

Ethical Issues Relating to Software Requirements Engineering in Selected Companies in Sub-Saharan Africa

Bright Kyeremanteng^{1*}, Andrew Quansah¹, Emmanuel Asiamah¹, Lawson Kobina¹, Esther Ntow Kesse¹

Abstract

Ethics is applied and required in different disciplines and fields. Ethics affects computing decisions in software product development and procedures. Ethics are examined during the requirements engineering phase of the software development life cycle. Using a case study, the study explores the various ethical issues that affect the requirements engineering phase in Sub-Saharan Africa. It also highlights the research gaps and provides a framework for addressing these issues. Interviewing, focus group deliberations, goal-directed sampling, and qualitative examination were all used. When it comes to incorporating ethical considerations of software during requirements engineering, this research finds a lack of industry norms, standard codes of conduct, and other rules inside firms. It also implies that practically all businesses lack ethical problem identification and verification processes. Furthermore, the key ethical difficulties observed are classified into the following: requirements identification issues, quality-based issues, conducting prohibited actions, refusal to provide requirements, the nonexistence of a legal basis for responsibility, and knowledge gaps. Based on the outcomes of this study, it can be stated that there is no specialized strategy for identifying ethical difficulties in software firms. Furthermore, standards are non-existent or procedures in place inside the businesses. This necessitates resolving existing and developing requirements for ethical engineering problems.

Keywords

software; ethics; requirement engineering; software problems; software quality

¹Computer and Electrical Engineering Department, University of Energy and Natural Resources.

*Corresponding author: andrew.quansah@uenr.edu.gh

DOI: 10.26796/jenrm.v8i2.211

Received: 20 September 2022 ; Received in revised form: 27 October 2022; Accepted: 29 October 2022; Published: 30 November, 2022

Contents

1	Introduction	69
2	Ethics analysis in software development firms	70
3	Methodology	70
3.1	Tools for data collection preparation	70
3.2	Procedure for data collection	72
4	Result and discussion	72
5	conclusion and proposed ethical framework	74
	References	75

1. Introduction

Ethics is applied and required in different disciplines and fields [1]. Ethics greatly affects users, customers, experts, and company decisions around software product development and operations. Ethics is defined “as a standardized framework for understanding, evaluating, and discerning of right and wrong, good and bad, and admirable and deplorable as they relate to the well-being of and relationships among sentient beings as they relate to the well-being of and relationships among sentient beings” by some scholars [2]. Ethics and software are inextricably

linked, whether directly or indirectly. The task of software engineering is inextricably linked to people. As a result, software engineers’ ethical familiarity, practices, and expert abilities are becoming increasingly important in the sector [2]. For that matter, software-related issues may have negative consequences for stakeholders. They are often at the root of several technical disasters [3]. Software system failure may severely affect people’s lives and create public harm [1]. Software project catastrophes have been a notorious issue since the beginning. Even though countless studies on software quality have been published and many changes to the software development cycle have been implemented, software project failure remains a significant concern. They create profit in a short span, but in the long run or probably shorter, they could result in significant monetary losses as well as societal harm owing to a lack of or complete disregard for guidelines, policies, customs, and ethical considerations [3].

Several studies [4] [5] have examined software initiatives’ success and failure rates. These investigations revealed that substantial issues with the development of effective software projects exist across several sectors. It was also stated that while project administration concerns

are a common cause of software system failure, customers and other stakeholders also play a role [3]. Mostly, these malfunctions are caused, actively or passively, by software engineers failing to execute their professional duties by engaging in unethical professional conduct [1] [6] [7]. To generate meaningful and important software products for all personnel, the whole development process requires careful identification and assessment of ethical considerations [3]. There are essential ethical considerations that should be well-thought-out in each step of the SDLC, despite the different software development paradigms [3] [8]. By evaluating ethical concerns in the requirement engineering phase, many issues will be resolved and may not even arise [9] [10].

Ethical considerations must be well-thought-out throughout software development to achieve a justifiable influence on development. Surely, ethical issues may and should be vital in the beginning stages of the Development Cycle, Specifically, the stage of requirements engineering [3]. Requirements engineering is a vital stage of the whole development process, to the extent that, if it is done excellently, it leads to the software development's success [10] [11]. Even if the software is correctly implemented, the software product will be unsuccessful after some time if it fails to match the appropriate requirements [11]. This stage is well-known for being the most difficult stage for introducing ethical issues and is often done without clear thought of moral issues. Hence, the requirement engineering phase has suffered a slew of ethical blunders [12]; examples include intentionally delaying noxious requirements and requirements with continuing and unknown hazardous consequences. Additionally, unfitting, deceptive, incomplete requirements, disregarding important parts of the business model, and pointless intricacy and operationality, are all considered ethical violations [12] [13]. Ethical considerations should be factored into the requirements engineering process to address this. Therefore, this research examines ethical issues arising in software requirement engineering in software development. This examination will be done by interviewing focus group deliberations, goal-directed sampling, and qualitative analyses.

