common ground, resulting in problems of information exchange, interpretation, and attribution [195]. | 3 (5%) |
| C109 | Expert area (prior experience) | The prior experience measures the number of team programmers who have participated in at least one similar project. Therefore, the level of uncertainty is expected to decrease as the number of team members with relevant experience increases [196]. | 2 (3%) |
| C110 | Scrum expertise | Having previous experience in the roles, practices, processes, procedures, and artifacts in Scrum [90]. | 2 (3%) |
| C111 | Scrum hours | Scrum is the most widely applied Agile methodology and is a process framework for delivering products and services of the highest possible quality and handling complex problems or situations. Iterative and incremental approaches are used to develop products using cross-functional teams [90]. | 1 (2%) |
| C112 | Number of sprints | The number of sprints is short work cycles for incremental development [90]. | 1 (2%) |
| C113 | Analytical thinking | Analytical thinking is a personal soft skill where the developer is highly proficient in a software programming language to build codes with complex instructions. Analytical thinking is a behavior required to support the success of highly active projects in global software development. It is a personality dimension [90]. | 1 (2%) |
| C114 | Time management | Time management planning is a practice where people plan what they intend to accomplish and when on a given day. How do people specifically engage, or how is technology involved with time management planning? [197]. | 3 (5%) |
| C115 | Conflict management | Conflict management could be divided into affective and substantive conflict. Affective conflict implies emotional clashes between individuals based on selfish or personal issues. Substantive conflict involves rational differences based on the content of the ideas or issues [198]. | 5 (8%) |
| C116 | Flexibility | Flexibility is adjusting one's leadership style, method, or approach in response to different or changing contextual demands to facilitate group performance [199]. | 3 (5%) |
| C117 | Handling stress | The behavioral paradigm characteristically defines stress in terms of stimulus-response connections. Stress can be described as the stimulus or force that, if sufficiently strong, can cause tension in the individual who experiences it. We can better comprehend stress by exploring the circumstances or context (i.e., occupational or personal) surrounding the events [200]. | 1 (2%) |
| C118 | Problem solving | The problem-solving ability or the inability to see the problem arises due to the uncooperative motivational attitude of higher-ranking management interacting with the team members at remote sites, resulting in a lack of team cohesiveness [31]. | 3 (5%) |
| C119 | Diplomacy | Diplomacy comes from the intercultural competence of specialists, i.e., the formation of practical skills and abilities that ensure the ethnocultural perception of the individual development and his/her ability to correctly interpret specific manifestations of verbal and nonverbal behavior in different ethnic cultures [201]. | 1 (2%) |
| C120 | Interfacing with different layers of development framework | If an application has to maintain persistent data, a mechanism for allowing it is required. CRUD pattern could be used to maintain a database and manage the life cycle of creating, updating, deleting, and reading data. In addition, it is essential for modeling related entity classes [90], [202]. | 3 (5%) |
| C121 | Code coverage concepts and tools | Code coverage measure the degree to which a test suite exercises a software system. Software testing is often used to determine and sometimes improve software quality. However, it is also very labor, and resource-intensive process that often accounts for more than 50% of the total cost of software development [203]. | 2 (3%) |
| C122 | Refactoring concepts | Refactoring is constantly improving the design of existing code without modifying the fundamental behavior. For example, in Agile, teams maintain and enhance their code on an incremental basis from Sprint to Sprint. In addition, refactoring enables simplifying unclear and complex code [204]. | 1 (2%) |
| C123 | Code-smell concepts | A code smell is a term commonly used to describe potential problems in software design [205]. | 1 (2%) |
| C124 | Religion and political attitudes | Somehow, personal religion and political factors and behavior also relate to inter-culture as every country has its law, rules, and regulations to follow by the citizens. People have different religions and beliefs, with festivals or events that demand holidays to organize and celebrate. This criterion is related to personality dimensions [65]. | 5 (8%) |
| C125 | Updated requirements | The requirements are timely updated owing to the evolving needs of customers, stakeholders, the organization, and the work environment. Furthermore, the updated requirements show customer satisfaction, achievement of business goals, and competence in the market [38]. | 6 (9%) |
| C126 | Change impact analysis in all sites | The impact analysis of a specific change request is important to estimate its effect on cost, time, and the system's quality. The poor analysis of the scope of demanded changes could cause the poor estimation of time, cost, and effort that could bring the project towards failure [38], [89]. | 3 (5%) |
| C127 | Management support | The involvement of top and lower-level management is essential to successfully implement the Requirements change management process. Besides, the participation and commitment of the management could be helpful for requirement elicitation, and change management [38]. | 3 (5%) |

*The last column represents the times and percentage that the criteria were cited. To see all the clusters click in Fig. 17.

