IDENTIFICATION AND PRIORITIZATION OF CRITICAL SUCCESS FACTORS TO ENHANCE QUALITY OF SOFTWARE IN AN OUTSOURCED ENVIRONMENT FROM A VENDOR PERSPECTIVE

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ABSTRACT: The Quality of a product makes it acceptable, usable, and beneficial for its users. Like any other engineering product, quality plays a vital role in the software industry, where software product' s acceptability, usability, productivity, and reliability are heavily dependent on software quality. Often too many factors can badly influence the quality of software if not dealt with care during the development stages. However, developing a quality product in an outsourced environment is particularly a challenging job due to the supervision of dispersed team members, lack of communication, responsibility, interest, lack of management, government policies, language barriers, and many others. In this research, a model will be suggested based on success factors (SF) that will minimize the issues and improve the software quality by providing guidelines to Vendor Organizations (VO) in an outsourcing environment. These factors will be identified through a systematic literature review and previously conducted empirical studies. We will assign weight to each identified factor based on experts' feedback and empirical studies and thus quantify our findings to get a clearer idea about a particular factor influencing software quality in an outsourced environment. The proposed model's validity will be checked with the help of a case study and an expert' s opinion.

Index Terms: Offshore Development, Software Outsourcing, Software Quality, Vendor Organization, Success Factors

INTRODUCTION

Software outsourcing means allocating development-related activities to a team of professionals outside the organization to reduce developmental costs without compromising on software quality. The client organization can present their project in an open bid environment where they select an outsourced team or teams who then work in parallel under the supervision of highly skilled team leaders to complete different milestones within a tight schedule, required quality and synced to a pre-estimated financial plan (budget) [1]. It can be quite difficult to work with people from different cultures in an outsourcing setting, and the process of developing software there is not always straightforward or problem-free [2]. A vendor company can quickly translate a client's business requirements into a usable software solution if they have a comprehensive understanding of those requirements. Strong relationships between the customer and the supplier organizations are necessary for this. In an outsourced situation, building a trust-based working environment is crucial because team members from different geographical locations may not be familiar with one another's work styles [3]. The best team selection from outside the organization is a relatively difficult task as in most cases nothing is known in advance about the VO. However, it requires sharp management skills and systematic procedures in comparison to in-house/endogenous development [4]. Many reasons lead an organization to outsource their projects. Some of the reasons are cost reduction, qualitative product and rapid development, load balancing and getting more control over core activities. High-quality products can be developed in a short time by engaging a team of professionals; thereby distributing the project among capable members who work in parallel to meet the deadlines. The joint team members improve their Skills and experience. Organizations may select the option of outsourcing for technical services such as coding and designing of software, maintenance of the system when a client makes a change request and business-oriented services with current infrastructure, outsourcing is the best choice among organizations in e-markets where online products are sold/purchased and managed [5].

There are always serious questions and concerns regarding the quality of software when being designed and developed in an outsourced environment. Where,

supervision of all segments and processes is relatively difficult because of a lack of communication, responsibility, interest, low control of management, language differences etc. Organization that owns low-quality software will pay the price in the form of losses which may be financial or even of human lives. Therefore, it is highly required for software engineers to strictly monitor software quality. Some of the tragic incidents for which software bugs are responsible are given below, Airbus A400 (Airbus knew of software vulnerability before A400M crash in May 2015, 2017) [6]. Some 8 patients expired because of uncontrolled exposure to radiotherapy in the National Cancer Institute (NCI), Panama City [7]. Chinook helicopter (June 02, 1994) (BBC, 2010) has taken the life of twenty-nine passengers on board [8], A hydraulic system issue on the U.S. Marine Corps Osprey hybrid aircraft and helicopter was made worse by a software problem. [9], The software testing company (Trincentis), in one of its reports, highlighted financial losses and the people being affected by software bugs in the recent past. In this report, they have identified 606 software bugs from 314 companies causing a loss of 1.7 trillion dollars and affecting 3.6 billion people besides 268 years of downtime [10]. In this sensitive situation where on one hand there is high dependency on information systems and on the other hand too many quality parameters affecting software performance, it is highly recommended that VOs follow a systematic procedure throughout the software development life cycle to deliver issues/bugs-free software to their clients. VOs dealing in an outsourced project must scan quality affecting factors at 3600 as the outsourcing environment is relatively hard to cover considering lower control on team members, language and communication barriers, cultural gaps, and country internal laws. Now, to achieve a quality product that meets customer requirements and satisfaction, client organizations should think about outsourcing these segments where they lack. Any payment to an external team of professionals will save money at later stages.

In this research, a model is suggested based on success factors that could be used by practitioners to minimize the issues and improve software quality by providing guidelines to VO in an outsourcing environment. These factors are identified through a systematic literature review and previously conducted empirical studies. The Analytical Hierarchy Process (AHP) is used to assign weight to each identified factor based on experts' feedback and empirical studies and thus findings are quantified to get clearer ideas about a particular factor influencing software quality in an outsourced environment. The proposed model validity is also checked with the help of case studies and expert' s opinions.

Client organizations should have good knowledge about vendors' expertise, their reputation, deadlines, payment terms, language, and cultural gaps etc. When the product is outsourced, a proper follow-up team is needed that can thoroughly check what is completed and how it meets the required specific situations. VOs should also very strictly consider the factors that need to be carried out for successful project completion.

Research Questions: The following are the research questions for the current research:
RQ1: What are the critical success factors that improve the quality of software in an outsourced environment?
RQ2: How the identified critical success factors in literature used by VOs, enhance the quality of software in an outsourced environment.

LITERATURE REVIEW

Projects often drift from their initial goals affecting overall control over the project quality. The drifts may be either balanced where the project keeps emergent goals synchronized to initial goals or may be un-balanced where the project drifts away from cost goals in favor of quality goals [9]. Software upgradation & maintainability is one of the important Quality parameters that are often needed by clients. The need for innovation in services is necessary to meet the ever-changing requirements. [1] reports that innovation could be more fruitful if carried out with external partners via collaboration. Collaboration needs a very high level of trust to exchange information for a better understanding of systems. However, clients are always reluctant to provide complete information regarding their business because they are worried about information leakage. [2] uses a hybrid approach of the waterfall model to get highly maintainable software with the desired efficiency and quality. They proposed critical maintenance quality measurement to enhance the efficiency & quality of maintenance operations. Quality should be maintained from the very beginning, Risk should be managed during requirement engineering, and continuous communication from the customer side is very important during the interface requirement. Requirements should be revised regularly to avoid the development of unwanted segments of the product. Code review for the development of quality software is equally important and should be done regularly [3]. [4][5] identifies the challenges faced by managers during project management. These challenges badly affect software requirements and ultimately software quality. Cultural differences and their misunderstanding, Communication hurdles, and insufficient or timed knowledge transfer were notable factors that affected software quality the most. Conflicts between customers and vendors should be managed with a win-win approach to keep customers satisfied with the desired and delivered software quality [6]. A Quality

product always meets customers' requirements list, requirement needs to be realistic, stable and well-defined, as client requirements are volatile and vary with new business needs, changes in organization policies, market demands, developer understanding of the product, conflicting requirements, un-clear and ambiguous requirements, in-adequate interface specification, in-adequate functional specification, vague product vision, risk management etc. [7][8]. Requirement change management in an outsourcing environment is more challenging than in-house development, especially if the requests are too frequent and the customer is in direct. In such a situation frequent communication with clients and an up-to-date, well-managed RCM infrastructure at GSD sites is needed [9].

Software quality is a broad area that needs extreme attention from all stakeholders from the very beginning and within each activity of the Software development life Cycle. Like Vendor organizations and developer teams, Client organizations are equally responsible for Software Quality. Active client Involvement, continuous, clear and effective communication with relevant information sharing, collaboration with sincere guidance and directions, coordination with each team on the vendor side, and appreciation and feedback on each milestone achieved, are very important to move forward for Quality software products [10] [11] [12] [13].