2. Ethics analysis in software development firms

To this day, software engineering ranks high on lists of the best jobs in the world [14]. With the advancement of software engineering, there has been a rise in the importance of value-based software, with novel approaches and methods being applied to always meet the increasing business and stakeholder demands, economic conditions, competition, and cost-effectiveness of enterprises [15]. Through the analyses of real-world projects, the importance of value-oriented software system design has been seen [16]. Value-oriented software development, as

they put it, helps to integrate values into software development. There are various distinctions between ethics and values [16]. However, there is a strong relationship between the two. [17]. Thus, ethical ideals are critical for supporting software engineers in their work [18]. In an attempt to solve some of the problems arising from the ACM/IEEE set of ethics, Al Ammar et al. [6] [19] made a scientific investigation into an organization referred to as SADA, a Saudi Arabia-based software development company, investigating their practices more intently. Interviews, questionnaires, and other secondary sources of information were utilized. The researchers proposed a novel system that considers the four main standards of the IEEE/ACM code of ethics. They then classified these standards into four categories: requirements engineering, design, test, and maintenance. This was approved by experts. The research demonstrated that there were not any proper guidelines for various stages in the software development life cycle. Also, another finding was that many did not know of any such code of ethics. On the downside, this study did not make the codes of ethics clearer. Additionally, no reason was given as to why only one company was studied, and only four of the principles were selected. Their study suggests that further research is needed to analyze the various ethical issues that may arise during the development of the SDLC.

In a study conducted on ethical issues surrounding software engineering in the digital age, Rashid et al. [20] discussed the need for software engineers to consider the negative effects of their work on society. Some of the many ethical worries that arise from software listed by the authors were privacy, monitoring, and data protection. The authors also did a basic comparison of the advantages and disadvantages of the applications and failed to examine deeply the ethical problems arising from the technologies used. Through their study, Whittle et al. [16] found a method for incorporating human values into software engineering and put forward a novel technique for considering the aforementioned values. The authors of the study noted that while developing software systems, it is important to consider the various human values involved in a system's design and implementation. For instance, values such as openness and liberty should be considered when building a software system. To obtain results for incorporating human values into software development processes, technical and non-technical solutions must work together. Nonetheless, Whittle et al. [16] focused their study more on values than ethics.

3. Methodology

The focus of this study is on software firms in Sub-Saharan Africa. Renowned software companies were used in this survey. In terms of development tasks, the companies vary from small to big (employees of more than 100). Job experiences ranged from 5 to 29 years. These organi-

zations work in various fields of IT. They are dispersed among IT-related fields like; E-Government, databases, hospital management software systems and other management systems, customer relationship management, mobile applications, and several others.

3.1 Tools for data collection preparation

Thirteen questionnaires and five focus group discussion questions were created and assessed by twelve experts in the field of computer science and engineering to ensure their legitimacy. The companies are located in Accra, Kumasi, Lagos, Freetown, and Abuja, which form most of the prominent cities in Sub-Saharan Africa. Participating firms were selected using purposive sampling among the available software companies. These are companies who were willing to participate in the research. To maintain confidentiality, the names of the companies were numbered using roman numerals except for one firm, which has four years of experience; the majority of the companies had been operating for more than seven years. Company II has been creating software products and services for twenty years. Table 1 gives the details of the companies.

Table 1. Participants and software firms

Company	Years of Operation	Number of those who partook in the re-search	Size of Com-pany
I	10	3	9
II	20	7	628
III	13	3	12
IV	18	3	501
V	4	2	6
VI	17	17	3001

Table 2 shows the demographic information of the participants. This allowed the research findings to be applied in various software development organizations, depending on their size and maturity. Purposive sampling is used to choose the firms and individuals who will participate. Following the selection of the organizations, thirty-five willing professionals with a theoretical and practical understanding of software development, notably requirements engineering procedures, were chosen.