TABLE XXXIX
CRITERIA LIST FOR CONTRACTING PROFESSIONALS IN GSD - 4/8

| Code | Criteria | Description | Cited* |
|---|---|---|---|
| C128 | Globally compete to market | Global competition becomes a form of international competition in which the position of an enterprise in one country affects its competitive position in other countries. As a result, companies compete for international leadership [206]. | 2 (3%) |
| C129 | Progress measure in distributed sites | The amount of working software produced determines progress in agile development. In addition, source code versioning, unit testing, continuous integration, and acceptance testing are technical factors that affect the software artifacts' maturity [207]. | 4 (6%) |
| C130 | Management commitment | Lack of management commitment. It may be inconvenient to develop a team across the organizational border, especially when there is a possible conflict of concern or distrust. It is sometimes challenging to combine separate, independent groups into one, coherent team. Management activities are not properly performed across the boundaries due to a lack of collaboration and communication [29], [31]. | 4 (6%) |
| C131 | Software Process improvement - Consultancy | The consultancy in software process improvement is the capability of the consultants, based on their experience, to help small and medium Web companies adopt formal software process improvement standards while remaining aligned with the Web company's vision [208]. | 2 (3%) |
| C132 | Process improvement evaluation | Most process improvement evaluation strategies are generic, and different organizations apply those methods for measuring success indicators based on organizational needs and contexts, indicating a shortcoming in the methods used and supporting the demand for a comprehensive measurement framework [209]. | 2 (3%) |
| C133 | Process improvement standards and procedures | Process improvement standards and procedures: a set of policies and standard procedures describing how the firm's processes will be conducted and maintained consistently [210]. | 2 (3%) |
| C134 | Site characteristics | Site characteristics, including analyst capability, programmer capability, language and tool experience, personnel continuity, and customer proximity, are variable factors in the task allocation decision [83]. | 1 (2%) |
| C135 | Task site dependency | Task-site dependencies, including application experience and platform experience, are also considered during task allocation and team division [83], [86]. | 2 (3%) |
| C136 | Personal availability | Practitioners sometimes require support to have personal availability. For example, unsurprisingly, the need for a designated professional to work with user experience is a difficulty most often pointed out by respondents from start-ups that do not have user experience professionals [211]. | 1 (2%) |
| C137 | Process ownership | Process ownership is defined as placing ownership with those closest to the process who experience bottlenecks and inefficiencies. Process owners are responsible for getting the work done by workers, designing it, and ensuring the execution and high performance of the process in different organizational units [83]. | 3 (5%) |
| C138 | Component dependency | Component dependencies in a product architecture give rise to communication and coordination needs. The architectural mechanisms other than module or component dependencies also create coordination requirements. The component dependencies must be addressed before allocating to temporally distant sites can be taken [83]. | 1 (2%) |
| C139 | Workload | Distribution of tasks refers to the number of responsibilities distributed among the team members working at remote sites. As teams are distributed geographically and the communication among the distributed teams is less, tasks and responsibilities are not appropriately allocated. That may lead to a lack of shared understanding and confusion among the team members [31]. | 4 (6%) |
| C140 | Task Size | First, when creating tasks for user stories at the beginning of each iteration, limit the size of the tasks to 4 hours, 8 hours, or no more than 16 hours in length. Thus, this will ensure that the team can work more efficiently in a fully integrated way [212]. | 1 (2%) |
| C141 | Participation and support to solve issues | This category consists of ideas to increase the acceptance of, and commitment to, both the organization and the transformation process. This can be achieved by the employee's participation in organizational processes and structures. Personal attachment and support towards the project Team members' ability to assist in solving problems [55], [92]. | 5 (8%) |
| C142 | Persistent, conscientious responsiveness information of teams | The managerial practice of persistent, conscientious responsiveness information of teams on project outcomes establish pertinent information towards the project outcome [55]. | 2 (3%) |
| C143 | Project requirements | Clear software requirements are compulsory for the quality product. It changes until the completion of software development, and that gradual changes create new challenges. Understanding requirements specification is a major challenge in global software development projects, especially during knowledge transfer from provider to recipients. The vendor does not understand the designed specification properly due to a high-level design of system requirement specification [39], [65]. | 5 (8%) |
| C144 | Capacity to absorb technical and business knowledge | Absorptive capacity is the dynamic capacity that allows firms to create value and gain and sustain a competitive advantage by managing external knowledge [213]. | 1 (2%) |
| C145 | Understanding the process | Understanding the process concerning knowledge transfer effectiveness on project outcome, also to ensure process improvement, a common understanding of procedures should be established, process adherence should be ensured, and regular process audits should be conducted in all distributed sites [55], [82]. | 5 (8%) |
| C146 | Mutual coordination among team members (managerial practices) | Mutual coordination among team members is the interactions and relationships among participants that have become increasingly crucial for coordinating work and improving performance. So also a mutually reinforcing process of interaction between communication and relationships carried out for task integration [214]. | 3 (5%) |
| C147 | Clear objective | In the context of service leadership, it is necessary to have a clear objective to initiate the project in the global software development environment [54]. | 1 (2%) |
| C148 | Knowledge incentive toward client business process | Knowledge-intensive business services, such as engineering, management consulting, and R&D, almost exclusively transfer knowledge and skills to client organizations—the incentives to expend effort and produce innovative services [215]. | 3 (5%) |
| C149 | Pilot knowledge between teams | Pilot knowledge between teams is like a Café event, a space/place where we meet with friends to chat, visit and share our latest news and thoughts or make connections and build relationships that offer a relatively informal and sociable way to engage participants in conversations [216]. | 2 (3%) |
| C150 | Project functionality toward client's business process | The project functionality toward the client's business process is the relationship between business and project processes is paramount for understanding project-based firms and how they sustain competitive advantage over time as they operate in multi-actor environments and based on one-off projects [217]. | 2 (3%) |
| C151 | Understanding over the client's business process environment | The knowledge of client language and culture. Gathering the information and experience among teams [55], [89]. | 6 (9%) |
| C152 | Brainstorming actions for organizations | Group thinking and decision-making are suitable tools for reducing possible errors in decision-making, improving organizations' efficiency, and utilizing scientific decision-making tools, such as Brainstorming [218]. | 1 (2%) |
| C153 | Flexibility among teams | Adaptability is essential to organizational success due to environmental change. Through team working, organizations can flexibly adapt and react to turbulent, complex, and dynamic environments and thereby focus their efforts on more efficiently handling subtasks resulting in overall organizational effectiveness [219]. | 2 (3%) |
| C154 | Learning of innovative technology | Learning of innovative technology is the participation, acceptance, and learning incentive of innovative technology in the global service climate [55]. | 4 (6%) |
| C155 | Component or Unit Testing prior to integration | If the distributed teams submit their developed components to the central team without proper component or unit tests, the integration phase will reveal many problems delaying the whole development process, and fixing one problem may introduce another problem [192]. | 2 (3%) |
| C156 | Advance and Uniform Development Environment and Training | For the Advance and Uniform Development Environment, all the development teams in GSD must use the same development environment. Even to use the latest technology and tools, the developers need to be trained appropriately to acquire the required skill and knowledge to ease the integration process in the long run [192]. | 5 (8%) |
| C157 | Continuous integration | Continuous Integration is a software practice where developers frequently integrate, at least daily [220]. | 3 (5%) |
| C158 | Interface Compatibility | In software development, different components in a product interact and integrate through well-defined interfaces. Through interfaces, the component avails and provides services. Therefore, the software developer should develop in-house components or select COTS components that are loosely coupled and have well-defined software interfaces to fit into the final product easily [192]. | 1 (2%) |
| C159 | Configuration management | In configuration management, the component version should easily track each component from start to final delivery. A different version of a product may have different sets and different versions of components, which need to be managed consistently and adequately for successful product integration [192]. | 3 (5%) |
| C160 | Components evaluation | Almost all types and sizes of software are composed of more than one software component or module developed in-house or outsourced. Similarly, in components evaluation, the components may be purchased from the market as a commercial off-the-shelf (COTS) component or from the large pole of the open-source community as an off-the-shelf (OTS) component [50]. | 1 (2%) |
| C161 | Process, Data and Product's Components | Typically, during the design process, the design team must identify adequate components to fulfill specific design requirements and use a standard model for process, data, and product components [221]. | 3 (5%) |
| C162 | Metrics | Automated metrics allow for to definition of code complexity metrics. Semi-automated metrics allow us to measure functional complexity, for example. Finally, manual metrics allow the frequency of use and the importance for the user [95]. | 4 (6%) |
| C163 | Specific Integration Timing | The specific integration timing in the integration phase, or the synchronizing of the various parts, is one of the most challenging phases of software projects in the GSD environment [50]. | 1 (2%) |
| C164 | Organization: resource | The resource-based view of the firm indicates that the activities in which an enterprise engages consist of a bundle of resources which include assets, processes, attributes, knowledge, information, and know-how that a firm possesses and can therefore use to formulate and implement competitive strategies [222]. | 1 (2%) |
| C165 | Organization: strategies | Due to economic expansion, the sophistication of communication means, and cost pressure, it is crucial to comprehend the risks, challenges, opportunities, and good practices within this new software development scenario to construct business strategies [223]. | 1 (2%) |
| C167 | Organization: culture | The organizational culture encompasses the employees' values, beliefs, and behaviors. Values, beliefs, and behaviors become assimilated into an organizational ideology or philosophy, which serves as a guide for dealing with the uncertainty of uncontrollable or difficult events that occur in organizational life [224]. | 5 (8%) |
| C168 | Organization: politics | Organizational Policy is mainly expressed as a particular behavior of a person, which includes intentional actions to effect specific decisions to safeguard their interests [225]. | 1 (2%) |
| C169 | Organization: practices | Organizational Practices are the behaviors and actions of employees. Hence, are the employees' daily work habits aligned with the core values of organizational culture? Practices are one of the Five Ps (purpose, philosophy, priorities, practices, and projections) of an organization [226]. | 1 (2%) |

*The last column represents the times and percentage that the criteria were cited. To see all the clusters click in Fig. 17.

