ENGINEERING ETHICS & ENTREPRENEURSHIP: A GROUNDED THEORY BASED STUDY AMONG ENTREPRENEURIAL ENGINEERS IN SRI LANKA

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Degree of Doctor of Philosophy

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DECLARATION

I declare that this is my own work and this thesis/dissertation does not incorporate without acknowledgement any material previously submitted for a degree or diploma in any other University or Institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text. I retain the right to use this content in whole or part in future works (such as articles or books).

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The above candidate has carried out research for the PhD thesis/dissertation under our supervision. We confirm that the declaration made above by the student is true and correct.

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Signature of the supervisor: Date: 18/07/2025

Signature of the supervisor: Date: 18/07/2025

DEDICATION

-To all who work tirelessly for the common good of the world in their life journey-

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ABSTRACT

Ethical considerations are integral to the work of entrepreneurial engineers, whose innovations and decisions frequently carry significant societal implications. This study explores how Sri Lankan entrepreneurial engineers as a group of technology entrepreneurs adhere to engineering ethics, the challenges they face, and the strategies they employ to uphold ethical principles in their techno-entrepreneurial ventures. Addressing a significant gap in the literature, the research employs a constructivist grounded-theory methodology, drawing on face-to-face interviews with a purposive and theoretically selected sample of 22 entrepreneurial engineers. The findings reveal that most entrepreneurial engineers perceive engineering ethics as a "guideline" for ethical business practices, navigating a business environment populated by stakeholders and competitors characterized as "ethical-unethical colleagues." They also encounter an "avaricious society" that presents numerous ethical challenges during their entrepreneurial journeys. To adhere to engineering ethics, the participants adopt a tripartite strategy involving internalization, employee engagement, and public outreach. The consequences of these practices include "lasting benefits" and "short-term losses," ultimately contributing to the "enduring prosperity" of their firms. This study introduces the substantive theory called “theory of enduring prosperity”, illustrating how adherence to engineering ethics fosters long-term business sustainability in the Sri Lankan context. The findings suggest that entrepreneurial engineers should prioritize ethical practices from the startup stage, as these lead to sustainable growth, even if they encounter temporary setbacks in a challenging societal environment. This study makes a holistic contribution to the existing literature by underscoring the importance of engineering ethics in entrepreneurial success. However, limitations such as gender bias and reliance on the perspectives of entrepreneurial engineers are noted. Future research could address these limitations and explore how entrepreneurial engineers can contribute to achieving sustainable development goals through the application of engineering ethics.

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Key Words

Engineering ethics, Enduring prosperity, Entrepreneurial engineers, Grounded theory, Sri Lanka

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LIST OF ABBREVIATIONS

Abbreviation	Description
SDG	Sustainable Development Goals
CGT	Constructivist Grounded Theory
ICTAD	Institute of Construction Training and Development
NFE	the French norm for naming the quality classes of bolts
BS	British Standards
ISO	International Standards Organisation
OSHAS	Occupational Safety and Health Administration Standards
CSR	Cooperate Social Responsibility
NSPE	National Society of Professional Engineers
IESL	Institution of Engineers Sri Lanka
ECSL	Engineering Council Sri Lanka
ASCE	American Society of Civil Engineers
IEEE	Institute of Electrical & Electronic Engineers
FEANI	European Federation of National Engineering Associations
MD	Managing Director
CEO	Chief Executive Officer
EIA	Environment Impact Assessment
ABC	Aggregate Base Coarse
AC	Air Conditioner
NPK	Nitrogen, Phosporous, Pottasium
SME	Small & Medium Size Enterprises
MEP	Mechanical, electrical & plumbing
CPD	Continuing Professional Development
LLL	Life Long Learning
PhD	Doctor of Philosophy
MSc	Master of Science
MBA	Master of Business Administration

R & D	Research & Development
UK	United Kingdom
HRM	Human Resource Management
SET	Science, Engineering & Technology
USA	United States of America
RBV	Resource-Based View
DCT	Dynamic Capabilities Theory

LIST OF APPENDICES

CHAPTER 1

INTRODUCTION

1.1 Background and motivation of study

In an era increasingly defined by technological innovation and entrepreneurial disruption, the ethical conduct of engineers functioning as entrepreneurs has become a subject of global significance. The case of Theranos Inc, once celebrated as a revolutionary biotechnology startup and later revealed as a massive ethical failure, serves as a cautionary tale about the consequences of neglecting professional integrity in the pursuit of innovation. The scandal, driven by exaggerated claims, lack of transparency, and disregard for scientific rigor, underscores how the absence of ethical accountability can result in widespread harm to the public, investors, and the credibility of the engineering profession itself (Carreyrou, 2018). This incident, among others, has spotlighted the ethical dimensions of technology entrepreneurship and emphasized the urgent need to revisit how professional ethics is practiced beyond conventional corporate settings.

While engineering ethics has traditionally focused on rule-based compliance, safety, and professional responsibility within formal employment contexts, today's engineers are increasingly transitioning into entrepreneurial roles where they independently develop, market, and scale technological innovations. These entrepreneurial engineers, particularly in developing countries, face complex and often ambiguous ethical terrains, where market pressures, regulatory gaps, and socio-cultural dynamics may conflict with professional ethical standards. Despite the growing academic attention to engineering ethics and entrepreneurship as separate disciplines, limited research has examined how these ethical frameworks are applied, interpreted, and negotiated by engineers operating in entrepreneurial environments, especially in non-Western contexts.

Sri Lanka provides a compelling backdrop for such inquiry. As an emerging economy with a growing technology sector, Sri Lanka has witnessed a rise in engineers pursuing entrepreneurial ventures. These professionals must navigate a business environment marked by both opportunity and institutional fragility, where unethical practices such as bribery, political interference, and undercutting are not uncommon. Yet, despite these systemic pressures, some entrepreneurial engineers strive to uphold ethical standards set forth by professional bodies like the Institution of Engineers, Sri Lanka (IESL). The IESL Code of Ethics, although well-defined, is primarily intended for engineers in traditional employment roles and does not explicitly address the ethical dilemmas encountered by engineers running their own enterprises.

The motivation for this study stems from this critical intersection: how entrepreneurial engineers in Sri Lanka interpret and adhere to engineering ethics while operating in ethically ambiguous, competitive business environments. By exploring their lived experiences, ethical challenges, and decision-making strategies, this research seeks to develop a grounded theoretical understanding of ethical agency among engineering entrepreneurs. In doing so, it addresses a notable gap in the literature and offers a contextually grounded contribution to the fields of engineering ethics, entrepreneurship, and professional practice.

1.2 Problem statement

Engineering ethics plays a vital role in safeguarding public interest and maintaining professional integrity. However, as more engineers move into entrepreneurial roles, especially in emerging economies like Sri Lanka, ethical adherence becomes more complex. Entrepreneurial engineers face intense market competition, institutional weaknesses, and ethically ambiguous practices such as bribery and political interference (Guardia, 2016). These realities often challenge the application of standard ethical frameworks like the IESL Code of Ethics, which is primarily designed for traditional employment settings.

While literature in engineering ethics focuses largely on compliance in corporate environments, and entrepreneurship studies prioritize innovation and growth, little is known about how ethical principles are upheld in engineering-led entrepreneurial ventures. The intersection of ethics and entrepreneurship in the Global South remains significantly underexplored.

Against this backdrop, this study seeks to address the central question:

"How do Sri Lankan entrepreneurial engineers adhere to engineering ethics while managing its implications on behavior and performance?"

This research aims to uncover how ethical values are interpreted, practiced, and negotiated in the real-world experiences of engineering entrepreneurs, contributing to both theory and practice in the fields of engineering ethics and responsible innovation.

1.3 Research questions

A broader problem statement encouraged the researcher to immerse himself in the substantive research domain more deeply. The familiarisation of the research literature to some extent and the initial steps of data collection & analysis supported the researcher in identifying more researchable areas to refine the research questions in a more precise manner in line with the broader problem statement. Research questions of this study were as follows.

1. What perception do Sri Lankan entrepreneurial engineers possess regarding engineering ethics?
2. What ethical challenges did Sri Lankan entrepreneurial engineers encounter from the society as entrepreneurs?
3. How do Sri Lankan entrepreneurial engineers adhere to engineering ethics?
4. What positive and negative consequences do Sri Lankan entrepreneurial engineers encounter by applying engineering ethics in their entrepreneurial journey?
5. What theoretical model can demonstrate the adherence of entrepreneurial engineers to engineering ethics in an entrepreneurial business environment and its consequences in the Sri Lankan context?

1.4 Research objectives

1. To explore the entrepreneurial engineers' perception possess regarding engineering ethics.
2. To explore the ethical challenges encountered by Sri Lankan entrepreneurial engineers from the society as entrepreneurs.
3. To explore how Sri Lankan entrepreneurial engineers adhere to engineering ethics?
4. To explore the positive and negative consequences that Sri Lankan entrepreneurial engineers encounter by applying engineering ethics in their entrepreneurial journey.
5. To develop a substantive theory that can demonstrate the adherence of entrepreneurial engineers to engineering ethics in an entrepreneurial business environment and its consequences in the Sri Lankan context.

1.5 Scope of research

Techno-entrepreneurial ventures are typically led by individuals with strong technical or scientific expertise. Globally, engineers, scientists, and business professionals constitute the primary founders of such firms (Proksch et al., 2018), with engineers often demonstrating higher success. In Sri Lanka, Thiranagama (2015) noted that professionally qualified engineers are more inclined toward technology-based entrepreneurship than other professionals.

This study focuses specifically on chartered engineers operating as entrepreneurs within the Sri Lankan industrial sector. Chartered engineers were selected due to their advanced technical knowledge, extensive industrial experience, and formal exposure to engineering ethics, including a professional review process involving written and oral assessments (*Professional Review Rules,* 2018). As ethically accountable and professionally recognized individuals, they are well-positioned to provide rich insights into ethical practice in entrepreneurial settings.

However, by limiting the sample to chartered engineers, the findings may not be directly generalizable to the broader population of technology entrepreneurs.

1.6 Significance of research

This study addresses a critical gap at the intersection of engineering ethics and entrepreneurship, particularly within the context of developing countries like Sri Lanka. While existing literature emphasizes ethical conduct in traditional engineering roles, little is known about how ethics is practiced by engineers operating as entrepreneurs in less regulated, ethically complex business environments. By introducing a substantive theory, the study offers a grounded explanation of how entrepreneurial engineers adhere to IESL Code of Ethics. It reframes ethics as a strategic driver of long-term business sustainability rather than merely a regulatory obligation. The findings have practical relevance for refining professional codes of ethics, enhancing ethics education, and informing policies that support responsible entrepreneurship. Methodologically, the study also advances the use of Constructivist Grounded Theory in exploring lived ethical practice among engineering professionals.

1.7 Thesis structure

Chapter 1 unwraps the thesis with a consice introduction and preliminary investigation of the significance of the study emphasizing on the problem statement, research questions and objectives.

Chapter 2 describes the context of entrepreneurship and ethics as the substantive areas of research. The initial literature review conducted in this chapter ascertains what was already known about above domains while narrowing down the study direction towards engineering entrepreneurship and engineering ethics before data collection began.

Chapter 3 outlines the researcher’s philosophical stance, grounded in relativist ontology and subjectivist epistemology, and justifies the adoption of constructivist grounded theory as the methodological approach. Influenced by symbolic interactionism and pragmatism, the chapter details the procedures for sampling, data collection, and analysis, and concludes with a discussion on ethical considerations and methodological rigour.

Chapter 4 presents participant demographics and explores how entrepreneurial engineers in Sri Lanka perceive engineering ethics, particularly the IESL Code of Ethics. It also examines their views on the ethical conduct of peers and the societal challenges they face as entrepreneurs. The findings reveal a professional landscape shaped by interactions with both ethical-unethical colleagues and an avaricious society, highlighting the complex ethical terrain within which these engineers operate.

Chapter 5 examines how Sri Lankan entrepreneurial engineers adhere to engineering ethics in relation to each clause of the IESL Code of Ethics. Through grounded theory analysis, three core strategies—internalising ethical values, engaging employees, and outreaching to the public—were abstracted. The chapter also explores both the positive and negative consequences of ethical adherence encountered by these engineers in their entrepreneurial journeys.

Chapter 6 begins with an explanation to the substantive theory which constructed as the final outcome followed by a critical evaluation to locate it in the extant literature. The substantive theory is presented based upon satisficing as the central organising phenomenon. Significantly, there is also an analysis of how the substantive theory fills in gaps in the extant literature and makes an original contribution to new knowledge. Further, this chapter discloses the interplay among the clauses of engineering, entrepreneurial and business ethics.

Chapter 7 summarizes the findings of this entire study as the conclusion. The limitations of the study provide a critical view of the thesis after reflecting on the implications of the substantive theory for the success of the entrepreneurial engineers and a space for further research.

1.8 Chapter summary

In today's competitive, technology-driven economy, entrepreneurial engineers play a pivotal role in advancing innovation and economic development. This study explores the application of engineering ethics in the business practices of Sri Lankan entrepreneurial engineers, with a focus on those holding Chartered Engineer status. Guided by five specific objectives, the research offers both theoretical and empirical insights into ethical conduct within entrepreneurial settings. The findings hold practical relevance for industry, academia, and policy, while also serving as a valuable guide for aspiring entrepreneurial engineers committed to building ethically grounded and sustainable ventures.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter critically reviews existing literature at the intersection of engineering ethics and entrepreneurship, with particular emphasis on the role of entrepreneurial engineers in emerging economies. It explores how ethics is conceptualized in engineering practice, the limitations of current codes in entrepreneurial contexts, and the evolving discourse around ethical decision-making in business. The review also examines the scarcity of empirical studies focusing on ethical behavior among entrepreneurial engineers, especially in the Global South. By identifying key theoretical gaps and practical limitations in existing research, this chapter establishes the foundation for the present study and justifies the need for a grounded, context-specific exploration of how Sri Lankan entrepreneurial engineers adhere to engineering ethics.

2.2 Engineers & engineering ethics

2.2.1 Engineers

Engineering is a dynamic discipline that drives technological advancement and addresses human needs through both technical and creative processes. Beyond problem-solving, it involves engagement with physical and social environments, integrating technical expertise within complex political, economic, and cultural contexts (Didier, 2009; S. Robinson et al., 2007).

The interplay between science, technology, and engineering is central to understanding human progress. While often aligned with scientific inquiry, engineering is equally shaped by societal contexts (Read, 1999). It functions as a form of social experimentation, where technological innovations both reflect and influence human development (Didier, 2009). As Pritchard (2013) notes, many engineering challenges cannot be resolved by science and mathematics alone but require experiential knowledge and ethical judgment.

Engineering is widely recognized as a prestigious and competitive profession globally, including in Sri Lanka (Fleddermann, 2012). While rooted in traditional fields such as civil, mechanical, and electrical engineering, the discipline has diversified into areas like software, biomedical, chemical, and aerospace engineering, driven by rapid technological advancement (*The Disciplines of Engineering | What Is Engineering*, 2016). This ongoing evolution suggests continued emergence of new engineering specializations in the future. Globally, over 7,000 universities and higher education institutions offered undergraduate engineering degrees as of 2014 (Bowersox, 2014). In Sri Lanka, engineering education is provided by seven state universities and a few private institutions, with an annual intake of approximately 1,900 students selected through the Advanced Level Examination (*Sri Lanka University Statistics 2016,* 2019).

The traditional image of engineers as isolated specialists is misleading, as engineering practice invariably involves interaction with a broad spectrum of stakeholders, including clients, peers, and policymakers (Fasano, 2015; Read, 1999). Engineers frequently influence public welfare and often transition into managerial or entrepreneurial roles, reinforcing the inherently moral nature of the profession (Poel & Royakkers, 2011). Given these responsibilities, adherence to ethical principles is essential across all engineering domains, whether technological or economic (Grunsven et al., 2024).

2.2.2 Professional ethics

Ethical behavior is a core aspect of human life, rooted in social interaction and the ability to discern right from wrong. Ethics, as a normative science, provides a framework for evaluating intentional human actions, focusing on principles that guide moral decision-making (Collste, 2012; Speight & Foote, 2011). It serves as a branch of moral philosophy, shaping professional conduct by defining what is considered acceptable within specific roles and responsibilities (Hansen & Zenobia, 2011).

Professional ethics is a multifaceted field that covers various frameworks and principles for guiding behaviour in different professional environments (Maxwell, 2008). Professional ethics refer to the moral standards governing conduct within a specific profession, binding individuals by virtue of their professional affiliation. These ethical frameworks, such as medical ethics, business ethics, and engineering ethics, guide practitioners in upholding responsible and disciplined behavior within their respective fields (Harris et al., 1996).

Professional responsibilities should be critically examined through ongoing discourse rather than through static declarations. Ethics, as Kipnis & South (2000) argue, is a collective pursuit of practical wisdom within a profession. Contemporary literature and rising instances of misconduct highlight the growing need for exemplary ethical behavior across all professional fields, particularly in technology-driven domains (Lawrence & Weber, 2020).

Generally, there are three categories of ethics in philosophical studies. They are the following:

- Meta-ethics

- Normative ethics
- Applied ethics.

Meta-ethics explores the nature and meaning of moral judgments, questioning the objectivity of ethical claims. Normative ethics aims to establish principles for evaluating right and wrong conduct, while applied ethics applies these principles to concrete issues like honesty, integrity, and deception in professional practice (Speight & Foote, 2011).

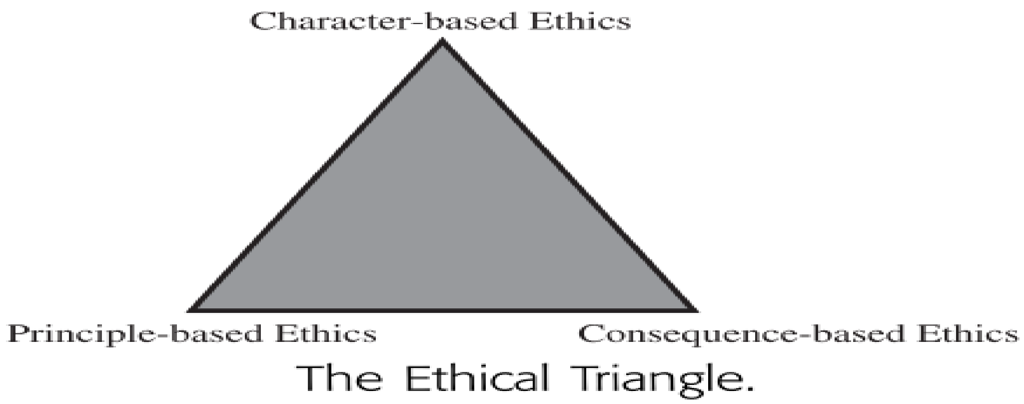
The rapid advancement of technology continues to shape the evolution of applied ethics by introducing complex moral challenges. For example, neonatal care advancements prompt ethical dilemmas about life-sustaining treatments, while developments in computer technology raise critical concerns over individual privacy and the balance between public information access and personal data protection. (Collste, 2012). These kinds of problem had laid the foundation for the development of the field of ethics.

Ethics and laws are two different subject matters. Starrett, Lara & Bertha (2017), in their textbook called "Engineering Ethics - Real-World Case Studies", explain the difference in ethics and laws as follows.

While professional bodies develop ethical codes to guide conduct, laws are government-imposed rules aimed at maintaining order. Though both share principles like fairness, ethics is rooted in moral reasoning and context, whereas law operates through fixed regulations. Conflicts may arise, for example, between legal confidentiality and ethical obligations to prevent harm. Engineers must navigate such tensions with awareness of both legal mandates and ethical frameworks, which generally fall into virtue ethics (character-based), deontology (principle-based), and utilitarianism (consequence-based) (Schmidt, 2014; Starrett et al., 2017).

Figure 2.1

The Ethical Triangle



Source: Starrett et al. (2017)

The above triangle model in figure 2.1 can be used to remember the three significant categories.

Starrett et al. (2017) classify ethical theories into three main categories: virtue ethics, deontology, and utilitarianism. Virtue ethics, rooted in Aristotle's philosophy, emphasizes moral character and the cultivation of virtues. Deontological ethics, influenced by Kant, focuses on duty and moral rules regardless of consequences. Utilitarianism, derived from Mill, evaluates actions based on their outcomes, promoting those that yield the greatest benefit for the majority.

Engineers frequently rely on internal moral reasoning to navigate complex ethical decisions. Ethical decision-making, as explored in business contexts, involves balancing objectivity with emotional engagement (Dunbar, 2005; Zollo et al., 2017). While various ethical theories can aid this process, they may also create ambiguity for practitioners (Read, 1999). Professional codes of ethics help address such challenges, emphasizing loyalty only when public welfare is not at risk. Many organizations also implement internal ethical standards, which promote accountability and enable employees to resist unethical directives (Andrews, 2006).

Research in organizational culture, leadership, and business ethics indicates that ethical behavior results from both individual traits and contextual influences. Among these, organizational culture plays a pivotal role in shaping ethical or unethical conduct (Ardichvili et al., 2009). To guide ethical decision-making, Rest's four-component model outlines key mechanisms: moral sensitivity, judgment, motivation, and character (Thoma & Bebeau, 2013), offering a widely used framework for understanding professional ethics. Implementing professional ethics is often challenged by cultural and organizational factors. Jackson (2001) emphasized the difficulty of applying uniform ethical standards across diverse cultural contexts. This highlights the importance of adopting culturally sensitive approaches to ethics training and policy implementation. In addition, organizational barriers such as weak support systems, conflicting objectives, and the absence of ethical leadership can significantly hinder ethical behavior within professional environments, as discussed by Kish-Gephart et al. (2010).

Research has shown that adherence to professional ethics strengthens organizational trust, enhances cooperation, and improves overall performance (Ma et al., 2020; Mayer et al., 1995). A strong ethical culture also contributes to higher employee satisfaction and lower turnover rates (Valentine & Fleischman, 2008). These findings highlight the critical role of ethical practices in sustaining professional integrity and public trust.

2.2.3 Professional codes of engineering ethics

Engineers hold significant societal influence through the scale and complexity of their work and the specialized nature of their expertise. Recognizing the potential risks of this power, the engineering profession has long emphasized the need to apply technical knowledge in ways that serve the public good and avoid harm (Harris et al., 1996).

Davis (1991) identifies three key functions of ethics: as general morality, as moral theory grounded in rational inquiry, and as context-specific norms guiding professional conduct. The latter, professional ethics, applies to individuals by virtue of their membership in a profession. Historically, engineering lacked a defined ethical framework until more recent developments.

Professional institutions have enabled engineers to establish themselves as socially responsible actors. These bodies promote standards of practice, ethical norms, and continuous professional development, aiming to elevate engineering to the status of classical professions such as medicine and law (Read, 1999). While institutional guidelines shape ethical conduct in engineering, they are subject to interpretation and influenced by cultural and national contexts. Values such as honesty, safety, and efficiency inspire ethical behavior but do not offer definitive guidance for action. While these values serve as moral motivations, they remain inherently unenforceable and can be followed or disregarded (Baron et al., 2015). In contrast, codes of ethics provide explicit, imperative standards that prescribe how engineers should behave. These codes hold engineers accountable and position them centrally in discussions on engineering ethics (Taebi, 2021).

In short, the ethical codes of professional engineers should comprise the following aspects (Wood, 1996).

- conduct as a member of the profession
- financial integrity
- be aware of risk assessment of potential social-environmental significances
- consciousness on restrictions of areas of capability
- accountability to create known detrimental impacts only evident to one with the engineer’s distinct competencies and understanding

A code of ethics offers a framework for ethical decision-making but does not substitute for personal moral judgment (Read, 1999). Since the founding of the American Society of Civil Engineers in 1852, engineering ethics have evolved across a highly decentralized profession comprising numerous specialized associations (ASCE, 2020; Monk, 1997). This lack of a unified body has led to divergent standards and public misconceptions about the engineer’s role. To address this, engineering societies have revised and clarified ethical codes, reflecting changing professional and societal expectations (Taebi, 2021).

Many codes of ethics are introduced by different engineering and technological professional organisations around the world to enhance engineers' ethical professionalism (Hansen & Zenobia, 2011). Some of the professional organisations are as follows.

- The National Society of Professional Engineers (NSPE)
- Institute of Electrical & Electronics Engineers (IEEE)
- European Federation of National Engineering Associations (FEANI)
- Institution of Engineering & Technology (IET)
- The American Society of Civil Engineers (ASCE)

The Institution of Engineers Sri Lanka (IESL), the country's primary engineering professional body, upholds a formal Code of Ethics that regulates member conduct. This code reflects core principles common to global engineering ethics frameworks, including public welfare, integrity, competence, and accountability. The following section outlines its key clauses and their alignment with international standards (*The Institution of Engineers Sri Lanka - Code of Ethics*, 2013).

1. Engineers shall hold paramount the health, safety and welfare of the public and proper utilisation of the funds and other resources in the performance of their professional duties. It shall take precedence over their responsibility to the profession, sectoral or private interests, employers or to other engineers. [FEANI, IEEE, ASCE]
2. Engineers shall always act in such a manner as to uphold and enhance the honour, integrity and dignity of the profession while safeguarding public interest at all times. [ASCE]
3. Engineers shall be committed to the need for sustainable management of the planet's resources and seek to minimise adverse environmental impacts of their engineering works or applications of technology so as to protect both present and future generations. [FEANI, ASCE, IEEE]
4. Engineers shall build their reputation on merit and shall not compete unfairly. [ASCE]
5. Engineers shall perform professional services only in the areas of their competence. [FEANI, ASCE, IEEE]
6. Engineers shall apply their skills and knowledge in the interest of their employer or client for whom they shall act, in professional matters, as faithful agents or trustees, so far as they do not conflict with the other requirements listed here and the general public interest. [FEANI, ASCE]
7. Engineers shall give evidence, express opinions or make statements in an objective and truthful manner. [FEANI, IEEE]
8. Engineers shall continue their professional development throughout their careers and shall actively assist and encourage engineers under their

direction to advance their knowledge and experience. [FEANI, ASCE, IEEE]

Codes of professional conduct represent the moral conscience of the engineering profession, outlining the expectations that guide member behavior. As noted by Bebeau & Monson (2008), such codes establish the premise that professionals will act in accordance with their ethical commitments. While their influence may differ across regions, these codes play a vital role in informing, motivating, and reinforcing ethical practices. They do not create ethical values but formalize morally acceptable behavior, thereby fostering public trust in engineers' competence and integrity (Quapp & Holschemacher, 2016).

However, a question is popping up in the minds of many engineers in society as 'Why is it important for engineers to adhere to the respective ethical codes?' Aside from the contractual need to adhere to the code as a condition of membership, there are valid justifications why engineers should come to an agreement among themselves to support an engineering code of ethics. According to Harris et al. (1996), these arguments include:

- Self-regulation - It will help protect engineers and those they care about from being injured by other engineers.
- Objecting as an engineer - It will help create a working environment that makes it easier for an engineer to resist pressure to do wrong by saying that the code prohibits it.
- Respectability of the profession - It will help make engineering a practice about which they need not feel justified embarrassment, shame or guilt.
- Fairness - It is an obligation of fairness to do one's part, assuming others do theirs.

Codes of professional conduct represent the moral conscience of the engineering profession, outlining the expectations that guide member behavior. As noted by Bebeau & Monson (2008), such codes establish the premise that professionals will act in accordance with their ethical commitments. While their influence may differ across regions, these codes play a vital role in informing, motivating, and reinforcing ethical practices. They do not create ethical values but formalize morally acceptable behavior, thereby fostering public trust in engineers' competence and integrity.

2.2.4 Research works on engineering ethics

Engineering ethics is increasingly recognized as a critical area of scholarly inquiry, with growing interest in its theoretical foundations and practical applications. The academic literature spans a wide spectrum, from the historical evolution of ethical norms in engineering to the exploration of diverse pedagogical strategies used in ethics education within the profession. Scholars like Hansen & Zenobia (2011); Harris, Pritchard & Rabins (2009); Poel & Royakkers (2011); Robinson et al. (2007); Starrett et al. (2017) have authored several valuable textbooks in engineering ethics which are handy resources for practising engineers. With the development of the technology, new ethical concerns have arisen for engineers practising in emerging fields like computer, software, bio medical engineering & artificial intelligence compared to traditional fields like civil engineering (Blundell, 2020). In response, tailored ethical guidelines and decision-making frameworks have been developed to address these novel concerns, drawing from historical lessons. Barry G. Blundell wrote the latest textbook with the title “Ethics in Computing, Science & Engineering; A Student’s Guide to Doing Things Right” discussing the emerging ethical issues in engineering (Blundell, 2020).