Table 2. Participants’ demographic information

Category	Category Percent-age (%)	Number of Participants
Gender	Male	22
	Female	13
Age	From 20–35	9
	From 36–50	22
	Above 50	4
Educational Level	BSc	9
	MSc	25
	PhD	1
Years of Expe-rience	1 year	3
	5 years	3
	7 years	4

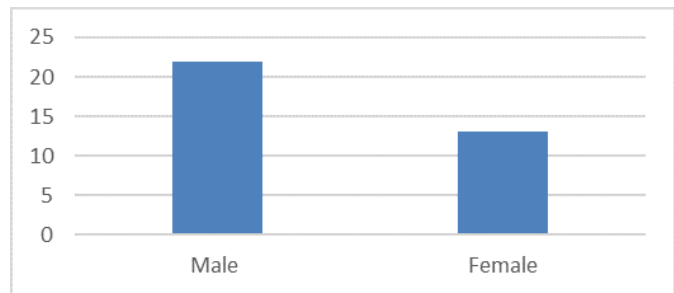


Figure 1. Gender

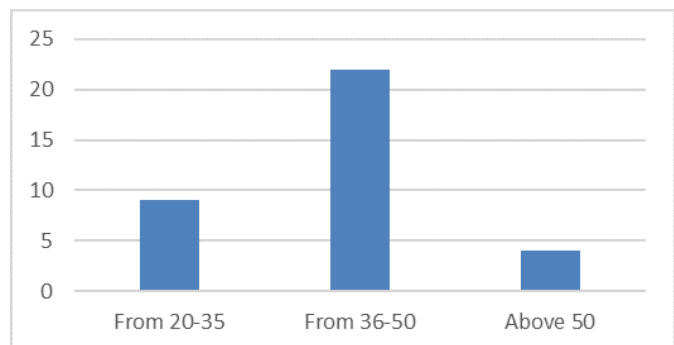


Figure 2. Age

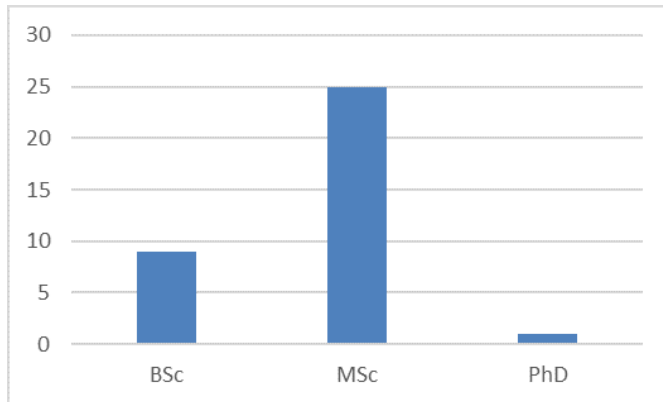


Figure 3. Educational level

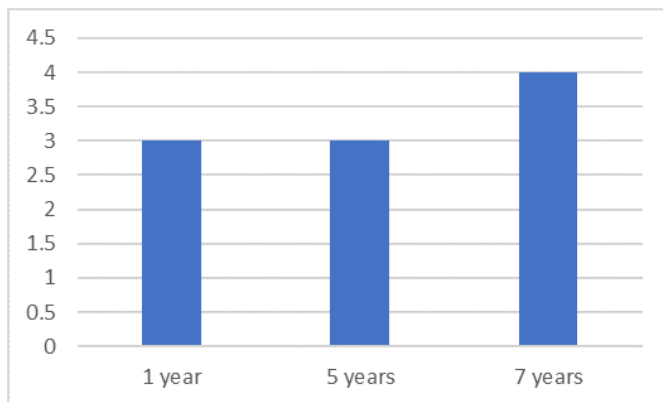


Figure 4. Years of experience

3.2 Procedure for data collection

The number of interview questions and discussion questions administered to each focus group was fifteen and five, respectively. For the requirements engineering phase in software development, the questions addressed ethical problems. The interview was audio-recorded, and it lasted around 45 minutes on average. During the interviews, we utilized probing questions to get specific information on pertinent ethical problems. Two focus groups were examined. Each focus group discussion lasted an hour on average. The talks in these focus groups were quite open and participatory. Furthermore, all of the participants agreed to participate in the study. The focus group and interview questions were designed to align with the research questions. There are three research questions. Each of the study topics is discussed about the designed data-collecting instruments in this section.