TABLE XL
CRITERIA LIST FOR CONTRACTING PROFESSIONALS IN GSD - 5/8

| Code | Criteria | Description | Cited* |
|---|---|---|---|
| C170 | Organization: regulations | The regulation describes any attempt to influence a population's behavior, whether, by law, force, nudging, or surreptitious manipulation [227]. | 1 (2%) |
| C171 | Organization: environment | The internal environment aspect can be observed using a functional approach consisting of production and operations, human resources, finance, management, and marketing information systems. The external environment is all circumstances outside the organization that has the potential to influence the organization [228]. | 1 (2%) |
| C172 | Organization: structure | The organizational structure that has proven effective in practice is characterized by a flatter structure, decentralized decision-making, greater collaboration and coordination, faster knowledge transfer between employees, knowledge networking, teamwork, proactive approach, horizontal communication, flexibility, and agility [229]. | 2 (3%) |
| C173 | Organization: size | Organizational size is defined as the number of employees at any given location. This would include the entire corporate organization if it is in one geographical location or a division of a decentralized corporation [230]. | 1 (2%) |
| C174 | Inter-team culture (NCASN) | Inter-team culture is related to National Culture and Social Norms [51]. | 1 (2%) |
| C175 | Social facilities | Inequality manifests in the unequal provision of social amenities within local government districts. The social amenities are educational, health, and market facilities, like drinking water, sanitation, electricity, housing qualities, and drainage arrangement. It is connected to geographic dimension [51]. | 1 (2%) |
| C176 | Social interaction | Social interaction is how individuals act and react concerning one another [231]. | 2 (3%) |
| C177 | Stakeholder: Client | The person paying the bill or the initial paying customer can be seen to be the project client [232]. | 2 (3%) |
| C178 | Stakeholder: Relationship | The stakeholder relationship is associated with customer feedback to improve development [103]. | 3 (5%) |
| C179 | Stakeholder engagement | Stakeholder involvement is essential for successful project delivery and is often considered a boundary activity or one that can be outsourced to business functions as usual. Nonetheless, project managers depend on people to respond to the outputs and benefits they deliver, and people will only respond if they are engaged [233]. | 3 (5%) |
| C180 | Stakeholder: requirements | Stakeholder Requirements, or user requirements, describe what users do with the system, such as the activities that users must be able to perform. Usually, we use narrative text, use cases, scenarios, user stories, or event-response tables to document it [234]. | 2 (3%) |
| C181 | Stakeholder Performance Domain | This domain addresses activities (identifying, analyzing, prioritizing, engaging, and monitoring)and functions associated with stakeholders [189]. | 1 (2%) |
| C182 | Stakeholder: problem domain | Pushing knowledge beyond the constraints of the previous domain into new fields means that the boundaries of a theory receive more testing and support. Furthermore, these advances mean a greater understanding of when a theory works and why. Thus, the problem and solution domains are considered more mature [235]. | 2 (3%) |
| C183 | Stakeholder Attitude | In varying degrees, attitudes comprise three components, known to behavioral phycologists as the ABC Model of Attitudes Saul McLeod. A: effectively based attitudes are the emotional reactions we have to an Attitude Object. B: behavioral attitudes express themselves when we react to an Attitude Object. C: cognitive attitudes are rooted in our beliefs about the Attitude Object [236]. | 1 (2%) |
| C184 | Climatic condition | Weather generally refers to day-to-day temperature and precipitation activity, whereas climate is the term for the average atmospheric conditions over more extended periods. Climate is the average weather conditions for a particular geographical location over notable years [237]. | 2 (3%) |
| C185 | Geological condition | Ecological-geological conditions are considered a geographical environment created by a set of contemporary morphologically expressed geological factors that influence specific features of the functioning of the biota, including human beings, within the framework of the ecological-geological system [238]. | 1 (2%) |
| C186 | Working and workplace atmosphere | Temperature, air quality, lighting, and noise in the office affect work concentration and productivity. Numerous studies have consistently demonstrated that the physical office environment's characteristics can significantly affect employees' behavior, perceptions, and productivity [239]. | 1 (2%) |
| C187 | Project: Characteristics | The main characteristics of the project are defined by: the way the work groups are organized, the project manager's level of authority; the level of dedication of the project manager; the availability of resources; who manages the budget; level of dedication of project management administrative staff [189]. | 1 (2%) |
| C188 | Requirement estimation | An estimate predicts how long a project will take or how much it will cost. Estimation and planning are related topics, but estimation is not planning, and planning is not estimation. Therefore, estimation should be treated as an unbiased, analytical process, and planning should be treated as a tiny, goal-seeking process [240]. | 1 (2%) |
| C189 | Collaboration, communication, and coordination: inter-team, inter-site | Internal project communication, intrainformation, and interinformation sharing across distributed sites. Requirements change management is considered a rich communication activity in GSD and an efficient information-sharing mechanism that facilitates the information management, integration, and coordination of Requirements change management activities across distributed sites [32], [89]. | 10 (15%) |
| C190 | Collaboration, communication, and coordination: cross-boundary | The requirement change management is considered to be a rich communication activity and an efficient information sharing mechanism that facilitates the management of the information, integration, and coordination of the activities across distributed sites has a significant positive impact in the GSD environment [32]. | 7 (11%) |
| C191 | Tools and technology: process selection | Whenever there is a significant time difference between remote team videoconferencing and any communication technology such as Skype is not suitable, in this case, email is the most recommended technology for communication between team members. Team members get instant feedback with chat, but the richness of tonal expression gained from voice calls has been lost [31]. | 3 (5%) |
| C192 | Project management performance | Project management performance questions: extent and frequency of plan changes; frequency of emergency meetings; agreement between effort invested and effort required; participant satisfaction; customer satisfaction; the number of post-delivery product changes [241]. | 2 (3%) |
| C193 | Tools and technology: management decision | Technology management tools are a subset of management tools related to decision-making and support around innovation-related activities in strategic decision-making about which technologies to invest in: R&D project selection, new product selection, capturing customers' needs, designing new products, promoting creativity, and monitoring and controlling development projects [242]. | 2 (3%) |
| C194 | Tools and technology: defect occurrence | Defect data contains knowledge about specific work conditions. A data feedback mechanism is required to prevent the reoccurrence of defects. However, most defective data are stored in unstructured ways, resulting in the fundamental problem of data utilization [243]. | 1 (2%) |
| C195 | Tools and technology: testing accuracy | A project's success or failure depends on the accuracy and effective management of requirements. Therefore, it is crucial to determine the mix of practical techniques for requirement acquisition and adequately document the process and the requirements to reduce the challenges and chances of failure [244]. | 2 (3%) |
| C196 | Knowledge assets | The widespread use of the terms in the following list hint at the increased importance knowledge assets have in organizations: intellectual capital, knowledge capital, knowledge organizations, learning organizations, organizational learning, information age, knowledge era, information assets, intangible assets, intangible management, hidden value, and human capital [245]. | 1 (2%) |
| C197 | Trust: among team members | Trust among team members is the confidence of development team members [86]. | 3 (5%) |
| C198 | Trust: cross-boundary | Trust building is a critical factor for developing cross-boundary information sharing and, in a much broader sense, is a crucial element of the social capital needed for any successful cooperation or collaboration within and across social networks [246]. | 1 (2%) |
| C199 | Trust: confidence in the company and leadership and other stakeholders | The mere act of mingling with employees promotes the concept of the leader as just another colleague. During that interaction, if employees feel confident expressing a personal concern or need, presumably due to preexisting trust, the leader should act on that to further reinforce trust and demonstrate care and respect. If the leader acts reasonably, trust and confidence in the leader will increase [247]. | 2 (3%) |
| C200 | Team size/ structure | Team size refers to the number of people working together to achieve certain goals. Team size is a major factor in a software development project. In general, there are three different team sizes, i.e., a small team consisting of a maximum of ten members for a small project, medium size team consisting of members ranging from 11 to 25, and a large team involving at least 26 members, appropriate for a large project [31]. | 9 (14%) |
| C201 | Team cohesion | Team spirit is the satisfaction and honesty that coexists between the team members and motivates them to do well or be the best. Unfortunately, in Global software development, teams are geographically dispersed, which may decrease the opportunity for effective communication and acquiring the benefits of a collocated environment and may lead to the loss of team cohesion and project failure [31]. | 4 (6%) |
| C202 | Capability to adopt team members | The project manager should adopt other team members to the project, increase the project's coordination and integration among project elements and use a consistent method to guide and control project execution [248]. | 1 (2%) |
| C203 | Team experience | The team experience evolves different project background issues arise due to the difference in working culture when developers from different countries need to work on a project that is not similar to the existing project background [31]. | 5 (8%) |
| C204 | Requirement management | Monitoring and controlling the requirements change management activities at offshore sites [89]. | 5 (8%) |
| C205 | Global project management issues | Requirements engineering meetings needs: engaging a human facilitator and using rich communication media that supports data, videos, and audio integration; preparing agenda and following it; selecting relevant participants and informing them of times to participate in requirement meetings; timely exchanging supporting documents to give participants enough time to read the relevant material; enabling participants of requirements meetings to access the resources that contain information about the requirements [66]. | 4 (6%) |
| C206 | Face-to-face meeting | In general, due to the geographical dispersion among sites, limited face-to-face meetings can decrease the opportunity for informal interaction, leading to a lack of team awareness and cohesiveness. Also, misunderstanding requirements are probably due to a lack of interaction [31], [103]. | 6 (9%) |
| C207 | User involvement | Involving end users during system development is paramount to ensuring project success. User involvement in development has many benefits: it delivers a more accurate and complete assessment of user requirements, provides the developers with knowledge of the information system's organizational and functional context, and increases users' acceptance of the new system [31], [103]. | 2 (3%) |
| C208 | Labor cost | Labor cost is the leading reason organizations go global, but the availability of human resources is more important than cost. Large Global Software Development organizations try to find available human resources in their regional offices, whereas others find the available skill set by outsourcing. Today's global market is about where resources are available. It is a human resource dimension [83]. | 2 (3%) |