A few of the high-impact reasons are the absence of obligation/dedication, cultural/racial changes; poor and timed communication, unsynchronized team members, needless delays and high capsizing causes them to terminate their projects somewhere in the developing process [14]. Some of the challenges reported by [11] are the lack of 3Cs (communication, coordination & control), following strict schedules for information exchange and incompatibility with clients. These issues are more challenging when agile development mode is used to develop software in an outsourced environment. Continued integration, continuous analysis and joint decision-making have a positive impact on software quality [15]. The offshore industry needs to take care of the quality-affective parameters from the very beginning and should not overlook them at any stage of development. Organizations should be in close coordination with the vendors, especially if they are outsourcing their product for the first time and should thoroughly investigate each move and its benefits. The user' s view explains the value of the product in the eyes of the client, it measures the degree to which a product meets the customer' s satisfaction and goals. The manufacturer' s view is concerned with the original specification collected during the early stages; it declares a product as a quality product if it confirms the endpoint is by these specifications. The product view checks if the developed product is exhibiting the same functionality for which it was developed. Finally, what is paid by the end customer and what is delivered to him. Garvin stated further that one should implement all the above 5 aspects for a quality product. Many of the authors [16] [17] [18] suggested their model to check the quality. Quality must prevail in all segments of the product to achieve an overall quality product. Quality: is it an entity that can be defined in a few lines? Or can be checked in some special module or specific parts of the software. There is no simple or standard definition of quality on which all the commentator agrees, however, some parameters can be considered for quality work. These parameters are timed delivery of the product, customer satisfaction level and alignment to allocated budget, productivity, usability, reliability, accuracy, security, and maintenance of the product. David A Garvin [19] of the Harvard Business School explained the term quality indirectly by the characteristics of a product, from five angles; in an artistic context, it is an undefinable term that can be instantly seen and recognized. Most of the researchers have explored the work done before 2018. This study aimed to find additional quality-related success factors by conducting extended research before 2018 as well as after 2018. The aim of this study is to supplement the existing studies with further findings and to find the quantified impact & importance of each identified factor. In one similar study carried out by [18], the authors found around 21 success factors out of which only 6 were considered to be more important success factors having frequency ≥50, they validated their findings by conducting only three case studies, and the factors were mainly related to a successful project. We have conducted additional case studies to find more concrete results about the latest factors specifically related to the quality of software in an outsourcing environment. Secondly, in previous studies, we did not find the adverse effect of each factor quantitatively if it was not implemented or missed by the VO nor they did interrogate which of the practices is more challenging to implement. Like previous studies, our findings are not based only on their frequency, that is the number of times it was re-ported in previous studies, rather, we had to seek experts' opinions to weigh the importance of each factor. The factors are mainly grouped into 5 categories namely, client-related factors, Vendor management related factors, Software team-related factors, product-related factors, process-related factors, and Technology-related factors. Vendor organizations need to consider all the factors, whether it is related to cross-boundary customer or internal organization teams and technologies.

RESEARCH METHODOLOGY

We have completed our research in three phases. In the first Phase, an SLR Study was conducted to find out the most relevant data. For this, a well-formulated

SLR protocol was developed to extract the relevant data from popular digital libraries using logical (OR and AND) operators between search terms/keywords. Initially, data was filtered based on keywords, titles, and abstracts and then it was again filtered using pre-defined inclusion and exclusion criteria. After thorough analysis, these factors were grouped into six distinct categories and the frequency for each factor was determined. In the second phase, we prepared a survey questionnaire and asked industry experts to rank each factor between 0 to 10 where 0 means " Not relevant" and 10 means factors have the highest importance. The average values for each factor were calculated. In the 3rd Phase, we obtained a table with critical success factors using the below formulas,

1st Phase (Weightage from SLR):
Average values = [Frequency of each factor/Total number of studies] x 100
2nd Phase (Weightage from Survey):
Average Values = [Total Score for each factor/ Total response] x 100
3rd Phase (SLR + Survey):
Final Ranking = SLR Score + Survey Score

Searching Process and Protocol Formulation: Keeping focus on our research questions, all relevant literature is scanned and analyzed at 3600 angles to discover the most helpful factors that should be implemented in our model to boost software quality in an outsourcing environment. During SLR, the focus was on collecting up-to-date work (2016 to 2021). Different factors that were suggested by authors to have positive impacts on quality improvement and other factors that hurt Software Quality and must be avoided by vendor organizations were selected for this study. Thus, the final set of selected studies for this research is comprised of what is to be done and what is not to be done. To find out the most relevant work that could answer our research questions we have carefully formulated a search string using Kitchenham guidelines and run it on renowned repositories including ACM Digital Library, Science Direct, IEEE Xplore, Emerald, Wiley, and Springer Link; The Search String for RQ-1 is as under,

Breaking research question 1 into individual facets; The population, Intervention, and outcomes of the research.

a) Listed each search term against their possible synonym, abbreviation, and alternate spellings.

b) Different domain-relevant studies are searched to know about the key terms.

c) Meaningful Combination of these search terms using Boolean operators AND and OR.

d) We have formulated the following search strings based on the terms in RQ-1 to find the most relevant re-search papers in a reputable digital library (Table 1.1).

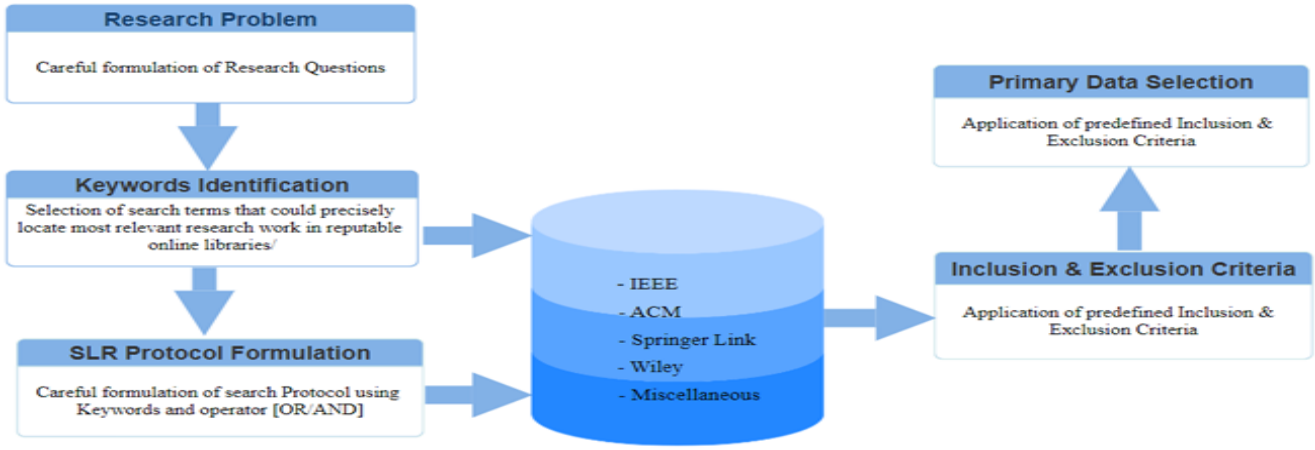


Figure 1: Summarizes all the Activities to select Primary Data

Table 1.1: RQ with SQ

Research Question (RQ)	Search Query
RQ-1: What are the key factors that drive quality enhancement in software outsourcing from the vendor's perspective?	**Key Concepts:** Software outsourcing, quality enhancement, quality improvement, influencing factors. **Keywords:** "Software outsourcing" AND ("Quality enhancement" OR "Quality improvement") AND ("Factors" OR "Drivers") AND ("Vendor" OR "Dealer" OR "Service-Provider").
RQ-2: How do various outsourcing models (such as IT outsourcing, IS outsourcing, and CBIS outsourcing) influence quality	**Key Concepts:** Different outsourcing models, quality advancement, quality characteristics. **Keywords:** ("Software outsourcing" OR "IS outsourcing" OR "IT

improvement in vendor-client relationships?	outsourcing" OR "Software contracting-out") AND ("Quality enhancement" OR "Quality improvement" OR "Quality advancement") AND ("Factors" OR "Drivers" OR "Motivators" OR "Elements" OR "Characteristics" OR "Parameters") AND ("Vendor" OR "Service-Provider" OR "Third Party Provider" OR "Marketer" OR "Developer" OR "Service Distributor").
RQ-3: What are the primary factors that influence quality improvement in software outsourcing agreements?	**Key Concepts:** Quality influencing factors, outsourcing relationships, vendor perspectives. **Keywords:** ("Software outsourcing" OR "IT outsourcing" OR "Software contracting-out") AND ("Quality influencing" OR "Quality improvement" OR "Quality advancement") AND ("Factors" OR "Drivers" OR "Motivators" OR "Elements" OR "Characteristics" OR "Parameters") AND ("Vendor" OR "Service-Provider" OR "Trader" OR "Developer" OR "Service Distributor").