The first study question looks at software businesses' practices when an ethical issue arises in the requirement engineering phase. Three interview questions and two focus group discussion questions were created to help with this. These questions were used to evaluate software businesses' use of professional codes of conduct and guidelines, as well as how they were applied in day-to-day operations to address ethical challenges in requirements engineering. The second study topic focused on the ethical considerations that should be made during the requirements engineering process. Two focus group discussion questions and five interview questions were created to answer the main questions of the study. The final study question examines whether firms employ any methodologies or approaches to uncover ethical issues throughout the requirements engineering process. After conducting interviews and focus group discussions, the researchers prepared a study report.

The acquired data were transcribed and examined several times to determine the key themes of the findings. The information was structured such that it could be analyzed. Four qualitative coding procedures were utilized to examine the data. The primary themes and groups derived from the data are grasped using this coding method. This coding approach assisted in gaining a general feel of the content and preparing a portion of the data for further coding and categorization. Furthermore, initial coding was employed to thoroughly evaluate each aspect of the data. Then, from each different segment of the data, starting codes were constructed. In addition to the aforementioned methodologies, in-vivo coding was used to capture some of the respondents' essential real phrases. We also employed attribute coding to aid in the discussion of software businesses and the demographic characteristics of individual participants (Table 2).

The phases of the coding process mentioned in the methodology were employed. The anchor code was identified. The overall ideas of the corpus were recognized

utilizing holistic coding. Furthermore, after catching up on the main aspects of each data collection, each word, phrase, and sentence was thoroughly examined. The appropriate statements were coded and placed under their corresponding anchor codes in the second step. In addition, in-vivo coding was used to capture certain key remarks from the respondents. The resulting preliminary codes were created during the third step of the coding process. They were then displayed in the fifth step. The sixth step involved creating and examining categories to build themes that met the research objectives. Finally, important themes emerged from the research findings. The primary findings of the research related to each subject are presented in the next section.

4. Result and discussion

The initial goal was to assess participants' understanding of the need to explicitly consider ethical problems throughout software requirements engineering procedures. All of the participants agreed that it is critical to consider ethical concerns throughout requirements engineering procedures. The participants mostly deliberated on two important groupings: ethical considerations in requirements engineering methods, which aid in the development of high-quality software while minimizing ethical concerns. This means that many benefits are reaped by considering ethical problems early in the system development life cycle. Some of these benefits include securing privacy and security, most importantly. It also improves software project success, refines products, and improves usability, as well as enables the retrieval of in-depth information that can be secured. Ethical considerations also help to reduce ethical infractions. This means that thinking about ethical issues may help to avoid false requirements, safeguard secrecy, uphold societal ideals, and identify comprehensive requirements, among other things.

Analyses of software-development companies were held to learn more about software engineers' behaviors in terms of incorporating ethics during requirements engineering. The evaluation of the application of the professional code of conduct and guidelines in the software industry was carried out. Except for one, all participating companies use a typical approach to requirements engineering procedures. During the requirements engineering procedures, that single firm attempts to concentrate on detecting ethical risks as early as possible, particularly security elements of ethics. This company practices a variety of methods, including guaranteeing security concerns by paying close attention to them. Filtering requirements are also done with issue-tracking tools.

Furthermore, this corporation has created divisions/departments, "this helps us increase our performance and generate better software," respondents said in response. Other companies which responded indicated their lack of any professional responsibility standards. Except for business

IV, virtually all the firms claimed they lacked procedures to assess ethical considerations throughout the software development life cycle.

The second part of the study is to find out what ethical issues should be included in the requirements engineering process and how they should be considered during software development. It also aims to analyze the various obstacles that prevent people from ethical behavior. Through this process, researchers will be able to identify the most common ethical problems that occur in software development and the most severe instances of misconduct that have happened. Two main categories (themes) of difficulties in response to this study topic were encountered. The first topic addresses significant issues, such as major issues related to ethical considerations in requirements engineering. This subject was dubbed "basic ethical concern theme" because it encompasses the most important ethical issues raised by participants during the interviews and focus group discussions.

Many viewpoints and reflections were observed among the participants. Nonfunctional needs, according to one participant, might include ethical issues. "Nonfunctional criteria are difficult to capture and expensive to test," he stated. Users were unable to appropriately identify them. Taking non-functional needs as a requirement is extremely difficult because of these and other comparable issues." Furthermore, he stated that even functional needs are unreliable in our nation. The presence of these insecure functional needs makes it tough to take non-functional needs like ethical issues into account. This is because it necessitates finances, a platform, and other resources.