A substantial body of research has explored engineering ethics education, with scholars emphasizing the importance of effective pedagogical strategies. Lynch & Kline (2000), for instance, advocated for the use of real-world case studies, such as the Challenger disaster, to enhance students’ understanding of the multifaceted nature of ethical dilemmas. Such contextual learning fosters deeper ethical awareness and critical thinking among engineering students. Balakrishnan & Tarlochan (2015) found that Malaysian engineering students demonstrated limited awareness of socio-ethical issues, prompting a call for improved teaching methods. In contrast, a 2018 study in Sri Lanka revealed that engineering undergraduates held a positive attitude toward the relevance of engineering ethics in their future professional roles (Wijesinghe & Jayawardane, 2018)

Loui (2005) found that engineering students largely form their professional identity through family and peer influences rather than technical coursework. However, dedicated engineering ethics courses were shown to strengthen ethical awareness, increase confidence in handling ethical dilemmas, and broaden students’ understanding of their societal responsibilities as engineers. The study's scope was limited by discipline-specific representation and instructional variability.

Teaching engineering ethics, whether integrated or offered as a standalone course, poses ongoing challenges. Ethics educators worldwide must actively engage students to emphasize the societal responsibilities of engineers. Dyrud (2014) advocated a case-based approach, using real-world ethical breaches to strengthen students’ ethical reasoning and foster professional responsibility. Atesh, Baruah, & Ward (2017) found that ethics education influences engineering students' moral reasoning, with trained students valuing intrinsic rewards, while others favored external incentives. Similarly, Shuman et al. (2003) emphasized the importance of ethics education in shaping professional behavior and proposed a rubric to assess students’ capacity to address ethical dilemmas, thereby contributing to the advancement of engineering ethics pedagogy.

Bairaktarova & Woodcock (2014) investigated the relationship between ethical motivation and moral conduct in engineering undergraduates, highlighting the influence of personality traits. Their study found that prior ethics education did not significantly impact moral judgment, underscoring the need to enhance curricula through authentic case studies and open-ended discussions to promote deeper ethical engagement.

Kabbashi & Khan (2013) analyzed the melamine contamination scandal to illustrate the grave consequences of ethical negligence in engineering and business. This and other high-profile disasters, such as the Challenger explosion, Chernobyl, Bhopal, Rana Plaza collapse, and the 737 MAX crashes, underscore the importance of integrating real-world case studies into engineering ethics education (Harris et al., 2009; Herkert et al., 2020; Rottmann & Reeve, 2020). These cases highlight the ethical dilemmas engineers often face when professional responsibilities conflict with commercial interests, reinforcing the need for critical engagement and further research in ethical decision-making. Similarly, Snieder & Zhu (2020) advocate for value-based ethics education, suggesting it is more impactful than purely theoretical approaches. They emphasize the integration of practical, real-life scenarios in instruction to foster ethical reasoning. To strengthen the empirical foundation, further research is needed on how engineering ethics is practiced in technologically advanced, business-oriented environments.

Tucker et al. (2008) explored alternative narratives in engineering, advocating for a feminist rethinking of ethics centered on care, interdependence, and inclusivity. Likewise, Nair & Bulleit (2020) highlight the importance of new epistemologies to navigate ethical decision-making under uncertainty. They propose integrating pragmatism with the ethic of care to enhance ethical responsiveness within evolving socio-technical and cultural contexts. These contributions underscore the need for broader philosophical foundations in engineering ethics.

Poel (2000) observes that engineering ethics has traditionally concentrated on the ethical aspects of engineers' actions and decisions. However, his research shifts focus toward a less explored area, emphasizing the importance of ethical considerations within the engineering design process. This perspective highlights the need for greater scholarly attention to the moral dimensions inherent in design decisions.

- Building and operationalisation of objectives and requisites for the process of design
- Selection of substitutes
- The interplay between design requisites and norms
- Dangers and ancillary impacts
- Scripts and political and social foresight intrinsic in a design.

Poel (2000) highlights the need to examine how morally significant decisions are made and structured within the engineering design process. He also stresses the importance of considering how responsibilities are distributed among those involved, suggesting that ethical reflection should be integrated into the design framework itself.

As artificial intelligence and robotics evolve, ethical decision-making increasingly applies to machines. Bouazzaoui et al. (2017) highlight the ethical concerns tied to machine learning algorithms. Emerging technologies like AI, biotechnology, and nanotechnology pose novel ethical risks, underscoring the need for updated frameworks beyond traditional engineering codes. Although engineering is a global profession, most ethical guidelines are shaped by local cultural contexts. Harris et al. (2009) emphasize the need to harmonize these standards while respecting cultural diversity. Global projects introduce complex ethical issues related to social justice, sustainability, and development, yet limited research exists on how engineers navigate such dilemmas or apply universal ethical standards (AlZahir & Kombo, 2014).

Managing a business extends beyond personal goals and is rooted in broader social responsibilities (Davis, 1994; Weil, 2014). Bowie (1985) highlights that engineering and business ethics address similar concerns, differing mainly in perceived professional status. Since engineers often work within business settings, their ethical responsibilities closely align with business ethics, necessitating further research on how engineering ethics applies in diverse entrepreneurial and commercial environments (Weil, 2014).

Engineering ethics research remains predominantly Western-centric, with limited exploration of ethical challenges in developing countries like Sri Lanka (Herkert, 2001). Despite the global scope of engineering, little empirical work has emerged from Asian contexts. Moreover, while ethical codes enhance awareness, their effect on actual behaviour is uncertain due to a persistent gap between ethical understanding and practice (Clancy & Zhu, 2023; Hess et al., 2023; Lynch & Kline, 2000). More context-specific, empirical studies are needed to assess real-world ethical compliance. Despite each engineering discipline having its own code of ethics, such codes are limited in addressing ambiguous or low-risk dilemmas (Subbian et al., 2022). Ethical decision-making in engineering remains underexplored, even though ethical lapses have been linked to organizational culture and large-scale harm (Hess et al., 2016). While several decision-making models exist, their practical utility is still contested, underscoring the need for comparative research to establish a unified, contextually relevant framework (Streiner et al., 2021).

2.3 Engineering entrepreneurship

2.3.1 Entrepreneurship

Understanding entrepreneurship is essential before examining entrepreneurial engineers. Contemporary business literature highlights entrepreneurship as a key driver of economic development, innovation, and product advancement. Despite its importance, the concept remains contested, with various definitions emphasizing autonomy, initiative, and independent decision-making as core characteristics of entrepreneurs (Longenecker et al., 1988).

Many associate entrepreneurships with starting new ventures. “To organize, entrepreneur requires to bring together current mutually supporting functions into arrangements that produce practical products.” This view aligns with Gartner's (1985) idea of venture creation. However, scholars like Shane & Venkataraman (2000) argue that entrepreneurship extends beyond new firm formation. They define the field as the study of how, by whom, and with what outcomes opportunities for creating future goods and services are discovered, assessed, and exploited. Thus, entrepreneurship includes both new ventures and innovation within existing firms. Additionally, such changes can be vended to other people or already established firms (Shane & Venkataraman, 2000). Another definition frames entrepreneurship as “economic activities carried out by persons, functioning individually or within a firm to identify and generate new opportunities and to present their thoughts in the marketplace, under ambiguity, by judging the place, design of products, use of resources, institutions and repayment mechanisms” (Carlsson et al., 2012). Entrepreneurial activities are shaped by socio-economic contexts and contribute to societal advancement. While not a universal remedy for social issues, especially where state intervention falls short, entrepreneurship often emerges as a viable response to complex challenges with conflicting goals and uncertain pathways (DeLeon, 1996).

Entrepreneurship, associated with achievement and success (Fassin, 2005), demands energy and passion to implement innovative solutions. It fosters economic development by generating direct and indirect employment (Chell, 2008). As unemployment rises with population growth, many governments have adopted entrepreneurship as a key strategy, investing heavily to promote entrepreneurial activity (Dangolani, 2011). “Self-employment” exemplifies direct entrepreneurship, while industrial sectors contribute further job creation. Committed entrepreneurs identify opportunities and mobilize labour, capital, and technology to drive positive societal change.

Literature on opportunity discovery and creation emphasizes that entrepreneurship originates from identifying a valuable idea. This prompts inquiry into the traits and knowledge that enable such recognition. From an innovation lens, entrepreneurship involves exploiting existing opportunities, while the invention perspective focuses on creating novel offerings (Woolley, 2010). In both cases, successful entrepreneurs must not only identify market opportunities but also act decisively to capitalize on them, as mere discovery alone is inadequate in a competitive environment (Shane & Venkataraman, 2000).

Entrepreneurship begins with recognizing valuable opportunities, shaped by both innovation and invention perspectives, which emphasize the need for knowledge acquisition and decisive action (Gujić et al., 2016). Beyond cognitive processes, entrepreneurs also experience emotional influences, termed entrepreneurial feelings, which drive the evaluation and pursuit of opportunities (Cardon et al., 2012). Ethical dilemmas frequently arise, particularly for novice entrepreneurs, involving fairness, stakeholder relationships, and communication integrity. Startups face added pressure due to limited brand visibility, sales, and cash flow, which may lead to unethical decisions made in isolation (Tanwar, 2013). This highlights the critical need for ethical awareness in early-stage ventures.

According to Schwartz & Malach-Pines (2007), three primary sources can be identified from which entrepreneurial perspectives have been stemmed out.

- Economic perspectives - the role of the entrepreneur in economic development
- Social perspectives - the impact of the social and business environment on entrepreneurship
- Psychological Perspectives - personality characters of entrepreneurs

Although entrepreneurship is significantly explored in economics and business perspectives, outcomes have still not been reliable about the personal entrepreneurial characteristics. More and more exploratory research is required in the field of entrepreneurial personality and ethical decision making.

2.3.2 Theories of entrepreneurship

Entrepreneurship discipline is a broad discipline and organised in various directions as per different theorists, period, and issues so forth (Ricketts, 2006). Like most other disciplines, entrepreneurship also has several theories introduced by different scholars over time according to their research findings. Few critical entrepreneurship theories which will be essential to consider for this research study are as follows (Chepurenko, 2015; Drucker, 1985; Ricketts, 2006; *Top 14 Theories of Entrepreneurship*, n.d.).

1. **Innovation theory of Schumpeter**

In addition to assuming threats and forming, Schumpeter presented a notion of innovation as a significant feature in entrepreneurship. He explains that entrepreneurship is ‘a creative activity”. In his view, an innovator who produces novel products or services in the economy has been identified as an entrepreneur. Schumpeter considers innovation an instrument of the entrepreneur.

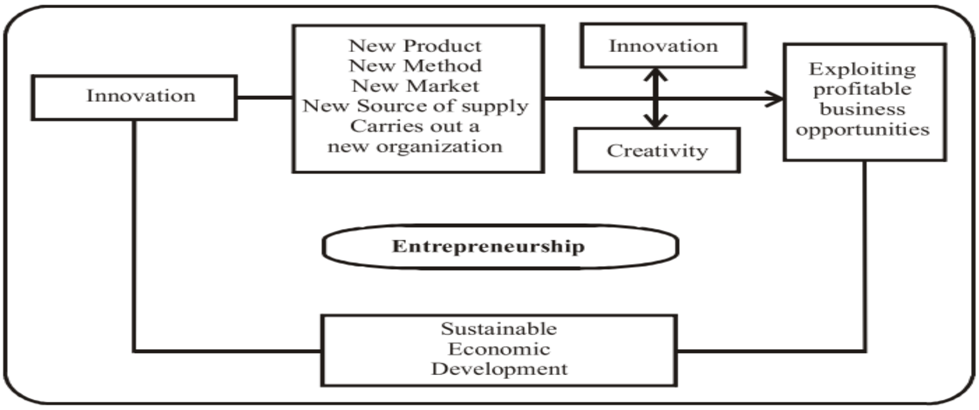
The following aspects can be considered under the innovation concept.

- Innovation of new products
- Innovation of novel procedures of production
- The establishment of a novel market
- Entrepreneurs may possibly discover novel methods for the distribution of raw materials
- Improvements in management functions

Generating novel products or innovations is the entrepreneur's main job while running the enterprise has not been considered a significant task. Entrepreneurs envisage and have a preference to start a personal territory. They love to do things and to get things done.

Figure 2.2

Innovation theory of entrepreneurship



Source: Schumpeter (1934)

In this theory, Schumpeter has neglected risk-taking, although he emphasised the innovative behaviour of the entrepreneur. They always face risk when developing innovative products and services to exploit their opportunities. In addition to these limitations, the theory helps the ‘enterprising spirit’ of the entrepreneur to innovate. That performance provides resources that have novel capabilities to generate prosperity.

2. **Need for achievement theory of McClelland**

McClelland has identified two features in the characteristics of the entrepreneur.

- Undertaking functions in a novel and enhanced way
- Making Decision under uncertainty.

He stresses accomplishment alignment as the utmost significant cause for entrepreneurs' achievement. Financial and other related incentives cannot influence entrepreneurs with high accomplishment orientation. High accomplishment-oriented entrepreneurs' success cannot be solely measured based on single factors like profit and incentives. McClelland identified people with extraordinary levels of accomplishment as potential entrepreneurs. The key features of such persons can be shown below.

- Setting adequate credible, and achievable goals
- Taking calculated risk
- Preferring situations wherein they can undertake individual obligations in problem-solving
- Expecting firm criticism on how extent they perform well
- The requirement for accomplishment lasts not just for the benefits of economic remuneration or social reputation but also over individual achievement, which is basically more convincing.

3. **Risk bearing theory of Knight**

Risk bearing can be considered a significant feature in entrepreneurship. The following aspects can be considered as significant aspects of the theory of the Knight (Knight, 1921).

- Risk creates profits – By undertaking risks, the entrepreneur generates revenue
- More Risk More Gain – Various industries have various levels of risks. Entrepreneurs accept a various level of risk based on individual abilities and orientation. It suggests that the more dangerous business features, the superior must be the revenue produced by it.
- Income of entrepreneur is unclear - It concludes that revenue is the return of an entrepreneur exertion, which results in tolerating non-insurable dangers and suspicions and the amount of income made sustains upon uncertainty tolerance.
- Profit as a Reward and Cost – Reward for the entrepreneur to assume risk is the profit. Therefore, risk also considered as a portion of the usual expenditure on production.

However, entrepreneurs' activity has been restricted to uncertainty bearing in this theory. Modern business activities are different. There is a dichotomy between ownership and management. These factors have not been taken into account. In addition, Critics feel that bearing the risk should not be considered as additional elements of production like land, labour, and capital. It should be considered differently since it is a psychological concept. These are some drawbacks of this theory.

4. **Economic theory of entrepreneurship**

Many economic scholars identified that entrepreneurship and its evolution in the economy would happen in such occasions where specific commercial conditions prefer the business environment. Economic benefits naturally advance the readiness among entrepreneurs to carry out different entrepreneurial activities. The connection between a person's internal desire and the desired economic benefits has an intense impact on the advancement of entrepreneurial skills. The economic factors that promote and demote entrepreneurial activities are as follows.

- The obtainability of financial loans
- Creation of elevated amount of funds with an effective movement of deposits and investments
- Provision of the lending amount of funds with an inferior rate of interests
- Amplified requirement for customer products and amenities
- Obtainability of useful resources
- Well-organized economic strategies like monetary
- Transportation and interaction of facilities

It concludes that advances in entrepreneurship and the economy's growth happen whenever particular economic conditions are preferable.

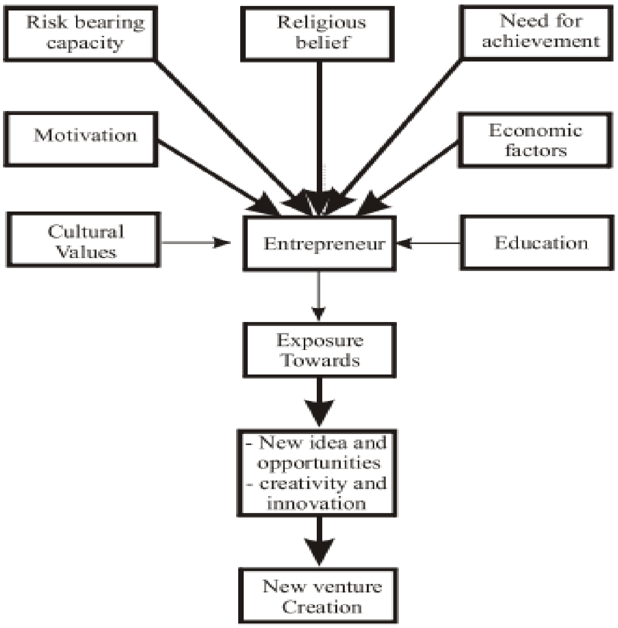
5. **Exposure Theory of Entrepreneurship**

Many researchers have identified that the creation of a new venture is facilitated by the revelation of novel ideas and opportunities directed to creativity and innovation. There are sufficient observations to demonstrate its validity.

Entrepreneurs routinely confront ethical challenges related to fairness, stakeholder relationships, and communication integrity, with such dilemmas being especially acute for young startups facing uncertainty and resource constraints. Limited brand recognition, sales, and cash flow may foster isolated and unethical decision-making. As entrepreneurship evolves, scholars must adapt by embracing novel research domains, emerging entrepreneurial profiles, and innovative methodologies. Chepurenko (2015) and Ratinho et al. (2020) argue for expanding research beyond Western contexts to reflect diverse environmental and societal dynamics in developing countries. Accordingly, greater scholarly attention is needed to explore entrepreneurship within these underrepresented regions

Figure 2.3

Exposure theory of entrepreneurship



Source: Lecture materials of Binary University College of Management and Entrepreneurship

2.3.3 Ethics of entrepreneurs

In an environment marked by uncertainty and rapid change, entrepreneurial action is essential yet difficult to execute effectively (Shepherd et al., 2014). Across domains, whether technological, social, or commercial, entrepreneurs face unique ethical challenges that influence their decision-making, behaviour, and performance. Pressures within entrepreneurial settings, including financial constraints and operational demands, often heighten moral dilemmas for both founders and their teams. These complexities underscore the need for deeper exploration of ethics within entrepreneurial practice.

‘Entrepreneurial behaviour’ can be defined as a group of deeds loaded with ethical controversies (Tanwar, 2013). Entrepreneurs are often celebrated for overcoming challenges through bold actions, but such behavior may conflict with ethical standards. Pressures like limited resources, tight deadlines, and weak ethical oversight often lead to justifying ethically questionable decisions.

Ethical entrepreneurship refers to conducting business in alignment with moral principles and social values. As Ratinho et al. (2020) state, it involves a commitment to fairness, honesty, transparency, and social responsibility. Ethical entrepreneurs must balance profit objectives with the interests of stakeholders, a topic increasingly emphasized in academic discourse due to its growing societal relevance (Vallaster et al., 2019). According to Ferrill & Getzler-Linn (2006), entrepreneurial ethics become significant in the world for the following reasons.

- Entrepreneurs may face ethical challenges different from those of non-entrepreneurs.
- Entrepreneurial studies have been a fast growing field seeking to distinguish itself from other fields.
- Entrepreneurs create a big impact on global economic stability.

While entrepreneurs are expected to engage in fair competition, they often face intense pressure, frequently greater than that within large corporations. Research indicates that entrepreneurs may experience stronger incentives to engage in unethical behavior than managers in established organizations (Longenecker et al., 1988).

This section presents a comprehensive investigation of contemporary scholarly studies on the ethics of entrepreneurs, focussing on ethical decision-making, the role of personal and cultural values, ethical dilemmas across different entrepreneurial stages, corporate social responsibility (CSR), and the impact of ethical leadership.

1. Ethical decision-making

Ethical decision-making is central to entrepreneurship, given the high-stakes choices entrepreneurs face. Hannafey (2003) highlights that uncertainty, limited resources, and pressure to succeed often lead to ethical dilemmas, with entrepreneurs relying heavily on personal values due to the absence of clear ethical guidelines. Brenkert (2002) explores the role of rule-breaking in entrepreneurial ethics, arguing that while some violations may be morally questionable, they can be ethically justifiable within a virtue-based framework that recognizes the transformative nature of entrepreneurial action. While some studies suggest entrepreneurs may exhibit strong moral reasoning, the unique pressures of entrepreneurship can also lead to unethical behavior (Tipu, 2015). For instance, during early-stage ventures, financial constraints often force entrepreneurs to make ethically questionable decisions to sustain operations (Hannafey, 2003). Such circumstances highlight the ethical tensions inherent in the entrepreneurial journey (Tipu, 2015).

Qureshi (2023) examined ethical decision-making in environmentally sustainable entrepreneurship, highlighting the challenge of balancing economic goals with environmental responsibility. The study found that entrepreneurs who prioritize ethics are more likely to establish ventures with positive societal impact.

Trevino & Nelson (2021) explored how ethical decision-making in entrepreneurship is shaped by moral intensity, anticipated consequences, and the organisational ethical climate. They advocate for clear ethical frameworks to support morally informed entrepreneurial choices. Similarly, Vallaster et al. (2019), through bibliometric and content analysis, identified underexplored areas in entrepreneurship ethics and recommended further in-depth research to advance understanding in this domain.

- The role of ethics & emerging technological innovations
- The role of corporate social responsibility in the field of ethics and entrepreneurship
- Social entrepreneurship & ethics in entrepreneurship

2. The role of personal and cultural values

The role of personal and cultural values in the formation of entrepreneurial ethics is the focus of recent research. Morris et al. (2002) examine the influence of personal values on business behaviour and ethical decisions. They believe that personal values such as integrity, honesty, and fairness, are the decisive determinants of their ethical behaviour. The study also indicates that these values are often influenced by entrepreneurial education, education and life experiences. Cultural values also play an important role in shaping entrepreneurs' ethical orientations. Hampden-Turner & Trompenaars (2000) discuss how cultural differences influence ethical decision-making in entrepreneurs. They contend that entrepreneurs from collective cultures should give priority to the well-being of groups and communities, whereas entrepreneurs from individualistic cultures should focus more on personal success and autonomy. Calza et al. (2020) compared the ethical perceptions of entrepreneurs from different cultural backgrounds. They found that the cultural context greatly influences the attitude of entrepreneurs toward ethical business practices, and some cultures place more emphasis on ethical behaviour as a critical element of business success.

3. Ethical challenges and stages of entrepreneurship

Entrepreneurs encounter distinct ethical challenges at each stage of their ventures. During the startup phase, dilemmas often arise from resource limitations and investor pressures, leading to practices such as misrepresentation or questionable marketing (Baron, 2000). Sarasvathy & Dew (2005) highlight the ambiguity and uncertainty of early-stage ventures, which can obscure ethical boundaries. They argue that entrepreneurs who adopt flexible, context-sensitive ethical decision-making strategies are better equipped to navigate these complexities.

Payne & Joyner (2006), through qualitative research, identified key ethical practices adopted by founders during the startup and growth phases of their firms. They outlined four categories of decisions where moral or social responsibility plays a significant role, offering insights into areas where future entrepreneurs must exercise ethical judgment throughout the entrepreneurial journey.

- Decisions related entrepreneurial values
- Decisions related to comfort organizational culture/staff
- Decisions related to consumer gratification and excellence
- Decisions related to external responsibility.

Ma et al. (2020) studied 296 Chinese startups and found that while ethical foundations posed initial survival challenges, they later contributed to a positive reputation, standardized employee conduct, and sustained competitive advantage.

As businesses evolve, ethical challenges shift in nature. Dees (1998) highlighted that growth phases bring ethical concerns in leadership, employment, and stakeholder management. Elkington (1998) introduced the triple bottom-line approach, urging entrepreneurs to consider social and environmental impacts alongside financial goals. Tanwar (2013) further emphasized that ethical considerations vary across different stages of an organizational life cycle.

4. CSR in entrepreneurship

Integration of CSR in the ethical study of entrepreneurs is increasingly important. Carroll (1991) defines CSR as the responsibility of a company to contribute to the well-being of society beyond profit. Those who embrace CSR are considered to create not only profitable but also socially and environmentally responsible enterprises. Spence & Painter-Morlland (2011)focus on the role of social entrepreneurship and investigate the relationship between entrepreneurship and CSR. Social entrepreneurs are motivated by their mission of addressing social and environmental problems and often place ethical considerations at the heart of their business models. In contrast to traditional entrepreneurs, CSR may be seen as a complementary activity rather than a core component of their business strategy. Aguinis & Glavas (2012) conducted a comprehensive review of CSR in the context of entrepreneurship, highlighting how entrepreneurs can incorporate CSR into their business models. They believe that CSR can improve brand reputation, attract socially conscious consumers, and improve the morale and retention of employees. However, they also point out that the implementation of CSR poses ethical challenges such as balancing shareholders' interests and those of other stakeholders.

5. Ethical leadership in entrepreneurship

Ethical leadership plays a vital role in fostering a culture of ethics within entrepreneurial ventures. Plinio (2009) highlighted its influence on employee behavior through role modeling, transparency, and commitment to justice. Kuratko & Goldsby (2004) emphasized that ethical leadership enhances trust among stakeholders and supports long-term success. Widyani et al. (2020) found that ethical entrepreneurs build loyal teams and reduce the risk of unethical practices such as fraud and corruption, especially in high-pressure environments.

Entrepreneurs often exhibit individualistic behavior, evaluating morality based on personal outcomes. Actions benefiting the self are viewed as moral, while unfavorable outcomes are deemed immoral (Longenecker et al., 1988). This aligns with egoism, an ethical theory emphasizing the pursuit of self-interest and personal satisfaction (Debeljak & Krkač, 2008).

A mixed-method study on Malaysian entrepreneurs by Ahmad & Ramayah (2012) identified three core ethical practices as ethical conduct, honesty and integrity, and accountability, and three areas of social responsibility: obligations to society, customers, and business partners. While entrepreneurs demonstrated both, structural equation modelling revealed that only ethical practices significantly influenced firm performance, with social responsibility showing no notable impact (Ahmad & Ramayah, 2012).

6. The role of ethics in entrepreneurial education

Entrepreneurial education plays a key role in shaping the ethical orientation of future entrepreneurs. Giacalone & Thompson (2006) discussed the importance of incorporating ethics into the curriculum of business education. They believe that educational institutions are responsible for fostering ethical values and decision-making skills in aspiring entrepreneurs and preparing them for the moral dilemma they will face during their careers. Neubaum et al. (2009) emphasises the need for experiential learning approaches such as case studies, simulations, and ethical decision-making exercises to effectively teach entrepreneurial ethics. These methods enable students to solve ethical problems in the real world and develop the critical thinking skills required to tackle complex ethical problems. Toledano (2019) further emphasises the role of ethics in entrepreneurial education and suggests that exposure to ethical dilemmas in the educational environment can help students develop a stronger ethical foundation. The study also points out that ethical education can improve students' awareness and sensitivity to ethics and make them more likely to give priority to ethical considerations in entrepreneurial endeavours.

7. Ethics and entrepreneurs in Sri Lanka

Entrepreneurial research in Sri Lanka is growing, but remains largely quantitative. (Gamage & Cameron, 2003) emphasized the need for more qualitative studies to uncover local realities. However, only a few such studies exist (Kusumsiri, 2018; Senadheera et al., 2014; Thiranagama, 2015) and research integrating ethics and entrepreneurship is particularly limited, indicating significant gaps for further exploration.

Ethical considerations in Sri Lankan entrepreneurship have received limited attention. Senadheera et al. (2014), using mixed methods with 333 entrepreneurs, found that while many follow formal business rules, their behaviour often reflects self-interest. Entrepreneurs also showed interest in sustainable practices like reuse and recycling. Senadheera & Karunarathne (2016), through interviews with 12 entrepreneurs, revealed a contextual mix of ethical approaches, with deontological and egoistic ethics prevailing over utilitarianism, indicating a stronger focus on self-interest than collective welfare. Senadheera (2019a), in a quantitative study of 300 Sri Lankan entrepreneurs, found a strong positive correlation between entrepreneurial traits and egoistic ethical concerns. The study showed that when personal values are embedded in business, ethical focus shifts toward profit, efficiency, and self-interest. Senadheera (2019b) found no significant link between Sri Lankan entrepreneurs' ethical approaches and factors like gender, education, or training. Only age and experience affected utilitarian ethics. These findings, based on general entrepreneurs, underscore the need for research on specific groups like entrepreneurial engineers.

Since entrepreneurship plays an important role in driving economic growth and social change, it is essential to understand the ethical challenges and responsibilities facing entrepreneurs. Future research should continue to explore the interconnection of ethics and entrepreneurs, focussing on developing practical frameworks and guidelines to help entrepreneurs navigate the complex ethical landscape of modern enterprises.

2.3.4 Technology entrepreneurship & ethics

Technology entrepreneurship can be differentiated from conventional entrepreneurship by its emphasis on creating opportunities through advancements in the fields of science and engineering. Therefore, technology entrepreneurship is of utmost importance since it focusses on the development of technical advancements and the emerging markets and unique products that they frequently facilitate (Beckman et al., 2012). Technology entrepreneurs contribute significantly to society and are influenced by its expectations. Their ventures create jobs, new firms, and can enhance societal welfare, though negative impacts may also occur. A social contract is believed to exist between these entrepreneurs and society, and failure to meet societal expectations can result in social disapproval (Chikweche & Fletcher, 2017).