We have also used some random words to search & locate additional missed work till 2022. All the factors that were directly related to Software quality (functionality, reliability, usability, re-usability, efficiency, Maintainability, portability) or related to successful project filling (client/vendor' s business objectives, meeting customer' s requirements, within budget and aligned schedule) were selected for our RQ-1.

Table 1.2: List of Searched Online Digital Libraries.

S.No	Digital Library	Link
1	Springer Link	www.springerlink.com
2	Science Direct	www.sciencedirect.com
3	IEEEXplore	http://ieeexplore.ieee.org
4	ACM Portal	http://dl.acm.org
5	Google scholar.	scholar.google.com
6	Wiley	https://www.wiley.com/
7	Emerald	https://www.emerald.com/

Inclusion criteria: Selection of suitable studies for RQ-1 required us to implement specific qualitative criteria. The criteria described served to eliminate studies which did not directly analyze elements affecting software outsourcing quality. Research was reviewed only if it studied crucial components that boost quality outcomes in outsourced software development projects from vendor perspectives. Research studies that focus on numerous impediments affecting software quality within the outsourcing context make up our selection list. The research area covers communication as well as resource management and project coordination concerns. Well-established organizations shared their frameworks together with methodologies and strategies which enhance outsourced software quality in the included research. Analysis required English-language studies for maintaining uniform accessibility because all English publications were included. This ensured consistency in interpretation and evaluation. The research explores essential factors for successful outsourced software project quality which includes collaborative capability along with proficient vendor services and sufficient project resources. A review of titles keywords and abstracts established that studies directly connected to research questions could advance to final selection. The initial step made it possible to exclude research which did not connect to the subject of investigation.

Exclusion Criteria: The research sought to exclude all studies that failed to meet the stated objectives. The research excluded the following types of studies: Any research studying other aspects than software outsourcing and vendor performance or quality enhancement failed to meet this study's requirements. The research excluded all studies that failed to make explicit statements about vendor contributions to outsourcing software quality enhancements. The analysis excluded research reports which failed to demonstrate dependable evidence while making baseless claims and offered unproven single-sided arguments. Studies that lacked data-based evidence together with case studies or analytical findings were omitted due to the unverifiable nature of their insights. Out of the studies screened for analysis researchers eliminated all duplicate publications to base their work on specific independent reports.

Table 1.3 Selection of Final Studies

Year	IEEE	Springer	ACM	Wiley	Emerald	Elsevier/Science Direct	Miscellaneous
Before 2015	0	8	0	0	1	3	12
After 2015	11	7	12	5	4	11	22
Total	11	15	12	5	5	14	34

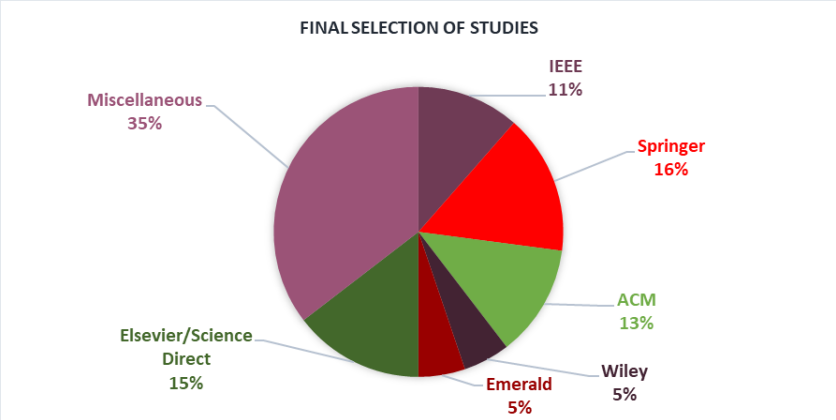


Table 2: Software Quality Influencing Factors Related to Clients' Organization,

S. No	Factors Related to Client' s Organization Management	Frequency	Percentage Frequency	Papers
QEF-2.1	Client Involvement/Participation /Feedback and appreciation for the importance of quality	36	37.50	[11], [12], [14], [18], [20]– [51]
QEF-2.2	Information/Knowledge Sharing between Client/Vendor	23	23.96	[21], [30], [33], [34], [36], [38], [39], [43], [52]– [66]
QEF-2.3	Client's trust in Vendor and vice versa.	18	18.75	[25], [33], [41], [45], [53]– [56], [64], [67]– [74]
QEF-2.4	A strong relationship between partners	15	15.63	[6], [21], [29], [36], [39], [46], [48], [55], [58], [59], [62], [64], [66], [70], [75]
QEF-2.5	Client Experience, Competency and Good Domain Knowledge	10	10.42	[51],[26],[76],[55],[31],[66],[32][77],[41],[78]
QEF-2.6	Clients' Contract with Vendor	7	7.29	[31], [34], [58], [60], [62], [79], [80]
QEF-2.7	Mutual understanding between partners	1	1.04	[66]
QEF-2.8	Clients'/Vendor alignment on different Quality impacting factors	1	1.04	[76]
QEF-2.9	Client Knowledge Management System	1	1.04	[33]
QEF-2.10	Clients' organization Turn Over	1	1.04	[34]

In this category [Table: 2] Client involvement is ranked at No.1 and is reported by many studies. This factor provides a solid foundation for other factors to be satisfied in an outsourced environment [24] [30] [31] Clients engage themselves when the information needed is unclear, or missing or when developmental activities are not in line with the goals and objectives. An inactive client would not be able to timely direct or guide related personnel on the vendor side, leaving the vendor organization to either develop a misunderstood final product or it may slow down and piggyback the developmental process thereby breaking the normal sequence of ongoing activities. Delayed responses also may extend the total duration needed for the project and hence speedy development may affect software Quality.

The 2nd most reported factor is the Information flow between stakeholders that enhances product quality by improving different developmental processes like requirement gathering, requirement specification, requirement change management, defect management, Relationship management, conflict & contract management etc. [65] [76]. Information in the form of customer review and feedback enables vendors to verify, validate and assess client' s satisfaction with the ongoing developmental activities. The 3rd important factor reported by [67]– [71], [74] is " Client' s trust in a vendor" which improves the first three factors. This factor becomes very important when the vendor organization is not familiar with the client' s business domain, or the client and vendor are working for the first

time. To gain a clear understanding of the client' s business needs and to provide a competitive IT business platform, the Client needs to provide all the relevant & explicit information to the vendor' s organization. The vendor organization also needs to set strict

SOPs for Privacy and Security to have a shiny honesty label on their name in the market so that clients' organization are not hesitant to share their sensitive information. The 4th important factor that could contribute to quality products is the relationship between the client and vendor. A strong relationship brings flexibility, motivation and closer connectivity with the client which enhances the vendor' s experience in understanding the client' s requirements [62], [64]. Strong relationships also help clients to feel more secure while sharing business secrets.