*The last column represents the times and percentage that the criteria were cited. To see all the clusters click in Fig. 17.

TABLE XLI
CRITERIA LIST FOR CONTRACTING PROFESSIONALS IN GSD - 6/8

| Code | Criteria | Description | Cited* |
|---|---|---|---|
| C209 | Human related problems | Companies' common human resource problems are compliance with laws and regulations, health and safety, change management, compensation management, landing top talent, retention, and monitoring productivity and performance [249]. | 1 (2%) |
| C210 | Technical Infrastructure | Technical incompatibilities among distributed sites cause communication obstacles due to technological issues. A project having various distributed teams introduces the probability of an incompatible database that may cause a threat of loss of data when transferring from one database to another. Distributed team members use different programming languages, which may cause conflict on the preferred technology or delay in communication as a result of incompatibilities of the artifact [31]. | 6 (9%) |
| C211 | Infrastructure | Potential differences in infrastructure across sites might lead to compatibility issues. Therefore, the GSD sites need to adopt advanced and uniform infrastructure while executing the requirement change management process [250]. | 3 (5%) |
| C212 | Effort and cost estimation for change | Software changes are inevitable due to the dynamic nature of the software development project itself. One factor influencing the effectiveness of the change acceptance decision is the accuracy of the change effort estimation [251]. | 1 (2%) |
| C213 | Productivity | The primary ingredients that impact the software development productivity of globally distributed projects are project delivery rate, team size, and communication complexity. The project distribution can be effectively done depending on the estimated productivity of the different sites [252]. | 1 (2%) |
| C214 | Project methodology (approach, mentoring) | Nowadays, the rise and fall of software companies are standard. Those who learned lessons from their past failures succeeded. Due to advances in technology, new approaches and methods are under development. The software industry also adopts new approaches with changing technology and techniques [253]. | 4 (6%) |
| C215 | Quality of build | Build quality comprises the risk variables, requirements analysis, design, and construction. Therefore, the project manager must be diligent in formulating and adopting appropriate quality processes, procedures, tools, templates, techniques, guidelines, and standards [49]. | 1 (2%) |
| C216 | Quality of test | Test quality underlies the risk variables, adaptation, regression, and performance tests. A regression test ensures that software changes do not break functionality. Performance tests are performed to ensure that software changes do not affect application performance. A retrofit test is about incorporating changes already made to production code in parallel by other project teams [49]. | 1 (2%) |
| C217 | Team rewards and recognitions | Human resource practices should be selected that complement and support an organizational strategy. More specifically, the human resource reward system should be aligned to motivate employee performance that is consistent with the firm's strategy, attract and retain people with the knowledge, skills, and abilities required to realize the firm's strategic goals and create a supportive culture and structure. It is a human resource dimension [254]. | 1 (2%) |
| C218 | Employee facilitation | Employee facilitation includes individual initiatives, mentoring by a core team, and employee work-life balance. Also, work-life balance and the need for attractive packages for hiring [47], [49] | 3 (5%) |
| C219 | Alignment between architectural decisions to organization structure | Lack of alignment between architectural decisions to organization structure and not reflecting architectural changes to an organization; challenges brought by misalignment between organization and architecture; challenges brought by personnel changes; difficulties ensuring compliance of modular design throughout the lifecycle and changes in an organization [31], [84]. | 2 (3%) |
| C220 | Project instability | Project instability manifests itself as changing team structures, responsibilities between sites, personnel changes, and roles of existing personnel [84]. | 2 (3%) |
| C221 | Software quality control | The software quality control comprises: delegating design decisions to the local team, deteriorating quality; poor quality management; decentralized data and state management leading to inferior quality; insufficient automation for testing and a lot of manual tests; insufficient recording of quality requirements [84]. | 3 (5%) |
| C222 | Align architecture with organization arrangement | Align architecture with organization arrangement, include business goals in design, base architectural decisions on available resources, and establish quality management practices [84]. | 2 (3%) |
| C223 | knowledge management practices | Insufficient knowledge management practices between projects and across the organization. Disagreement in design choices. Problems recognizing and caused by conflicting assumptions on software. Insufficient understanding of architectural decisions in teams and other stakeholder groups. Incorrect assumptions made during design. Unclear ownership of architectural elements [84]. | 3 (5%) |
| C224 | Communicate architectural decisions to all stakeholders | Establish practices enhancing communication and knowledge distribution. Architects should handle communication with different stakeholders, considering stakeholders' backgrounds. Communicate architectural artifacts and practices clearly to all sites. Maintain a single repository for architectural artifacts accessible to all [84]. | 1 (2%) |
| C225 | Conformance to share practices | Conformance to share practices is the ignorance of or incorrect use of principles, rules, and guidelines for architectural design and knowledge management. Lack of stability in architecture leads to difficulties in applying design rules and dividing tasks. Inconsistent versioning. Insufficient interface specifications [84]. | 2 (3%) |
| C226 | Standardize architectural practices | The standardized architectural practices ensure that teams develop code based on standard design agreements. Thus, use common architectural practices and ensure they are well-defined, consider a service-oriented approach, take advantage of Agile methods, use prototyping, and ensure fit to requirements [84]. | 1 (2%) |
| C227 | identifying dependencies on architectural design decision | Identifying dependencies on architectural design decisions, insufficient decoupling, or cross-component features are challenges brought about by software complexity and difficulties defining logical entities and finding interface boundaries in architecture [84]. | 2 (3%) |