Technological entrepreneurs disrupt outdated systems, creating opportunities and enhancing social welfare. However, their innovations often generate ethical dilemmas, both for themselves and their clients (Hall & Rosson, 2006). While new technologies may be profitable, they can also lead to unintended societal consequences, raising concerns about their responsible pursuit.

Fassin (2005) observes that many entrepreneurs act opportunistically and unethically during startup phases but adopt more honest conduct as they achieve success, sometimes turning to philanthropy. Early unethical practices often lay the foundation for later fortunes. Reports of professional misconduct, including corporate greed, corruption, and ethical violations in sectors like education, public service, and sports, are increasingly prevalent (Janosik, 2007). Unethical actions by technological entrepreneurs, in particular, have significant societal repercussions, highlighting the need for in-depth research across global contexts. Technological entrepreneurs operate under intense pressure to reduce development time, lower costs, and enhance product value, often amid uncertainty and conflicting goals. Ethical considerations add complexity, requiring decisions that are not only sound but also ethically justified (Yassine & Chelst, 2018). Thus, professional ethics significantly influence their decision-making processes.

As technology transforms industries and societies, the ethical responsibilities of technology entrepreneurs face growing scrutiny. This section reviews existing research in technology entrepreneurship through various ethical theories, aiming to examine their influence on ethical decision-making and highlight gaps in the current literature.

1. Technology entrepreneurs & utilitarianism

Utilitarianism, centred on maximizing overall happiness, is a key ethical framework in technology entrepreneurship. Researchers apply it to evaluate the social impact of innovations by balancing their benefits against potential harm. The first utilitarian principles expressed by Bentham (2017) and Mill (1863) have played a key role in the evaluation of the ethical impact of technology. In the context of entrepreneurship, these principles are often used to justify innovations that assure extensive benefits, such as improved efficiency, improved health outcomes, or increased access to information. Mingers & Walsham (2010) examined the ethical dilemma entrepreneurs need to navigate when introducing disruptive technologies. They emphasise some examples where the search for innovations has led to unwanted negative effects such as job displacement and environmental degradation, and question the hypothesis that technological progress leads fundamentally to greater overall satisfaction.

The study of Bostrom & Yudkowsky (2011) examines the possibility of artificial intelligence (AI) to solve complex global challenges. Zuboff (2019) and others have criticized utilitarianism for overlooking long-term social costs such as privacy loss and inequality. This underscores its limitation in prioritizing short-term gains over deeper ethical concerns. While useful for evaluating broad impacts, utilitarianism often fails to address complexity and uncertainty, and may obscure the effects on specific groups. A more nuanced approach is needed to assess both the benefits and harms of innovation.

2. Technology entrepreneurs & deontological ethics

Deontological ethics, which prioritises moral duties over outcomes, contrasts with utilitarianism by focusing on entrepreneurs' ethical obligations. It applies to areas like data management and product development. Bowen (2013) highlights that technology entrepreneurs have a moral duty to respect the rights and dignity of those affected by their innovations. This is especially relevant to data privacy, where respect for autonomy often conflicts with data-driven business models. Floridi (2016) extends the principles of deontology to the field of information ethics and considers that technology entrepreneurs are responsible for ensuring that their innovations do not harm people or society. This view is consistent with the concept of "responsible innovation," which emphasises the significance of anticipating and alleviating the ethical risks associated with new technologies. Empirical studies such as the Isaak & Hanna (2018) analysis of the Facebook-Cambridge Analytica scandal illustrate ethical dilemmas arising from violations of moral principles. This case emphasises the costs of failing to respect ethical standards in data management, leading to serious breaches of trust and reputational damage.

Deontological ethics provides a strong basis for the promotion of ethical business practices in technological entrepreneurs. However, strict adherence to moral principles is challenging in a dynamic, often unclear, environment faced by entrepreneurs. The application of deontological ethics in the field of technology entrepreneurialism requires careful consideration of how to stabilise firm moral responsibilities with the practical realities of innovation and competition.

3. Technology entrepreneurs & virtue ethics

Virtue ethics moves from the focus on rules and consequences to entrepreneurs' characteristics and virtues. This approach stressed the significance of morality in guiding ethical decisions, especially in the context where established rules are lacking or insufficient. Vallor (2016) explores the role of virtue ethics in the formation of moral characteristics of technology entrepreneurs. He argues that virtues such as wisdom, courage, and empathy are crucial to directing the ethical challenges posed by rapidly progressing technologies. This viewpoint proposes that ethical entrepreneurship includes not only the application of rules but also the expansion of the moral qualities requisite to make sound ethical decisions. Research by Hartman et al. (2021) provides a case study of entrepreneurs who demonstrate good behaviour, such as those who place social and environmental goals at the forefront of profits. These case studies illustrate the application of moral ethics in practice and provide examples of the positive results of moral character in entrepreneurship in technology. Freeman & Auster (2011) studied how virtuous leadership influences corporate culture and ethical behaviour within technology companies. They argue that entrepreneurs who model ethical virtue create an environment that encourages responsible innovation and ethical behaviour among employees.

Virtue ethics provides a holistic approach to understanding ethical behaviour in technology entrepreneurs by emphasizing the significance of moral characteristics. However, its application in the technology sector is challenging, where the pressures of innovation and competition are in conflict with the cultivation of beneficial behaviour. Furthermore, subjective characteristics of "virtous" entrepreneurs vary, making it difficult to set up coherent ethical standards.

4. Technology entrepreneurs & stakeholder theory

The theory of stakeholders expands the scope of ethical decision-making, including the interests of all stakeholders involved in the company's operations, not just shareholders. This theory is particularly relevant in the field of technology entrepreneurs, and the impact of innovations is large-scale and multifaceted. Freeman (1984) stakeholder theory has been widely applied to analysis of technological entrepreneurs, emphasising the need for entrepreneurs to take into account the interests of all stakeholders, including customers, employees, suppliers, and broader communities. This approach encourages a more holistic approach to ethical decision making in which the long-term impact of technology is carefully considered. Mitchell et al. (1997) research explored how technology entrepreneurs can recognise and give precedence to stakeholders, especially in situations where interests conflict. This study highlights the challenges of balancing the demands of different stakeholders, such as investors looking for rapid returns and customers concerned about data privacy. Porter & Kramer (2006) argued that by solving social and environmental issues in a way that benefits society and the bottom line, companies can accomplish competitive advantages in technology entrepreneurship. This view is in line with the stakeholder theory by upholding a more inclusive approach to business strategy that takes into account the needs of all stakeholders.

Stakeholder theory offers a valuable lens for understanding the ethical duties of technology entrepreneurs, especially given the broad impact of innovation. However, its application is complex, requiring entrepreneurs to balance conflicting interests and make difficult trade-offs. The global scope of the tech industry further complicates this, as stakeholders often hold diverse ethical and cultural values.

5. Technology entrepreneurs & social contract theory

Social contract theory holds that ethical behaviour arises from implicit agreements to promote societal well-being. In technology enterprises, it implies that entrepreneurs have a duty to shape innovations that enhance the broader good of society. Donaldson & Dunfee (1994) investigated how technology entrepreneurs fit into a broader social contract and considered the obligation of companies to contribute to social well-being.

This view emphasises the importance of ethical innovations that align with social values and expectations. Lesig (2006) examines the role of regulation in shaping social contracts for technology entrepreneurs. He argues that legal and ethical standards are necessary to ensure that technological innovation does not undermine social contracts and creates serious inequality or damage. Rawls' (1971) justice theory, based on the principles of the social contract, applied technology entrepreneurship to assess how innovations affect social justice. Sandel (2010) explored the ethical implications of technologies that may exacerbate inequalities and argued that entrepreneurs have the duty to ensure that innovation contributes to a more just and equitable society.

Social contract theory offers a broad ethical framework for assessing technology entrepreneurs' societal responsibilities. However, its application is difficult due to ambiguity around defining the 'common good' and prioritising it. Variations in cultural and legal norms across global contexts further complicate the establishment of universal ethical standards.

Theoretical approaches such as utilitarianism, deontological ethics, virtue ethics, stakeholder theory, and social contract theory provide valuable insights into the ethical challenges of technology entrepreneurs. These frameworks highlight the need to balance innovation with ethical responsibility. However, the fast-paced nature of the tech industry complicates their practical application. Continued research is necessary to develop comprehensive ethical models tailored to the evolving complexities of technological entrepreneurship.

2.3.5 Entrepreneurial engineers & ethics

2.3.5.1 Entrepreneurial engineers

Engineering entrepreneurship is not merely a subset of technological entrepreneurship. Schuelke-Leech (2018) argues that entrepreneurial engineers integrate creation, discovery, engineering, and problem solving into the entrepreneurial process, rather than just contributing technological content. Many leading technology entrepreneurs are engineers, and globally, engineers often pursue entrepreneurship due to their innovation-driven mindset (Goldberg, 2006). An entrepreneurial engineer is one who establishes and manages a technology-based business, focusing on advanced technology development and commercialisation (Farsi et al., 2018).

Entrepreneurial engineers represent a distinct subset of technology entrepreneurs, defined by their technical expertise and ability to identify and exploit opportunities through engineering solutions (Uchino, 2010). Narrowly, they are engineers with formal training who apply their technical skills to create and pursue entrepreneurial ventures (Goldberg, 2006). Often, they transition from technical positions to entrepreneurial roles by recognizing the commercial value of their innovations (Barba-Sánchez & Atienza-Sahuquillo, 2018). Colombo & Grilli (2005) found that engineering-led technology firms prioritize product innovation and technical development, reflecting the strengths of entrepreneurial engineers. Mosey et al., (2017) note that these engineers often require additional support in areas like market analysis and strategic planning, distinguishing them from other technology entrepreneurs and highlighting their unique challenges.

Entrepreneurial engineers typically start with technical solutions and seek market applications, while technology entrepreneurs often begin with market needs and develop technologies accordingly (Kohlert et al., 2013). Innovations by entrepreneurial engineers usually arise from engineering R&D, whereas technology entrepreneurs may draw from market research or business model innovation (Guardia, 2016). Although entrepreneurial engineers possess strong technical expertise, they often lack formal training in business management, unlike technology entrepreneurs who usually have broader managerial backgrounds.

Studies show that entrepreneurial engineers face difficulties in converting technical expertise into business success, often needing support in areas like business model development, customer discovery, and venture financing (Mosey et al., 2017). University-led programs that address these knowledge and skill gaps are crucial for promoting engineering entrepreneurship today.

2.3.5.2 Foundational theories to study engineering entrepreneurship

The distinctive relationship between technical expertise and entrepreneurial behaviour requires a diverse theoretical frameworks integrating engineering and entrepreneurial elements to understand deeply. This section explains few seminal theories that enhance the understanding of the field of engineering entrepreneurship.

1. Resource-Based View of the firm (RBV).

The Resource-Based View (RBV) introduced by Wernerfelt in 1984 and further developed by Barney in 1991 advocates that the competitive advantages of companies stem from their unique resources and capabilities (Barney, 1991). RBV can be used in clarifying how entrepreneurial engineers use specialized knowledge, technical competences and innovation capabilities to create new enterprises. Engineers often have unique technical resources, such as patents, proprietary technologies and specialized knowledge, which are the basis for new ventures (Colombo & Grilli, 2005). The RBV framework further assists understand how these resources are managed and integrated into business activities, and brings sustainable competitive advantages.

2. Effectuation theory

The effectuation theory describes how entrepreneurs make decisions under uncertain conditions. Entrepreneurs use the existing means to create new opportunities rather than starting with a predetermined goal (Sarasvathy, 2001). Entrepreneurial engineers often work in very uncertain environments where the development of technology and market needs are not well defined (Uchino, 2010). They can develop and refine business models by using their technical expertise, resources and networks to effectively think and rationalize.

3. Dynamic Capabilities Theory (DCT)

Dynamic capabilities theory advocates that companies can achieve long-term success by continuously adapting, integrating, and rearranging internal and external competences in response to changing environments (Teece et al., 1997). Entrepreneurial engineers often operate in a dynamic and fast-paced technological environment. Adaptation and reorganisation of resources, such as technical applications or business models with pivotal technology, are vital to their survival and growth (Kohlert et al., 2013). This theory can be utilized to explain how entrepreneurial engineers manage innovation processes, intellectual property and strategic partnerships to maintain competitive advantages.

4. Open Innovation Theory

Chesbrough's open innovation theory stated that companies should use external ideas and internal channels to advance technology (Chesbrough, 2003). Entrepreneurial ventures run by entrepreneurial engineers often operate in industries that require extensive collaboration and information exchange beyond the venture's boundaries (Guardia, 2016). Open innovation provides a framework for understanding how entrepreneurial engineers engage with external sources of knowledge such as universities, research institutions and other enterprises to improve innovation processes.

5. Human Capital Theory

The theory of human capital suggests that investing in education, training and experience can improve the productive abilities of individuals (Becker, 1964). The theory has been widely applied in entrepreneurship research to understand how the human capital of entrepreneurs affects the success of ventures (Unger et al., 2011). Human capital theory provides a solid framework for understanding entrepreneurial activities of engineers by highlighting the role of human capital. Technical expertise and commercial skills are indispensable to successful identification, development and commercialization of technology innovations within the firms run by entrepreneurial engineers.

As a summary, it can be concluded that each theory brings unique insights into how entrepreneurial engineers can use their technical expertise to navigate uncertainty and collaborate with various stakeholders to drive innovation and create value.

2.3.5.3 Ethics of entrepreneurial engineers

Schuelke-Leech (2018) argues that engineering-based entrepreneurship may differ from other forms of entrepreneurship due to the engineering profession's ethical obligations. Engineers remain bound by professional codes of ethics even when they become entrepreneurs. However, these codes often overlook the commercial ambitions of entrepreneurial engineers, creating ethical tensions during this transition (Read, 1999). The absence of dedicated ethical guidelines for entrepreneurial engineers raises the question of whether a separate code is needed, or if all engineers can be governed by a universal ethical framework.

While multiple moral theories can enrich ethical decision-making, they often introduce complex concepts that challenge engineers in practice. Despite advancements in human capabilities through science and technology, managing these powers effectively remains difficult. Traditional codes of ethics, designed for engineers working in stable institutional settings, may not fully address today's evolving challenges. As the business landscape becomes more dynamic, engineers are increasingly pursuing entrepreneurial paths, both within and beyond corporate structures, prompting a need to reassess ethical frameworks. As innovation is central to entrepreneurship (Chell, 2008), entrepreneurial engineers must pursue innovation ethically, akin to ethical design. They serve as crucial links between technical development and market application (Uchino, 2010). Foley & Gibbs (2019) advocate for examining their ethical practices in innovation. This dual role presents unique ethical challenges that neither traditional engineering nor business ethics fully address (Weil, 2014), making the ethical behaviour of entrepreneurial engineers a vital area of research.

1. Engineering ethics & entrepreneurship

Engineering ethics traditionally emphasises public safety, honesty, and environmental responsibility, guided by organisations like NSPE, IEEE, and IESL (Fleddermann, 2012). However, when engineers become entrepreneurs, they face added ethical challenges in balancing technical integrity with business demands. Herkert (2001) highlights their dual responsibilities, which often create conflicts of interest under market pressure. Borenstein & Howard (2021) note that startup environments pose dilemmas involving product safety, intellectual property, and responsible use of venture capital, with fast-paced, resource-limited settings complicating ethical adherence. Pritchard (2013) points to historical failures like the Challenger disaster and Ford Pinto case to show how prioritising profit over ethics can result in major harm.

Literature indicates that entrepreneurial engineers often work in settings where ethical standards are less clearly defined than in traditional engineering roles. Balancing technical integrity with business success presents unique ethical challenges. However, most existing research is descriptive, identifying dilemmas without offering comprehensive strategies for resolving them.

2. Engineering ethics and business ethics for entrepreneurial engineers

The intersection of engineering and business ethics is a key area of research to understand the ethical behaviour of entrepreneurs. This intersection includes a reconciliation of the often contradictory ethical framework that governs technical and business decisions. Harris et al. (2009) emphasised the need for a multi-disciplinary approach to ethics, combining engineering and business ethics. The author argues that engineers must be trained to understand and navigate the ethical considerations of the two fields because their decisions often have a wide-ranging impact. A study by Martin & Schinzinger (n.d.) proposed a model of decision-making that included both engineering and business ethics. This model emphasised the importance of taking into account the long-term social impact of entrepreneurial entities rather than focussing exclusively on short-term commercial profits. The author also highlights the role of ethical leadership in establishing an ethical tone for engineering-led start-ups. Van de Poel and Royakkers (2011) explored the concept of CSR in the engineering business environment. They believe that entrepreneurial engineers are responsible for considering the social and environmental impact of innovations. This perspective reflects an increasing emphasis on sustainability and ethical business practices in the technology industry.

The intersection of engineering and business ethics presents a challenge due to differing priorities, engineering ethics emphasizes safety and public welfare, while business ethics focuses on profit and competition. Addressing this requires an integrated approach to ethics education and practice in engineering entrepreneurship.

3. The role of code of ethics

The engineering codes of ethics by NSPE, IEEE, and IESL guide ethical conduct but offer limited relevance for entrepreneurial engineers. These codes do not fully address the business-related ethical challenges encountered in entrepreneurial environments. Davis (1991) criticised the limitations of traditional engineering codes in addressing the ethical challenges faced by entrepreneurial engineers. The author argued that these codes are designed primarily for engineers working in established organisations and cannot provide adequate guidance to people who are in entrepreneurial roles where business considerations are key. Ladd (1985) suggested that it was necessary to adapt engineering ethics codes to better suit the entrepreneurial context. The authors propose the development of additional guidelines on topics such as intellectual property, venture funding, and ethical marketing practices.

Personal ethics strongly influence decision-making, especially on ethical matters (Cordeiro, 2011). For engineers running their own businesses, adherence to engineering ethics can significantly shape business operations. The fast-paced entrepreneurial environment often demands quick decisions with lasting impacts on a firm's ethical climate. According to Cordeiro (2003), most employees practice ‘follow the leader’ at work. When entrepreneurial engineers act ethically, their employees are more likely to follow suit. Studies show that many entrepreneurs believe ethical behaviour is vital for a functioning economy (Ahsan, 2020). Borenstein & Howard (2021) stress the need for engineering-led startups to foster ethical cultures, noting that while professional codes offer a foundation, they must be reinforced by organisational values that support ethical decision-making and accountability.

Professional ethical codes, designed for traditional engineering roles, offer limited guidance to entrepreneurial engineers. These codes must evolve to address the unique ethical challenges of entrepreneurship. Read (1999) argues that interpreting moral values becomes difficult for entrepreneurial engineers, as existing codes often remain silent on emerging issues, prompting growing uncertainty and unanswered questions among this group. Some questions are

- How can engineers adapt to this new challenge and fulfil their professional responsibilities in an entrepreneurial environment?
- Can an ethical framework be built to satisfy engineers' entrepreneurial goals while adhering to their rigid professional moral value system?

There seem to be more questions than answers and the further one delves into the concepts of entrepreneur and professional the bigger the ethical chasm seems to become. To date, above questions have not been properly answered yet in most of the contexts due to the dearth of studies relevant to entrepreneurial engineers.

Senior professional engineers in Sri Lanka highlight the importance of ethical behaviour in engineering-related business activities. This underscores the need for an in-depth, qualitative study on the intersection of engineering ethics and entrepreneurship. Such research aims to expand the current knowledge base and promote a strong ethical culture within startups to ensure effective implementation of ethical codes.

4. Entrepreneurial engineers and ethics education

Ethics education is vital for preparing engineers for entrepreneurial roles, yet current engineering programmes often overlook the ethical challenges entrepreneurs face.

Bucciarelli (2008) highlights significant gaps, noting that most curricula emphasize technical skills and traditional ethics, neglecting business-related ethical concerns that engineers encounter as entrepreneurs. Colby & Sullivan (2008) advocate integrating ethics into engineering and business curricula through a multi-disciplinary approach, equipping students to navigate complex ethical issues in technology entrepreneurship. Harris et al. (2009) support case-based learning, enabling students to understand real-world ethical dilemmas faced by engineers and entrepreneurs.

Engineering education must better address the ethical challenges of entrepreneurship, as current programmes often fail to prepare engineers for the complexities of running their own ventures. Integrating ethics into engineering and business curricula, along with case-based learning, can enhance the ethical readiness of future entrepreneurial engineers. Engineers face complex ethical challenges that demand a strong grasp of both engineering and business ethics. While past studies highlight issues like balancing technical integrity with business goals and the limits of traditional standards, a comprehensive strategy to address these concerns is still lacking.

2.4 Gaps & Critiques

2.4.1 Introduction

While engineering ethics has become a well-established academic field, much of the existing literature remains confined to frameworks of compliance, moral obligations, and individual ethical failure (Davis, 1991; Herkert et al., 2020; Nair & Bulleit, 2020). Ethics in engineering is typically taught as a set of principles to follow, particularly through formal instruction and codes of conduct such as those developed by the NSPE or IESL. However, these discussions often centre on institutionalized professional environments, leaving entrepreneurial spaces largely unexamined (McGinn, 2022; Wijesinghe & Jayawardane, 2020). Parallelly, the field of entrepreneurship research has flourished, particularly in exploring opportunity recognition (Shane & Venkataraman, 2000), innovation (Drucker, 1985), and business growth strategies (Baron, 2006). Yet, ethical considerations in entrepreneurship are often reduced to corporate social responsibility (CSR) or governance structures, neglecting the everyday moral struggles and commitments of entrepreneurs themselves.

Notably, the intersection of engineering ethics and entrepreneurial behaviour remains underdeveloped (McGinn, 2022; Wijesinghe et al., 2021). Entrepreneurial engineers often operate in resource-limited, ambiguous environments with minimal institutional ethical oversight, requiring a balance between profit and professionalism. Despite their growing presence in developing countries, especially in informal economies, there is limited empirical research on how they uphold professional ethics (Wijesinghe & Jayawardane, 2020b). This study fills that gap by examining how Sri Lankan entrepreneurial engineers apply the IESL Code of Ethics in daily practice, offering an inductively grounded view of ethics in real-world business settings.

2.4.2 Gaps & critiques for engineering ethics

The literature on engineering ethics has traditionally focused on compliance-based models that emphasize rule-following and avoidance of malpractice. Central to this discourse are professional codes of ethics, which serve as normative guides for acceptable conduct within regulated engineering environments (Davis, 1998; Martin & Schinzinger, 2005). While such codes offer a foundational ethical structure, they have been critiqued for reducing ethical practice to a checklist of obligations rather than promoting reflective moral engagement (Harris et al., 2009). Furthermore, many empirical studies have concentrated on cases of ethical lapses, such as the Challenger disaster or Enron, reinforcing a reactive view of ethics where violations trigger investigation and regulation (Herkert, 2001; Post, 2014; Vesilind & Gunn, 2011). This risk-centric framing leaves less space for exploring how engineers proactively internalize and enact ethical values in complex, everyday business environments.

A significant gap lies in the absence of research that views ethics as a lived and adaptive process, especially in entrepreneurial contexts where formal institutional oversight is minimal. Studies have shown that engineers often operate in settings marked by economic pressures, political influence, and cultural variability, yet most ethics research remains centered on Western regulatory frameworks and corporate engineering roles (Mitcham, 2009; Poel & Royakkers, 2011). There is a growing call for moving beyond the prescriptive to understand the ways in which engineers interpret and apply ethical reasoning in context-sensitive ways (Herkert, 2005). Despite this, few studies have examined ethical engagement as an integral part of entrepreneurial engineering in resource-constrained or informal economies, where engineers may confront unique ethical dilemmas, such as client manipulation, low-quality demands, or unethical competition (McGinn, 2022; Wijesinghe & Jayawardane, 2020b). This study addresses that void by focusing on how entrepreneurial engineers in Sri Lanka adhere to their professional code of ethics in dynamic and often morally ambiguous settings. It builds on the emerging strand of ethics literature that views moral action as situated, relational, and constructed through practice, not merely abstract principle. By doing so, it contributes to a more nuanced and contextualized understanding of engineering ethics as both a personal and professional endeavor.

2.4.3 Grounded theory & South Asian context

Grounded Theory (GT), first introduced by Glaser and Strauss (1967), has evolved significantly from its origins in positivist assumptions to more constructivist iterations that emphasize reflexivity, co-construction, and interpretive depth (Charmaz, 2006; Charmaz & Thornberg, 2020). Constructivist Grounded Theory (CGT) moves beyond the search for objective social facts to recognize that both data and theory are mutually constructed through interaction between researcher and participant (Bryant & Charmaz, 2017). CGT is especially valuable for understanding complex, situated phenomena such as ethics, where individual meaning-making is shaped by context, culture, and power dynamics (Mills et al., 2006). Despite this, the use of CGT in engineering ethics research remains rare, and its application in entrepreneurship or engineering-business crossover domains is even less frequent.

Moreover, the body of engineering ethics literature emerging from the Global South, and particularly South Asia, is markedly limited. Much of the existing work tends to mirror Western ethical frameworks, often emphasizing macro-level policy discussions or formal ethics education, rather than grounded insights into how engineers in developing contexts engage with ethical dilemmas in practice (Baligar & Joshi, 2025; Cheruvalath, 2024). In Sri Lanka specifically, there is a lack of empirical scholarship that investigates how local engineers internalize and apply professional ethics within the entrepreneurial sector, which operates with different norms, informal market dynamics, and limited regulatory oversight.

This study addresses both methodological and geographical gaps by using constructivist grounded theory to explore how Sri Lankan entrepreneurial engineers follow the IESL Code of Ethics. It reveals context-specific understandings of professionalism and ethical agency shaped by economic, political, and cultural factors. The research contributes to the limited grounded theory literature on engineering ethics in non-Western, postcolonial contexts by generating theory from lived experiences rather than applying predefined ethical frameworks.

2.4.4 Positioning this study – filling the gap

Despite increased focus on engineering ethics, entrepreneurship, and qualitative research, their intersection remains underexplored, especially in developing countries. Existing literature lacks a coherent theory on how entrepreneurial engineers uphold ethical standards in dynamic, often unregulated settings. Most research emphasizes reactive ethics and compliance, rather than how ethical values are proactively practiced for sustained success (Davis, 1998; Poel & Royakkers, 2011). Moreover, entrepreneurship research has largely remained focused on value creation and opportunity exploitation (Pinelli et al., 2022; Schlichte & Junge, 2024; Shane & Venkataraman, 2000), with ethical dimensions often treated as peripheral or confined to corporate social responsibility (CSR) frameworks.

In the Sri Lankan context, a significant scholarly gap exists regarding how engineering entrepreneurs engage with professional ethical frameworks such as the IESL Code of Ethics (Wijesinghe et al., 2021). Given engineers' growing shift to entrepreneurship and their role in national development, understanding their ethical decision-making is crucial. However, limited research explores how they interpret and apply ethical standards in business, especially within contexts marked by weak institutions, economic uncertainty, and cultural norms (Fernando & Jackson, 2006).

This study uses CGT to develop the Theory of Enduring Prosperity, explaining how Sri Lankan entrepreneurial engineers ethically navigate business. It identifies three key processes, Internalising, Employee Engagement, and Outreaching the Public, as pathways to ethical adherence, leading to sustainable outcomes. The study extends engineering ethics beyond rule compliance, positions ethics as a strategic force in entrepreneurship, and shows CGT's value in exploring ethical agency in informal Global South contexts.

2.5 Chapter summary

As the world moves toward a technology-driven future, engineers are increasingly central to societal progress, with ethical adherence being fundamental to their professional role. However, most engineering ethics literature emphasizes rule-based compliance and education, offering limited insights into how ethical values are internalized, especially among entrepreneurial engineers in culturally complex and resource-limited settings. These professionals often work in ethically ambiguous environments shaped by market demands and weak institutional frameworks—conditions overlooked by traditional codes of ethics. Similarly, entrepreneurship research tends to prioritize growth and opportunity, sidelining ethics as a strategic factor. In response to these gaps, this study employs Constructivist Grounded Theory to develop The Theory of Enduring Prosperity, illustrating how Sri Lankan entrepreneurial engineers ethically navigate their business environments through internalising ethical values, engaging employees, and outreaching to the public, demonstrating that ethics can serve as a foundation for long-term entrepreneurial success.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Introduction

Chapter 2 laid the groundwork by reviewing key concepts in ethics and entrepreneurship, with a focus on engineering ethics and technology entrepreneurship in both global and Sri Lankan contexts. This chapter outlines the research philosophy, paradigm, methodology, and design to explore how engineering ethics influence the behaviour and performance of entrepreneurial engineers in Sri Lanka. This chapter outlines the chosen research philosophy and the rationale behind its selection, linking it to the nature of engineering ethics, technology entrepreneurship, and the study's objectives. It then justifies the use of grounded theory over other methodologies, followed by a discussion on participants, sampling, data collection, and analysis. The chapter concludes with ethical considerations and evaluation criteria relevant to the study.