The fifth most important factor related to clients is " Client Experience, Competency and Good Domain Knowledge" . A capable, talented, and experienced customer can assist the development team by actively engaging in the development process, offering valuable input, and creating a collaborative environment with the vendor's team. Because of this, a knowledgeable client may follow the development of the project more actively. A customer with the necessary technical expertise and experience can use problem-solving techniques to identify various flaws early on and therefore reduce the cost of re-work. Formal contracts between partners always convince them to follow agreed upon specifications and hence deviation from project goals could be formally eliminated [31], [34], [58], [60], [62], [79], [80]. High Turnover of employees has a relatively low impact on Software quality; however, this factor could not be ignored especially if key people leave an organization. Skilled people can provide a clearer picture of the client business, and their departure could create a negative impact, especially during requirement collection and product acceptance testing [34]. In the second category [Table: 3], we have collected factors related to vendor organization and their strategic policy. The most reported factor is " Organization Top Management Engagement/involvement/commitment and support" [6], [10], [74], [81]– [83]. Top management plays an important role in the completion of every ongoing process. Their product-centric or service-centric policies define a well-defined operating procedure to allocate sufficient budget, human resources and time. Sincere top management support always motivates organization employees, and this creates a dedicated team working in a healthy, cooperative environment [74], [81].

The 2nd factor that could be used to improve Organization Quality standards is " Organization's Training, Rewards, Incentives and Work Recognition Policies" . These policies define the future or survival of an organization in a competitive market. Proper arrangement of training sessions, seminars, and workshops empower team members to face the challenges of rapid technological advancements. Rewards, incentives and work recognition will push the team members to work diligently on their milestones [84]– [86].

" Organizations' Culture and Power Distribution" is reported by many researchers [51], [52], [65], [66], [68], [74], [81]. Strict power distribution criteria and a clearly defined organizational culture have a big impact on all developmental processes. Software quality can be raised by creating a work environment that values teamwork, open communication, and knowledge sharing. A team environment that encourages learning and innovation is one in which members feel at ease discussing problems, exchanging ideas, and asking for assistance. Individual talents and expertise are always polished in a culture that supports continuous learning, allowing people to select the optimal approach for each work. Encouraging team members to participate in workshops, conferences, and other learning events can help them stay current with industry trends and best practices. Clearly defined power distribution among employees avoids multiple boss situations and strengthens them to share their views or make their own decisions [44] [45]. Overall software quality improves because of this. 18 of the researchers [21], [48], [61], [65]– [69] highlighted the importance of " Organizations' Skilled Human Resource & its Management" . Skilled and experienced people are familiar with the best practices in industry and can more easily & effectively implement different standard procedures during the development phase. Talented people consistently apply strong problem-solving techniques to identify the best solutions quickly, minimizing the need for rework. Since skilled individuals typically manage themselves, very little effort is needed to make them productive. The famous quote " When Love and Skill work together, expect a masterpiece" by John Ruskin (English Art Critic 1819-1900) could be applicable here with slight changes like " When dedication, efficient management and Skill work together, expect a masterpiece software product" .

The 5th most highlighted factor is " Politics Free environment with clear roles and responsibilities" [23], [27]– [29], [54]. Politics and leg-pulling always piggyback team achievements. Organizations should maintain a well-defined hierarchy of roles and responsibilities. The employee should be given sufficient powers within his jurisdiction and should be encouraged enough to make stress-free decisions in case of any issue. On the other hand, employees should be aware of their responsibilities being assigned and they should be dedicated & sincere to achieve their goals. Vendor organization' s alignment with the client' s culture and knowledge about the client' s business has also been reported by many authors that are placed at number 6 and

7. Software quality relies on the client’ s culture because it

Table 3 - shows Software Quality influencing Factors Related to Vendor Organization Management Team.

S. No	Factors Related to Vendor Organizations' Management	Frequency	Percentage Frequency	Papers
QEF -2.1	The organization's Top Management Support and Commitment	32	33.33	[6], [10]– [12], [18], [21]– [23], [26], [29]– [33], [38]– [40], [42], [45], [48], [51], [52], [55], [60], [66], [68], [70], [74], [78], [79], [81]– [83], [87]– [93]
QEF -2.2	Organization's Training, Rewards, Incentives and Work recognition Policies	29	30.21	[6], [10], [11], [20], [22], [24], [28], [33], [36], [38], [43]– [46], [48], [49], [54], [58], [65], [67], [72], [82], [84]– [86], [90], [92], [94], [95]
QEF -2.3	Organizations' Culture and Power Distribution	19	19.79	[22], [26], [33], [34], [39], [51], [52], [55], [58], [62], [65], [66], [68], [74], [81], [89], [92], [95], [96]
QEF -2.4	Organizations' Skilled Human Resources & its Management	18	19.79	[21]– [23], [30], [36], [46], [48], [61], [62], [65]– [69], [72], [73], [77], [86]
QEF -2.5	Organizational' Politics Free Working Environment with clearly Defined Roles and Responsibilities	14	14.58	[6], [9], [23], [27]– [29], [39], [48], [50], [54], [60], [68], [86], [88]
QEF -2.6	Organizational' understanding & alignment with Cross-Cultural Clients	14	14.58	[31], [34], [41], [44], [55], [62], [68], [69], [72]– [74], [80], [81]
QEF -2.7	Organizations' Alignment to and Knowledge about the Clients' business	11	11.46	[20], [28], [31], [32], [45], [47], [52], [55], [76], [81], [97]
QEF -2.8	Organization’ s Expertise in SPI/SPI Certifications	10	10.42	[18], [21], [28], [39], [48], [62], [65], [66], [86], [88]
QEF -2.9	Implementation of Information/Knowledge Management System	8	8.33	[44], [49], [56], [61], [64], [67], [71], [98]
QEF -2.10	Organizations' Financial Stability/Maturity and Financial Support	6	6.25	[27], [58], [60], [62], [69], [70]
QEF -2.11	The organization's policy of Data confidentiality and Security	5	5.21	[55], [62], [63], [69], [81]
QEF -2.12	Organizations' Capability and Maturity (Process, Technical and Financial maturity)	5	5.21	[58], [64], [67], [82], [93]
QEF -2.13	Organization Vision and Mission	5	5.21	[26], [31], [42], [51], [78]
QEF -2.14	Organization Flexibility and Reliability	4	4.17	[58], [59], [74], [81]
QEF -2.15	Political Stability at Organization Location	4	4.17	[25], [34], [58], [75]
QEF -2.16	Organizational Joint Management Infrastructure	4	4.17	[65], [66], [70], [74]
QEF -2.17	Organizational' Relationship Management Policy Effectiveness	3	3.13	[29], [59], [74]
QEF -2.18	Organization's Empathy, Honesty and Openness	3	3.13	[70], [74], [99]
QEF -.19	Organizational' Human Resource Management Policies	3	3.13	[14], [20], [100]
QEF -2.20	Organization's Experience in outsourcing	3	3.13	[25], [50], [68]
QEF -2.21	The role of the Quality and IS department within the Organization	2	2.08	[22], [79]
QEF -2.22	Reusability	1	1.04	[101]
QEF -2.23	Organization's Location	1	1.04	[49]

allows one to understand and meet the client's needs and expectations. The development team can deliver software that aligns with the client's culture, values and goals when one has a deep understanding of the client's culture. Thus, client satisfaction is directly related to understanding of client's culture and business [39], [58], [62]. Factor No. 8 SPI methodologies improve the software development process by ordering tasks, define techniques to carry out different activities and imparting required resources. Most of the researchers [18], [21], [28], [39], [48], [62], [65], [66], [86], [88] have reported that organizations must seek SPI expertise before putting hands in the development process. Organization employees must be trained and certified for smooth implementation of SPI recommended practices. Some other notable Quality Enhancement factors were identified but their frequency was relatively lower. They are listed along with their frequency in the above table 2.