| C228 | Architectural design practices | Architectural design practices are about implementing well-defined interfaces to increase modularization and aid loose coupling. Strive for high modularity and separation of concerns. Locate dependencies within architecture [84]. | 1 (2%) |
| C229 | Architecting modeling techniques | Architecting modeling techniques use (call) graphs/matrices to depict and detect coupling. Use visualization of decisions/metrics. Use collaborative modeling. Using a variety of diagrams promotes awareness [84]. | 1 (2%) |
| C230 | Task allocation | Allocation of the core team. Allocation of a whole team. An increased amount of effort with modifications involving several developers across different sites. Increased needs for coordination when using experts from different sites. Difficulties evaluating work input due to distribution. Difficulties in synchronizing tasks. Insufficient matching of code to available resources. Difficulties with correctly identifying dependencies between work units and thus assigning work to distributed teams. Insufficient prioritization rules [32], [49], [84]. | 4 (6%) |
| C231 | Architecture-based task allocation | Architecture-based task allocation identifies where the domain expertise lies and allocates tasks accordingly. Retain tightly coupled work items at one site. Acquire and arrange resources based on architecture. Base work allocation on available resources and minimize the need for communication between sites [84]. | 2 (3%) |
| C232 | Compliance to processes | Challenges due to inconsistent standardization, tools, and equipment between sites. The schedule is prioritized over processes. Challenges fitting practical work to defined processes. Problems were caused due to not involving a technical architect. Impractical condensing of knowledge due to high dependency on one lead architect [49], [84]. | 6 (9%) |
| C233 | Governance implemented | This criterion contains one concern that encourages engaging developers across sites. Assign responsibilities for prioritization, managing architectural work, and sharing knowledge with teams. Break work items into easily manageable pieces (consider one subsystem can be handled by one person). Define clear responsibilities for the architecture team to handle changes spanning several components and/or sites. Ensure each site has a representative architect. Engage developers across sites in architectural work [84]. | 4 (6%) |
| C234 | Handling soft issues | Handling soft issues requires more commitment to software development processes and guidelines and more commitment or interest in work items (distributed across sites) by individuals. It is a behavioral characteristic comprised of misaligned interests, lack of report progress, and tasks' undesirability, making task distribution challenges. It is related to personality dimensions [84]. | 1 (2%) |
| C235 | Socio-culture distance | Every culture has its standards, styles, and moral principles that can provoke communication-related issues. Socio-cultural distance includes national, organizational, political, and religious background and moral values, which increases the probability of misunderstanding, which may negatively impact the team's performance [31]. | 2 (3%) |
| C236 | Team members' attitude | Team members' attitudes express the satisfaction or dissatisfaction towards an individual, working environment, or event and an individual's behavior. The impact of attitudes influences communication in optimistic and pessimistic ways because of the individual's religious belief, personal attitudes, mindset, and knowledge [31]. | 1 (2%) |
| C237 | Customer relationship | The customer may be far from the development team, and it is difficult for them to travel to elaborate on the requirements in detail. Customers usually show little involvement while discussing the requirements in detail during the development process, which may lead to a weak relationship between the developer and the customer [31]. | 5 (8%) |
| C238 | Cost and logistics of meetings | In GSD, sometimes it is essential to conduct face-to-face meetings, mainly in the initial phases of the project. However, it can be very costly and time-taking to travel frequently to a remote location. Moreover, logistical issues such as visa insurance, flight connectivity, and traveling charges also contribute to the problems caused by geographical distance among remote sites [31]. | 1 (2%) |
| C239 | Effort to initiate contact | The effort to initiate contact is an obstacle between team members isolated by geographic distance. In addition, it may lead developers to make a minor modification to the system without contacting someone with rich knowledge about it [31]. | 1 (2%) |
| C240 | Time overlapping | Less overlapping working hours increase the possibility of using asynchrony communication, as the overlapping working hours is the only time synchrony communication is feasible [31]. | 2 (3%) |
| C241 | Communication frequency | The communication frequency decreases in a remote location due to temporal distances. In addition, critical concerns may be reported after a period, which could affect work patterns and schedules for the next business day. Due to the low frequency of communication between distributed teams, the risk of communication failures and misunderstandings increases [31]. | 5 (8%) |
| C242 | Detailed level of communication | Due to the low communication frequency among distributed teams, the risk of miscommunication and misconception increases, provoking a low detailed level of communication [31]. | 2 (3%) |
| C243 | Mutual understanding | In interdisciplinary requirements engineering, stakeholders need to understand how other disciplines think and work (mutual understanding) and agree on the system they develop (shared understanding) to collaborate effectively [255]. | 1 (2%) |
| C244 | Domain of manager's opinion | The attitude of the manager or team leader, which has to diverge point of view and opinions, influence the effective communication between the team members attitude. Also, restricting all forms of interaction and communication between the distributed teams working in GSD may lead to miscommunication and misunderstanding [31]. | 1 (2%) |
| C245 | Connectivity issues | Since virtual teams rely on electronic communication, any internet downtime could isolate team members and halt workflow. In addition, such technologies as web conferencing, instant messaging, document-sharing sites, and the like can supply rich communication conditions for team members who cannot hold face-to-face encounters [31], [89]. | 2 (3%) |

*The last column represents the times and percentage that the criteria were cited. To see all the clusters click in Fig. 17.