3.2 Background to the research philosophy

Engineering ethics is a research domain that is not well established due to the lack of systematic studies in the past. With the mandatory requirements of engineering accreditation bodies to incorporate engineering ethics into engineering curricula, it is now gaining broader attention from the engineering community. However, entrepreneurship is a research domain that has attracted scholars' attention to conduct various studies from many different philosophical perspectives for many years. Any researcher needs to exploit a method of thinking about data and the living world to recognise an appropriate research methodology (Strauss & Corbin, 1998). Therefore, characteristics of engineering ethics and techno-entrepreneurship are discussed in the following sections by demarcating its characteristics that ask for alternative views to understand the implications of engineering ethics on entrepreneurial firms run by engineers.

3.2.1 The context of engineering ethics

The intellectual history of engineering ethics began three decades ago (Burgess et al., 2013). Much attention has been paid to research on the pedagogy of engineering ethics (Bairaktarova & Woodcock, 2017; Balakrishnan & Tarlochan, 2015; Loui, 2005). Medical ethics, business ethics, and other significant fields of practical ethics are having responsible institutions to develop scholars in the relevant field. However, in engineering ethics, there is a lack of systematic approaches to developing deep studies on the practical application of engineering ethics worldwide (Burgess et al., 2013). Although many professional bodies have introduced codes of ethics, understanding how practising engineers adhere to them requires direct inquiry or observation. With ongoing innovations in engineering and management, professionals increasingly face complex situations that challenge ethical judgment. Barry & Herkert (2014) have recommended that there is a blooming requirement to carry out more studies in the areas of application of engineering ethics as it lacks such studies (p.833). Ethical behaviour is a deliberate human choice, allowing engineers to decide their actions based on the outcomes of such practices. As practices stem from human functions (Gartner, 2010), understanding engineering ethics requires exploring engineers' perspectives rather than relying on statistics. This places the study within the social world, making it inherently subjective (Schmidt, 2014).

3.2.2 The context of technology entrepreneurship

Entrepreneurship is a social phenomenon (Shane & Venkataraman, 2000), and many social realities have not yet been investigated under the significant domain of entrepreneurship (Chepurenko, 2015). Innovation and entrepreneurship in technological areas are getting extensive attention (Drucker, 1985) in the business and economic sectors. Therefore, technology entrepreneurship can be identified as a nexus of entrepreneurship and innovation (Beckman et al., 2012). As human behaviours define the phenomenon of entrepreneurship (Kusumsiri & Jayawardane, 2013), it can be concluded that technology entrepreneurship, as a subdomain of entrepreneurship, is also broadly defined by human behaviours. Gamage & Cameron (2003) suggested the requirement of investigation through bottom-up translations of human actions coherent with the viewpoints and values of the person involved, employing qualitative methodology to recognise the reality of human behaviour in deep-rooted cultural and social contexts.

Social actions related to entrepreneurship are meaningful subjective human behaviours. They form a numerous, changing, and contextual interpretation (Gamage & Cameron, 2003). This denotes that the meanings reflecting from the behaviours of entrepreneurs can be discovered from the point of views of themselves through the different forms of multiple mental constructions in the areas of social and experience (Gamage & Cameron, 2003). Hence, researcher must identify a methodology that permits him to reach participants closer, understand their core judgments, and elucidate their subjective meanings of reality.

Mostly subjective matters shape human behaviour rather than objective matters in uncertain environments consisting of surprises, disagreeing events, and problems. During the entrepreneurial journey, entrepreneurs confront ambiguity, equivocality, discrepant events, and surprises (Mills, 2011). The entrepreneurship process is incorporated with uncertainty (De Vries, 2007). Because of that, researchers in the field of entrepreneurship should recognise the subjectivity and unpredictability associated with the reality of the social world (Gamage & Cameron, 2003; Mills, 2011).

3.2.3 Nature of the substantive topic

Engineering ethics and entrepreneurship are gaining scholarly attention due to advances in science and technology. However, both fields lack empirically grounded theories. Their evolving nature demands new concepts and frameworks, requiring deeper practical and theoretical insight through qualitative research (Godfrey, 2014; Zupic, 2014).

Studying how Sri Lankan entrepreneurial engineers adhere to engineering ethics in their techno-entrepreneurial ventures requires careful methodological procedures and theoretical sensitivity. Gaining a deeper understanding of their ethical practices necessitates exploring their experiences and perspectives. This research, therefore, calls for methodological approaches that account for the social processes underlying the application of engineering ethics by individual entrepreneurial engineers in the realm of technology entrepreneurship.

3.2.4 The nature of research objectives

The literature review highlighted insufficient understanding of how entrepreneurial engineers in Sri Lanka apply engineering ethics, making it difficult to form hypotheses. As the researcher engaged with the field and gained insights, the initially broad objectives were revised and refined based on evolving understanding and experience. The absence of a robust theoretical foundation in the literature led to the development of broad research questions, which, in turn, motivated the researcher to adopt qualitative methodologies. This approach enabled a deeper immersion into the phenomenon under investigation (Braun & Clarke, 2013). Considering the nature of the code of ethics for engineers, the behavior and performance of entrepreneurial engineers, and the research objectives, a qualitative methodology is appropriate for this study. This approach enables the examination of entrepreneurial engineering firms holistically, allowing the researcher to closely engage with participants, explore their diverse realities, and interpret findings along with the various factors that influence their actions.

3.3 Philosophical position of the present research

Researchers require following a scientific approach in research to generate acceptable truth about the subject of the research. All research studies are constructed on views regarding the world around human beings and what human beings can probably ascertain by research. Various researchers have different philosophical thoughts about these topics. (Sekaran & Bougie, 2016, p.28). Hence, the philosophical position of the present study is constructed on a set of beliefs and feelings about the world (ontology) and how it should be understood (epistemology) and studied (methodology) (Denzin & Lincoln, 2018).

3.3.1 Ontology

The nature of reality is described as ontology. Further elaboration on ontology can be done as ‘the set of ideas within which the researcher approaches the world’ (Denzin & Lincoln, 2018, p.208). Two major concepts of ontologies available in the world contribute to much of the debate regarding the world's reality. They are critical realism and relativism. Critical realism means that ‘reality exists independent of the human mind regardless of whether it is comprehendible or directly experienceable.’ This means that only a single reality exists in the world (Levers, 2013). Relativist ontology means “the belief that reality is a finite subjective experience and nothing exists outside the human thoughts”(Guba & Lincoln, 1994, p.108). Different experiences can have multiple interpretations by humans and can give multiple realities. Since there are many people, there can be many different realities. Researchers in relativist ontology aim to recognise the subjective experience of reality and numerous truths (Levers, 2013). Therefore, the ontological approach for this study is relativism, where concepts such as rationality, truth, reality, knowledge, and means are not absolute and must be determined concerning culture, society, paradigm, or form of life.

3.3.2 Epistemology

Disagreements about the nature of knowledge or ‘how we come to know” have a history of more than 2000 years among researchers (Sekaran & Bougie, 2016, p.28). The study of knowledge, or ‘a way of understanding and explaining how I know what I know’, is known as epistemology (Levers, 2013). According to Guba & Lincoln (1994), epistemology means ‘how do I know the world” (p.108). Two opposing epistemologies are available in the world, objectivism and subjectivism. Objectivity can be defined as the ‘belief that truth and meaning reside within an object and are independent of human subjectivity’ (Crotty, 1998). Objectivity argues that truth and reality are independent of human bias, leading to the generation of real knowledge. Simply, knowledge is not affected by the knowledge creator, and the knowledge creator is not influenced by the knowledge he or she tries to generate. Objectivity epistemology is closely associated with the ontological approach of critical realism (Levers, 2013). Subjectivism can be defined as the belief that “knowledge is always filtered through the lenses of language, gender, social class, race, and ethnicity”(Denzin & Lincoln, 2005). Here, knowledge is affected by the knowledge creator, and the knowledge creator is influenced by the knowledge he or she tries to generate. The knowledge realised is dependent on the person realising; there is no right or wrong aspects in such knowledge. Therefore, this study adopts a subjectivism epistemology that recognizes knowledge as value-laden. Entrepreneurship is a field where researchers can construct multiple realities with numerous interpretations. Therefore, they cannot deal with the social phenomenon under investigation in a distanced and uninvolved manner.

3.3.3 Research paradigm

It is essential to select a suitable research paradigm compatible with their views regarding reality's nature to guarantee a robust research design. Paradigm is defined as 'a system of ideas, or world view, used by a community of researchers to generate knowledge'. It is a set of assumptions, research strategies, and criteria for the rigour that are shared, even taken for granted by that community" (Fossey et al., 2002, p.718). According to Cresswell (2014), there are four main paradigms (world views) that are widely discussed in the research literature. They are post positivism, constructivism, transformative and pragmatism. Post positivism and constructivism are the two major opposite extremes of the paradigms. Transformative and pragmatism are situated in between them. The major characteristics of each four paradigms are displayed below (Cresswell, 2014).

Table 3.1

Characteristics of four major paradigms

Post positivism	Constructivism	Transformative	Pragmatism
Determination	Understanding	Political	Consequences of actions
Reductionism	Multiple participant meaning	Power & justice oriented	Problem centered
Empirical observation & measurements	Social & historical construction	Collaborative	Pluralistic
Theory verification	Theory generation	Change oriented	Real world practice oriented

The post positivist paradigm has identified that scientific research is the method to recognise the truth (Sekaran & Bougie, 2016). It is the traditional form of research and supports quantitative research designs. This paradigm can be further elaborated as the researcher commences the study with a theory, collects data to prove the theory or disprove the theory, and then holds supplementary tests to do required revisions (Cresswell, 2014). The nature of this research does not match the post positivist paradigm. Hence, the post positivist paradigm is rejected.

Constructivism is a totally different approach from the post-positive paradigm. Research literature contains several terminologies for constructivism as constructionism, social constructivism or interpretivism, where they hold similar meaning with the interpretation (Cresswell, 2014; Guba & Lincoln, 1994; Sekaran & Bougie, 2016). The constructivist paradigm can usually be understood as an approach to qualitative research design. Constructivists believe that individuals are making multiple and various subjective interpretations about their actions and experiences relevant to a particular social phenomenon making it more complex in nature. As much as possible, constructivists try to rely on the views of the participants with respect to a situation being studied (Berg, 2001; Braun & Clarke, 2013). They identify that their background has had an impact on the way they interpret and acknowledge how their interpretations develop from their personal, cultural, and historical experiences while positioning themselves in the research (Cresswell, 2014). Positivists start from a theory, while constructivists inductively generate a theory from the data gathered from the broad research problems. Considering the nature of this research, the constructivist paradigm was selected to design the research.

3.3.4 Research methodology

According to Guba & Lincoln (1994), research methodology can be explained as a question; "How can the researcher go about finding out what he or she believes can be known?' (p.108). Methodology can also be elaborated as the manner of thinking about and examining social reality. As per the problem statement, it can be answered by close collaboration and through a dialectical interchange between the researcher and the entrepreneurial engineers.

The nature of engineering ethics and technological entrepreneurship calls for a methodology that captures both ethical practices and the complex entrepreneurial processes shaped by Sri Lanka's context. Based on the researcher's ontological, epistemological, and paradigm-related views, qualitative methodology was chosen over quantitative and mixed methods.

The qualitative methodology group consists of five major types of research designs. They are phenomenological studies, ethnography, narrative studies, grounded theory, and case studies. The basic characteristics of these designs are discussed below (Braun & Clarke, 2013; Cresswell, 2014; Denzin & Lincoln, 2018; Seidman, 2006).

- Narrative Research

This design of research investigates about the peoples in which the scholar examines the life styles of people and requests other persons to bring narratives about the life styles of themselves. This material is then frequently recited and re-evaluated by the scholar into a narrative sequence of events. In the end, narratives integrate the opinions of the contributor's life using the opinions of the scholar's life in a collective narrative.

- Phenomenological Research

This research design is derived from psychology and philosophy and in which the scholar defines the lived involvements of persons regarding an incident as defined by the participants. This explanation concludes in the spirit of the experiences of several persons who have all been involved in similar incidents. This has solid theoretical grounds and usually consists of data gathering through interviews.

- Grounded Theory

This design of investigation comes from sociology, wherein the scholar develops a common, abstract theory of a procedure, deed, or relations with in the opinions of the contributors. It comprises the use of numerous phases of data collection and the fine-tuning and cross-connection of sets of information.

- Ethnography

This research design is also derived from sociology and anthropology in which the scholar examines the collective array of conducts, linguistics, and activities of a complete ethnic group in a normal place over a long period of time. Data gathering regularly comprises interviews and field observations.

- Case Studies

This research design is employed in many fields like those that evaluations, wherein the scholar creates a thorough exploration of a case, frequently a programme, incident, action, procedure, or one or many persons. Cases are surrounded by time and action, and scholars gather comprehensive facts using different data collection techniques over a continued period of time.

In Sri Lanka, systematic scholarly studies on entrepreneur engineers and engineering ethics are scarce, lacking a solid theoretical foundation to support phenomenological research. Narrative research is unsuitable as the focus is not on life stories, and ethnography is inapplicable since entrepreneurial engineers do not form a distinct ethnic group. Given the problem statement and objectives, the researcher aimed to develop a model based on study findings. Grounded theory was selected as the most suitable research design over case study, as it supports theory development. The study seeks to explore how entrepreneurial engineers conduct business while adhering to the engineering code of ethics through their actions and interactions. Grounded theory is ideal for studying processes, actions, or interactions involving multiple individuals. It is especially suited for addressing problem statements beginning with ‘how’ and aligns with the constructivist paradigm, where theory emerges inductively from data. Therefore, grounded theory was chosen as the most appropriate methodology for this study. The following sections outline its application in this research.

3.4 Overview of grounded theory

Grounded theory (GT), one of the major qualitative research strategies, was initially developed by Barney Glaser and Anselm Strauss. They have presented their novel methodology in their text book 'The Discovery of Grounded Theory", which was published in 1967 (Glaser & Strauss, 1967). With the passage of time, both qualitative scholars had departed from their collaborative works on the development of GT due to the dissimilarities present in their views regarding GT. With their separate involvements according to their own views and ideologies, several versions of grounded theory are available in the literature. The dominant versions of GT are as follows.

- Original version of the GT (Glaser & Strauss, 1967)
- Post-positivistic version of the GT (Corbin & Strauss, 1990a)
- Constructivist version of the GT (Kathy Charmaz, 2006)
- Situational analysis GT (Gokbayarak, 2012)

In this research study, the constructivist GT proposed by Kathy Charmaz is used.

GT involves extensive writing, which may seem excessive. Therefore, researchers must have a deep understanding of its core procedures and principles. Without this, they risk misapplying the methodology or only partially following its guidelines, despite claiming to use GT (Strauss & Corbin, 1998).

Therefore, the following section extensively describes how GT is developed for the present study with the reference of relevant literature.

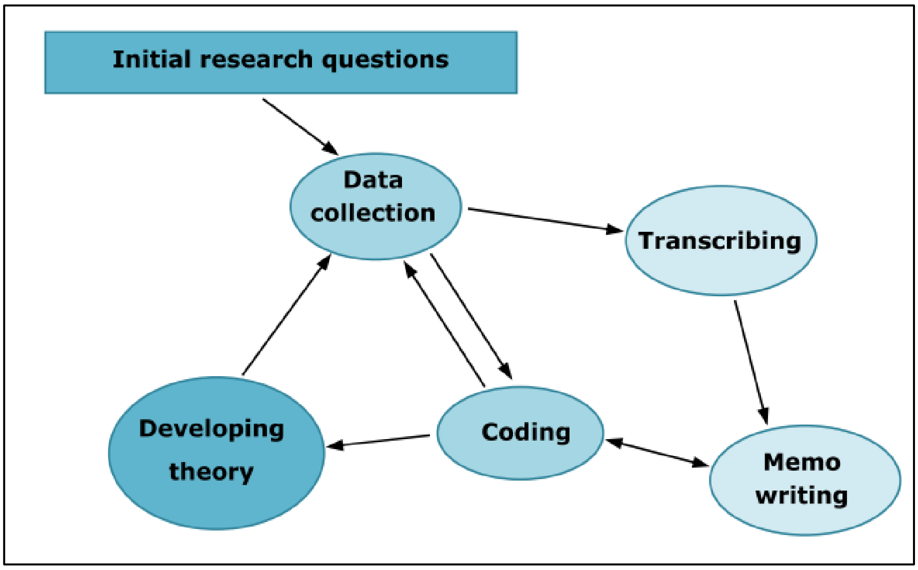
3.5 Grounded theory development process

Grounded theory focusses on developing a new theory from systematically collected data. The analysis involves an iterative process of comparing and contrasting its data, earlier literature, and the emerging theory. Gradual identification and incorporation of categories of meaning from data are included in that process (Strauss & Corbin, 1998).

Face-to-face interviews served as the primary data collection method. With participant consent, most interviews were recorded and later transcribed verbatim into Microsoft Word files. In one instance, where recording was not permitted, key points were noted manually. The transcripts were then analysed using coding. Unlike other methods, GT requires simultaneous data collection and analysis. It involves iterative and deductive cycles consisting of data collection and constant comparison between results and new findings to direct further data collection. Moving back and forth between findings and new data is necessary, in an effort to 'ground' the analysis in the data, aiming for 'theoretical saturation'. What is meant by theoretical saturation is to carry out the research until no new or relevant data emerge regarding a category and relationships between established categories (Charmaz, 2006). Therefore, there is no requirement to identify and develop variables before data collection. It should be done during data collection as part of it. The application of GT is concluded with the emergence of conceptual categories and the resultant, empirically grounded, inductive theory or theories (Jacelon & O'Dell, 2005). The following figure demonstrates the steps involved in developing the GT as per Kusumsiri (2018).

Figure 3.1:

Steps of grounded theory development



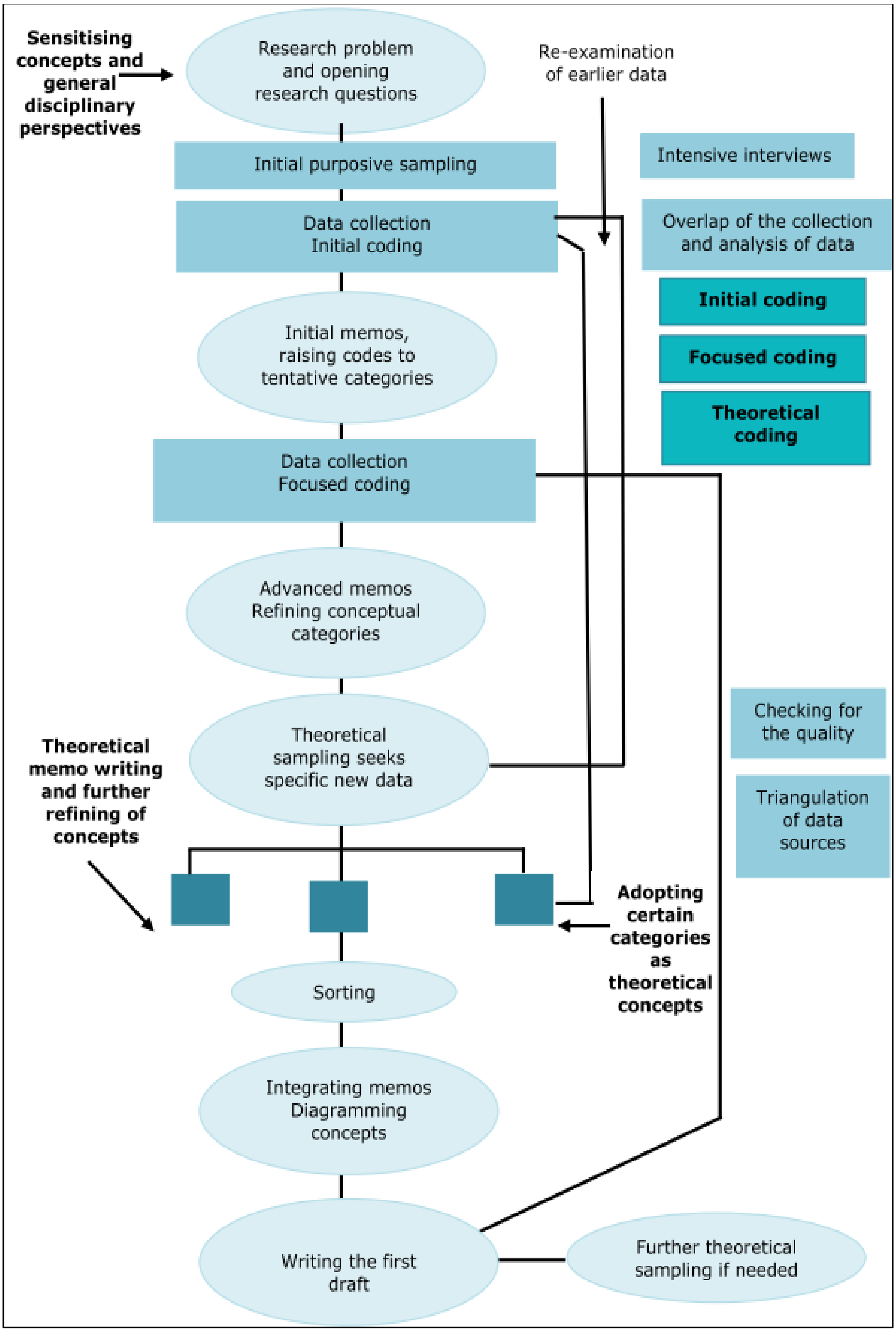
Source: Developed by the author based on Charmaz (2006)

3.6 Research design

Research design is the logical procedure of the action plan to arrive at conclusions from the initial research questions. It involves the collection, analysis, and interpretation of data according to the purpose of the study (Cresswell, 2014). It was found to be challenging to develop sequential procedures and linear processes as the research design of this study due to the integrated and cyclical nature of grounded theory. After referring to the available literature on grounded theory, the researcher has adopted the following procedure for this study (Braun & Clarke, 2013; Charmaz, 2006; Cresswell, 2014; Denzin & Lincoln, 2018; Kusumsiri, 2018; Strauss & Corbin, 1998).

Figure 3.2:

Research design for this study



Source: Kusumsiri (2018)

3.6.1 Problem statement

The grounded theory research process begins with the identification of probable initial constructs to concentrate the researcher's mind on the specific phenomenon under investigation and the research question (Willig, 2013). Therefore, the primary research problem should have the ability to identify the phenomenon without any initial assumptions (Charmaz, 2006; Corbin & Strauss, 1990a). In the grounded theory process, predetermined questions and hypotheses extracted from existing theories available in the research literature make hindrances to construct context-specific new knowledge. Consequently, researchers should avoid familiarising themselves with the concepts resulting from the existing literature (Willig, 2013). However, some sort of understanding regarding the extant literature is necessary to properly plan and focus the study into the specific phenomenon (Strauss & Corbin, 1998).

Therefore, the problem statement for this study was developed as ‘How do Sri Lankan entrepreneurial engineers adhere to engineering ethics while managing its implications on behavior and performance?’ with the intention of identifying the consequences of engineering ethics in a techno-entrepreneurial business environment.

3.6.2 Sampling procedure; purposive and theoretical sampling

This study focuses on techno-entrepreneurial firms led by engineers, whose unique traits shape entrepreneurial behaviour and firm performance in line with engineering ethics in Sri Lanka. As individual perceptions are central to understanding these dynamics, the unit of analysis is the individual (Sekaran & Bougie, 2016).

Qualitative research strategies do not employ probability sampling strategies as in quantitative research designs since their major objective is to generate an in-depth understanding about the problem, not to generate a generalisable result (Braun & Clarke, 2013; Kathy Charmaz, 2006; Sekaran & Bougie, 2016; Willig, 2013). Non-probability sampling strategies are widely used in qualitative methods. Braun & Clarke (2013) have mentioned that a typical approach to sampling in qualitative research studies is purposive. Purposive sampling, also known as judgemental sampling, is the most common sampling strategy in qualitative studies. In purposive sampling, the researcher selects the most suitable sample that can answer the research question in a more productive manner (Marshall, 1996). Furthermore, it can be explained as choosing data cases (participants, texts) considering the possibility of delivering ‘information-rich’ data to analyse (Braun & Clarke, 2013). The researcher adopted a purposive sampling strategy for the initial stage of the grounded theory study, selecting entrepreneurial engineers with Chartered Engineer status in Sri Lanka. Chartered engineers were chosen due to their deeper understanding of engineering ethics and the IESL Code of Ethics, demonstrated through mandatory examinations and professional review interviews required for charter recognition (*Professional Review Rules*, 2018).

To complete the charter process, applicants attend IESL-led lectures and discussions on engineering ethics. As a result, entrepreneurial chartered engineers possess valuable insights relevant to this study. Their extensive industrial experience was also a selection criterion; those with over 10 years of experience were initially chosen for their deeper understanding of the research questions shaped by Sri Lanka's socio-political and economic context.

Theoretical sampling is a unique sampling strategy specific to the accurately followed grounded theory study. It deals with the refinement and, eventually, saturation of existing, and progressively analytic, categories (Corbin & Strauss, 1990a; Eisenhardt, 1989; Willig, 2013). Theoretical sampling is an iterative process involving continuous data comparison to refine emerging categories. It requires identifying gaps and new questions, then addressing them through follow-up interviews or new participants. This approach focuses not on fixed groups but on exploring concepts, their properties, dimensions, and variations (Corbin & Strauss, 1990a). The concepts and categories derived from purposeful sampling are further refined through theoretical sampling. Information-rich cases are selected to deepen understanding and strengthen the emerging analytic categories, supporting the ongoing development of the inductive theory.

As the study advanced, the researcher expanded the participant pool to include entrepreneurial engineers from various disciplines to address analytical gaps. While civil engineers adhered strictly to the IESL code by avoiding work outside their specialization, non-civil engineers believed they could do so with adequate knowledge. To examine this contrast, more non-civil engineers were included. Theoretical memos guided the refinement of emerging categories, and follow-up interviews were used to explore these areas further, consistent with Charmaz's (2006) approach to theoretical sampling.

As data analysis progressed, the sample was expanded to align with grounded theory requirements. Emphasizing diversity, the study included entrepreneurial engineers leading a broad spectrum of techno-entrepreneurial firms, ranging from small startups to established enterprises, across various market levels, specializations, and both local and international contexts. Corbin & Strauss (1990) explained this requirement as 'the researcher tries to vary or contrast the conditions as much as possible" (p.421).

3.6.3 Planning for field work

The field work for this study was carefully planned and executed in line with grounded theory methodology. The following section outlines the preparatory activities and key data collection procedures conducted in accordance with the chosen research strategy.

1) **Identifying entrepreneurial engineers**

Most entrepreneurial engineers conduct their entrepreneurial business ventures in the technological domain as technology entrepreneurs. The definition given by Dorf & Byers (2008, p.xv) about technology entrepreneurship is the "style of business leadership that involves identifying high-potential, technology-intensive commercial opportunities, gathering resources such as talent and capital, and managing rapid growth and significant risks using principled decision-making skills". Bearing the above definition in mind, the researcher selected a set of entrepreneurial engineers who are giving leadership to their firms to identify high potential, technology intensive commercial opportunities.

Most entrepreneurial engineers had prior industry experience, which inspired them to launch their own ventures. As official records were unavailable, the researcher used online company websites and personal professional networks to identify participants. Chartered engineer status of MDs or CEOs was verified through company websites, as most entrepreneurs did not use social media but maintained websites for information. The researcher's role as an engineer and university lecturer also aided in identifying suitable participants.

The study initially involved purposively selected entrepreneurial chartered engineers in Sri Lanka with five to twenty years of experience. Most were founders leading successful firms in various technological domains. One non-founder participant had led the firm as MD since its early stage. Some also held prominent roles in professional associations.

2) Securing contacts with entrepreneurial engineers

Data collection was arranged by calling entrepreneurial engineers. Most interviews were scheduled on the first attempt, though a few required multiple calls due to participants' busy schedules. The researcher introduced himself, explained the study's aims, and obtained verbal consent for a meeting. After consent, participant information sheets and consent forms were emailed for further details.

Most contact details were found on company websites. If unavailable, the researcher used the IESL chartered engineer directory or personal and professional networks. After explaining the study, most participants were eager to share their experiences. Only one entrepreneurial engineer declined to participate. Although Fassin (2005) has mentioned that most entrepreneurs and managers refuse to participate in surveys and interviews on ethical issues mentioning that they are on busy schedules, Sri Lankan entrepreneurial engineers were eager to contribute for such researches. Before each interview, the researcher reviewed the entrepreneurial firm's website and other online sources to gain background knowledge. This familiarisation helped the researcher connect more effectively with participants and conduct smoother interviews.

3.6.4 Phases of data collection

Data collection occurred in two phases for some entrepreneurial chartered engineers, while others were interviewed only once. Pseudonyms using English letters (excluding 'I') were assigned from the transcription stage to ensure confidentiality. A pre-prepared questionnaire was used to gather demographic data and enhance research credibility (Braun & Clarke, 2006).

The coding process began with Participant A's interview, which was transcribed verbatim after multiple listenings. Initially, due to limited research experience, the coding was incomplete. However, with Participant B's interview, the researcher developed greater theoretical sensitivity, leading to revisions in earlier codes. Interview questions were gradually refined based on emerging categories to explore new dimensions. As the study progressed, these insights shaped subsequent interviews. A total of 22 participants, A to W, excluding 'I', were interviewed.