According to the other responder, most ethical problems are personal. Thus, they are linked to a person's behavior. "The difficulty with requirements engineering is that, despite the existence of frameworks and rules, the recommended framework is seldom applied," he stated. Another issue is the lack of expertise on both the customers' and business analysts' (requirements engineers') sides. The capacity to recognize needs, listen, gather, and properly write those requirements is a difficult challenge to solve. Furthermore, they have no idea how their firm is going from the customer's perspective."

"The main difficulty during requirements engineering is the irritation of consumers using an automated solution", observed another attendee. Because they felt automation would result in, them losing their employment, causing overload (workload), and bringing them closer to it, as a result, when questioned about needs, they may not want to provide the true requirements. They keep the requested information to themselves. Other ethical difficulties observed include imprecise business processes, vague needs, unfilled infrastructure, and the use of outdated tools and technology". "Customers may not be willing to provide all relevant formats, papers, and reports," the other individual added. They have the propensity to

be hidden. Some may be ignorant, but most do so on purpose for various reasons, such as fear of losing their jobs due to automation, loss of unneeded perks linked with corruption, and so on. Observation of about six kinds of ethical difficulties in the analysis: requirements for detecting issues, issues with quality, carrying out prohibited activities, reluctance to provide requirements, gaps in knowledge, and an absence of legal justification or standards for accountability. Identification of requirements is a process that involves identifying the various elements of a project that need to be done to meet a business' needs. Some of the issues identified regarding this subject include lack of attention to detail, focusing only on the functional requirements, missing requirements, unclear requirements, and omitting requirements. There were concerns linked with quality in addition to needs identification issues throughout data collecting. Among these are difficulties with usability, confidentiality, cyberattacks, security, and privacy, among other things. Another category includes engaging in prohibited activities. The majority of responders highlighted issues like poor work ethics, carelessness, adding malicious code to the code base, copying the codes of others, and so forth. The other area under this issue in basic ethical considerations is refusing to offer engineers suitable requirements. Many consumers are hesitant to provide the essential data for the desired system from the customer's standpoint. As previously stated, this is the customer's major issue. Some codes in this category are impure and too complex, making it difficult to provide clear, precise and acceptance criteria.

One of the main reasons why there is a lack of accountability is due to the lack of specific legal requirements or guidelines for software development. This category shows the lack of national standards for software development. "We supply services for service-giving organizations," claimed business V responders. "In practice, however, this is just too tough and demanding. We do this because we build services and then sell them to service providers. They stated that some corporations might be able to get their consent by using a variety of methods, such as voice or manually. They also claimed that there are no laws or regulations that require developers to follow certain rules and regulations when it comes to their work. The punishment of developers who neglect moral issues lacks a legal foundation. Therefore, there needs to be a system in place to hold developers responsible for their unethical actions. It should be in the form of practice or policy. There should be legislative mechanisms to ensure that ethical problems are addressed and that software developers are held accountable."

The knowledge gap is the last but not least category. As previously said, both technical workers and customers lack expertise. The second topic that emerges from this is management-related issues. Data analysis results in management difficulties, which are problematic. The fo-

cus of this subject is on software project management. This addresses a variety of issues. To name only two issues, frequent modification requests and a reluctance to make adjustments are the most serious. These categories are used to classify various problems that can affect the quality of an organization's work. Some of these include conflicts of interest, inadequate requirements, poor change management, and scope creep. The third research question concerns the methods and techniques used to determine the ethical issues that can be addressed in the requirements engineering process. This issue is addressed by examining software businesses' approaches to identify and address these issues. The study also highlighted the need for further research on the various ethical concern processes and their applications. It makes it important to consider the existence of these processes and their approaches. As a result, an evaluation was made on ethical considerations using interviews; some of the interview questions before identifying and recommending applicable techniques. Questions two point three (2.3) and three were also utilized in the focus group discussion.

The approaches, existence, or lack of ethical problem identification methods were explored under this subject. Most firms have no defined methodologies for identifying ethical problems during the requirements engineering process. Most respondents stated that they do not have any processes or checking mechanisms to do so. Only a few mentioned some of the approaches they employ during requirements engineering. Few firms employ conversations, seminars, and prototypes to communicate utilizing various methodologies such as user acceptability testing and checklists, as well as their intuitive ways. They did, however, primarily employ these metrics for functional needs. They are seldom utilized for nonfunctional reasons, particularly due to ethical issues. In general, the study findings show that virtually all firms lack well-established procedures and systems for determining if ethical considerations are examined and included in requirements engineering processes. Firms in Sub-Saharan Africa lack a well-organized system for recognizing and incorporating ethical problems throughout the requirements engineering procedures. During the early stages of the SDLC, the majority of them did not employ any guidelines for the incorporation of ethical problems. Instead, the majority of respondents requested that explicit guidelines, norms, regulations, and policies be developed at a national level to include ethical issues in requirements engineering procedures.