TABLE XLII
CRITERIA LIST FOR CONTRACTING PROFESSIONALS IN GSD - 7/8

| Code | Criteria | Description | Cited* |
|---|---|---|---|
| C246 | Degree of infrastructure | Countries with limited infrastructure limit rich discussions between team members, which can influence the transmission of informal news or casual conversations during informal meetings. Failures of these limited infrastructures of communication technologies can result in poor interaction, and communication [31], [89]. | 6 (9%) |
| C247 | Quality of telecommunication bandwidth | The low quality of telecommunication bandwidth is a communication issue because the context, tone, and emotion could be disoriented. This problem leads to an excess of time describing things being addressed, and with poor transmission quality hampering communication implements, communication networks can be slow and unreliable [31]. | 1 (2%) |
| C248 | Lack of ICT and technological cohesion | We need technology that creates shared understanding. We need people who understand how to build bridges in divided communities to be better equipped to use technology, avoiding deficiencies in the current digital environment [94]. | 4 (6%) |
| C249 | Uniform processes | Lack of uniform process between different development sites. Best practices are: to organize process-based training for new employees; ensure that management-level workshops synchronize global processes; follow standard processes and tools; follow a single process with all teams; follow documentation standards; adopt process evaluation standards, and establish process training programs in the organization [256]. | 2 (3%) |
| C250 | Communication of customer requirements | Communication of customer requirements allows for identifying the user's requirements and relevant derivative acceptance criteria to establish priorities in the tests. Failures to meet customer requirements and expectations are often related to misunderstanding, and misconception [31], [95], [257]. | 2 (3%) |
| C251 | knowledge creation ability among the teams | The multiplicity of different actors with different expertise sets makes it challenging to understand each other in teams working virtually. This shared understanding is the set of norms, behaviors, and understanding team members have about the assumptions, tasks, work processes, and contexts necessary for effective and successful collaboration [258]. | 3 (5%) |
| C252 | Ability to solve their professional problems | The individual with a clear vision to solve their professional problems toward the result of the project. The extent to which the customer leader took the individual initiative and shared responsibility for developing solutions and resolving issues and problems that arise in the team relationship. The developer or a person proactively identifies and resolves potential problems with the proposed solution. It is related to personal technical dimension [259]. | 1 (2%) |
| C253 | Cooperation and competition within the teams' to fulfill the goals | The organization's needs are best served by employing cooperative reward structures. Collaborative systems incorporate norms of equality and emphasize group accomplishments. They emphasize downplaying distinctions among group members (i.e., performance-based distinctions) because they can inhibit teamwork, information sharing, and helping [260]. | 2 (3%) |
| C254 | Explicit and standard communication pattern for knowledge transfer effectiveness | To facilitate the interpretation and integration of the knowledge transfer process, we must create norms providing a standard frame of reference and definitions of key technical terms. Thus, shared knowledge influences the efficiency of this process by facilitating the transfer of knowledge [261]. | 2 (3%) |
| C255 | Specialty ability of the teams | The gap in the teams' specialty ability would lead to some differences in performance. The practitioners with lower specialties might need more solid knowledge foundations (hard skills) and are comparatively weaker in thinking and learning abilities. Their self-confidence, motivation, and soft skills are insufficient [262]. | 1 (2%) |
| C256 | Mediating role knowledge transfer | Strong ties effectively provide valuable knowledge. Such relationships are helpful because they tend to be trusting. The benevolence and competence-based trust mediate the link between strong ties and the receipt of helpful knowledge [263]. | 1 (2%) |
| C257 | Assessment of teams knowledge transfer effectiveness | The assessment on knowledge transfer methods for development teams are documentation, mutual code reviews, code comments, pair programming, face-to-face question and answer sessions, mentoring, hackathons, brown bag lunches (BBLs), writing tests, communication and collaboration tools, and communities of practice [264]. | 2 (3%) |
| C258 | Communality | Communality refers to the personal characteristics that the trustor has in common with the trustee, like a similar goal they wish to achieve, shared language use, common identity characteristics, or shared values. It is a personal technical dimension [41]. | 1 (2%) |
| C259 | Benevolence | Benevolence is the willingness to help, availability, sharing, faith in intentions, friendliness, openness, caring, and commitment. Also, it refers to the perceived level of courtesy and positive attitude a trustee displays towards the trustor [41]. | 1 (2%) |
| C260 | Internalised norms | Internalized norms are integrity, discretion, honesty, fairness, and loyalty. This criterion refers to the intrinsic moral norms a trustee uses to guard his/her actions. The language Analysis regarding how a trustee uses the chat and walls could infer some people's values [41]. | 1 (2%) |
| C261 | Accountability | Accountability refers to the degree to which a person is liable and accountable for his/her acts and meets another person's expectations. It includes the extent to which a person seems to be: reliable, consistent, self-confident, persistent, and responsible [41]. | 1 (2%) |
| C262 | Interpersonal relationships skills | In GSD, communication becomes low due to a lack of group interaction among distributed team members, which initiates multiple communication issues. Lack of interpersonal relationships originates due to geographical distance among globally distributed teams. Therefore, due to improper communication at remote sites, task dispute occurs, which might lead to relationship conflict and the frequency of rework increases [31]. | 3 (5%) |
| C263 | Reasoning skills | The ability to reason with emotions, or emotional reasoning skills, is the ability to employ emotional knowledge to understand and analyze emotions. Specifically, it includes capabilities such as understanding the links between emotion-eliciting situations and emotional reactions and describing one's and others' emotional experiences [41]. | 2 (3%) |
| C264 | Communication protocols and customs | A communication Protocol is a system of rules that allows two or more entities in a communications system to transmit information via any variation of a physical quantity. Communication protocols are formal descriptions of formats and rules for producing digital messages for electronic data exchange [265]. | 1 (2%) |
| C265 | Communication skills in a second language | There are four language and communication skills: listening, speaking, reading, and writing. These four language skills allow an individual to comprehend and produce spoken language for proper and effective interpersonal communication. Skills can be oral or written and active or passive [266]. | 3 (5%) |
| C266 | Ability to motivate others and create trust | The ability to motivate others and create trust happens when a person can motivate and inspires; builds potential in others; creates an environment that fosters learning, collaboration, and fluid teamwork, and attracts high performers [267]. | 3 (5%) |
| C267 | Extroversion (personality dimensions) | Extroverted behaviors, for example, tend to result in a higher frequency of communication through electronic messages and increased team performance. It was found that high levels of positive personal traits, such as helpfulness and agreeableness, increased team performance satisfaction [76]. | 1 (2%) |
| C268 | Computer anxiety (personality dimensions) | In terms of anxiety, computer anxiety is the interactions with computers, negative global attitudes, and negative cognitions or self-critical internal dialogue. It is related to personality dimensions [268]. | 1 (2%) |
| C269 | Self-control (personality dimensions) | Self-control is the personal aptitude and behavior to do work. It is related to personality dimensions [269]. | 2 (3%) |
| C270 | Sensitivity (personality dimensions) | Enhanced sensitivity predicts both reactivities to adverse contexts and the propensity to benefit from supportive resources from favorable environments. In other words, sensitivity is proposed to better and worse influence the impact of environmental influences [270]. | 1 (2%) |
| C271 | Emotional stability (personality dimensions) | Emotional stability (i.e., calm, steady, self-confident, and secure), of the five major personality dimensions, conscientiousness, and emotional stability are the most valid predictors of performance outcomes across different occupations [271]. | 1 (2%) |
| C272 | Conscientiousness (personality dimensions) | Conscientiousness describes a person's ability to regulate impulse control to engage in goal-directed behaviors. It measures elements such as control, inhibition, and persistence of behavior. It is related to personality dimensions [272]. | 1 (2%) |
| C273 | Charismatic leadership | Exceptional leaders transform followers' needs, values, preferences, desires, and aspirations from self-interests to collective interests, alternatively called charismatic, visionary, transformational, and inspirational leadership. It is claimed to influence followers in quantitatively more significant and qualitatively different ways than the follower effects specified in past leadership theories [273]. | 1 (2%) |
| C274 | Age | Age is the number of years a person has lived. The age criteria are because cognitive functions begin to decline as the person age. Thus, older people may have more difficulty coping with managing an eventful daily routine, even those experiencing a healthy aging process. It is a personal technical dimension [274]. | 1 (2%) |
| C275 | Frequent information sharing | Up-to-date progress reporting, and an organized frequent meeting among distributed teams [89], [92]. | 5 (8%) |
| C276 | Requeriments elicitation techniques | Requirements elicitation is the process of defining stakeholders' needs and putting this information together in an understandable manner such that developers can construct a system that will address those needs [275]. | 1 (2%) |
| C277 | Client and vendor organizational management commitment | Due to change frequently occurring in requirements during the system development process, organizational management must commit to and support change management activities. Therefore, upper and lower management involvement is essential to implement the RCM process successfully [89]. | 2 (3%) |
| C278 | Financial maturity | Financial maturity is when a stand's anticipated future value growth will not increase the firm's net worth. The comparison of the internal rate of return and present net worth solutions illustrates that the various financial maturity models may be distinguished according to implicit or explicit assumptions regarding the accessibility of factor markets on input fixities [276]. | 2 (3%) |
| C279 | Use of English for communication | Use of English for communication. It is recommended to do some tests to see if practitioners detect some errors in conversations in English (chats, emails, or phone calls) and show that they notice communication problems when non-native languages are being used [44]. | 1 (2%) |
| C280 | Informal communication | Lack of informal communication leads to a lack of mutual understanding of project goals, misunderstanding of requirements, and mistrust between distributed teams. In addition, a lack of informal communication between team members can result in a lack of implicit knowledge [31]. | 4 (6%) |
| C281 | Experienced staff | Experienced staff plays an essential role: a pre-start project briefing session; assigning inexperienced employees with experienced employees whenever possible; language training for long-term assignments if language is a crucial component; and briefings on payroll, pension, and tax aspects [277]. | 2 (3%) |
| C282 | Agile team training | Adopting Agile-driven team training methodologies is an efficient way of excelling in agile software project management with significant advantages in production costs, time-to-market, complexity, and quality improvement over traditional human resource management methodologies. It is a human resource dimension [278]. | 2 (3%) |
| C283 | Budget constraints | The firm's retained earnings mainly determine budget constraints, the net present value of its future investments, the quality of its management, and the liquidation value of its assets are other examples [279]. | 2 (3%) |
| C284 | Project scope | Project scope is the work that must be performed to deliver a product, service, or result with specified characteristics and functions [189]. | 2 (3%) |