3.6.5 Process of intensive interviewing

The main data collection for this study was intensive interviews conducted face-to-face with the participants. Charmaz (2006) has explained the interviewing process as "the in-depth nature of an intensive interview fosters eliciting each participant's interpretation of his or her experience by asking the participant to describe and reflect upon his or her experiences in ways that seldom occur in everyday life".

The researcher enhanced interviewing and grounded theory skills through extensive study of doctoral theses, academic articles, and methodological texts. Open-ended, non-judgmental questions were tailored to participants' backgrounds to encourage rich responses. Company websites were reviewed in advance to inform interviews. As Charmaz (2006) suggests, broad questions can elicit unexpected insights. Interviews typically began with participants' entrepreneurial journeys, building rapport and easing discussion. Informal pre-interview chats further established trust, facilitating open dialogue on sensitive topics like engineering ethics.

Interview questions were adapted based on participants' backgrounds, emerging findings, and context. While many offered detailed responses, some required prompting. Loosely guided, semi-structured interviews were used to facilitate in-depth conversations (Willig, 2013). Interviews were conducted in a friendly, conversational manner, allowing participants to share freely. Interruptions were minimal, only for clarification or elaboration. When discussing IESL Code of Ethics, the researcher introduced each clause of the IESL Code as sensiticing concepts, as participants often struggled to recall them, a need first identified during the interview with participant A. The following memo describes that initial interview.

Participant A, a senior irrigation engineer and entrepreneur, was interviewed at his residence for 50 minutes. He agreed to participate after a phone briefing on the research purpose. With over 30 years in the government sector and exposure to entrepreneurship in the USA, he later founded a firm offering irrigation solutions for Sri Lankan farmers, operating both roles until retirement. Though unaware of specific clauses in the IESL Code of Ethics, he emphasized public safety and environmental sustainability. Early in his venture, he admitted to fabricating experience to secure subcontract work, reflecting a pragmatic view of honesty. His perspective aligns more with utilitarianism than deontology. As my first interview experience, it provided valuable insight into relationship building and eliciting rich data.

Although the IESL Code of Ethics guided data collection, the study followed CGT principles. The Code served as a sensitizing concept (Charmaz, 2006), sparking context-specific discussions rather than acting as a strict analytical framework. Interview prompts addressed each clause, but participants were encouraged to speak freely and share personal views. The analysis remained inductive, using initial coding, constant comparison, and memo writing. Emerging themes both reflected and extended beyond the Code. Thus, the Code helped contextualize the inquiry without limiting it, supporting a grounded theory rooted in the lived ethical experiences of Sri Lankan entrepreneurial engineers. Most interviews lasted about an hour, except one shortened to 15 minutes due to a participant’s urgent commitment. Engaging with leading entrepreneurial engineers also expanded the researcher’s professional network. All interviews were conducted in English, ensuring fluency and minimizing meaning distortion from translation (Seidman, 2006).

The researcher personally conducted all interviews without third-party help. The initial interview was less effective, prompting further study to improve interviewing skills. With participants' consent, interviews were recorded, using a smartphone for in-person sessions and Zoom for online ones. Key points were noted during interviews, and related materials were collected to deepen insight into participants’ ethical perspectives.

3.6.6 Interview transcription & use of NVivo

Interviews were transcribed verbatim into Word files on the same or following day to preserve key details and clarify ambiguities. The researcher aimed to conduct one interview per day to maintain focus. Only once were two interviews held in a day due to participants’ limited availability.

To gain a deeper understanding of participant meanings, the researcher repeatedly listened to each interview recording before transcription, as recommended by Braun & Clarke (2013) & Willig (2013). Transcribing was time-consuming, initially taking two days per interview, but improved with practice. To ensure confidentiality and enhance data familiarity, transcription was not outsourced. Immersion in the data, through repeated listening and transcript review, helped the researcher grasp context, language, jargon, and pauses, as emphasized by Charmaz (2008).

Qualitative research generates large, complex datasets, and the interview transcripts in this study exceeded 100,000 words. To manage this, the researcher used NVivo 12 Plus to efficiently organize and analyse data. The transcripts were uploaded into the software, and coding was conducted using its features, enabling effective sorting of concepts, categories, and memos essential for grounded theory development (Bryant & Charmaz, 2007). This approach facilitated pattern identification and concise presentation of findings (Charmaz, 2006).

3.7 Data analysis

3.7.1 Development of analysis Protocol

This subsection outlines the data analysis process, which in grounded theory is not linear but iterative. Unlike other methodologies, grounded theory integrates data collection, analysis, and conceptual theorizing concurrently from the outset of the research.

Immersing in the data is the first step in the analysis process. Then steps like separating, sorting, and synthesising these data through qualitative coding begin (Charmaz, 2006). The coding practices followed in the grounded theory methodology are different from other qualitative approaches like phenomenology and thematic analysis. This study follows the analysis method described by Kathy Charmaz in her Constructionist Grounded Theory approach (Bryant & Charmaz, 2007; Charmaz, 2008; Charmaz, 2006). She has suggested three steps in the coding process as initial coding, focused coding and theoretical coding. Consequently, it involves several phases to develop concepts and theoretical frameworks, as mentioned below.

(1) Data collection and initial coding

(2) Initial memos and raising codes to tentative categories

(3) Further data collection and focused coding

(4) Advanced memos, refining conceptual categories and adopting certain categories as theoretical concepts

(5) Sorting memos and theoretical categories

(6) Integrating memos with draft writing and conceptual diagrams

(7) Writing the first draft

(8) Further refinement of the draft

Detailed explanations of each phase is given below.

3.7.2 Initial coding

Initial coding breaks down data to assign conceptual labels to events, actions, or conditions, forming the basis for identifying underlying phenomena. Interview transcripts were examined progressively, allowing early categorization through constant comparison. Charmaz (2006) recommends line-by-line coding for grounded theory, as it encourages new insights and reduces bias. While this method is time-consuming, it is effective; irrelevant lines were excluded if unrelated to the research focus (Braun & Clarke, 2013; Charmaz, 2006, p.50). Line-by-line coding procedure was followed as the initial coding whenever applicable with the relevancy of data.

Grounded theory procedures recommend not to use labels derived from existing theoretical formulations during the initial coding as it expects to develop a context specific new theories (Willig, 2013). Therefore, as the labels for the initial coding, the researcher had utilised the words used by the entrepreneurial engineers and the gerunds relevant to the statements. The use of special terms for coding is known as 'in vivo codes' while gerunds are words ending in 'ing' that reflect process rather than topic (Charmaz, 2006). Relying on the words and actions of the entrepreneurial engineers during the analysis process had supported to look at their experience from their perspectives. Initially, the researcher performed coding in MS Word using a two-column format, interview text on the left and codes on the right. Later, coding was shifted to NVivo for easier data handling. Memos were written throughout different stages of analysis, aligning with grounded theory requirements.

The following memo highlights how the researcher developed the initial coding at the middle of the study process.

> *During the initial coding phase of my CGT study, I engaged in line-by-line analysis of interview transcripts. My primary aim at this stage was to stay close to the data, code each segment with gerunds or simple labels, and remain open to unexpected or subtle insights that might emerge from participants' narratives.*
>
> *A striking early pattern was the emergence of language related to unethical or ethically ambiguous behaviors, often described either as direct personal experiences, observations of industry peers, or contextual challenges the participants encountered in their entrepreneurial journeys. Many participants voiced frustration or ethical conflict around the business practices prevalent in their fields. As a result, I generated a list of initial descriptive codes that captured these actions and perceptions as they were expressed in the data.*
>
> *These included codes such as:*

- *Bribing, Corruption, and Political influence – indicating perceived or experienced misuse of power or unethical negotiations in business processes.*
- *Undercutting, Charging lesser fees, and Unfair competition – capturing participants' concerns about competitive behavior that undermines professional standards.*

- *Earning from commissions, Reducing the cost, and Money mindedness – reflecting financial motivations that may conflict with ethical principles.*
- *Practicing in inexpert areas and Unethical part-time businesses – suggesting boundary-crossing behaviors or violations of professional competence.*
- *Lying and Avoiding telling truth – pointing to compromised honesty in client relations or peer interactions.*
- *Mudslinging, Opposing, and Trying to get down the business – describing unethical rivalries or attempts to damage competitors' reputations.*
- *Not teaching the younger generation – highlighting a perceived decline in ethical mentorship or knowledge-sharing.*
- *Creating an unfavorable business environment – a broader label that reflects the cumulative effect of these behaviors on industry norms and values.*

> *These initial codes were not intended to categorize data into pre-existing ethical categories, but rather to reflect the language and ethical concerns articulated by participants themselves. In line with CGT methodology, I maintained openness to multiple meanings, tensions, and contradictions present in their narratives. At this early stage, no attempt was made to group or reduce codes, the aim was to capture diversity and detail across different ethical challenges.*

3.7.3 Focused coding

According to Charmaz (2006), focused coding involves using the most significant or frequent initial codes to analyze large amounts of data. It goes beyond grouping concepts under abstract headings by constructing categories based on their properties, dimensions, conditions, actions/interactions, and consequences. These specifications enhance the explanatory power of categories, which can then be broken into subcategories. Focused coding makes implicit ideas explicit, creating a recursive rather than linear process. The researcher revisited transcripts, notes, and published materials, using questions like when, where, why, and how to analyze experiences and ethical views of entrepreneurial engineers. Initial focus codes were provisional and refined through transcription and constant comparison, allowing openness to emerging insights (Bryant & Charmaz, 2007).

The following memo highlights how the researcher engaged in focused coding at the middle of the study process.

> *Following the initial phase of line-by-line coding, I engaged in focused coding to synthesize and categorize the most significant and frequent patterns in the data. The goal at this stage was to move from detailed description to more abstract and conceptually meaningful codes that could support theoretical development. The initial codes, generated directly from participants' words and experiences were highly granular and diverse. While these codes captured the breadth of ethically challenging behaviors observed or experienced by entrepreneurial engineers, they required conceptual consolidation to make analytical sense of the underlying dynamics.*
>
> *Through constant comparison and memo writing, I clustered related initial codes into broader focused codes. This helped me to reduce analytic clutter while staying close to the meanings that participants conveyed. For instance:*

- *The codes "Bribing", "Corruption", and "Political influence" were grouped into the focused code "Bribery & Corruption", reflecting institutional-level ethical compromises often tied to external pressures and systemic malpractice.*
- *"Money mindedness", "Earning from commissions", and "Reducing the cost" were categorized as "Going behind money", which captures profit-driven behavior that participants often described as undermining ethical boundaries.*
- *"Mudslinging", "Opposing", "Trying to get down the business", "Not teaching the younger generation", and "Creating an unfavorable business environment" were integrated into "Professional jealousy", as these acts appeared motivated by rivalry and competitiveness rather than client service or innovation.*
- *"Lying" and "Avoiding telling truth" were abstracted into "Hiding the truth", signaling intentional withholding or distortion of information.*
- *Other codes such as "Charging lesser fees", "Practicing in inexpert areas", and "Unfair competition" were retained as focused codes in their own right because they emerged as distinct, repeated practices that held specific ethical significance for participants.*

Each focused code thus represents a higher-level conceptual category that captures not just a behavior but the ethical implications and social context of that behavior. This process reflects the CGT principle of constructing meaning through interpretive coding rather than simply cataloging actions. In developing these focused codes, I also began to identify interconnections between them, for example, how "Going behind money" often led to "Unfair competition", or how "Bribery & Corruption" was sustained by "Hiding the truth". These links became the foundation for building more abstract theoretical categories and for mapping out the ethical landscape that entrepreneurial engineers in Sri Lanka must navigate.

3.7.4 Theoretical coding

The process of unifying all categories around a central core category is known as theoretical coding. According to Charmaz (2006), it is ‘how the substantive codes may relate to each other as hypotheses to be integrated into a theory’ (p.63). In simpler words, it can be described as ‘specifying possible relationships between categories developed in focused coding’. The so-called ‘core category’ symbolises the major problem as a ‘skeleton’ that aggregates the substance existing in the data and keeps them together. These questions can be asked during the theoretical coding process: What is the main analytic idea presented by this research? What would I say if I were to conceptualise my findings in few sentences? What do all the actions/interactions seem to be about? How can I explain the variation that I see between and among the categories? (Corbin & Strauss, 1990b). Once the core category is identified, other major categories must relate to it through propositions, as conditions, actions/interactions, or consequences. The core category should be abstract to enhance the theory's applicability. A refined grounded theory emerges by filling theoretical gaps, removing excess, and continuing theoretical sampling until theoretical saturation is reached.

The following memo highlights how the researcher engaged in theoretical coding at the middle of the study process.

> *During the theoretical coding stage of this Constructivist Grounded Theory study, the concept of "Avaricious Society" emerged as an overarching explanation for patterns of unethical behavior identified in the data. This construct integrates several focused codes, including Bribery & Corruption, Going Behind Money, Charging Lesser Fees, Practicing in Inexpert Areas, Professional Jealousy, Unfair Competition, and Hiding the Truth. These focused codes were derived from participants' descriptions of widespread unethical practices, often motivated by profit, rivalry, or survival in a highly competitive environment. Participants repeatedly emphasized how financial gain, political interference, and peer sabotage distorted ethical standards, pointing to a broader culture that normalizes such behaviors.The label "Avaricious Society" reflects a systemic environment where greed and self-interest often override professional integrity. Rather than focusing on individual ethical lapses, this construct explains how socio-economic pressures and professional norms jointly shape engineers' ethical decision-making. It aligns with CGT's interpretive focus, offering a contextualized understanding of why adherence to the IESL Code of Ethics becomes challenging for entrepreneurial engineers in Sri Lanka*.

3.7.5 Memo writing

Memo writing is a unique feature of a grounded theory study. According to Charmaz (2006), memo writing was defined as 'The initial intermediate step between data collection and draft paper writing' (p. 72). It supports the researcher in analysing the data and codes in the early research process. Furthermore, this was elaborated as 'writing definitions of categories and justifying labels chosen for them, tracing their emergent relationships with one another, and keeping a record of the progressive integration of higher and lower-level categories (Willig, 2013, p.218) . Continuous engagement in memo writing develops new ideas and insights towards the data. Consequently, memos offer details of the research along with fundamental discoveries of the study. Researcher has the freedom to draft memos in long or short, abstract or concrete, integrative of previous memos or ideas, or original while utilising words or diagrams. Grounded theory requires memos with the date prepared and a meaningful heading, stating which fragments of the data inspired the memo writing. Therefore, the researcher continuously engaged at memo writing in different stages of data collection and analysis in order to achieve the objectives of grounded theory. Several memos were included in the above sub section to clarify how memos have been used in the grounded theory development.

3.7.6 Theoretical saturation

The sample size of the grounded theory study depends on theoretical saturation. Therefore, sampling and data collection continue until the theoretical saturation occurs (Willig, 2013). According to Charmaz (2006), theoretical saturation was defined as 'a point in the grounded theory process where collecting fresh data no longer sparks new theoretical insights, nor reveals new properties of the core theoretical categories' (p.113). Eisenhardt (1989) has also confirmed the same for theoretical saturation. Glaser (2001) has mentioned the requirements for theoretical saturation as follows.

> "Saturation is not seeing the same pattern over and over again. It is the conceptualization of comparisons of these incidents which yield different properties of the pattern, until no new properties of the pattern emerge. This yields the conceptual density that when integrated into hypotheses make up the body of the generated grounded theory with theoretical completeness" (p.191)

According to Glaser & Strauss (1967), flexibility of the grounded theory is also applicable to the theoretical saturation, as follows.

> "When generation of theory is the aim, however, one is constantly alert to emergent perspectives, what will change and help develop the theory. These perspectives can easily occur on the final day of study or when the manuscript is reviewed in page proof: so the published word is not the final one, but only a pause in the never-ending process of generating theory" (p.40).

It is clear from the above definitions that theoretical saturation is not just the repetitions of same events or stories in data. It should happen in the categories and their properties theoretically.

Theoretical saturation was achieved through in-depth interviews with 22 entrepreneurial engineers from various engineering sectors in Sri Lanka. By the 20th interview, no new concepts or variations emerged, and the final two interviews confirmed existing categories. Consistent with CGT (Charmaz, 2016), the sample size was not fixed but determined by the point at which the theory became conceptually rich, coherent, and integrated, making 22 participants sufficient for analytical depth and completeness.

The following memo was written at the time of the researcher observed the theoretical saturation during the data analysis.

> *Theoretical saturation was achieved in this CGT study following 22 in-depth interviews with entrepreneurial engineers across Sri Lanka. As data collection and analysis progressed simultaneously, no new codes or categories emerged after the 20th interview, and the final two interviews confirmed the stability of the conceptual framework. By this stage, the major theoretical codes were conceptually saturated and well-developed.*
>
> *The theoretical code "Avaricious Society" emerged to represent the systemic and cultural ethical challenges entrepreneurial engineers face, encompassing focused codes such as Bribery & Corruption, Unfair Competition, Going Behind Money, and Professional Jealousy. In contrast, three theoretical codes, "Internalizing," "Employee Engagement," and "Outreaching the Public", explained how engineers actively adhered to the IESL Code of Ethics in practice. These codes were supported by focused actions like committing to sustainability, training staff, following guidelines, engaging clients truthfully, and delivering quality services.*

Additionally, the implications of ethical adherence were captured in the theoretical code "Enduring Prosperity," which consolidated outcomes such as enhanced reputation, long-term business sustainability, and increased opportunities. These findings consistently recurred across participants, and no new properties or dimensions were identified in the final interviews.

Given the completeness, conceptual density, and integration of these theoretical codes, further data collection was not required. This confirms that theoretical saturation defined as the point at which categories are fully developed and new data only reinforces existing findings, was reached in alignment with CGT principles.

3.7.7 Assuring the quality

A qualitative study which uses a grounded theory approach cannot be judged for quality considering traditional positivistic criteria like reliability, objectivity, and generalisability (Corbin & Strauss, 1990b). Qualitative research should be judged employing appropriate quality criteria which are in line with the canons of 'good science' while fitting with the realities of qualitative research and the complexities of social phenomena they pursue to realize (Corbin & Strauss, 1990b; Guba & Lincoln, 1994). Mäkelä & Turcan (2007) propose the ways to ensure the quality of the grounded theory research in the aspects of validity, reliability, and the value of the results in the following ways.

(1) theory–data compatibility

(2) consistency of process

(3) the generalizability, reproducibility and significance of the theory generated

In grounded theory, data collection and analysis occur simultaneously. The researcher continuously verified emerging categories through interviews, observations, and field notes, ensuring theory-data compatibility by retaining only consistently relevant concepts. This constant comparison enhanced precision and consistency, particularly in identifying indicators related to the implications of engineering ethics on behaviour and performance in Sri Lanka. The below mentioned strategies which are recommended in the qualitative research literature have been followed as strategies to ensure validity and accuracy of this study (Cresswell, 2014; Jacelon & O'Dell, 2005).

- **Participant checking:** Participant checking involves validating the researcher's interpretations with the interviewees. Transcriptions were emailed to participants for feedback, and non-response was taken as approval. For controversial excerpts, the researcher followed up via email or phone to confirm participants' intended meanings.
- **Using rich, thick description to deliver the outcomes:** Providing detailed contextual explanations and diverse viewpoints enhances the validity of qualitative research. Therefore, the researcher used rich, thick descriptions

from various interviews to illustrate key categories and offer meaningful insights in the thesis and related publications.

- **Clarifying the bias**: the researcher brings to the study. An excellent qualitative study comprises remarks by scholars regarding in what way the explanation of the outcomes is formed by the contextual factors such as their culture, masculinity, past records, and socioeconomic origin. This is discussed in 3.7.8 section of this thesis.
- **Presenting undesirable or discrepant facts that runs against the category:** Including testimonies that challenge dominant viewpoints strengthens the realism and validity of interpretations. Therefore, the researcher intentionally incorporated such discrepancies in the thesis and related publications.
- **Spending pro longed time in the field**: Extended engagement enhances the accuracy and credibility of research findings. In this study, the researcher spent over five years interacting with entrepreneurial engineers in Sri Lanka, discussing engineering ethics and entrepreneurship. Additionally, extensive literature was reviewed throughout the study, demonstrating sustained immersion in the research field.

3.7.8 Positionality & reflexivity

The concept is generally linked with qualitative research approaches (Guillemin & Gillam, 2004). All people survive in an extremely linked socio-cultural and political system. The quality of such a system is different from variations in geography, culture, and time. It reveals that all individuals enjoy a distinct 'position' on economic, socio-cultural, and political aspects. That position is clearly visible in their all efforts to do, create, talk and write. The investigator or scholar is also a person who comprises this distinct 'position' which rest on scholar's own socio-cultural standards, viewpoints, emotional states and judgements. Numerous researchers have then debated that 'position' is uncovered in many sections of a social investigation approach (Walker et al., 2013).

This study was conducted within the framework of CGT, which emphasizes the co-construction of meaning between researcher and participant (Charmaz, 2014). The researcher, a lecturer in Engineering Ethics and a graduate of the engineering profession in Sri Lanka, brought an informed insider perspective to the inquiry. This professional background facilitated a deeper understanding of participants' experiences and enabled access to contextually rich data. At the same time, the researcher maintained a critical reflexive stance throughout the study, recognizing that prior disciplinary knowledge, teaching experience, and ethical orientation could shape the research process. Reflexivity was practiced through consistent memo writing, theoretical sensitivity, and conscious examination of assumptions during data collection, coding, and analysis. This approach enhanced the credibility and trustworthiness of the study by ensuring that the emergent theory remained grounded in participants' narratives while also reflecting the researcher's informed and ethically engaged perspective.

NVivo software was used to support the data analysis process, particularly in facilitating reflexivity, which is central to CGT. The software enabled systematic memo writing, iterative coding, and the organization of evolving concepts, allowing the researcher to continuously reflect on personal assumptions and their influence on data interpretation. NVivo's ability to trace the development of codes, compare participant narratives, and visualize relationships among categories enhanced transparency and supported the reflexive audit trail. While NVivo did not replace critical thinking, it provided a structured environment that encouraged ongoing self-awareness and theoretical sensitivity throughout the analysis (Ibrahim, 2012).

Below memo describes how the author adhered to the reflective practices during the research process.

> *As a lecturer in Engineering Ethics and a professionally trained engineer, I entered the field with well-established understandings of what constitutes ethical and unethical behavior in engineering practice. Prior to data collection, I was particularly sensitive to issues such as bribery, undercutting, and working outside one's area of expertise, practices I would typically classify as clear violations of professional ethics. However, early in the interview process, it became evident that participants often described these behaviors not as ethical failings, but as pragmatic responses to the systemic and competitive pressures of their entrepreneurial environment.*
>
> *This prompted a conscious effort to examine and set aside my personal assumptions during data collection. I became more aware of how my professional stance could unintentionally influence the framing of questions or interpretation of responses. To mitigate this, I intentionally shifted toward more open-ended and neutral questioning, such as asking, "Can you describe how you adhere to the code of ethics?" or "What factors influenced your decision?" instead of posing questions that might imply moral judgment.*
>
> *This reflexive adjustment allowed participants to express their experiences more openly and reduced the risk of imposing my ethical perspective on their narratives. It also enriched the data by revealing the contextual and cultural complexities behind decisions that may appear unethical on the surface. This process highlights the importance of ongoing reflexivity in CGT and reinforces my role as a co-constructor of meaning, rather than a detached evaluator of ethical correctness.*

3.7.9 Position of literature

Before starting any research project, an extensive review of the literature is an essential feature for many research inquiries. However, grounded theory is an approach which is totally different from usual research designs. As the initial proponents of the grounded theory methodology, Glaser & Strauss (1967) explicitly refused the gaining familiarity on extant literature, before data collection and analysis for the development of the grounded theory.

This belief has changed with the evolution of the grounded-theory methodology with the passage of time. Authors like Kathy Charmaz, Juliet Corbin, and Anselm Strauss who contributed to the development of later versions of Grounded theory have not recommended the earlier belief of avoiding literature review hundred percent until the data collection and analysis are over (Charmaz, 2006; Corbin & Strauss, 1990a, 2008). Conducting a fundamental literature review during the early stage of a grounded theory enhances the theoretical sensitivity of the researcher. Furthermore, its helpfulness in delivering secondary data, value in raising questions, worthiness in providing a guide to the theoretical sampling process, and ability to provide supplementary vitality can be highlighted.

Accordingly, the researcher reviewed the existing literature to understand basic concepts of engineering ethics and techno-entrepreneurship, ascertain the existing research gaps, and resolve methodological issues. According to the methodological requirements of grounded theory, researcher did not use the knowledge gained during the initial literature review to formulate interview questions and analyse data in early stages of the study. The researcher avoided the use of preconceived concepts derived from the initial review of the literature. With the development of the theoretical categories, further review of the literature is essential as per the grounded theory (Charmaz, 2006). Therefore, the researcher reviewed more literature that is comprehensively relevant to the categories identified in this study and included in chapters 4, 5 & 6 respectively.

3.7.10 Ethical considerations

Ethical considerations were strictly followed, with approval obtained from the University of Moratuwa Ethics Review Committee (EDN/2019/007). Confidentiality was ensured by using pseudonyms and omitting identifying details. Audio recordings were securely stored and will be deleted post-study. Transcriptions were done solely by the researcher to maintain confidentiality, with neutral replacements for identifiable information.

Before conducting interviews, the researcher contacted suitable entrepreneurial chartered engineers by phone to explain the research project. Upon receiving verbal consent, the participant information sheet and consent form were emailed for further details. Both documents are included in the annexures of this thesis. The consent form secured written approval from participants to record interviews and anonymously use excerpts for publication. Participation was fully voluntary, and a few engineers declined based on the research nature. Those who agreed were interviewed at their offices or via Zoom at their convenience. Before each interview, the researcher reiterated project details and obtained signed consent forms. After the interviews, participants were thanked verbally and by email. Hard copies of consent forms and demographic sheets were stored securely and will be destroyed upon study completion.

3.8 Chapter summary

Research philosophy, methodology and methods which explain how the researcher addressed the research question to seek solutions in a systematic way are discussed in this chapter. The reality of application of engineering ethics by entrepreneurial engineers in the techno-entrepreneurial business setting in Sri Lanka cannot be interpreted in a concrete way as it is combined with specific human factors that are further impacted by society, culture & environment. Consequently, the subjective realm in entrepreneurial functions impacted by engineering ethics in techno-entrepreneurial businesses headed by entrepreneurial engineers (ontology), and the recognizing of these subjective actions and outcomes in entrepreneurial engineers' activities in Sri Lanka must affect the study of legitimate modes of knowledge (epistemology). The selection of qualitative methodology for this study was justified with these assumptions. The constructivist grounded theory methodology was used in the design of this research. Information-rich data was gathered from purposively and theoretically selected sample of entrepreneurial engineers having charter status in Sri Lanka by conducting in-depth interviews. The interviews were recorded in voice with the consent of the interviewees and transcribed verbatim into Microsoft Word files. Data were analysed simultaneously with data collection while employing grounded theory techniques such as constant comparative analysis and theoretical sampling to achieve the objectives of the study. Initial coding, focused coding and theoretical coding was done during the analysis process using NVivo qualitative data analysis software. This chapter finally discussed how the quality and research ethics of this study were ensured.

CHAPTER 4

RESULTS & DISCUSSION PART I

4.1 Introduction

Chapters 4, 5, and 6 aim to present the original analysis findings derived from grounded theory, based on the in-depth interviews with entrepreneurial engineers in Sri Lanka. These findings were used to construct an original theory grounded in the data, addressing the research questions of this study. The analysis focuses on the perspectives of entrepreneurial engineers in Sri Lanka regarding how they adhere to engineering ethics (IESL Code of Ethics) within a highly competitive business environment. The study's objectives were achieved through a rigorous and systematic process of constant comparison, supported by critical questioning, as outlined in the grounded theory methodology for data analysis.

This chapter examines the demographic characteristics of the participants, their awareness of engineering ethics, and the unethical experiences they encountered during their entrepreneurial journey.

4.2 Participants & their firms

As outlined in Chapter 3, intensive in-depth interviews were conducted with 22 entrepreneurial engineers who hold chartered engineer status in Sri Lanka to gain a comprehensive understanding of the research issue under investigation. The essential demographic information of the participants is summarized in the table below. In accordance with the ethical approval criteria for this study, identification details are not disclosed in this report to preserve confidentiality. Pseudonyms assigned to each participant are provided in the table, and from this point onward, each participant or interviewee will be referred to using their assigned pseudonym.