In the category of factors related to the Vendor organization' s development team [Table: 4], the leading factor which is reported the most is " Team competency/Capability, Experience, Problem-Solving and Learning Skills [14], [48], [65], [66], [68], [69], [81]– [83], [87]. Experience is a teacher of all things (Julius Caesar)" . A competent/capable and experienced team will easily implement modern techniques & tools for problem-solving. They could develop a competitive quality product by priory notifying us about possible risks, defects or unfavorable results of an ongoing process. The 2nd most important factor that is necessary for a cooperative working environment is " Communication, Coordination, Cooperation, Control and Cohesion" being reported by [47]– [50], [61], [66], [69]– [71]. Close Communication and coordination enable team members to participate actively in the group activities. Cooperation between team members not only polishes each other' s skills but they could better deal with a complex task thereby breaking it among different team members.

" Team Leadership Skills, Experience and Competency" is at the 3rd position among most contributing factors to software quality being reported by many authors [6], [10], [11], [14], [51], [68], [102]. A good team leader should promote team spirit, direct team members' activities towards the goals and objectives, and avoid imbalance allocation of resources. The 4th most highlighted factor is related to the training of team members [9], [29], [33], [38], [40], [57], [73], [103]. The ever-changing development platforms, Software quality standards, testing techniques, information handling and the arrival of new hardware are extremely challenging in the beginning, however, if organizations regularly provide proper training by arranging seminars and workshops then the use of advanced technology makes life easier at later stages, not only quality could be improved but also it saves time and money, makes an on-time decision and prepare proper organization structure which enables team members to every challenge. A positive attitude towards information/knowledge sharing among team members also contributes to improving software quality. Development activity is a multi-hands activity where support, cooperation and coordination are not only extremely beneficial to resolve different issues but also helps team member to clear their ideas and polish their skills. In a supportive environment, team members come up with different solutions and by consensus, an optimal solution is chosen as a final solution [21], [49], [51]– [55], [71], [76]

Project Managers' project management Skills and competency have also been reported by many authors to have a positive impact on Software Quality in an outsourcing environment [49] [51] [20] [23] [97]. The project manager initiates a project by defining its objectives and scope and then defining a set of actions in detail during the planning phase, converging all his focus on the activities that could lead towards the completion of a quality product that meets customer requirements within the required schedule and budget. The project manager' s strict supervision, consistent progress report monitoring, control of budget, resource allocation and comparison of what is achieved and what was planned make it easier to under-stand project success.

The 7th most contributing factor is " Team Commitment/involvement and Shared Goals" [59]. Team members who are completely involved in different activities have more knowledge about the system under development and hence they can better coordinate, collaborate and contribute to the requirements finally needed by the end user [12] [20] [21] [22] [54]. A committed team is not only well-aligned with the project schedule but could also execute different strategies to manage change requests, identify different risks and remove defects before it' s too late. Team Size, Formation, Composition and Workload Balance Distribution are the quality-affecting factors ranked No.8 in our literature review [36] [37] [43]. The number of members within a team, and their composition based on their experience, competence and skill reduces the workload on each individual and hence minimizes stress on an individual' s schedule. The better we divide the activities among team members the better the solution will be. Proper and balanced distribution of activities among self-organizing team members considering their expertise will lead to a masterpiece at the end. " Team Familiarity with Technology and development methodology" has also been reported to have a positive impact on Software quality [14], [23], [29], [51], [52], [68], [72]. Methodology encompasses different processes like planning, designing, coding, testing and reporting. These processes are so important that any misunderstanding, miss-calculation or divergence could lead to complete project failure.

Team members' job satisfaction is inversely proportional to employee turnover, and it also boosts team motivation. Turnover of employees at key levels and then filling up these position costs in multiple ways, newly hired positions will take time to understand the working environment, ongoing activities, team members' strengths and weaknesses, organization preferences and business goals. The high ratio of Turn-over harms less-managed projects in terms of time and quality [20], [32], [48], [52], [104]. The 10th most reported factor is " Rewards/Incentives work recognition and other motivational activities" . These activities develop a competitive working environment where every individual wishes to contribute their full support to win incentives which ultimately boost team performance and productivity [58], [72], [85], [86], [90].

Some other quality-affecting factors were also reported, however, their frequency was less seen, these are " Team clear understanding of work break down and Roles/Responsibilities" [16], " Team and Teams' Leader awareness about process improvement Standards" [62], " Teams' Flexibility/Positive attitude towards conflict resolution and Change management" [95], " Teams' Language Proficiency" [80], " Trust Among Team Members" [72], " Team' s Morale and Performance" [98], " Team Members Availability and Sincere Efforts" [29], " Use of Quality Matrices for measurements, Development Team" [64], " Team ability to adapt to new Environment" ," Politics Free Team" [55], " Team members Empowerment for making decisions" [58], " Use of Benchmarking by Development team" , " Senior Team members alignment with Client working hours" [20], " Task ownership" [25]. These factors are important and cannot be overlooked during the Software Development Life Cycle.

Table 4 - shows Software Quality influencing Factors Related to the Vendor' s Organization Development Team.

S. No	Factors Related to Vendor Organizations' Development Teams	Frequency	Percentage Frequency	Papers
QEF -3.1	Team competency/Capability, Experience, Problem Solving and Learning Skills	45	46.88	[6], [14], [21]– [23], [25], [26], [28], [30], [31], [33]– [36], [38], [40], [44]– [46], [48]– [51], [55], [58], [59], [61], [62], [64]– [66], [68], [69], [72], [73], [81]– [84], [87], [95], [103]
QEF -3.2	Coordination/collaboration, Cooperation, Control and Cohesion	34	35.42	[9], [23]– [26], [29], [33], [38], [40], [41], [44], [47]– [50], [53], [54], [57], [61], [63]– [67], [69]– [74], [76], [102], [103]
QEF -3.3	Team Leadership Skills, Experience and Competency	25	26.04	[6], [10], [11], [14], [23], [24], [26], [30], [34], [38], [44], [45], [51], [53], [58], [60], [68], [77], [86], [89], [90], [92], [95], [100], [102]
QEF -3.4	Team mentoring/training, certification, workshops and seminars	25	26.04	[10], [11], [22], [24], [28], [33], [36], [38], [43], [45], [46], [48], [49], [54], [65], [67], [75], [82], [84]– [86], [90], [92], [94], [95]
QEF -3.5	Team information/Knowledge sharing attitude	23	23.96	[9], [18], [21], [33], [36], [38], [39], [43], [44], [49], [51]– [55], [57], [59], [60], [65], [71], [76], [98]
QEF -3.6	Project Managers' Project Management Skills & Competency	23	23.96	[14], [20], [23], [25], [30], [34], [37], [40], [43], [45], [49], [51], [54], [60], [62], [72], [77], [83], [84], [93], [95], [97], [103],
QEF -3.7	Team Commitment/involvement and Shared Goals	22	22.92	[9], [11], [12], [18], [20]– [22], [26], [28], [34], [39], [40], [43], [45], [48], [51], [54], [65], [66], [82], [92], [102]
QEF -3.8	Team Size, Formation, Composition and Workload Balance Distribution	19	19.79	[6], [14], [29], [34], [36], [37], [43]– [45], [49], [51], [53], [64], [68], [79], [82], [88], [97]
QEF -3.9	Team Familiarity with Technology and development methodology	19	19.79	[9], [14], [23], [29], [30], [34], [37], [39], [43], [45], [51], [52], [58], [60], [68], [72], [84], [86], [100]