*The last column represents the times and percentage that the criteria were cited. To see all the clusters click in Fig. 17.

TABLE XLIII
CRITERIA LIST FOR CONTRACTING PROFESSIONALS IN GSD - 8/8

| Code | Criteria | Description | Cited* |
|---|---|---|---|
| C285 | Organizational commitments | Employees feel compelled to reciprocate when offered valuable resources via social exchange and reciprocity mechanisms. Support, as it constitutes a socioemotional resource, leads employees to experience affective commitment toward the organization. Furthermore, organizational support may contribute to an affective commitment by fulfilling basic socioemotional needs, such as affiliation, approval, and respect [280]. | 1 (2%) |
| C286 | Scaling tools and standards | Beyond regular global projects, agile scaling involves many challenges, including coordination among multiple agile teams and the need for an initial architecture and requirement analysis. Several frameworks for scaling agile software development have been suggested, such as the Scaled Agile Framework (SAFe), Disciplined Agile Delivery, Large-Scale Scrum, Nexus, and Scrum@Scale [281]. | 1 (2%) |
| C287 | Error management culture | The error management culture refers to the organization's culture of bargaining with errors. A productive culture of error is seen as a prerequisite for a successful digital transformation, especially during the transition phase [92]. | 1 (2%) |
| C288 | Handling of data | Handling of data describes competence in the handling of data, also includes large data volumes and data security [92]. | 1 (2%) |
| C289 | Lifelong learning | Lifelong learning is the individual behavior to develop competencies for performing the various roles required in human life and figuring out the learning skills by keeping the learning curve unrestricted. This process happens especially when the characteristics of the change in activity cannot be explained based on native response tendencies, maturation, or temporary states of the organism. It is a personal technical dimension [92]. | 1 (2%) |
| C290 | Legislation and regulation with cloud provider | In July 2014, ISO and IEC published a public cloud computing and data protection standard. The standard aims to address the downsides of cloud computing and the concerns of the cloud clients, mainly the lack of trust and transparency, by developing controls and recommendations for cloud service providers acting as personally identifiable information processors [282]. | 1 (2%) |
| C291 | Choose the right cloud service provider | Cloud computing is risky since there is no guarantee that the information is monitored or preserved by the service provider. In addition, the transition from local computing to cloud computing has created several security issues for the client and service provider. The suggested mitigation techniques to address these threats are encryption, access control, and blockchain and service level agreement between client and provider [283]. | 1 (2%) |
| C292 | Reuse ability | The application of reusable requirements catalogs to the development of software products implies changes in the basic Requirements Engineering process model (elicitation, analysis and negotiation, documentation or specification, and validation). The differences between the reuse-based and general process models are mild but may still lead to some process overload [284]. | 1 (2%) |
| C293 | Eminence Education | Eminence Education is reserved for individuals with fully developed talents who are incredibly talented in a domain relative to other highly accomplished producers and performers. This relative superiority is recognized by senior members of the domain and is usually related to sustained contributions or contributions that have had or will have a lasting and memorable impact on the domain [284]. | 2 (3%) |
| C294 | Lack of conviction issues | The personal conviction issue is related to someone relying on verified evidence rather than personal observation, which can be biased, error-prone, and spotty. The rigorous, demanding experimental design constraints are needed (or even morally obligated) when the findings might contradict strongly-held prior beliefs and practices. It is related to personality dimensions [285]. | 1 (2%) |
| C295 | Gender preference and segregation | Gender segregation at work is widespread; within software engineering, the gender composition of contract workers differs significantly by occupational subspecialty. For example, women are far more prevalent in software quality assurance than in other software subspecialties [286]. | 3 (5%) |
| C296 | Work-Life Balance Issues (Women) | Work-Life Balance Issues. After the COVID-19 pandemic and suddenly working from home, women reported being pressured to work overtime, with no working hours limits, and having to attend meetings in different time zones or learn new knowledge. Thus, they would be excluded from decisions made in meetings and perceived by others as lacking in teamwork [104]. | 1 (2%) |
| C297 | Benevolent Sexism (Women) | Benevolent sexism represents the subjectively positive feelings towards gender that often bring some sexist antipathy. For example, [104] reported that participants were spoiled, never receiving harsh/direct feedback, and being included in initiatives only because they were women, not because of their skills and abilities. | 1 (2%) |
| C298 | Lack of Recognition (Women) | Lack of Recognition (women). Feeling valued or appreciated is part of Maslow's hierarchy of human needs. The woman mentioned not being recognized for her work and that the women's results are usually evaluated as OK, never as excellent, even when they perform exceptional work. No praise from managers was considered one of the reasons for leaving [104]. | 1 (2%) |
| C299 | Lack of Peer Parity (Women) | Being surrounded by similar individuals to compare oneself, or identifying with at least one other peer in the team, is known as peer parity. The women mentioned a [im]balance in men: women ratio and two consequences: impact on their social capital, [be]cause men to socialize in a different way than women do; and impact on developing their self-confidence due to lack of role models [104]. | 1 (2%) |
| C300 | Impostor phenomenon (Women) | Impostor Syndrome describes an experience of individuals who, despite their objective successes, feel persistent self-doubt and are exposed as fraud or impostor. The women mentioned it as a challenge and reason to leave situations in which women personalize failures and feel ashamed and inferior more than men. They tend to escape the job but always mask for personal reasons [104]. | 1 (2%) |
| C301 | Pay inequality between genders (Women) | Pay inequality between genders and inferior career growth opportunities. Men raise only their counterparts to the top layer. Lack of transparency about the laddering criteria [104]. | 1 (2%) |