Table 4.1

Details of interviewees

Pseudonym	Field of Practice	No of Employees	First Degree	Postgraduate Qualifications	Start-up Year
A	Irrigation Engineering	10+	Civil	MS	1998
B	Chemical and Construction	30+	Chemical	MSc	2005
C	Highway & Transportation	30+	Civil	MSc, PhD	2009
D	Structural Engineering	30+	Civil	MPhil	1998
E	Structural Engineering	20+	Civil	PG Dip	2012
F	Electrical Engineering	40+	Electrical	MSc	2013
G	IT & Cyber Security	27	Electrical	MSc	2006
H	Wastewater Treatment	50+	Chemical	MBA	2004
J	Building Services	40+	Mechanical	PG Dip	2015
K	Architecture/Structural Engineering	8	Civil	MBA	2001
L	Structural Engineering	7	Civil	PG Dip, MSc	2009
M	Engineering & Project Management	20+	Electrical	PG Dip	2010
N	Architecture/Structural Engineering	10+	Civil	MEng	2008
O	Electrical Engineering	200	Electrical	-	1982
P	Power Engineering	10+	Electrical	-	2003
Q	Electrical product manufacturing	400	Mechanical	-	2000
R	Construction Engineering	2000+	Civil	-	1984

S	Construction Engineering	2000+	Civil	MBA	1978
T	Power Engineering	10	Electrical	PhD	1999
U	Structural Engineering	18+	Civil	Diploma	2012
V	Structural Engineering, Construction Engineering, Boat Manufacturing, Hotels	200+	Civil	PG Dip, MSc	1994
W	Construction Engineering	600+	Civil	-	2019

Source: Developed by the author based on the interviews conducted

All study participants were male, as no suitable female entrepreneurial engineers with chartered status were identified. This reflects global trends, where women entrepreneurs are underrepresented in SET fields (Martin et al., 2015), and was influenced by the study's sampling criteria.

All participants were IESL-registered chartered engineers. Many held postgraduate qualifications in engineering or management, including two with PhDs, while five had not pursued advanced study in their respective engineering fields. Entrepreneurial engineers with management qualifications pursued them to strengthen business skills. All participants had prior experience in private or state engineering roles before launching ventures. This experience, along with networks and financial stability from salaried employment, supported the success of their entrepreneurial firms (Wijesinghe et al., 2020).

Of the 22 entrepreneurial engineers, 20 founded their firms and served as MD or CEO. Participants G and O, though not founders, advanced to MD/CEO positions after initial employment, reflecting entrepreneurial growth within established firms. The startup years of the entrepreneurial ventures ranged from 1978 to 2019, reflecting a broad spectrum of experiences across different time periods. Nineteen entrepreneurial engineers led service-based firms, while three operated manufacturing businesses. Fifteen worked solely in Sri Lanka; seven expanded internationally. Staff included permanent, contract, part-time, and external contributors, complicating exact headcounts. All firms were classified as small, medium, or large-scale techno-entrepreneurial enterprises. Furthermore, all companies, except for two entrepreneurial firms, employ qualified engineers in various roles within their organizations. Twenty out of the twenty-two techno-entrepreneurial firms maintain well-developed websites to disseminate information about their operations and competencies, while the remaining two do not.

The following sections present the core themes and categories that emerged from the in-depth data analysis, conducted using grounded theory techniques, in alignment with the research objectives.

4.3 Perception of engineering ethics and awareness

Recent engineering scandals highlight widespread unethical practices, often involving major corporations and government bodies (Bairaktarova & Woodcock, 2017). This section explores entrepreneurial engineers' self-perception of ethics and their views on peers' ethical conduct in Sri Lanka. As all participants are IESL chartered engineers, they possess formal training and foundational knowledge of engineering ethics (*Professional Review Rules*, 2018). This was the primary reason behind the above assumption.

4.3.1 Self-perception on engineering ethics

As entrepreneurial engineers, most participants hold a positive perception of the IESL Code of Ethics, which is the primary standard for engineering ethics in Sri Lanka. Based on the analysis conducted over the past few years, the researcher identified a key category, "Code of Ethics as a Guideline," grounded in the interview data. The majority of participants view the IESL Code of Ethics as a guiding framework for ethically managing their entrepreneurial businesses. However, a few participants expressed opposing viewpoints, challenging the predominant perception of engineering ethics.

4.3.1.1 Code of ethics as a guideline

Generally, practising engineers should follow the respective code of ethics of their professional bodies when performing their professional duties (*Code of Ethics | National Society of Professional Engineers*, 2019; *Engineering Council of Sri Lanka - ECSL Code of Ethics*, 2020; *The Institution of Engineers Sri Lanka - Code of Ethics*, 2013). Most engineers are employed in the state and corporate sectors, with only a few taking on the role of business leaders by starting their own ventures. However, there is no distinct code of conduct specifically designed for engineers in entrepreneurial roles.

> *"As engineers, we are required to adhere to the guidelines set by the IESL, which includes its Code of Ethics. It is essential that we follow this code, as any violation could lead to serious consequences. Our primary focus is on complying with the IESL Code of Ethics." U*

Participant U, who runs an engineering consultancy, stresses adherence to the IESL Code of Ethics, noting the consequences of violations. He also highlights that all practicing engineers in Sri Lanka must now be members of both IESL and ECSL, following both ethical codes (*Engineering Council Sri Lanka - ECSL Code of Ethics*, 2020). At the time of the interview, Participant U prioritized the IESL Code of Ethics over the ECSL Code of Ethics as his primary ethical guideline. The engineering code of ethics serves as a clear application of deontological principles, as it explicitly outlines the norms, responsibilities, and obligations to be followed (Schmidt, 2014). As such, entrepreneurial engineers also tend to consider these ethical codes when making business decisions.

> *"Sometimes, when faced with critical decisions, the code of ethics comes to mind because, as chartered engineers, we are committed to adhering to it. As a result, we make a conscious effort to remember and apply the code of ethics in our decision-making." K*

Like other participants, K started his firm after years in the state sector. He gained formal ethics training upon becoming a chartered engineer. He now instinctively refers to the code when making decisions and considers it essential to his entrepreneurial role, reviewing it regularly. Participant K further stated the:

> "*We must always keep the code of ethics in mind. It has taught us patience and self-control. While there may be moments when we feel tempted to take aggressive actions against our*

> *competitors, the code of ethics helps us refrain from such behavior. It is a vital guide in maintaining ethical conduct." K*

Participant K believes that all entrepreneurial engineers should keep a printed copy of the code of ethics on their desk to reference when making professional judgments. The clauses in the code guide him to practice patience, especially in the face of business rivalries. The code of ethics serves as a safeguard, preventing unethical actions. Consequently, Participant K considers the code of ethics essential for entrepreneurial engineers. His perspective aligns with the views of the renowned ethicist Michael Davis, who asserts that professional engineers can act ethically, stating, "As a professional, I cannot ethically put business concerns ahead of professional ethics." (Hansen & Zenobia, 2011, p.66). In this context, professional ethics for engineers refers to the established codes of ethics defined by their respective professional bodies. These principles are universally applicable to engineers across diverse industries. However, contradictions may arise when examining the behavior of entrepreneurial engineers, whose priorities often center on business objectives. As previously noted, Participant K demonstrates a commitment to upholding the code of ethics, even when confronted with competing business interests.

> *"We consistently adhere to ethical principles, strictly following the IESL Code of Ethics. I ensure that my services are provided exclusively within areas of my expertise." L*

Participant L highlighted the IESL Code's importance in his entrepreneurial work. Both he and Participant K run small-scale firms as owner-managers, bearing full responsibility for their services. While the "problem of many hands" is less relevant, defining individual accountability remains complex in engineering practice. Dennis Thompson (1980) used the term "problem of many hands" to describe the phenomena of dilution of individual responsibility in huge companies, where it is difficult to determine who is morally accountable since several individuals contribute to choices in diverse ways (Didier, 2009).

Since Participants K and L bear full moral responsibility for their services, using the code of ethics as a guiding framework helps them maintain ethical practices. Participant N stated, *"I went through so many times in this IESL code of ethics to get familiarized with it and infuse that guideline into life."* A strong grasp of the code is essential for ethical professionalism. This reflects Participant N's dedication to understanding the code deeply. Scholars emphasize that the code should serve as a "living document," actively guiding engineers throughout their careers and societal duties (Harris et al., 2009). American philosopher Michael S. Pritchard stated, "One test of character and virtue is what a person does when no one is watching." A society grounded in expertise depends on individuals who uphold this principle. The public must trust engineers to act ethically, even without supervision (Pritchard, 2013). Previous studies highlight that the code of ethics can guide the development of professionals' morality to do the right thing when no one is watching (Bielefeldt, 2018). If entrepreneurial engineers consistently act ethically in business settings, society stands to benefit in numerous ways. The narratives presented above illustrate that most participants view the code of ethics as a guiding framework for their entrepreneurial endeavors. However, a few participants have expressed differing perspectives that contrast with the majority's views.

In ethics, the concept of "ethical relativism" or "ethical subjectivism" suggests that the moral permissibility of an act depends solely on the belief of the individual performing it. Under this theory, an act is morally permissible if the agent believes so, regardless of justification. Thus, ethical subjectivism rejects objective standards, emphasizing the agent's personal viewpoint (Whitbeck, 2011, pp. 24). Therefore, the following comments regarding the code of ethics are not surprising.

> *"I know engineering ethics, but I don't care about it. But I really feel it is social responsibility. Every engineer has a social responsibility." E*

Participant E acknowledged his awareness of engineering ethics but admitted he does not prioritize them in practice. He believes fulfilling the social responsibilities tied to being an engineer is enough to qualify as an ethical professional and entrepreneur. However, the scope of these responsibilities is open to varied interpretations within the engineering field (Bielefeldt, 2018). Furthermore, the business dimensions of engineering can create conflicts among these professional social responsibilities (Conlon, 2008). Entrepreneurial engineers, often driven by profit and investor goals, may overlook societal impacts. Participant E, though dismissive of engineering ethics, stresses social responsibility as central to his role as an engineering business owner. For him, fulfilling this duty outweighs formal ethical guidelines.

> *"Adhering to legal regulations and engineering ethics is very difficult in Sri Lanka with the prevailing political and social environment." B*

Participant B shared that maintaining engineering ethics and legal compliance is difficult in Sri Lanka's current socio-political climate. He believes the code of ethics should serve as a dynamic, "living" guideline, regularly updated to reflect the profession's evolving needs (Schmidt, 2014). Participant B noted that the current code of ethics needs updates to better assist entrepreneurial engineers in running their businesses. While he agrees that harming society is unethical, he believes the code should also help engineers meet business goals. As noted by Starrett et al. (2017), many engineers worldwide have struggled to comply with every aspect of the clauses outlined in the code of ethics. Since ancient times, individuals have faced such challenges, and entrepreneurial engineers are no exception. They confront ethical dilemmas in business, much like traditional engineers, highlighting the relevance of Participant B's remarks.

Most participants view the IESL Code of Ethics as a guide for running their businesses ethically. Generally, such codes help engineers perform their duties with moral responsibility (Weil, 2014). Although a few participants questioned its relevance, most affirmed the code of ethics as a vital guide. Globally, business ethics remain the primary framework for entrepreneurs (Ardichvili et al., 2009). Sri Lankan entrepreneurial engineers also consider the IESL code of ethics as a guide to becoming an ethical entrepreneurial engineer. However, Weil (2014) has highlighted that engineering codes of ethics rarely, if ever, gain visibility in business organisations. However, the above results reveal that Weil (2014) is invalid for companies run by professional engineers.

4.3.2 Perception of ethics among other entrepreneurial engineers in Sri Lanka

Entrepreneurial engineers rarely work in isolation. Most interact with peers who are competitors or stakeholders. Understanding their views on the ethical conduct of fellow engineers in Sri Lanka offers insight into the broader ethical landscape. A grounded theory analysis revealed the category 'Ethical-unethical colleagues,' shaped by several subcategories.

4.3.2.1 Ethical colleagues

Based on their years of work and entrepreneurial experience, a majority of participants indicated that most entrepreneurial engineers in Sri Lanka adhere to engineering ethics. While there are some contradictions in the rough estimation of the number of entrepreneurial engineers who follow these ethical guidelines, the interview excerpts suggest that the majority of the entrepreneurial engineering community upholds engineering ethics.

> *"I generally believe the ninety percent of the people and ninety-five percent of the engineers who have become entrepreneurs do their entrepreneurial works according to ethics". N*

According to Participant N, most entrepreneurial engineers adhere to ethics more than other entrepreneurs in the country. Similarly, Participant K emphasized the same point during his interview, stating, *"Most entrepreneurial engineers respect ethics. Ninety-five percent of engineers working in various institutions uphold ethical standards."* Both participants highlighted that the majority of entrepreneurial engineers demonstrate respect for ethics.

> *"Actually, both parties are there. Some are running genuinely. They do the work according to the specifications. Quality, time and everything is managed ethically. That kind of persons are there." U*

He observed that some entrepreneurial engineers in Sri Lanka act unethically. Both ethical and unethical engineers operate in the same environment, and intense competition often leads some to compromise ethical standards (Knill, 2012). Entrepreneurs often face unique tensions, mainly due to market competition and difficulties in securing financial support for their ventures (Ferrill & Getzler-Linn, 2006). Entrepreneurial engineers also face this tendency. Those less committed to ethics may adopt unethical practices. Participant U referred to ethical engineers as "Genuine" businessmen who uphold societal norms and avoid compromising ethics for profit (Wood, 1996). Furthermore, a study conducted in the United States revealed that, in general, technological entrepreneurs do not believe they must sacrifice their ethics to achieve success in their ventures (Christensen et al., 2008). In the Sri Lankan context, the narratives presented here also indicate that genuine businesspeople do not abandon their ethics in the pursuit of business success.

> *I personally know such entrepreneurial engineers. They are still trying to run the business ethically. Like me, they don't want to expand their businesses much more by doing unethical things like going behind the politicians to get jobs. Hence, their businesses are not very much growing." W*

Participant W, an entrepreneurial engineer in the construction sector, shared his views on the ethical conduct of peers. The construction industry, locally and globally, faces criticism for poor ethics, frequent safety issues, and environmental harm (Somachandra & Sylva, 2018). Participant W's experience highlights the difficulties ethical entrepreneurial engineers face in the construction sector. Unethical engineers often gain support from politicians and corrupt officials, helping them secure unfair business deals. Meanwhile, ethical entrepreneurial engineers who uphold their values typically see slower business growth.

> *I have completed more than three hundred works in Sri Lanka. During these three hundred works, I met engineers around hundred or hundred twenty-five. I worked with those engineers. But I think it is below five (unethical engineers). Many of them are ethical and professional also." H*

Participant H, a consultant in wastewater treatment, has transferred technologies to industries across Sri Lanka through his firm. Based on his extensive experience, he observed that most engineers, including entrepreneurial ones, act ethically and professionally. His comments support the view that Sri Lankan engineers maintain ethical standards. A previous study also found that entrepreneurs in the USA view themselves as ethical (Christensen et al., 2008) and the majority of entrepreneurial engineers in Sri Lanka perceived the same.

4.3.2.2 Unethical colleagues

Although the participants acknowledged that most entrepreneurial engineers adhere to engineering ethics, a few still violate the code of ethics in their entrepreneurial activities. The following excerpts from Participant F's interview transcript provide evidence for the development of the category "Unethical Colleagues."

> *"I think most people (entrepreneurial engineers) are doing ethical work. They are producing good and trying to do good things for society. Some people are doing, you know, other disciplinary works and all those unethical things. There are instances." F*

Participant F supported the earlier finding that most entrepreneurial engineers follow ethical standards but noted that some violate them. A key issue he identified is engineers working beyond their areas of specialization. These ethical breaches occur within broader sociocultural and regulatory contexts and merit further investigation (Radouche, 2014). Therefore, ethical and unethical characters can be observed in any society in the current world.

"*Too many players in the market have created competition for survival. Therefore, unacceptable practices are quite common now. Companies respecting values cannot drop down to that level.*" *S*

Participant S, an industry leader in the construction sector, stated that the intense competition within the industry has led many entrepreneurial engineers to adopt unethical practices. He noted that the construction industry is rife with corruption, and numerous unethical activities take place both locally and internationally (Somachandra & Sylva, 2018; Vitharana et al., 2015). Hence, such behavior can be expected in the construction industry. Participant S attributed unethical practices in the sector to rising competition. With survival at stake, many entrepreneurs resort to unethical means to stay competitive. Business survival remains a core motive for entrepreneurial engineers (Fowosire et al., 2017). Since businesses aim to avoid losses, entrepreneurs may sometimes resort to unethical practices to generate profit, driven by the intense rivalry among competitors (Williams & Bezeredi, 2018).

"I have met many people (entrepreneurial engineers) who believe strongly in ethics. But still, I have seen a lot of people who do not care about ethics. It is like fifty to fifty". J

Based on his experience, Participant J observed an equal presence of ethical and unethical entrepreneurial engineers. He noted that unethical counterparts continue to challenge his work. Unlike earlier views asserting general ethical adherence, he believes around half of Sri Lankan entrepreneurial engineers do not prioritize ethics. Participant R, a large-scale construction MD/CEO, shared a similar view.

"But, some businessmen still wish to do unwarranted practices to make financial gains. Not only this industry, but also other industries may be like that. Earlier, five percent were bad, and ninety-five percent were good. Now I think five percent are good and ninety-five percent are bad." R

Participant R extends his view beyond entrepreneurial engineers to all business actors in Sri Lanka's construction industry. His stance, consistent with Participants J and S, highlights the sector's troubling ethical landscape. Drawing from years of experience, he assessed the ratio of ethical to unethical actors. This serious concern calls for deeper investigation into the root causes of such misconduct. However, findings suggest that simply having an ethical code does little to curb unethical practices in the construction field (Mason, 2008).

The number of unethical entrepreneurs in the construction industry has grown over time. Previously, such cases were much fewer. Participant R noted that while some stakeholders have acted against unethical behavior, these efforts have failed to eliminate the issue. Although intense competition may stem from such practices, it does not always benefit consumers. Understanding when competition becomes harmful allows stakeholders to better challenge claims of ineffective market dynamics (Stucke, 2013).

"Many engineers' behavior and behavioral patterns are ethical. It is my view. But there are some nuts. You know that there are some cases. Because we all depend on money, I think that's the thing. Just say if someone gets lower income, he has to go for such thing". H

Participant H believes most engineers, including entrepreneurial ones, act ethically. However, he has encountered a few unethical individuals. He attributes such behavior mainly to financial motives, noting that low-income individuals are more likely to act unethically to supplement their earnings. Participant R observed that entrepreneurs often adopt unethical practices for financial gain. However, upholding moral standards remains essential for individuals, organizations, and the global market. When entrepreneurial engineers prioritize profit over ethics, they reflect ethical egoism—disregarding accepted norms, believing such rules apply only to others (Lawrence & Weber, 2020, pp.101). Thus, such entrepreneurial engineers operate with an egotistical mindset, driven by personal gain and selfish interests. It is worth noting that a study has shown business ethics has a greater impact on brand attitude than corporate social responsibility (CSR) activities (Ferrell et al., 2019). Entrepreneurs who follow ethical principles often see their brand gain recognition, leading to increased business opportunities. Overall, the findings indicate that some entrepreneurial engineers in Sri Lanka, especially in construction, engage in unethical practices mainly for financial gain.

4.3.2.3 Not willing to comment

Although most participants commented on the ethical and unethical behavior of other entrepreneurial engineers in Sri Lanka, Participants O and Q did not express their opinions on this matter, citing the following reasons. Participant O stated, "*I don't like to comment on that about other entrepreneurial engineers in Sri Lanka*." Similarly, Participant Q remarked, "*I have not specifically studied this point, and I will not be able to make any comments*." Both participants manage medium-scale manufacturing firms outside the construction sector. With fewer competitors and limited interaction with other entrepreneurial engineers, they lacked sufficient awareness to comment on the ethical conduct of their peers in Sri Lanka.

Entrepreneurial engineers in this study expressed mixed views on the ethical conduct of peers in Sri Lanka. While some believed most act ethically, others observed widespread unethical behavior, especially in the construction sector. Participants noted working with both ethical and unethical engineers. Financial gain, a key motivator for ethical egoists, often drives such behavior in Sri Lanka's highly competitive entrepreneurial landscape (Kirzner, 1973; Schumpeter, 1934). Anyone who does not have the capabilities to face this competition will not have the opportunity to remain in the business (Urbig et al., 2020). Achievement-oriented ethical egoist entrepreneurs often adopt any practice, regardless of its moral implications, to run their businesses. In such cases, some entrepreneurial engineers also behave similarly, neglecting engineering ethics and setting a negative example for society and the broader engineering community.

4.4 Ethical challenges encountered by entrepreneurial engineers

"Even if everyone is doing it, wrong is never right. Evil, error & darkness will never be truth, even if popular". *-Russel M. Nelson-*

The business world comprises both ethical and unethical practices among various stakeholders and the competitors. Therefore, any business holder has to encounter ethical issues frequently in the current business climate (Lawrence & Weber, 2020, pp. 94). As Mr. Russel M. Nelson noted, widespread wrongdoing does not make such actions right. Similarly, entrepreneurial engineers in Sri Lanka often face unethical societal practices that are inappropriate for business conduct. This section presents the major findings, based on constructivist grounded theory, on the ethical challenges these engineers face, barriers that have hindered their entrepreneurial success. Additionally, the relevance of these challenges to violations of the IESL Code of Ethics is examined.

4.4.1 Ethical challenges

The ethical challenges faced by entrepreneurial engineers fall under several major categories, including bribery and corruption, pursuit of money at any cost, charging lower fees, practicing in areas outside their expertise, professional jealousy, unfair competition, and concealing the truth. These unethical incidents are most commonly encountered by entrepreneurial engineers from their competitors and stakeholders. Based on their discussions, the majority of their competitors and stakeholders include technology entrepreneurs, as well as their clients/customers within society. The findings indicate that unethical practices are widespread within the field of technology entrepreneurship in Sri Lanka. These unethical behaviors have had a negative impact on the success of entrepreneurial engineers to some extent.

4.4.1.1 Bribery & corruption

Bribery and corruption are among the most common unethical issues faced by entrepreneurial engineers in Sri Lanka. Starrett et al. (2017) define a bribe as a payment made to a person or group, separate from legitimate business transactions, to gain an unfair advantage. Most entrepreneurial engineers reported encountering some form of bribery or corruption during their careers.

> *"But today, the bribe is being demanded to do even what a person is paid to do as his duty and responsibility. This is the level of deterioration that the industry has suffered during my career. Sadly, even professionals have fallen into this group." S*

Participant S observed that bribery is severely affecting Sri Lanka's industrial sector, contributing to broader socioeconomic decline. He noted that professionals, including engineers, are involved in these unethical practices, which can harm their credibility and standing in society.

"I think it is a big issue in Sri Lanka. Because in most of these big projects, you need to pay bribes. Actually, I have enough experience on that." O

Participant O shared frequent encounters with bribery during large construction projects. De Jong et al. (2009) state that public works and construction are globally among the most corrupt sectors. This observation aligns with the experiences of Participants S and O, both active in the engineering and construction industries. Similarly, Participant U, also working in construction, highlighted unethical practices between consultants and contractors, as described below.

"Sometimes, contractors may try to give bribes, and then the consultant does poor work. Sometimes, the consultant wanted to get some benefits and do the work. That is a possibility from that side, though it should not be done." S

Passing off a substandard project in exchange for a bribe can have detrimental consequences for the ultimate client, the general public. Unfortunately, such bribery practices are not confined to Sri Lanka but are also prevalent in other countries, often leading to disastrous outcomes. According to the 2008 Transparency International Bribe Payers Index, public works and construction were identified as the most corrupt industry sectors globally (Krishnan, 2009). Unethical practices like bribery are widespread in the construction industry, particularly in developing countries. Although efforts by organizations and individuals aim to curb these behaviors, bribery remains persistent in Sri Lanka and beyond. Participant U also recounted a similar experience, detailed below.

"As I told you, these non-engineers in the previous workplace who were in the top management used to give millions of rupees to other parties to get jobs. So, not only the politicians, but also some engineers from the other side took them. This is a very sad situation." U

In Sri Lanka, the general public typically perceives that bribery and corruption practices are primarily associated with politicians and public sector employees (Sivakumar, 2014). The above account indicates that some professional engineers, similar to politicians, may solicit bribes from companies in return for awarding projects. The scale of such bribery, including grease payments and illicit transactions, often involves millions of rupees. Although Sri Lanka has established robust legal frameworks to combat bribery and corruption, these unethical practices continue to be embedded in routine business operations. Participant U noted that bribery is usually initiated by senior management rather than junior staff. Such unethical practices give an unfair advantage to firms willing to pay bribes, while ethical companies that reject bribery are often excluded from project opportunities despite being qualified. As noted by Herath et al. (2019), corrupt politicians and government officials have contributed to a decayed business environment in the country. While many participants shared their experiences with bribery, Participant P offered a contrasting perspective, as described below.

"Bribery could only take place with people who work to make money and not with the purpose of rendering a service. I have no experience with bribery, since from the inception, we never used bribery to get our things done". P

According to Participant P, bribery is largely driven by politicians' and government officials' desire for extra income beyond their official salaries. While these individuals may not always directly request bribes, stakeholders often initiate payments to gain favorable treatment. This practice has become widespread, resembling a deeply rooted societal issue. Participant P, a consultant in the power engineering sector, stated that he had never encountered or engaged in bribery to accomplish tasks. However, this perspective stands in contrast to the more widespread observations of bribery in society. As highlighted by De Jong et al. (2009) & Krishnan (2009), the construction industry is highly vulnerable to bribery due to fierce competition. In contrast, Participant P observed that the power sector consulting field experiences less rivalry, which may explain the lower incidence of unethical practices. Reflecting this context, Participant P reported no involvement in bribery during his entrepreneurial career.

Corruption beyond bribery is also common in techno-entrepreneurship. Entrepreneurial engineers face setbacks from unethical actions by stakeholders, including peers. Such corruption creates barriers that hinder their business growth and success (Budak & Rajh, 2014).

> *"Construction by nature is said to be a corrupt industry in the World over. So, how do we expect ethics from stakeholders? Those who value ethics will gradually disappear from the market". S*

Participant S, like Participant R, observed that corruption is deeply rooted in Sri Lankan society. He noted that ethical individuals face difficulties thriving in such an environment, as corruption has become widespread and deeply embedded, posing serious challenges for ethical entrepreneurs. Although most participants opposed corruption and pledged not to support it, Herath et al. (2019) emphasized the serious consequences faced by those who challenge it. These include career setbacks, transfers, threats, harassment, psychological distress, physical harm, and even death. Due to these risks, many are reluctant to act against corruption despite their opposition.

> *"Of course, there is corruption all over the country. That is a big problem in Sri Lanka because most places are highly corrupted. If you don't give to the corruption, you won't be able to start the project". O*

Participant O, a power sector entrepreneur, shared that refusing to engage with corrupt officials often results in major obstacles that block project initiation. Without access to such projects, entrepreneurs struggle to earn profits. His experience highlights the severe challenges entrepreneurs face in navigating a system where corruption is deeply rooted. As Avnimelech et al. (2014) have identified, corruption has a direct negative impact on entrepreneurship in both developed and developing countries. This narrative further confirms what Avnimelech et al. (2014) have identified. Additionally, it was observed that companies doing business with public sector organizations in Balkan countries have to engage with corrupt and dishonest business practices since public procurement is more susceptible to corruption (Budak & Rajh, 2014). The same can be observed with the entrepreneurial engineers who work with public sector organizations in the Sri Lankan context.

Unnecessary political interference in public sector construction organizations has undermined their long-term sustainability, while also negatively affecting entrepreneur-led construction firms operating within the same sector.

> *"Now, these organisations came to this situation because of political influences, nothing else. I don't formally blame politicians in general, but on this construction company like............., even today, they suffer totally due to political influence." R*

Participant R observed that some public sector construction companies have suffered serious financial and reputational losses due to corruption among professionals involved in operations and decision-making. Political interference in bidding and tender processes often skews selections in favor of friends and relatives. This undermines fairness and adversely affects entrepreneurial construction firms, as skilled entrepreneurial engineers frequently lose project opportunities due to politically influenced contractor and consultant appointments.

Entrepreneurial engineers in Sri Lanka often face ethical challenges involving bribery and corruption, mainly from competitors and stakeholders. While most strive to avoid corrupt practices, some have felt compelled to engage in them to secure projects and sustain their businesses in a challenging environment.

4.4.1.2 Going behind money

In today's world, many people consider money the ultimate goal, often making significant efforts to acquire it. While money holds great value, major world religions warn of its potentially harmful effects. For example, Buddhism's *Brahmajala Sutta* advises against accepting money as part of the path to enlightenment. Similarly, Hindu scriptures caution that even a small amount of money can incite deep hatred: "Men will develop hatred for each other even over a few coins." Similarly, the Bible, Christianity's sacred book, states, "For the love of money is the root of all evil" (Macdonald, 2019). Despite these warnings, entrepreneurs, as wealth creators, are inevitably engaged with money in their daily operations. However, as these religious teachings emphasize, the love of money can lead to trouble, especially when ethics are neglected.