The second research question was conducted to analyze the various factors influencing ethical behavior. These included the time spent on challenging tasks, the number of ethical violations, and the fundamental ethical questions that were asked. The findings were then used to develop two main topics: management-related challenges and fundamental ethical problems. In addition, the third

research topic is about methodologies. It becomes crucial to the study to determine if any ethical issues are present by using identification techniques and check mechanisms. As a result, research was done on existing methods and approaches to detect ethical problems in those instance firms before determining and offering applicable ways for ethical concerns. The study revealed that many firms do not have the necessary procedures and tools to identify ethical problems during the requirements engineering process. They also use standard methodologies to identify functional needs. Only one business, company IV, attempts to utilize traceability matrices and Jira tools to discover ethical risks throughout requirements engineering processes. On the other hand, these approaches and tools are not limited to nonfunctional needs; they may also be used to assess functional requirements. This means that there is no formal mechanism for quantifying ethical issues throughout requirements engineering processes in software organizations. With these data in hand, our next goal will be to offer an ethical framework for requirements engineering processes, complete with relevant components and techniques.

5. conclusion and proposed ethical framework

After undertaking this ethical analysis of the sub-Saharan African companies, the proposed ethical framework is discussed in this section. Eight principles were proposed. Firstly, software engineers should act consistently in the public interest. The developer should consider how it will affect the public at large. Secondly, software engineers are obliged to listen and act accordingly to the request of clients and employers considering the public interest. Thirdly, the quality of the product they produce needs to be prioritized. The products should meet the highest professional standards and the latest modifications. Fourthly, software engineers should maintain integrity and independence in their professional judgment. Furthermore, the managers of software engineers should encourage adherence to moral standards in both the development and maintenance stages. Again, software engineers should prioritize upholding integrity and honor of the profession while aligning with the public interest. Again, software engineers must develop the habit of aiding their colleagues, completely disregarding any bad sentiments. Lastly, software engineers should participate in intense self-advancement. They should strive to consciously better their professional skills and promote an ethical approach to the practice of the profession. With all these steps followed, quality products are guaranteed to serve the public needs with minimal or no downsides.

By distinctly defining the ethical issues with requirements engineering and taking them into account in the early stages of the SDLC, excellent software products and services may be produced while also decreasing the

instances of ethical lapses. This research explored the importance of addressing ethics, software industry standards, approaches for detecting ethical obstacles, and the core ethical issues with requirements engineering. The study's conclusions showed how important it is to include ethics in the SDLC's first phases if one wants high-quality software products and services and to keep from breaking any ethical rules. The study also found that there are no industry standards or guidelines that specify how software companies should conduct themselves when it comes to integrating ethics into their requirements engineering processes. The results also demonstrate that, regardless of whether ethical issues are brought up and handled, almost all firms lack identification and verification procedures. To include ethical issues in the requirements engineering phases of the SDLC, a unique ethical framework for requirements engineering was designed. This framework acts as a guide for doing so.

References

- [1] S. VALLOR AND A. NARAYANAN. An Introduction to Software Engineering Ethics. Santa Clara, CA, USA, 2015; pp. 1–60., Santa Clara, CA: Santa Clara University, 2015.
- [2] W. R. BOWEN, ENGINEERING ETHICS. Challenges and Opportunities, Cham, Switzerland: Springer International Publishing, 2014.
- [3] Y. LURIE AND S. MARK. "Professional ethics of software engineers: An ethical Framework," *Science and Engineering Ethics*, pp. 22, 417 - 434, 2016.
- [4] M. BLOCH, S. BLUMBERG, AND J. LAARTZ. "Delivering Large-Scale IT Projects on time, on budget, and value.," *Harvard Business Review*, pp. 5, 2-7, 2012.
- [5] GENECA. "Why up to 75% of Software Projects will fail.," 25 January 2017. [Online]. Available: <base href="https://www.geneca.com/why-up-to-75-of-software-project-will-fail/#: :text=Key%20survey %20findings%20include%3A, half%20their%20%20on%20rework">
- [6] F. ALAMMAR. A Framework for Ethical Practices in Software Development Life Cycle: A case study in the Kingdom of Saudi Arabia., Riyadh, Saudi Arabia: University of Prince Sultan, 2016.
- [7] F. B. AYEDEMIR AND F. DALPIAZ. "A roadmap for Ethics - Aware Software Engineering," in *International Conference on Software Engineering: Companion (ICSE - Companion)*, Gothenburg, Sweden & Washington, DC, USA, 2018.
- [8] D. GOTTERBARN. "Software Engineering Ethics," *Encyclopedia of Software Engineering*, pp. 2, 1-13, 2001.
- [9] T. SHAH AND S. V. PATEL. "A Review on Requirement Engineering Issues and challenges in various