QEF-3.10	Rewards/Incentives, word recognition and other motivational activities	10	10.42	[6], [20], [49], [58], [72], [85], [86], [90], [100], [105]
QEF - 3.11	Teams' Flexibility/Positive attitude towards Conflict resolution and Change management	9	9.38	[22], [34], [59], [64], [68], [74], [81], [92], [95]
QEF - 3.12	Team clear understanding of work breakdown and Roles/Responsibilities	8	8.33	[6], [9], [28], [39], [41], [60], [73], [89]
QEF - 3.13	Team Job Satisfaction and Low turn over	8	8.33	[20], [32], [34], [48], [52], [85], [86], [104]
QEF - 3.14	Trust Among Team Members	7	7.29	[53], [58], [64], [69], [71], [72], [88]
QEF - 3.15	Team and team leader awareness of process improvement Standards	6	6.25	[21], [39], [48], [62], [86], [88]
QEF - 3.16	Politics Free Team	5	5.21	[29], [50], [55], [86], [88]
QEF - 3.17	Team's Morale and Performance	3	3.13	[92], [98], [103]
QEF - 3.18	Team Member's Availability and Sincere Efforts	3	3.13	[29], [49], [50]
QEF - 3.19	Use of Quality Matrices for measurement by the Development Team	3	3.13	[22], [64], [106]
QEF - 3.20	Team member's Empowerment for making decisions	2	2.08	[22], [58]
QEF - 3.21	Use of Benchmarking by Development team	2	2.08	[22], [89]
QEF - 3.22	Teams' Language Proficiency	2	2.08	[25], [80]
QEF - 3.23	Senior Team members' alignment with Client working hours	1	1.04	[20]
QEF - 3.24	Task ownership	1	1.04	[25]

The 4th Category [Table: 5] consists of factors related to Development Processes. In this category, 3C (Communication, coordination, and control) among All Stakeholders is very important. Through effective communication, team members not only educate each other on different issues but also keep them synchronized on different activities. Team performance and work quality could be improved when they share information on different matters. Communication between client & vendor teams keeps clients' team updated to know the current status of each activity (work in progress) at the vendor side and enables the Vendors' team to get clients' feedback and satisfaction with the work in progress. Clear, correct, complete, concrete and concise communication defines a clear, well-understood outcome of each activity, enabling team members to avoid re-inventing the wheel, thereby saving cost and time [53] [23] [89] [54] [24] [55][72][25][26].

" Proper Implementation and Tracking of Change Management Processes" is ranked at No.2 in the list of factors linked to software development sub-processes [87] [69] [61] [20]. Considering the context of Change management, it may refer to the change in code, documentation, and requirements, or it may refer to the change in the Organization's business strategy and infrastructure. In all contexts, proper change management

has a visible impact on software quality. Change requests come on a usual basis during the development life cycle, even if the requirements are complete in the beginning, and project planning & design are very clear, this is because the factors are not in control like changes in the client business plan, implementation of a new and better idea, upgradation of the Software product to run client new policies, synchronizing with government new policies etc, in all cases, a proper change management process is required to handle the request in a way to get optimal advantage with minimal cost of resources (time plus money) [30][84]. The set of factors related to the ongoing processes during the development of Software products in an outsourcing that has been reported by many studies is the " Execution of Proper testing, Monitoring and inspection processes" [19], [21], [70]–[72], [79], [100]. The testing process highlights bugs, and logical errors in the code and ensures that the Software product is performing following client needs. Testers continuously check if the software fulfils all requirements. Does the software meet security-related standards? Is the data validation fulfilling the client' s needs before getting stored in the database? Is the software functioning smoothly on the client' s hardware/software platforms? Monitoring and Inspection of development activities are equally important to check whether the ongoing processes are cost beneficial. On the correct track and produce reliable, efficient results that could improve product quality? The fourth most important factor among the factors related to development processes is the " Execution of Risk Management Processes" [38], [39], [94], [96]. Risk factors always harm software quality, and one type of risk may spring up another type of risk, therefore there should be a proper management process to cope with different risks, for instance, poor estimation of project duration might result in Projects' un-realistic schedule (Schedule slippage), Project un-realistic Schedule may sprout cost overrun risks. No matter what type of Risk is concerned, it is always an issue and processes with unmanaged Risks/issues yield an outcome that doesn' t meet customer satisfaction. The fifth factor that was identified during SLR is " Expertise in Software Process Improvement" [58], [64], [67], [82], [93]. Software development processes are complex, and hence correct quantification is very hard. Vendors' Organizations need SPI experts who play a vital role in measuring efforts, schedules, costs, and human resources. There is always a space for improvement in the ongoing processes which could be implemented by conducting testing in the beginning & frequently when an objective or milestone is achieved. If faults are not isolated in the beginning, they propagate in the proceeding activities, producing more severe complications. Strong monitoring and careful inspection of the progressing activities should be carried out throughout the development process to get a quality product at the end.

Table 5- Shows Software Quality Influencing Factors Related to Software' s Development Process.

S. No	Factors Related to Development Processes	Frequency	Percentage Frequency	Papers
QEF-4.1	3Cs: Communication between All Stakeholders	64	66.7	[6], [10]– [12], [14], [20]– [26], [28]– [30], [34], [36]– [39], [41], [43], [44], [49]– [57], [59]– [61], [63]– [76], [78]– [80], [85], [86], [88], [89], [94], [95], [97], [99], [102], [103], [106]
QEF-4.3	Proper Implementation and Tracking of Change Management Processes	18	18.8	[20], [23], [24], [26], [30], [47], [53], [61], [69], [72], [80], [83], [84], [87], [89], [95], [101], [106]
QEF-4.2	Execution of Proper testing, Monitoring and inspection processes	17	17.7	[9], [11], [23], [26], [27], [30], [34], [51], [55], [57]– [60], [68], [90], [95], [101], [103]
QEF-4.4	Execution of Risk Management Processes	14	14.6	[22]– [25], [29], [30], [53], [55], [62], [69], [84], [86], [98]
QEF-4.5	Expertise in Software Process Improvement	10	10.4	[18], [21], [28], [39], [48], [62], [65], [66], [86], [88]
QEF-4.6	Proper Implementation of Conflict Management or Conflict Resolution Processes	5	5.2	[58], [64], [67], [82], [93]
QEF-4.6	Financial, Technical and Process Maturity	4	4.2	[6], [34], [60], [101]
QEF-4.8	Proper Implementation of Defect Management tracking using a Centralized Database	3	3.1	[14], [90], [91]

QEF-4.9	Execution of Correct Effort Estimation Processes	2	2.1	[9], [103]
QEF-4.10	Verification and Validation of Each Process or Activity	2	2.1	[9], [84]
QEF-4.11	Process Automation	1	1.0	[11]

In the below [Table: 5] factors related to the Product or Project are listed. The Vendor organization is mainly responsible for taking care of these factors to improve the software quality in an outsourced environment. Vendor organizations should carefully constitute and assign teams to different activities and processes. A successful product is the output of well-organized, well-governed, measurable, and systematic processes. It is also heavily dependent on clear requirements, planning, resource allocation, project duration, correct estimation and following Standards and Quality enhancement procedures.

Table 6- Shows Software Quality Influencing Factors Related to Software Project/Product.