Money can attract, retain, and motivate people on various issues in ethical and unethical ways (Tang & Chiu, 2003). Entrepreneurial engineers noted that many competitors pursue financial gain through unethical practices and scandals. This concern, repeatedly mentioned during interviews, formed a distinct category reflecting the widespread apprehension about peers' ethical conduct in the industry.

Anyone who enters the workforce after completing their education typically dreams of earning more money to secure a better life in the future. Those entering the industry often exhibit the same drive. As Participant C mentioned, "*After entering the industry, people chase money. That's the main reason they don't follow ethics, including IESL or any other*." This statement highlights the clear connection between the pursuit of money and the unethical behaviors observed among professionals. (Rahman, 2020). According to Participant C, the pursuit of money has led professionals to neglect ethics. Similarly, Participant D commented on the current situation, stating, "*Now everything is commercialized, so engineers cannot be away from that. But, while doing that, you can strictly adhere to ethics*." Participant D recognizes the commercial nature of modern industries but maintains that engineers can still uphold ethical standards. His comment stems from observing professionals acting unethically due to monetary motives. He believes that even in a highly commercialized environment, ethical engineering practice is possible without compromising moral values.

> *"There are a lot of engineers who are not designing, but who put their signatures just for five hundred rupees, as there are especially so many government engineers. They are putting their signatures on many drawings." M*

Participant M shared an unethical practice observed in his entrepreneurial journey, which is driven by the love of money among some state-sector engineers. Due to their relatively lower salaries, these engineers seek additional income by approving designs that they did not prepare or review. This practice clearly violates the IESL Code of Ethics (*The Institution of Engineers of Sri Lanka, Code of Ethics*, 2013). Therefore, it cannot be claimed that engineers are unaware of this ethical clause; rather, they knowingly engage in this behavior for personal gain. Participant M's statement that there is "no ethics in the field" reflects the complexity and frustration felt by entrepreneurial engineers who witness these unethical practices within their community.

> *"But there are some nuts. You know that there are some cases. Because we all depend on money, I think that's the thing. Just say that if someone in the government sector gets a low salary, he has to go for such a thing." H*

Participant H confirms that low salaries often push professionals toward unethical practices. In a financially driven society, earning money frequently takes precedence over ethical conduct. H observes this trend particularly among state-sector engineers in Sri Lanka, where modest pay compels some to take part-time jobs to increase their income. This reflects the broader ethical dilemmas engineers face in a profit-focused environment. As Kopicko (2018) highlighted, the root of all unethical practices is usually related to monetary transactions for individual gain.

> *"With too many newcomers to the industry and due to the lack of continuity of work, the need is to survive and not to behave ethically. The objective is to make easy money and have a comfortable life rather than worry about values or ethics." S*

Participant S explained that intense competition in the construction sector forces entrepreneurial engineers to focus heavily on earning money to survive. With numerous competitors, securing projects is difficult, and meeting financial obligations like staff salaries becomes a priority. This financial pressure can lead some to prioritize income over ethics. Since their earnings depend on project volume, many place financial gain above ethical standards. Supporting this, studies on managers indicate that workplace pressure is a major driver of unethical behavior (Kopicko, 2018). Entrepreneurial engineers, being both owners and leaders, face higher pressure to generate income than typical managers. This dual responsibility often forces them to prioritize financial survival over ethics, despite recognizing its importance. To remain competitive and sustain their businesses, many focus on profit, which can sometimes lead to compromising ethical standards.

> *"Most of the civil engineers are not going to professional businesses. Most of them are doing business along with their employment. Unofficially, they are doing business while hiding their business from their employers." U*

Everyone does not like to take the risk of being an entrepreneur (Kerr et al., 2017). Participant U highlighted that many civil engineers in Sri Lanka undertake unofficial consultancies alongside their primary employment, often without informing their employers. They fear restrictions if disclosed, but U views this as unethical. He emphasized that such undisclosed income-generating activities during work hours breach the IESL Code of Ethics, affecting both employees and full-time entrepreneurial consultants. (*The Institution of Engineers Sri Lanka - Code of Ethics*, 2013). The love of money has become more potent for professionals in most industries to take decisions that breach ethics.

> *"They do this for this thing and that thing, and they only think for the money and they are not doing anything for the industry or the engineering community. So, that will be a bad thing. So we are not trying to get to that thing. Even if we lose money." W*

Participant W, reflecting on his competitors, noted that many earn money without offering genuine service to the industry or engineering community. In contrast, W refuses to engage in such unethical practices, despite the financial disadvantages it brings to his business. His account highlights how ethical entrepreneurial engineers are often at a disadvantage in industries where competitors prioritize profit over integrity. The narrative also links certain unethical societal behaviors, such as rule-breaking and theft, with lower levels of personal wealth and social status (Zagorsky, 2017). This finding applies to entrepreneurial engineers as well. Professionals lacking a strong ethical foundation may engage in unethical practices, such as theft or rule-breaking, especially during financial hardship. Several narratives illustrate how intense competition in specific sectors, driven by the rise of new ventures, pressures entrepreneurial engineers. Although promoting entrepreneurship is encouraged to boost job creation, wealth generation, and innovation for national development, these initiatives can also lead to unintended negative consequences, including ethical compromises in the race for survival (Shane, 2009). In sectors like the construction industry in Sri Lanka, numerous consulting and contracting firms are led by entrepreneurial engineers, with both engineering and non-engineering entrepreneurs frequently entering the field. The heightened competition, coupled with the pressure to earn money quickly, can often lead to a decline in the quality of work. Shane (2009) observed that many startups pursue profits without offering quality or innovation and recommended that support should be limited to those with high-growth and wealth-creation potential. This is relevant to Sri Lanka's technical sectors, where, as participants noted, intense competition has led many competitors to prioritize financial gain over ethical conduct.

4.4.1.3 Charging lesser fees

Another frequently mentioned unethical behavior of entrepreneurial engineers in Sri Lanka is the practice of charging lower fees by competitors for professional services and products. Many participants expressed their displeasure regarding this issue. For a broader audience, terms like "going behind money" and "charging lesser fees" might be ambiguous. The following evidence from the interview transcripts helps to clarify these points:

> *"Most of the engineers in the consultancy field are corrupt. Corrupted in a sense, actually they do a business. They charge a fee, a small fee, and they get the business. But they earn from commissions from contractors and suppliers" M.*

People often prefer lower-priced services, aiming to save money by selecting cheaper vendors. However, in engineering businesses, excessively low pricing can compromise quality, raising concerns about the reliability and safety of the products or services offered. Despite attracting more clients, firms offering lower prices often face reduced profit margins. Participant M noted that to offset these limitations, some engineering consultants engage in unethical practices, like accepting commissions from contractors and suppliers, to maintain profitability.

> *"Some professionals are charging a very lesser fee than the standard fee. So, it takes time for us to mmm establish because when we charge standard fees, other professionals could quote lesser fees and get the job. So, we always face that". D*

Participant D encounters challenges as his adherence to standard fees results in fewer clients and slower business growth. Meanwhile, competitors who charge lower fees attract clients more quickly, gaining faster industry recognition. This reflects a common ethical dilemma faced by many entrepreneurial engineers in the consulting sector.

> "*Some design engineers are quoting low prices, and they get more jobs and money from the supplier by specifying the supplier's brand. Those who don't have enough opportunities are doing wrong things, such as not charging the correct price." N*

Participant N supports the concerns raised by Participants D and M about competitors using low pricing strategies to attract clients, a common trend in service-oriented firms. This issue is especially prevalent among entrepreneurial engineers in consultancy and contracting. However, product manufacturers face this challenge less frequently due to lower competition in their markets.

Participant N noted that entrepreneurial engineers with limited opportunities tend to charge lower fees to attract clients. Like Participant M, he observed that some compensate for low earnings by engaging in unethical practices, such as taking commissions from suppliers. Such actions compromise professional integrity and damage the reputation of the engineering field.

Participants C and U echoed concerns about competitors lowering fees to win projects. Participant C noted, *"Now some people, when they want to get the job, they reduce their fees like that,"* while Participant U remarked, *"To get jobs, some people are going for very low rates in the bids."* These statements reinforce that many in the industry use low pricing as a tactic to secure more work. Although such strategies may attract clients, they raise ethical concerns in fields like engineering, where quality and professionalism are vital. Entrepreneurs may adopt flexible pricing to survive, but such approaches must align with ethical standards to protect business integrity and industry sustainability (De Toni et al., 2017). Some competitors gain a market advantage by offering products and services at lower prices, which appeals to cost-conscious customers. In engineering practice, charging fees that deviate from the standard values whether lower or higher is deemed unethical (*The Institution of Engineers Sri Lanka - Code of Ethics*, 2013). Instances of competitors charging above standard rates are uncommon. More often, firms set prices below standard, intensifying competition within the industry (Kohlert et al., 2013). Entrepreneurial engineers interviewed confirmed that this widespread pricing tactic, especially in the service sector, poses a major challenge to business growth and long-term sustainability.

4.4.1.4 Practicing in inexpert areas

Another major unethical concern raised by entrepreneurial engineers is competitors working outside their areas of expertise. Engineering tasks demand technical competence, yet some businesses allow inexperienced or unqualified individuals to handle complex projects. This compromises safety, reduces product durability, and raises costs, ultimately endangering users and diminishing trust in engineering services.

> *"There are many engineers without proper knowledge and practice in different areas. They don't know the essential standards. There are many engineers who are designing without even knowing the subject area." M*

Participant M identified the engagement of unqualified engineers in design work as a major industry concern. Engineering design demands expertise and should only be handled by professionals or under their supervision. Without proper knowledge, critical errors can go unnoticed, leading to disastrous outcomes, including loss of life and significant property damage. The Kansas City Hotel walkway collapse serves as a well-known example, illustrating the dangers posed by unqualified individuals handling complex engineering tasks (Fleddermann, 2012). Participant M observed that many design engineers operate beyond their areas of expertise due to business pressures. Intense competition, spurred by the entry of numerous firms, pushes some entrepreneurial engineers to accept projects outside their knowledge domain. This trend compromises both the quality and safety of engineering outcomes and highlights a growing ethical concern within the profession.

> *"I know that some road sector engineers also instruct building and house construction. Finally, the clients are suffering. Because in this area we have to get a vast knowledge." K*

Participant K, who manages a consultancy firm in housing construction, argued that civil engineers from unrelated sectors, like road development, lack the expertise needed for residential housing projects. He emphasized that such work requires specialized knowledge, and involving inexperienced professionals can harm public safety and deny qualified experts rightful opportunities.

> *"There are other consulting companies that perform work for which they do not have no in-house expertise. They just collect a group of CVs and then make a submission. They only have management. There is no one in the house who knows anything about the project.". T*

Participant T noted that some consulting firms in Sri Lanka operate without in-house expertise but still accept projects, claiming to use external experts. However, poor coordination among these consultants often leads to unsatisfactory outcomes for clients.

According to entrepreneurial heuristics, businesses should aim to differentiate themselves to attract and serve a broader customer base, focusing on survival (Makings & Barnard, 2019). This involves exploring new business opportunities beyond one's initial area of expertise. Most technological entrepreneurs begin with specialized knowledge in a specific domain but gradually expand into other fields by leveraging innovation and differentiation (Dorf & Byers, 2008). Trial and error has sometimes led to new business ideas. However, most entrepreneurial engineers in this study consider working in unfamiliar domains unethical. Their concern stems from the fact that engineering products and services involve safety and reliability, which demand domain-specific expertise (Vesilind & Gunn, 2011). Spanjer & Witteloostuijn (2017) stated that entrepreneurs with industry experience are more likely to remain within familiar industries. Consistent with this claim, participants in this study also preferred to adhere to areas they had practiced for years before transitioning to entrepreneurial roles. Additionally, the presence of a clause in the IESL Code of Ethics discouraging practice in non-expert areas further reinforces this behavior among entrepreneurial engineers (*The Institution of Engineers Sri Lanka - Code of Ethics*, 2013).

4.4.1.5 Professional jealousy

"Every time a friend succeeds, a part of me dies." Gore Vidal, American writer.

Professional jealousy, defined as the persistent envy of others' achievements or success, is a universal phenomenon rooted in human nature (Denier, 2021). (Li et al., 2021). Participants in this study also highlighted instances of professional jealousy from competitors and individuals within society. Notably, some engineers in Sri Lanka have exhibited jealousy or envy toward entrepreneurial engineers on various occasions.

> *"Actually, from the last eleven years, I have had many experiences like this industry is not so good for engineering entrepreneurs. It is like non-engineering entrepreneurs that is okay... engineers do not like engineers to come. Professional jealousy, that is the thing". C*

Based on 11 years of experience, Participant C highlighted the unique challenges entrepreneurial engineers face in Sri Lanka. Unlike typical entrepreneurs, they encounter resistance from fellow engineers, with professional jealousy acting as a major obstacle. C also noted that the broader societal environment is unfavourable to engineering entrepreneurship, making it harder for such ventures to grow and succeed.

> *"There are so many honest people who are very bad. They are personally jealous of others, but they are very honest. They never bribe or take bribes, but they have personal jealousy of other knowledgeable people, other bright engineers, right?" A*

According to Participant A, some professionals who outwardly appear honest also experience envy or jealousy toward others in the field. These individuals may not engage in unethical actions or harm anyone in society; they lead exemplary lives and project an ethical persona. However, when they encounter a highly successful or knowledgeable engineer, their professional envy becomes apparent. This jealousy, though not manifesting in direct unethical behavior, is the only negative trait observed in such professionals. Professional jealousy is an emotional response often triggered by an inability to control circumstances. Essentially, it arises as a reaction to perceived social threats, whether real or imagined. When individuals feel powerless or helpless in the face of such threats, negative emotions like jealousy emerge, potentially leading to actions that hinder the professional success of others. (Vecchio, 2000).

> *"Probably, there will be some mudslinging tomorrow on various websites against me. But I don't get agitated about this. But it is something negative, so I don't jump into the bad bucket and try our company. Although it looks like most people agree with it, why are we saying something different? That could be considered a disadvantage, but we keep to our principles". T*

Participant T explained he often faces criticism for exposing technical truths. He observed that many professionals avoid facing facts and prefer illusions. He strives to correct public misconceptions, but those benefiting from misinformation try to silence him. Despite peer opposition, Participant T continues educating society and speaking the truth. He has faced online slander, largely driven by professional jealousy. Mudslinging often stems from those who feel threatened by individuals who challenge dominant narratives. As Chen & Kristjánsson (2011) have emphasized, professional jealousy is a negative emotion that creates detrimental situations for both parties involved. In this case, the mudslinging against Participant T tarnishes his professional dignity in front of the entire community, severely impacting his entrepreneurial journey.

A common unethical behavior among entrepreneurial engineers is the reluctance of senior engineers to mentor juniors, often stemming from professional jealousy.

Participant F noted, *"People don't teach the youngsters, and once you (senior engineers) teach the youngsters, they will try to take your position. That is nature, right?"* In some industries, seniors fear job loss as juniors gain expertise and may challenge their roles. This hesitation to share knowledge, driven by job insecurity, reflects a broader issue of professional jealousy identified in Sri Lanka (Wijesinghe & Jayawardane, 2020). Such behaviors obstruct the growth of both junior and senior engineers, whether or not they pursue entrepreneurship. Professional jealousy often arises when less successful individuals witness others' achievements. As Brooks et al. (2019) note, visible success can trigger malicious envy, a harmful emotional reaction. Many participants, being professionally successful, became targets of such jealousy, identifying it as a key ethical challenge in their entrepreneurial journey.

4.4.1.6 Unfair competition

> *"Entrepreneurship and competition are two sides of the same coin. Furthermore, entrepreneurial activity is always competitive and that competitive activity is always entrepreneurial"*

The above statement was made by Israel M. Kirzner in 1973 (Urbig et al., 2020). Entrepreneurs face various levels of competition on their journey to success. Promotion of competition is broadly accepted as the best tool to promote consumer well-being (Stucke, 2013). While competition is inherent in business, many participants noted that the rising number of competitors in Sri Lanka has led to unfair competition. Competitors' unethical strategies have created challenges that threaten the survival of entrepreneurial engineers.

> *"Competitors still feel that we are getting wealthy and doing a business and we are better than their performance, and so many things. And a lot of arguments come, and most of them are trying to get us down when we are getting a lot of jobs." V*

Participant V stated that competitors closely monitor and attempt to obstruct his company's success. He described the industry as highly competitive and noted that some rivals engage in unethical practices that violate professional engineering standards.

> *"Having been in business for nearly 80 years, upholding the company's values was quite tough with so much unfair competition we now see." S*

Participant V noted that his competitors frequently track his company's progress and attempt to obstruct its success. He described the industry as highly competitive, with many rivals resorting to unethical tactics that compromise professional engineering standards.

> *"I am trying to get consultancy from the university, but they have become my competitors. What can I do then? They have to do the expert work, and we have to do the side works or the general works or the society works, so it is very bad." C*

Participant C expressed concern that university academic staff are competing with his firm by taking on similar projects. He believes they should focus on complex consultancy work beyond the capacity of entrepreneurial firms, rather than directly competing with experienced engineering entrepreneurs like himself. Participant C argues that university academic staff should not participate in consultancy work, as their involvement leads to unfair competition. Since these staff members already receive full-time salaries, their entry into consultancy deprives full-time entrepreneurial engineers of valuable business opportunities. C emphasizes that for small businesses like his, such competition can significantly obstruct growth and sustainability (Krasniqi, 2007). Unethical practices by entrepreneurial engineers create unfair competition for those committed to ethical conduct. These actions conflict with accepted social standards and hinder the progress of ethical professionals. While scholars like Williams & Bezeredi (2018) advocate for policy interventions to counter such effects, the issue remains complex, as fair competition is vital for entrepreneurial development.

4.4.1.7 Hiding the truth

Several participants noted that some competitors hide the truth to gain business advantages, especially in service-oriented industries. However, honesty, integrity, and truthfulness remain fundamental to ethical entrepreneurial conduct globally (Harrison, 2015). However, there is evidence from local and international contexts where entrepreneurs could not adhere to professional standards like honesty and truthfulness (Azmat & Samaratunge, 2009; Senadheera, 2019b).

> *"But we have seen many instances where forecasts have been significantly overestimated to largely satisfy politicians or engineers to say that projects are good. So, for example,………………………(named two large-scale construction projects in Sri Lanka). If there were good feasibility studies for that, these projects may not have been done or may have been done with a different cost and structure." T*

Participant T expressed concern over two recent large-scale construction projects in Sri Lanka, where professionals preparing feasibility reports allegedly concealed key information to satisfy political interests. Consequently, these projects failed to yield the anticipated economic benefits for the country. Participant T noted that if consulting engineers had disclosed accurate information in their reports, authorities might have pursued more cost-effective alternatives. Instead, truth was withheld to serve political and personal interests, contributing to the country's current economic crisis. Massive foreign loans were used to fund these flawed projects, with decision-makers prioritizing short-term gain over long-term national well-being. Participant T emphasized during the interview: "*There are consultants who will give positive reports for projects that should actually receive negative reports*." Participant T emphasized that many organizations in Sri Lanka conceal unethical incidents from the public. As a result, citizens unknowingly bear the financial burden of unfeasible projects with low returns. He attributes this issue to professionals, including engineers, neglecting ethics and hiding the truth for personal gain. Such unethical conduct not only harms the professional community but also inflicts lasting damage on the general public.

> *"But even every time what I am telling to these senior IT people is 'don't hide things, don't hide things even from their superiors, that is not good for you also, that is not good for us, that is not good for you. If you have any issues, go and tell the relevant parties. Don't try to hide it." G*

Participant G, a cybersecurity consultant, emphasized the importance of truthfulness in professional settings. He advises clients' employees to uphold honesty and consistently values integrity in business. He believes that all stakeholders, including customers, employees, and society, benefit when entrepreneurs act honestly. This concern is shared by other participants, who also observed widespread untruthful behavior among competitors in Sri Lanka. Guardia (2016) advised that entrepreneurial engineers must avoid submitting reports or documents solely to appease clients or offer short-term solutions. He stressed that maintaining honesty, even under pressure, is essential for long-term business sustainability.

4.4.2 Avaricious society

Most participants identified that the root of ethical challenges faced by entrepreneurial engineers lies in a societal mindset driven by excessive greed and materialism. These financial expectations among various stakeholders underpinned all the unethical behaviors discussed. To encapsulate this dynamic, the grounded theory study introduced the theoretical code 'Avaricious society' to describe the societal context in which these unethical experiences occurred.

Table 4.2

Unethical experiences of entrepreneurial engineers

Initial Codes	Focused Coding	Theoretical Coding
Bribing	Bribery & Corruption	Avaricious society
Corruption		
Political influence		
Undercutting		
Monopoly in business		
Money mindedness	Going behind money	
Earning from commissions		
Reducing the cost		
Unethical part time businesses		
Charging lesser fees	Charging lesser fees	
Practicing in inexpert areas	Practicing in inexpert areas	
Mudslinging		

Opposing	Professional jealousy	
Trying to get down the business		
Not teaching the younger generation		
Creating an unfavorable business environment		
Unfair competition	Unfair competition	
Lying	Hiding the truth	
Avoiding telling truth		

Source: Developed by the author based on the analysis

The below memo demonstrates how conceptual integration of focused codes into the theoretical construct "Avaricious Society" happened during the analysis process with constant comparison approach.

As I progressed from focused coding to theoretical coding in this CGT study, I began to synthesize and integrate the most conceptually significant focused codes into higher-level constructs that could explain underlying patterns in the data. One such emergent theoretical code is "Avaricious Society," which encapsulates the systemic and cultural context in which entrepreneurial engineers operate, often in conflict with the ethical standards outlined in the IESL Code of Ethics.

This theoretical code evolved through constant comparison and iterative memo writing, particularly as I noticed recurring references to personal gain, unethical competition, profit-driven behaviors, and systemic corruption in participant narratives. The focused codes contributing to this construct include:

• Bribery & Corruption (from initial codes like bribing, political influence, and corruption)
• Going Behind Money (from money mindedness, earning from commissions, and reducing cost)
• Charging Lesser Fees (as a market-devaluing strategy)
• Practicing in Inexpert Areas (violating professional boundaries to secure projects)
• Professional Jealousy (stemming from rivalry, mudslinging, and damaging others' business reputations)
• Unfair Competition (including undercutting, monopoly, and creating a hostile market)
• Hiding the Truth (capturing behaviors like lying and concealing relevant information)

These focused codes, while distinct in behavior and outcome, pointed toward a broader cultural and economic environment characterized by avarice, where ethical boundaries are frequently compromised in pursuit of financial gain or market dominance. Participants spoke not only of individual unethical actions but also of systemic pressures, including political influence, financial insecurity, peer rivalry, and weak enforcement of ethical standards, that normalize or even reward such behavior.

The term "Avaricious Society" emerged as a theoretical label that best captured the interplay between individual actions and the sociocultural environment in which those actions occur. It reflects the normalization of unethical conduct in a business environment where greed, self-

interest, and competitive aggression override professional integrity. Importantly, this construct does not simply describe isolated incidents; it represents a patterned system of values and behaviors that conflict with the spirit of professional ethics expected of engineers.

This theoretical code allows for a deeper understanding of why entrepreneurial engineers may struggle to adhere to the IESL Code of Ethics. It shifts the explanatory power away from individual moral failure and toward a structural critique of the professional ecosystem, a core contribution of CGT, which aims to interpret how meaning and action are shaped by broader social forces. Going forward, this theoretical code will serve as a central lens for explaining the moral and practical dilemmas faced by engineers in Sri Lanka, and will inform the final model of ethical navigation within entrepreneurial engineering settings.

Upon further investigation into the ethical challenges faced by entrepreneurial engineers, most participants attributed these issues to a society driven by extreme greed and materialism. The unethical practices discussed were largely rooted in the overwhelming financial expectations of various stakeholders. To characterize this context, the CGT study introduced the theoretical code “Avaricious society”, capturing the essence of these dynamics. Such a societal environment is ultimately unfavourable for entrepreneurial engineers. Confronting with various ethical challenges in an avaricious society as highlighted above, affects the successful performance of the entrepreneurial engineers. Knight (1921) described entrepreneurship as involving uncertainty and bearing non-insurable risks. His risk-bearing theory provides a useful lens for understanding the challenges entrepreneurial engineers face in an avaricious society. In such a context, perceptions of risk and reward become distorted, pressuring individuals toward unethical or illegal behavior while undermining support for long-term innovation. This environment normalizes and sometimes even rewards unethical practices in business (Gino & Pierce, 2009). Entrepreneurial engineers are typically guided by engineering ethics and innovation, but they often face pressure to compromise on product safety or use deceptive marketing tactics in pursuit of rapid financial success. This pressure has heightened the ethical risks they encounter and added uncertainty to their entrepreneurial roles.

Similar to Knight's risk-bearing theory of entrepreneurship, Schumpeter's innovation theory (Schumpeter, 1934) provides a valuable framework for understanding the challenges of entrepreneurial engineers in an unstable society. Entrepreneurial engineers are key drivers of innovation and economic growth, integrating technical knowledge with entrepreneurial ambition. While they introduce transformative technologies and processes, their impact on societal norms can be profound. In societies dominated by the pursuit of wealth, short-term profit motives often hinder the development of conditions necessary for sustained innovation. Schumpeter’s theory of innovation provides a useful lens to examine how such societal pressures shape the motivations and activities of entrepreneurial engineers.

Entrepreneurial engineers are often motivated by high performance requirements, as described in McClelland's need for achievement theory (McClelland, 1961). Entrepreneurial engineers aim to solve complex problems, innovate, and create lasting value through their ventures. In societies dominated by materialism, the intrinsic motivations of entrepreneurial engineers are often compromised. The pursuit of financial gain can lead to ethical dilemmas, including reduced attention to quality, safety, and integrity. For those with a high need for achievement, such compromises conflict with their core values. The societal focus on short-term profits discourages long-term innovation, suppressing creativity and deterring commitment to high-risk, high-reward ventures. As a result, entrepreneurial engineers may feel unfulfilled, unable to apply their full technical and creative capabilities (Shane et al., 2003).

The exposure theory of entrepreneurship highlights how the social environment shapes entrepreneurial outcomes. For entrepreneurial engineers, success depends on applying technical expertise within ethically sound frameworks. However, in an avaricious society marked by corruption and bribery, their adherence to engineering ethics often clashes with prevailing norms. This ethical conflict creates significant barriers to innovation and business sustainability (Starrett et al., 2017). The widespread corruption and bribery create imbalances between personal values and the business environment of entrepreneurial engineers. These unethical practices can distort market opportunities, favoring those who engage in corruption rather than those who innovate based on merit (Tonoyan et al., 2010). In highly corrupt environments such as Sri Lanka, entrepreneurial engineers often struggle between upholding ethical standards and navigating a business climate shaped by unethical practices. This conflict may discourage ethical individuals from pursuing entrepreneurship. Corruption also distorts opportunity recognition, where technical skill and innovation alone are insufficient. Those unwilling to participate in unethical practices may be excluded, allowing only corrupt actors to access business opportunities and ultimately stifling genuine innovation (Tonoyan et al., 2010). High levels of bribery in an avaricious society can lead to increased operational costs, legal risks, and reputational damage, all of which limit innovation and reduce the competitiveness of technology-based companies (Anokhin & Schulze, 2009). Moreover, the constant need to navigate a corrupt system can divert entrepreneurial engineers' attention away from technological development and market expansion. As a result, the long-term performance and growth of their firms can be negatively impacted by the pervasive effects of corruption.

In summary, leading entrepreneurship theories reveal that an "avaricious society" imposes significant barriers for entrepreneurial engineers. It undermines innovation and creativity, fosters ethical dilemmas, and prioritizes short-term profits over sustainable value creation. Addressing these issues requires policy reforms aimed at reducing corruption, promoting regulatory transparency, and cultivating ethical awareness across society to create a more supportive business environment.

4.4.3 Ethical challenges & their relevancy to engineering ethics

The ethical challenges encountered by entrepreneurial engineers are strongly associated with breaches of various clauses in the IESL Code of Ethics. Many competitors and stakeholders identified in this study, including some entrepreneurial engineers, are technology entrepreneurs. To emphasize the implications of these violations within the engineering community, the findings have been aligned with the relevant principles of the IESL Code of Ethics.

Bribery and corruption emerged as major concerns among entrepreneurial engineers in this study, primarily due to widespread disregard for several clauses in the IESL Code of Ethics. A key provision under the first clause states, “Engineers shall hold paramount proper utilization of the funds and other resources in the performance of their professional duties.” Adherence to this principle by all stakeholders would eliminate the justification for bribery or corruption, as public or private resources are not intended for such misuse. Furthermore, two sub-clauses under the sixth clause explicitly forbid engineers from participating in bribery and corrupt practices, reinforcing the ethical obligations that are often neglected:

- Engineers shall neither solicit nor accept gratuities, directly or indirectly from contractors or their agents, or other parties dealing with their clients or employers in connection with work for which they are responsible.
- Engineers shall not accept a commission, fee, reward or other benefit from a third party, while advising a client.