- software development methods.," *International Journal of Computer Applications.*, pp. 99, 36 - 45, 2014.
- [10] A. ABERKANE. *Exploring Ethics in Requirements Engineering.*, Utrecht: Master's Thesis, Utrecht University, 2018.
- [11] M. PAVAN. *Value-Based Requirements Engineering: State-of-Arts and Survey*, Karlskrona, Sweden: Masters Thesis, Blekinge Institute of Technology, 2016.
- [12] G. LEVESON NANCY. "The role of software in recent aerospace accidents.," in *International System Safety Conference*, Unionville, VA, USA, 2001.
- [13] W. E. WONG, V. DEBROY, A. SURAMPUDI, H. KIM AND M. F. SIOK. "Recent Catastrophic Accident: Investigating How Software was Responsible.," in *Fourth International Conference on Secure Software Integration and Reliability Improvement*, Singapore, 2010.
- [14] B. D. LEE AND C. J. PAREDES. "A conceptual framework for value-driven design and systems engineering," *Procedia CIRP*, pp. 21, 10 -17, 2014.
- [15] N. A. ZAKARIA, S. IBRAHIM, AND M. N. R. MAHRIN. "Examining value-based factors in software development: A survey study in Malaysian Public Sector.," in *9th Malaysian Software Engineering Conference*, Kuala Lumpur, Malaysia, 2015.
- [16] J. WHITTLE, M. A. FERRARIO, W. SIMM, AND W. HUSSAIN. "A case for human values in software engineering," *IEEE Software*, pp. 36, 106 - 113, 2019.
- [17] W. G. EVANS. "Values and Practice.," *South Africa Dental Journal*, pp. 74, 333 -334, 2019.
- [18] G. LEE. "Is there a "software engineering ethics"? Comparing commercial and research software engineering.," in *IEEE/ACM 2nd International Workshop on Ethics in Software Engineering Research and Practice.*, Madrid, Spain, 2021.
- [19] N. KARIM, F. AL AMMAR AND R. AZIZ. "Ethical Software: Integrating code of ethics in software development life cycle.," in *Computer and Applications*, Doha, UAE, 2017.
- [20] A. RASHID, J. WECKERT AND R. LUCAS. "Software Engineering Ethics in a Digital World.," *Computer*, pp. 42, 34 -41, 2009.
- [21] L. G.. "Lost radio contact leaves pilot on their own.," *Journal of IEEE Spectrum*, pp. 41, 16 - 17, 2004.
- [22] B. CARI. "Overexposure of radiation therapy patients in Panama: Problem recognition and follow-up measures.," *Pan American Journal of Public Health*, pp. 173 - 187, 2006.
- [23] Z. B, J. VEIJALAINEN AND D. KOTKOV. "Volkswagen emission crisis: Managing stakeholder relations on the web.," in *12th International Conference on Web Information Systems and Technologies*, Rome, 2016.
- [24] L. PHILLIP. *Requirements Engineering for Software and Systems*, 2nd ed; London, UK, 2014.: CRC Press, Taylor & Francis Group: Boca Raton, 2014.
- [25] N. R. DARWISH AND R. M. BRUCE. *Software Engineering: A practitioner's Approach*; New York, NY, USA: McGraw-Hill Education, 2015.
- [26] S. P. ROGER AND R. M. BRUCE. *Software Engineering: A practitioner's Approach*, New York, NY, USA: McGraw-Hill Education, 2015.
- [27] N. R. DARWISH AND S. MEGAHED. "Requirements Engineering in scrum framework.," *Journal of Requirement Engineering*, pp. 149, 24 -29, 2016.
- [28] S. IAN. *Software Engineering*, 9th edition, New York, NY & San Francisco, CA: Addison-Wesley, 2011.
- [29] B. M. I, G. M, J. D. N., AND Z. K. B. StakeMeter: Value-Based stakeholder identification and quantification framework for value-based software systems., *PLoS ONE*, 10, e0121344, 2015.
- [30] L. W. T AND K. R. "Engineering Practice and Engineering Ethics.," *Engineering Ethics*; Routledge, pp. 601-631, 2017.
- [31] Q. M. *Encyclopedia of Information Ethics and Security*, Hershey, PA, USA: IGI Global, 2007.
- [32] J. GÉNOVA, G. M. R AND F. A. "Ethical Responsibilities of the Software Engineer," in *The CAISE*06 Workshop on Philosophical Foundations of Information Systems Engineering.*, Luxembourg, 2006.
- [33] G. D, M. K AND R. S. "Software engineering code of ethics is approved," *Communications of the ACM*, pp. 42, 102 -107, 2003.
- [34] IEEE-CS/ACM JOINT TASK FORCE. "Software Engineering Code of Ethics and Professional Practice," *Science and Engineering Ethics*, pp. 7,231-238, 2001.
- [35] B. BERENBACH AND M. BROY. "Professional and Ethical Dilemmas in Software," *Computer*, pp. 42,78-80, 2009.
- [36] D. GOTTERBARN AND K. MILLER. "The public is the priority: Making decisions using software engineering code of ethics," *Computer*, pp. 42,66-73, 2009.
- [37] R. VOLKMAN. "Computer ethics beyond mere compliance," *Journal of Information communication ethics society*, pp. 13,176-189, 2015.
- [38] I. VAN DE POEL. "An ethical Framework for evaluating experimental technology," *Science and Engineering Ethics*, pp. 22, 667 - 686, 2016.
- [39] G. D. W, B. B, C. FLICK, M. S. KIRKPATRICK, K. MILLER, K. VAZANSKY AND M. J. WOLF. "ACM Code of Ethics and Professional Conduct," *Association for computing machinery*, 2018.