S. No	Factors related to Product/Project	Frequency	Score out of 10	Papers
QEF-5.1	Clear, Complete and Stable or Frozen Requirements	37	39.58	[9], [14], [22]– [24], [29], [30], [34], [36]– [38], [41], [42], [44], [45], [47], [49], [54], [56], [60], [64], [67], [68], [71]– [73], [77], [80], [83], [84], [87], [90], [91], [103], [105], [106]
QEF-5.2	Project Planning and Objectives	28	29.17	[14], [22], [26], [30], [37], [41], [51], [55], [58]– [60], [68], [69], [72], [78], [83], [84], [86], [87], [89], [91], [92], [95], [101], [105]
QEF-5.3	Project Governance and Control	22	22.92	[9], [10], [21], [23], [24], [26], [30], [34], [36], [48], [51], [65], [66], [68]– [70], [73], [81], [84], [90], [94], [101]
QEF-5.4	Projects' deadline, Alignment with schedule and Progress Reporting	19	19.79	[6], [23]– [25], [30], [34], [37], [41], [42], [44], [55], [58], [68], [72], [78], [86], [92], [98], [104]
QEF-5.5	Allocation of financial funds/budget and other resources	17	17.71	[9], [10], [34], [39], [43], [55], [58], [60], [62], [65], [66], [68]– [70], [88], [90], [105]
QEF-5.6	Frequent Unit Testing, Monitoring, Inspection	17	17.71	[20], [23], [24], [26], [28], [30], [47], [53], [61], [69], [72], [80], [83], [84], [87], [89], [105]
QEF-5.7	Project Formal and complete Documentation with all Constraint Clearly Defined	15	15.63	[11], [14], [29], [31], [32], [55], [59], [61], [76], [91], [100], [101], [103], [105], [106]
QEF-5.8	Project Complexity and Duration of Project	9	9.38	[23], [24], [26], [30], [34], [37], [49], [68], [79]
QEF-5.9	Correct Estimation of Cost, Time, Budget and Other Resources	8	9.38	[9], [34], [35], [43], [64], [68], [72], [103]
QEF-5.10	Type of programming language Used	4	4.17	[31], [32], [49], [96]

The next [Table: 7] groups Software Quality enhancement factors related to infrastructure employed at vendor organization and the use of advanced testing and statistical tools at vendor organization. The suitability of the technology and infrastructure is one of the crucial factors that raise software quality whether it is developed in-house or in an offshore mode of development. Quality Product is always an outcome of well-structured development processes [75]– [78]. These development processes could be significantly improved using modern development tools and technology such as Sophisticated IDEs (Integrated Development Environments), which offer capabilities like code completion, debugging, and version control integration, such as Visual Studio, Eclipse, or IntelliJ IDEA. Automated build and deployment procedures can aid in the timely and accurate release of software upgrades. The build, test, and deployment processes can be automated using tools like Jenkins, Travis CI, or GitLab CI/CD, resulting in consistent and dependable software releases. Teams can

collaborate effectively with upgrades/Subversion by using a version control system, such as Git or Teams, to log changes and revert to prior versions as needed. This encourages cooperation and guarantees the validity of the code. Software Quality can be enhanced by executing frequent, cost-effective, accurate test scenarios to locate the invisible flaws or bugs. To write and perform automated tests, advanced testing frameworks like JUnit for Java or NUnit for.NET can be used. By helping to identify flaws or issues early in the development process, these frameworks help to raise the standard of the final output. Continuous Integration (CI) procedures can raise the caliber of software by routinely merging updating updated code and executing automated tests. The CI process can be automated using programs like Jenkins, Travis CI, or GitLab CI/CD. Maintaining thorough documentation and promoting knowledge sharing inside the software house can both contribute to higher product quality. Code, APIs, and architectural documentation are all parts of this.

Table 7 - Shows Software Quality Influencing Factors Related to Infrastructure.

S. No	Factors related to Product/Project	Frequency	Percentage Frequency	Papers
QEF-6.1	Suitability of the Employed Technology/ Appropriate Infrastructure	32	37.50	[6], [9], [10], [14], [22], [23], [30], [31], [36]– [39], [41], [43], [45], [47], [50], [52], [58], [64]– [68], [74], [81]– [84], [88], [100], [103]
QEF-6.2	Use of Advanced Testing/Statistical Tools and use of Social Networking	13	11.8	[28], [30], [90], [95], [37], [42], [43], [47], [50], [64], [67], [88]

SURVEY RESULTS

After identifying Quality improving factors from SLR, we asked industry experts to rank the factors in each category. The experts were asked to assign weights between 0-10, where zero weightage means that the factor is not relevant to improving the Quality of the software and 10 means that it is of very high importance. Factors with ranks between 3 and 6 were important and should not be neglected during the Software development life cycle. We collected 88 responses from Software Engineers, Team Leaders, Testers, and Software Quality analysts; however, it was further filtered and only 38 experts were chosen who had at least one year of experience in an outsourcing environment. In the following section, the weight for each factor in each category listed above is calculated, considering the SLR score, and the Survey being conducted. The Survey score was calculated by using the formula below.

- **Survey' s Average Value = (Total score obtained by a Factor/ Total response submitted for that factor).**
  Similarly, Average SLR values were calculated by considering the following formula,
- **SLR' s Weightage = (Frequency of each factor/Total Paper being studied) x 100.**
  Finally, we calculated the average value for each factor using the below formula,
- **Final Average Weightage = (Survey weightage + SLR weightage)/2**

The above tables (2 to 7) have listed Critical factors related to Client organization as well as to Supplier organization. This research aims to find out critical success factors related to Vendor organization. Therefore, we have retrieved & regrouped those factors which are related to the Vendor organization management team, technical team, project, and process along with their SLR and Survey raking. The final score (average of SLR and Survey) for each factor was calculated. We can see that the Communication process is on the top rank while Communication is the backbone of every outsourced project. Timed, well-recorded and formal communication among stakeholders not only removes the unnecessary delays but also shows the interest of all stakeholders. It not only enables team leaders to track project progress but also enables them to get control of the undergoing activities. Top management' s interest always boosts team members to put extra effort into achieving their assigned targets and hence goals. The third most important factor is the project requirement. Software vendor organizations must be very clear about the customers' needs and hence they should be very careful to collect functional and non-functional requirements such that the end product completely reflects customer business needs. The incomplete or changing requirement may interrupt the ongoing activities and hence may turn back it to some initial stages, leaving the software development process in chaos.

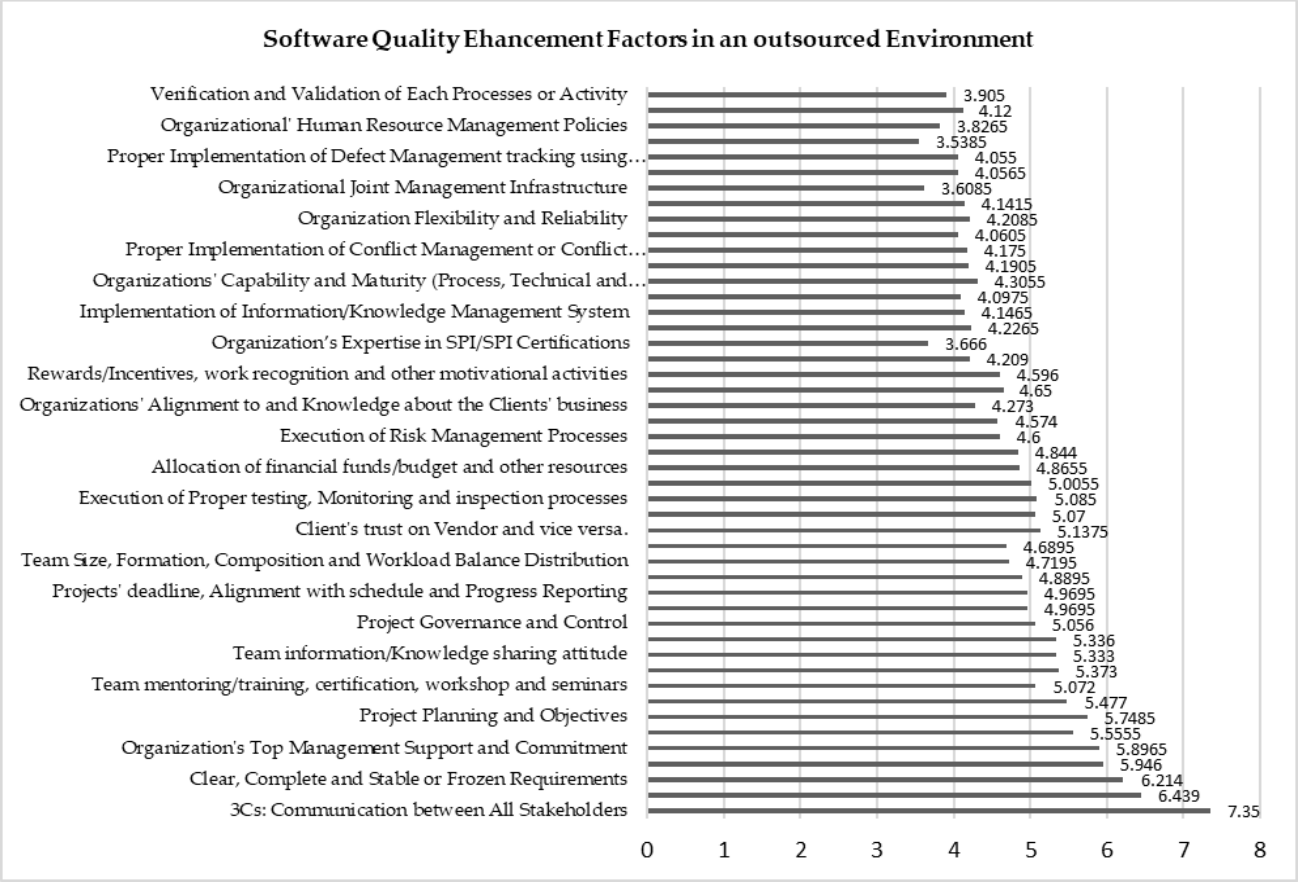
Table: 8 Shows Software Quality Enhancement factors from a Vendor Perspective.