| C302 | Prove-it Again (Women) | Prove it Again is a bias effect that occurs when a group member who does not align with the stereotypes is measured by a stricter criterion than those who align with them. So, for example, women always need to show competence: put extra effort to be heard when there is competition between men and have no room to slip[up] [104]. | 1 (2%) |
| C303 | Maternal Wall (Women) | Maternal Wall expresses the experience of mothers whose coworkers perceive and judge them as having made one of two choices: either they continue to work and neglect their family, making the motherless likable, or the mother prioritizes family over work, making them less reliable in the workplace [104]. | 1 (2%) |
| C304 | Total number of technical skills (one employee) | A total number of technical skills (one employee) comprise the following capabilities information technology, business domain, project management, and sourcing managing customers or suppliers. In addition, it is a personal technical dimension related to the human resource department [287]. | 1 (2%) |
| C305 | Degree of task information | The degree of task information, a content element of communication in service exchanges, is conveyed through functional duty terms. The proportion of task terms to the number of words in a message defines the degree of task information. Greater (lesser) degrees of task information decrease (increase) uncertainty [61]. | 2 (3%) |
| C306 | Degree of personal information | The degree of personal information is a communication content element conveyed through self-disclosure terms. The ratio of self-disclosure terms to the total number of words in a message defines the degree of personal information [61]. | 1 (2%) |
| C307 | Degree of communication concreteness | Degree of communication concreteness is a manner element of communication conveyed by perceptible, precise, or specific terms. The ratio of concrete terms to the total number of words in a message defines the degree of concreteness [61]. | 2 (3%) |
| C308 | Degree of affective intensity | The degree of personal affective intensity is a manner element of communication conveyed through affective terms. The ratio of affective terms to the total number of words in a message defines the degree of affective intensity. It is related to personality dimensions [61]. | 1 (2%) |
| C309 | Limited support for reusability | Usability consists of how users' features affect the use of an interactive system in the work environment. So, software reusability is an attribute that refers to the expected reuse potential of a software component. Software reuse not only improves productivity but also positively impacts the quality and maintainability of software products [274]. | 1 (2%) |
| C310 | Lack of long-term planning | The traditional linear approach, which refers to long-term strategic planning, assumes normal conditions in their planning process and thus implements annual or multi-year planning. However, in times of disruptive changes, this strategic planning is replaced by an iterative approach which requires a calibration between execution and planning [288]. | 1 (2%) |
| C311 | Efficient utilization of time and computing resources | The use of cloud computing is increasing day-to-day, and the loads encountered by cloud servers are also increasing significantly. Therefore, the scarcity of resources must be minimized to maintain adequate service, bypassing potential overloads. It is, therefore, essential to reduce the load on the server so that all users have equal performance [289]. | 1 (2%) |
| C312 | E-waste minimization | The electronics industry is the world's largest and most innovative industry. However, after a time of use, it becomes a complex residue. It contains many hazardous heavy metals, acids, toxic chemicals, and non-degradable plastics. Thus, the electronics industry is still specifying the purpose of about 75% of e-waste or finding ways to use it, including refurbishment, remanufacturing, and reusing parts for repair [290]. | 1 (2%) |
| C313 | Green and sustainable management of product life cycle | A Green or Sustainable Product Life Management strategy could be defined as follows. First, Mission by supplying products that satisfy customer needs considering all the lifecycle impacts. Then Vision, when the company coordinates the generation, change, and storage of all the relative product metadata with metrics that will assess the sustainability of all the product lifecycle phases. Finally, the Objective is to share data, information, and knowledge of all the product lifecycle stages, to encourage collaboration with all stakeholders, and enable sustainability through Green Products and Processes [291]. | 1 (2%) |
| C314 | Minimal reengineering | Reengineering systems on a microservices-based architecture can be seen as implementing a service-oriented architecture (SOA). However, deploying SOA in a company is demanding, as it may implicate updating mission-critical systems with high technical debt and maintenance costs. Thus, a process is required that supplies a fine set of stages and techniques that minimize risks and simultaneously ensure the quality of the systems during the migration process [292]. | 1 (2%) |
| C315 | Polymorphic design | Agile software developers focus on polymorphic designs that meet the project's long-term goals. The sustainability of a software project can be compromised if agile software developers do not consider the impact of straightforward and polymorphic design in software development. These features of agile methods support the development of green, and sustainable software [293]. | 1 (2%) |
| C316 | Team Empowerment | Team empowerment is defined as the collective belief in a group that it can be effective and its role in determining its effectiveness. Empowerment is the delegation of authority and decision-making responsibilities, strengthening the role of people and teams [96]. | 1 (2%) |
| C317 | Metrics to assess risk-based testing | Metrics to assess risk-based testing is to assess how many risks we mitigated through risk test cases. In addition, it allows checking how many risks we mitigated per requirement. Finally, identifying prioritized risks allows us to confirm prioritized risks with the highest level of requirements [95]. | 1 (2%) |
| C318 | Metrics to assess risk-based testing activities (time) | Metrics to assess risk-based testing time identification allows knowing the average time taken to analyze a requirement with a certain number of lines. Assessing risk identification activity allows setting useful or meaningful risks to develop test cases [95]. | 1 (2%) |
| C319 | Training of DevOps activities | Training in DevOps activities has a positive impact while implementing DevOps. Formal training sessions are required to understand the concept and DevOps environment properly. The organization must support its teams with training sessions to help their organization successfully work on DevOps activities [294]. | 1 (2%) |

*The last column represents the times and percentage that the criteria were cited. To see all the clusters click in Fig. 17.