- [40] J. GOGOLL, N. ZUBER, K. S, T. GREGER, A. PRETSCHNER AND J. NIDA-RUMELIN. "Ethics in the software development processes: From codes of conduct to ethical deliberation," *Philosophy And Technology*, pp. 34, 1085 - 1108, 2021.
- [41] C. JONES. *Software Requirements and the Ethics of Software Engineering*, Pittsburgh, PA, USA: Capers Jones & Associates LLC, 2012.
- [42] S. THEW AND A. SUTCLIFFE. "Value-Based Requirements engineering: Method and Experience," *Requirements Engineering*, pp. 23, 443 -464, 2018.
- [43] D. CEMIOGLU, E. ARDEN-CLOSE, S. HODGE, T. KOSTOULAS, R. ALI AND M. CATANUA. "Towards Ethical Requirements for Addictive Technology: The case of online Gambling," in *1st Workshop on Ethics in Requirements Engineering Research and Practice*, Zurich, Switzerland, 2020.
- [44] R. ALI, N. JIANG, K. PHALP, S. MUIR AND J. MCALANEY. "The Emerging Requirements of Digital Addiction Labels," in *International Working Conference on Requirements Engineering: Foundation For Software Quality*, Essen, Germany, March 2015.
- [45] A. ALROBAI, K. PHALP AND R. ALI. "Digital addiction: A requirement engineering perspective.," in *International Working Conference on Requirement Engineering: Foundations for Software Quality*, Essen, Germany, 2014.
- [46] B. PAECH AND K. CHNEIDER. "How do users talk about software? Searching for common ground.," in *1st Workshop on Ethics in Requirements Engineering Research and Practice*, Zurich, Switzerland, 2020.
- [47] N. ALI AND J. E. HONG. "Requirements-Driven Evolution in Software Product Lines," in *KSII The 10th International Conference on Internet, (ICONI)*, Phnom Penh, Cambodia, 2018.
- [48] N. ALI AND J. E. HONG. "Using social network service to determine the initial user requirements for small software businesses," *arXiv*, 2019.
- [49] N. ALI AND J. E. C. L. HONG. "Social Network sites and requirements engineering: A systematic literature review," *Journal of Software Evolution Process*, pp. 33, e2332, 2021.
- [50] N. ALI AND J. E. HONG. "Value-Oriented Requirements: Eliciting domain requirements from social network services to evolve software product lines.," *Applied Sciences*, pp. 9, 3944, 2019.