S. No	Quality Enhancement Factors	SLR Frequency	SLR Percentage Frequency	Survey Weightage (Scale:0-10)	*Final Weightage = (SLR Percentage/10 + Survey weightage)/2
1	3Cs: Communication between All Stakeholders	64	66.7	8.03	7.35
2	Team competency/Capability, Experience, Problem Solving and Learning Skills	45	46.88	8.19	6.44
3	Clear, Complete and Stable or Frozen Requirements	37	39.58	8.47	6.21
4	Coordination/collaboration, Cooperation, Control and Cohesion	34	35.42	8.35	5.95
5	The organization's Top Management Support and Commitment	32	33.33	8.46	5.90
6	Organization's Training, Rewards, Incentives and Work recognition Policies	29	30.21	8.09	5.56
7	Project Planning and Objectives	28	29.17	8.58	5.75
8	Team Leadership Skills, Experience and Competency	25	26.04	8.35	5.48
9	Team mentoring/training, certification, workshops and seminars	25	26.04	7.54	5.07
10	Project Managers' Project Management Skills & Competency	23	23.96	8.35	5.37
11	Team information/Knowledge sharing attitude	23	23.96	8.27	5.33
12	Team Commitment/involvement and Shared Goals	22	22.92	8.38	5.34
13	Project Governance and Control	22	22.92	7.82	5.06
14	Team Familiarity with Technology and development methodology	19	19.79	7.96	4.97
15	Projects' deadline, Alignment with schedule and Progress Reporting	19	19.79	7.96	4.97
16	Organizations' Skilled Human Resources & its Management	18	19.79	7.8	4.89
17	Team Size, Formation, Composition and Workload Balance Distribution	19	19.79	7.46	4.72
18	Organizations' Culture and Power Distribution	19	19.79	7.4	4.69
19	Client's trust in Vendor and vice versa.	18	18.75	8.4	5.14
20	Proper Implementation and Tracking of Change Management Processes	18	18.8	8.26	5.07
21	Execution of Proper testing, Monitoring and inspection processes	17	17.7	8.4	5.09
22	Frequent Unit Testing, Monitoring, Inspection	17	17.71	8.24	5.01
23	Allocation of financial funds/budget and other resources	17	17.71	7.96	4.87
24	Organizational' Politics Free Working Environment with clearly Defined Roles and Responsibilities	14	14.58	8.23	4.84
25	Execution of Risk Management Processes	14	14.6	7.74	4.60
26	Organizational' understanding & alignment with Cross-Cultural Clients	14	14.58	7.69	4.57
27	Organizations' Alignment to and Knowledge about the Clients' business	11	11.46	7.4	4.27
28	Expertise in Software Process Improvement	10	10.4	8.26	4.65
29	Rewards/Incentives, work recognition and other motivational activities	10	10.42	8.15	4.60
30	Project Complexity and Duration of Project	9	9.38	7.48	4.21
31	Organization’ s Expertise in SPI/SPI Certifications	10	10.42	6.29	3.67
32	Team Job Satisfaction and Low turn over	8	8.33	7.62	4.23
33	Implementation of Information/Knowledge Management System	8	8.33	7.46	4.15

34	Organizations' Financial Stability/Maturity and Financial Support	6	6.25	7.57	4.10
35	Organizations' Capability and Maturity (Process, Technical and Financial maturity)	5	5.21	8.09	4.31
36	The organization's policy of Data confidentiality and Security	5	5.21	7.86	4.19
37	Proper Implementation of Conflict Management or Conflict Resolution Processes	5	5.2	7.83	4.18
38	Organization Vision and Mission	5	5.21	7.6	4.06
39	Organization Flexibility and Reliability	4	4.17	8	4.21
40	Organization's Empathy, Honesty and Openness	3	3.13	7.97	4.14
41	Organizational Joint Management Infrastructure	4	4.17	6.8	3.61
42	Organizational' Relationship Management Policy Effectiveness	3	3.13	7.8	4.06
43	Proper Implementation of Defect Management tracking using a Centralized Database	3	3.1	7.8	4.06
44	Political Stability at Organization Location	4	4.17	6.66	3.54
45	Organizational' Human Resource Management Policies	3	3.13	7.34	3.83
46	Execution of Correct Effort Estimation Processes	2	2.1	8.03	4.12
47	Verification and Validation of Each Process or Activity	2	2.1	7.6	3.91

* Final average weightage = (Percentage Frequency of SLR/10 + Survey Weightage)/2

** The survey Scale was chosen between 0 and 10 and hence we have divided the SLR Average Frequency Value by 10 before calculating the final average value



Conclusion: This research mainly focuses on finding out the most critical success factors that could enhance software quality in an outsourcing environment from a vendor perspective. All the factors that were identified through SLR were initially separately grouped into different categories to get the proper attention of the

experts for each success factor being interviewed. Tables 2, 3, 4, 5, and 6 list all these categories. Keeping the focus on RQ-1, all the factors belonging to different categories that could be directly or indirectly controlled by Vendor organization are re-combined in the Table along with the SLR and Survey Score. The table is sorted in descending order using the average score for each factor. The Total Score for each factor is calculated using the below formula,

Factor-ave-score = (SLR Score + Survey Score)/2

The factor with the highest average shows the criticality /importance of that factor. However, it was found during SLR and the same was observed during analysis of Survey responses that the ranking of factors is not similar or even close for all respondents, this indicates firstly, that every organization should pay more attention to the factors where they lack or have little control. Project higher-ups should be very clear about their organization's capabilities and should mainly focus on the weak points of their technical knowledge, skills and expertise of team members, project managers, team leaders etc. They should prioritize the weakest areas to get more control over expected risks related to ongoing projects. Secondly, some of these factors are closely related to each other and one factor could improve another factor. For instance, Top management support is very important to create a cooperative work environment by approving well-defined policies and clear goals and objectives. Similarly, well-recorded communication will improve team coordination and mutual understanding. It also removes ambiguity during requirement gathering. An organization with a new setup or having fewer projects in its portfolio should thoroughly gauge its SOPs, Management Policies, Teams and leadership capabilities, Team Skills/expertise and combination, and Technological Infrastructure, must be very stringent to take care of all the above factors, however, an experienced setup should have more focus on factors/challenges where they lack or they are facing it for the first time. Some of the high-ranked factors are 3Cs (Communication, Coordination & Control), Top Management Support, Clear, complete, and Frozen requirements, training, incentives and rewards etc.

Future Work: To obtain a more succinct order of precedence for the aforementioned factors, we will re-group the elements given in Tables 2 through 7 depending on their nature and relevance and then apply the AHP technique to these subcategories. This will allow us to create a model for vendor organizations that will allow them to adhere to a methodical process for improving the quality of their software.

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