Despite the presence of ethical guidelines for engineers in Sri Lanka, many still engage in bribery and corruption within their professional roles. This issue is especially prominent among entrepreneurial engineers in the construction sector. However, such unethical practices are not unique to Sri Lanka; similar challenges exist in many developing countries. These behaviors undermine industry growth, compromise safety, and lead to inefficient resource utilization. (De Jong et al., 2009; Wiramidjaja, 2011).

The second most cited unethical experience in this study was the excessive pursuit of financial gain by stakeholders and society. Although the IESL Code of Ethics does not explicitly label profit-seeking as unethical, related sub-clause violations were evident. Interview narratives revealed that prioritizing money over ethics frequently led to breaches of professional standards, compromising both integrity and the quality of engineering work.

- Engineers shall not affix their signature to any designs or documents dealing with subject matter in which they lack competence or to any plan or document not prepared under their direction or control.

- Engineers shall not involve themselves with any business or professional practice, which they know to be fraudulent or dishonest in nature

The study reveals that some state-sector engineers engage in dishonest practices by approving designs and documents without proper review, often to earn extra income through undisclosed part-time consultancy. These engineers typically take on such roles during office hours without informing their employers, motivated by dissatisfaction with their salaries. This behavior compromises professional ethics and harms full-time entrepreneurial engineers by reducing fair access to consultancy opportunities. When state-employed engineers undertake private work during official hours, it distorts competition and undermines the integrity of the consultancy profession.

Multiple participants identified the practice of "charging lesser fees" as a widespread unethical issue among entrepreneurial engineers in consultancy and contracting, though less common in manufacturing. This violates the IESL Code of Ethics, which prohibits unfair competition through extremely low or high professional fees. While overcharging was not a concern, underpricing frequently led to compromised quality, as projects delivered on minimal budgets often lacked durability. Clients drawn to low-cost services typically overlooked long-term consequences, resulting in substandard outcomes. This trend not only undermines service quality but also creates unfair competition for engineers adhering to standard fee structures, placing ethical practitioners at a disadvantage.

Practicing beyond one’s area of expertise is a notable unethical behavior reported among entrepreneurial engineers in Sri Lanka. This violates the IESL Code of Ethics, which states, "Engineers shall perform professional services only in the areas of their competence." Despite this guideline, some engineers pursue projects outside their expertise to secure business, especially in the consultancy sector where specialized services are critical. Such practices risk the quality and safety of engineering outputs and highlight the importance of ensuring that only qualified professionals undertake expert tasks (Taebi, 2021).

Participants reported facing several challenges from within the engineering community that hindered their entrepreneurial progress. These issues could be minimized if the engineering community adhered to the IESL Code of Ethics. A key concern was the reluctance of senior engineers to support the growth of younger professionals, violating the clause requiring engineers to promote continuous professional development and mentorship. Additionally, instances of professional jealousy and attempts to undermine successful peers contradict the ethical guideline that mandates engineers to respect others and avoid harming their reputation or business. Such behavior reflects a broader societal disregard for these ethical principles.

While competition is vital for entrepreneurship, interviews revealed that some competitors employ unfair tactics against entrepreneurial engineers. Such practices violate Clause 4 of the IESL Code of Ethics, which states, “Engineers shall build their reputation on merit and shall not compete unfairly.” This guideline discourages gaining benefits through improper means. Despite this, several entrepreneurial engineers observed that their competitors sought advantages without regard for ethical consequences, undermining fairness and professional integrity in the engineering industry.

Concealing the truth is a notable unethical practice observed by entrepreneurial engineers, especially among competitors in Sri Lanka’s service-oriented sectors. This behavior contradicts Clause 7 of the IESL Code of Ethics, which states, “Engineers shall give evidence, express opinions, or make statements in an objective and truthful manner.” Despite this directive, some entrepreneurial engineers disregard this clause in pursuit of business advantages. The interviews suggest this malpractice is more prevalent in consultancy and service-based firms than in the manufacturing sector, raising concerns about transparency and professional accountability.

The ethical challenges faced by Sri Lankan entrepreneurial engineers largely arise from violations of the IESL Code of Ethics by stakeholders such as competitors and clients, many of whom are engineers or technology entrepreneurs. Strengthening adherence to ethical standards within the engineering community could help reduce these challenges. Moreover, non-engineering entrepreneurs and the public should also engage ethically with entrepreneurial engineers contributing to national economic development and job creation. Establishing a code of ethics for non-engineering stakeholders, akin to the IESL Code, could reduce unethical practices and support the growth and sustainability of entrepreneurial engineers. As ethical behavior in society remains inconsistent, such a framework would strengthen the overall entrepreneurial environment.

4.5 Chapter summary

Twenty-two entrepreneurial engineers with chartered engineer status were interviewed face-to-face to collect data for this study, which followed a constructionist grounded theory methodology. All participants were male, as it was difficult to find suitable female entrepreneurial engineers in the country for data collection. The participants' techno-entrepreneurial firms ranged from small to large-scale businesses, with start-up years spanning from 1978 to 2019. Many of the participants hold various postgraduate qualifications, ranging from postgraduate diplomas to PhDs, in addition to their first degree in engineering. Furthermore, they possess a variety of professional qualifications and memberships in various professional associations that support their entrepreneurial journeys.

This research study primarily focuses on the IESL code of ethics and its adherence in the entrepreneurial business environment by entrepreneurial engineers. Grounded theory-based analysis revealed that most participants view the code of ethics as a guiding framework for ethical business practices within the engineering entrepreneurial sector. They expressed mixed perceptions regarding the ethical behavior of their competitors, including other entrepreneurial engineers in the country. The theoretical category of "Ethical and Unethical Colleagues" emerged from the interview transcripts, highlighting that study participants are surrounded by both ethical and unethical engineers, competitors, stakeholders, and colleagues within the Sri Lankan techno-entrepreneurial business context.

Entrepreneurial engineers encounter various unethical scenarios from the business community throughout their entrepreneurial journey. Key themes identified from the interview data regarding these unethical experiences include: (1) Bribery and Corruption, (2) Pursuit of Money, (3) Charging Lesser Fees, (4) Practicing in Inexpert Areas, (5) Professional Jealousy, (6) Unfair Competition, and (7) Concealing the Truth. These focused codes collectively led to the development of the theoretical code "Avaricious Society," which encapsulates the societal context in which entrepreneurial engineers operate during their business activities.

This study highlights that functioning within a predominantly profit-driven society, characterized by frequent ethical challenges, has created a disadvantageous business environment for Sri Lankan entrepreneurial engineers. Many participants expressed that adherence to the IESL code of ethics, or the implementation of a similar framework tailored for the non-engineering community, would significantly reduce the frequency of these ethical challenges during their entrepreneurial ventures.

CHAPTER 5

RESULTS & DISCUSSION PART II

5.1 Introduction

Building on the previous chapter's exploration of Sri Lankan entrepreneurial engineers' self-perceptions of ethics, their views on peers' ethical conduct, and the challenges encountered in their entrepreneurial journeys, framed through the lens of the IESL Code of Ethics, this chapter examines how these engineers actively adhere to the code while managing their business ventures. It further analyzes the positive and negative outcomes associated with such adherence. The discussion is organized around the eight core clauses of the IESL Code of Ethics, with each clause evaluated individually in terms of the strategies employed and the resulting implications.

Although CGT emphasizes an inductive, emergent approach to theory development, this study purposefully incorporated the IESL Code of Ethics as a sensitizing concept during the design of the interview guide. As described by Charmaz (2006), sensitizing concepts provide researchers with a loose framework that offers direction without determining the content of analysis. The IESL Code was not used as a predefined coding scheme or theoretical lens but rather as a culturally and professionally grounded entry point to elicit participant reflections on ethically relevant experiences in entrepreneurial engineering settings. This approach aligns with the constructivist epistemology of CGT, which acknowledges the co-construction of meaning between researcher and participant within specific social, institutional, and professional contexts (Birks & Mills, 2015; Charmaz, 2008).

During data collection, each clause of the Code served to initiate discussion around areas commonly encountered in engineering practice, but participants were encouraged to expand freely beyond the scope of the Code. The analytical process remained rooted in the core CGT principles of open coding, constant comparison, memo-writing, and theoretical sampling (Charmaz, 2006; Corbin & Strauss, 2015). Categories were developed inductively, based on recurring patterns in participants' narratives, rather than being imposed by the Code. The decision to structure the integrated Results and Discussion chapter around the clauses of the IESL Code was made at a later stage, not as a deductive analytic device, but to reflect how participants themselves frequently invoked the Code, either directly or indirectly, as a moral and professional reference point.

This presentation strategy is consistent with CGT's emphasis on analytical flexibility, context-sensitivity, and meaning co-construction (Charmaz, 2006). It supports the interpretive goal of the study, which is not only to develop grounded theoretical insights into ethical decision-making but also to situate these insights within the institutional and normative realities that shape professional conduct in Sri Lankan engineering entrepreneurship.

5.2 Clause 1: Holding paramount health, safety & welfare of the public

5.2.1 Introduction

The first clause of the IESL code of ethics says, "Engineers shall hold paramount the health, safety, and welfare of the public and proper utilization of the funds and other resources in the performance of their professional duties. It shall take precedence over their responsibility to the profession, sectoral or private interests, employers or other engineers" (*The Institution of Engineers Sri Lanka - Code of Ethics*, 2013). The first clause of the engineering code of ethics is widely regarded as the most fundamental by professional engineering organizations (Hansen & Zenobia, 2011; Vesilind & Gunn, 2011). This section examines how entrepreneurial engineers uphold this principle throughout their entrepreneurial journeys.

Health and safety are essential in all activities due to the intrinsic value of human life. Many businesses follow Occupational Health and Safety Assessment Series (OHSAS) guidelines to protect workers, customers, and the public. In Sri Lanka, several studies have examined workplace safety in relation to OHSAS standards (Premanathan & Rajini, 2018; Vitharana et al., 2015). While large enterprises have shown significant improvements, small and medium-sized companies lag behind (*Report on Situational Analysis on Occupational Health and Safety in Sri Lanka*, 2016). Regardless of regulations, engineers have an ethical duty to ensure safe workplaces. Entrepreneurial engineers, as business owners, must place public health, safety, and welfare as top priorities.

5.2.2 How is the 1st clause applied?

After examining the interview transcripts, the author found that there are primarily three different types of approach to apply the 1st clause.

Table 5.1

Strategies of applying the 1st clause

Focused codes	Initial codes

Committing individually for safety	Prioritizing health & safety, Minimising mistakes, Reducing profit margins, Criticising malpractices, Sharing knowledge.
Achieving safety through employees	Advising employees, facilitating knowledge updating, employing competent people, Organizing CSR & welfare activities.
Reaching the public safely	Following standards, introducing safe products, improving the health & safety conditions in the industry, convincing the people, not cheating the clients.

Source: Developed by the author based on the analysis

5.2.2.1 Committing individually for safety

As organizational leaders, entrepreneurs are responsible for promoting a strong culture of health and safety for both employees and the public. Leadership commitment is crucial, as employees are less likely to prioritize safety without visible support from their leaders. The views of small business owners play a key role in shaping workplace safety practices (Brosseau & Li, 2005). In this study, entrepreneurial engineers demonstrated strong personal commitment to public health, safety, and welfare, in alignment with the IESL code of ethics. Their actions reflect the core category of "Individual Commitment".

1. **Prioritizing health & safety**

Participants unanimously prioritized the health and safety of employees and the public, framing it as a fundamental operational objective. Participant A notably emphasized the intrinsic link between ecological integrity and human well-being, asserting that "*the supreme profit of any project is the health of mankind and the rest of the ecosystem."* This perspective underscores a holistic, ethically grounded approach to project implementation, driven in part by religious values, which views environmental preservation as integral to safeguarding public health.

> *"In any development project, the engineer should ethically know that the main profit should be health. Then another term in Buddhism is called 'Arogya Parama Laabha' There is another verse in the same sutra preached to a particular king as 'Santhusti Paraman Dhanan'. That profit should be the happiness of the people." A*

Furthermore, Vesilind & Gunn (2011) contend that diverse religious beliefs can bring about varying degrees of value propositions with regard to the interpretation of the 1st clause. Participant B prioritises health & safety as follows.

> *"You know that, in chemical engineering, chemical reactions are frequent in the manufacturing of chemical products. So, safety is very important. From my employees to my customers, I should ensure safety. I pay much attention to that." B*

An essential attribute of an entrepreneurial engineer as an expert in a certain technology is the ability to understand the gravity of their deliveries and ensure all stakeholders' safety. Participant D has provided his view as *"So, the consultant has a* *role in ensuring that health and safety are established on construction sites. Because in our offices, of course, it is not a major thing."* Participant D emphasizes the ethical responsibility of consultant engineers to uphold health and safety standards, particularly in Sri Lanka's construction sector, where persistent safety violations and limited awareness prevail. This underscores the profession's moral imperative to address systemic deficiencies in workplace safety culture and compliance (Bhagyani & Kottawatta, 2017; Darshana, 2017). In light of these systemic challenges, Participant D's proactive stance is commendable and exemplifies the critical role of professional ethics in addressing industry-wide deficiencies.

> *"I always recommend that if you are building a high-rise building, it should be reviewed by an external party. We do it on all our high-rise building projects and always ask reputed foreign parties to review our designs." D*

Participant D voluntarily implements additional structural evaluations, demonstrating a strong commitment to public safety that exceeds regulatory requirements and prioritizes ethical responsibility over cost.

> *"Whatever the designs we do; we first maintain safety. Safety is the main concern. Another thing is, it should not harm and affect the people. Those are the things we always follow." J*

Recognizing that design is fundamental across all engineering scales, Participant J prioritizes safety from the earliest stages of the design process. As a small-scale business owner, his proactive attitude affirms findings by Brosseau & Li (2005), who identify owner mindset as a key driver of workplace health and safety improvements. While defining what is "safe enough" remains a nuanced judgment shaped by various stakeholders ("Engineering Ethics in Practice: A Guide for Engineers," 2011), Participant J's approach illustrates how entrepreneurial engineers can lead by embedding ethical and safety considerations into the foundation of their work.

2. **Minimizing mistakes**

Given the potential for catastrophic outcomes resulting from engineering errors, as noted by Vesilind & Gunn (2011), entrepreneurial engineers' mindset recognize that minimizing errors is essential to protecting health, safety, and welfare. The interviews revealed that several participants personally committed to reducing the likelihood of mistakes through conscientious and responsible practice

> *"You cannot say that I am a senior structural engineer and that I will never make mistakes. This statement is wrong because we are human beings and we can make mistakes. Doing a proper review means we are getting an extra certificate." D*

Although human error is unavoidable, it does not excuse compromising safety. Participant D, a structural engineering consultant, stresses the necessity of rigorous review mechanisms to reduce errors, a principle embedded in his firm's operations. Likewise, Participant F demonstrates a personal commitment to consistently enforcing high safety standards in engineering practice. *"We normally do not provide the work quickly. We do some research, find details, analyse the thing and then provide our solutions, that is, multiple approaches."* Participant F and his team employ diverse strategies to ensure error-free project completion, acknowledging the complexity, time, cost, and effort involved. He further underscores the importance of sustained diligence and strategic planning in achieving consistent engineering excellence.

> *"Even if we get something wrong, many mistakes or something like that, it is normal. But even then, once you find it, you should correct it at the moment." F*

Error prevention is critical in engineering, particularly for entrepreneurial engineers who must swiftly acknowledge and rectify mistakes to safeguard public safety (Runge, 2014). The Kansas City Hotel walkway collapse, which killed 114 people, underscores the catastrophic consequences of overlooked design flaws and reinforces the imperative for vigilance and accountability in engineering decision-making (Fleddermann, 2012).

> *"Junior engineers can make mistakes because we also have made mistakes in our life, then what we do is admit that and we are not going to respond saying these are not our faults, we are not bypassing them". G.*

Participant G emphasized error reduction and leadership by example, noting his firm's focus on combating cyberattacks amid Sri Lanka's rising cybersecurity demands. Entrepreneurial engineers influence institutional norms, with past technological failures highlighting oversight gaps. Love et al. (2011) advocate integrated strategies across all levels, reinforcing the broader impact of proactive error-prevention in engineering leadership.

3. Reducing profit margins

Profit is a critical success factor for any entrepreneur (Runge, 2014). Entrepreneurial engineers demonstrate a strong ethical commitment by willingly reducing profit margins to prioritize safety. Participant B stated: *"I follow a rigorous testing process before launching any chemical product on the market. Although it seems costly, it is a practice in my company.*" Participant B described conducting extensive and costly testing of chemical products prior to market release, acknowledging the financial impact but emphasizing the confidence it provides in product safety. Similarly, Participant D employs a practice that significantly affects his entrepreneurial company's profit margins. He explained: *"Doing a proper review, I mean that we are getting an extra certificate. And you also feel very comfortable, and the client also feels very comfortable when we have additional checks."* These additional reviews require extra resources, including money, time, and effort, which could otherwise be allocated to other projects. Both participants accept these financial trade-offs as necessary for upholding safety and ethical responsibility, showing that profit is consciously subordinated to public welfare in their operational decisions.

> *"As well as we try to reduce our margins. Because clients try to do something for the environment. Especially in high tech installations, we are going with a little margin". H*

Participant H prioritizes public health by installing high-tech water treatment systems despite low profits, illustrating the ethical trade-off between safety and financial gain in entrepreneurial engineering. *"Without arranging the safety and environmental* *precautions, I am not encouraging them (subordinates) to save money by cutting the cost for safety."* Participant W prioritizes ethical leadership by upholding safety standards and guiding employees, choosing public welfare over profit.

> *"With the outbreak of the the Covid pandemic, we upgraded the facilities to comply with the directives of the Health Ministry, although we are forced to incur additional and unplanned expenses in this regard." S*

Participant S implemented costly COVID-19 safety upgrades, prioritizing employee well-being over profit. His response illustrates a shared ethical commitment among participants to uphold engineering's core duty: protecting human health.

4. Criticising the violations.

Entrepreneurial engineers challenge unethical practices that threaten public welfare, demonstrating their ethical obligation to advocate accountability and uphold broader societal responsibility (Carberry et al., 2018). Here, entrepreneurial engineers demonstrate their opposition toward the misconduct of their stakeholders and the community, which jeopardises the public's health, safety, and welfare.

> *"What the hell is this development? Now we cannot live in the city. It is full of harmful fumes. Now Kandy has become the highest polluted city in Sri Lanka. What is this development?" A*

Participant A voiced concern over the negative environmental consequences of modern development, noting that ongoing pollution continues to harm public health and safety (Griggs, 2013). Through publications, research, and keynote speeches, he actively promotes ethical awareness, reflecting a strong personal commitment to societal well-being. Research affirms that ethically driven entrepreneurs can catalyze positive change by steering practices toward greater responsibility (Mai et al., 2019).

> *"They (Clients) never ask who the architect was when there is a failure. They sue the contractor. The culprit is the architect who made the design with errors. Even if the building collapses, they ask who the contractor is. They never ask who is the structural engineer." R*

Participant R, a leader in construction, highlighted the reluctance of some designers to acknowledge errors flagged by contractors. Despite not being at fault, contractors often face blame and legal consequences. He views this negligence as a risk to public safety and actively advocates for greater accountability in industry forums to promote ethical practice and reduce harm.

> *"Fifty percent of the houses in Sri Lanka do not have trip switches. Price may be the reason. This is related to the very lack of attitude of Sri Lankans toward safety. We are trying to set up a system with a good quality trip switch available in the market. We could have saved each of our lives for four thousand rupees."* T

Participant T is drafting a government proposal to address electrical hazards in Sri Lankan homes. His voluntary efforts reflect the broader role of entrepreneurial engineers in promoting public safety and societal well-being.

Fostering a safety culture requires leaders to prioritize safety and possess strong safety knowledge (Bisbey et al., 2021). Entrepreneurial engineers must demonstrate this commitment, as it supports ethical responsibility and protects public health through their technology-driven business practices (Fruhen et al., 2019).

5.2.2.2 Achieving safety through employees

Entrepreneurial engineers have implemented various practices within their firms to uphold the first clause and fulfill their ethical obligations as professional engineers. They collaborate closely with their subordinate staff to ensure compliance. It was found that advising employees on health and safety, facilitating knowledge updates, and employing competent individuals were key subcategories contributing to this main objective. By enacting these practices, they ultimately prioritize the health, safety, and welfare of the public, including their employees.

1. **Advising employees on health & safety**

While entrepreneurial engineers delegate tasks as MDs/CEOs, responsibility for public health, safety, and welfare is shared across all staff. To uphold this, they guide employees and raise awareness to ensure ethical standards are maintained throughout the organization.

> "*Although we have good technical knowledge, our workers do not have such knowledge. Therefore, we must educate them about our work and safety. It is essential." B*

Concerned about his workers' lack of technical knowledge, participant B actively advises them on safe practices. His hands-on approach addresses the gap in safety awareness among less-educated employees, highlighting a vital responsibility within the engineering profession (Bhagyani & Kottawatta, 2017). Participant H stated, "*We always think about safety precautions with workers and always ask them to use safety measures."* Participant H emphasizes safety protocols in mechanical installations, ensuring staff adherence to OSH and ethical standards. Alongside Participant D, he addresses safety gaps prevalent in Sri Lanka's construction sector, countering prior studies that highlighted poor safety practices through active employee education and strict procedural enforcement (Vitharana et al., 2015). Participant F conveyed the following message regarding mistakes: *"We tell our employees that if you find mistakes later on, even at a later stage, you can correct them, or whatever corrective measures should be taken.*" It was not only the entrepreneurial engineer who took action to correct mistakes; he also instructed his employees to do so independently. Therefore, having such clear guidelines is crucial to minimizing the health and safety risks associated with mistakes in engineering products and services.

> *"Each week, we had a toolbox meeting in separate clusters and allocated separate officers. That responsibility is delegated to the deputy project managers, site engineers, and all other officers to educate them, and conduct awareness programmes, especially for diseases like HIV and Covid, so we have a schedule." W*

During the Covid-19 pandemic, Participant W organized safety awareness sessions on Covid-19 and HIV risks, appointing a safety officer and engaging his executive team to enhance health oversight. These measures addressed reduced job satisfaction due to psychological stress and weakened safety perceptions (Li & Griffin, 2022). According to Peker et al. (2022), when supervisors demonstrate integrity for safety, it strengthens employee motivation, suggesting that delegating safety to trusted staff reinforces ethical commitments in practice.

2. **Facilitating knowledge updating**

An essential aspect of "focusing on employees" is enabling continuous knowledge updating. In the face of rapid technological change, staying current is critical for engineers to uphold public health, safety, and welfare (Bhagyani & Kottawatta, 2017; Runge, 2014). Practising with updated expertise minimizes workplace hazards, as emphasized by Participant D:

> *"I strongly believe that updating knowledge is of paramount importance for engineers. If you do not update your knowledge, you will become outdated." D*

Participant E has recommended the same as follows.

> *"Even technology is changing; systems are changing, so it is a must. If you don't understand the next generation things if you don't develop, you will be a dinosaur". E*

Participants D and E, as entrepreneurial engineers, recognized the importance of utilizing the most up-to-date information in their work. This strategy has not only helped them thrive in their business but also enabled them to adopt more responsible business practices.

> *"If my knowledge is not enough, I just call my supplier and get a training session. If not, ask them to come here at the installation stage. We improve our knowledge like that". H*

Participant H imports modern equipment for water purification but acknowledges his team's limited knowledge poses risks to clients. To address this, he organizes formal and on-the-job training. As noted by Love et al. (2011), inadequate technical understanding can endanger lives. Engineers are ethically obligated to continuously enhance their knowledge and that of their teams (*The Institution of Engineers of Sri Lanka - Code of Ethics*, 2013). This obligation directly affects the success of efforts to improve the health, safety, and welfare of the general population. Maintaining up-to-date knowledge of technical issues and safety practices will contribute significantly to achieving professional goals.

> *"Handling this kind of engineering team is not easy because they are up to date with all these security things and technologies. So that is why even now I am working on learning new things in cyber-security." G*

With growing reliance on internet-based systems, cybersecurity is critical to public safety. Participant G supports continuous learning but relies on his team to stay updated. Gressgård (2014) emphasizes that knowledge exchange enhances safety in high-risk settings, reflecting a broader trend of promoting learning to maintain safety standards.

3. Employing competent people

Entrepreneurial engineers often delegate tasks to those more skilled in specific areas, aligning with the IESL code of ethics, which emphasizes practising only within one's expertise (*The Institution of Engineers Sri Lanka - Code of Ethics*, 2013). This principle, echoed across various ethical codes, reinforces the priority of public health, safety, and welfare (Vesilind & Gunn, 2011). Employing experienced staff is one strategy identified through interviews as a means to uphold these ethical standards.

> *"You know that a knowledgeable person can do the right thing, and the user is benefitted by safety, economically, financially, and in every aspect." C*

Participant C noted that experienced professionals can ensure precision while optimizing both safety and economic outcomes. Hence, employing specialists is essential for entrepreneurial firms to maintain this balance. Participant C further emphasized this by stating,

> *"We recruit the correct persons. When we have qualified persons only, we can do it. I cannot ask my civil engineers to do some electrical or plumbing or something." C*

Participant F follows a similar approach: *"We have competent people for every segment which we are doing. All chartered engineers."* He engages chartered professionals to ensure expert handling of services. As noted by Vesilind & Gunn (2011), engineers with specialised training are best equipped to assess health and safety risks. Participant D shared his approach: *"Especially we must understand who we are. We are specialised in one field. Therefore, you should not provide services in the other areas, those things that we strictly maintain."* As a structural consultant, he adheres strictly to his domain, aligning with the 'Safe by Design' concept, which promotes addressing safety in early technology development (van de Poel & Robaey, 2017). Specialisation enables engineers to deliver safer services (van Gelder et al., 2021). He further stated, *"So, like from the beginning, you have to work with other consultants. I am sharing and getting advice from other consultants. Even for a small job, you can do that."* This reflects his practice of collaborating with peers to ensure professional integrity and safety.

> *"Especially for the environmental, health and safety aspects, we have allocated a qualified officer, a graduated person, an experienced graduated person." W*

Given the critical nature of health, safety, and environmental concerns in construction (Darshana, 2017), participant W appointed experienced personnel to oversee these areas. Unlike others who emphasized employing technical experts for general staff roles, W specifically assigned qualified professionals as health and safety officers. This reflects the belief that technical expertise enhances the ability to foresee and manage risks. Supporting this view, Bisbey et al. (2021) argue that the 'practice of knowing', the ability to apply knowledge effectively, is more crucial than formal credentials alone, aligning with Participant W's approach.

By combining collaboration with employees and employing technically skilled staff, entrepreneurial engineers help ensure the delivery of safe products and services.

Through these direct and indirect strategies, they uphold the paramount importance of public health, safety, and welfare.

5.2.2.3 Reaching the public safely

The community serves as the ultimate consumer of engineering products and services. Hence, it is crucial for entrepreneurial engineers to establish and sustain positive, secure relationships with clients and the public. Interviews revealed that they employ diverse approaches when engaging with the general public to meet the requirements of the first clause. Several techniques adopted by entrepreneurial engineers are discussed below.

1. **Following standards**

Most participants reported adhering to relevant standards to ensure safety in their products and services. As Harris et al. (2009) note, engineers must not disregard industrial standards, which are regularly updated to reflect best practices and enhance public safety (Bielefeldt, 2018).

> *"Generally, when we do a design, one portion anyway covers within the guidelines Most of the things get covered. Because we cannot do a design that will collapse next month". E*

Participant E acknowledges that following design standards effectively mitigates safety risks. His company's value statements, as shown on its website, reflect a strong commitment to safeguarding staff, constructors, and end-users. Darshana (2017) affirms that integrating safety into corporate policies is crucial for promoting health and safety.

> *"We should maintain our proper engineering practices. All these engineering practices are made standards for public safety, right?" F*

Participant F further elaborated on his approach to clients and the public as follows.

> *"Normally, we advise what to do and it governs through the standards. If it is not to the standards, we do not do that" F*

Participant F consistently rejects clients who request services that violate engineering standards, even when offered extra payment, prioritizing ethics over profit. Similarly, Participant D stresses the importance of safety and adherence to standards, stating, *"I always think, prefer, and advise our young engineers to follow proper procedures and standards to ensure the safety of the public."* Entrepreneurial firms, like his, must ensure employees follow the same ethical standards as their leaders. Participant B also highlights legal compliance, noting, *"What I observe is that we have to work according to the applicable legal regulations in the country. If you are doing construction work, you should follow the ICTAD regulations and so on."* For B, legal and engineering standards are equally essential for ethical practice.

> *"We have obtained ISO 9001, ISO 14001, and 19000, all these three ISO certifications and OSHA. So we must comply with the terms and conditions of all these things. So within the organisation, we must maintain health, safety, and environmental conditions." S*

Many firms pursue ISO and OSHA certifications to foster a safe environment for employees and clients. For Sri Lankan entrepreneurial engineers, these certifications are vital tools for upholding public health, safety, and welfare. Memon (2020) notes that OSHA guidelines have a stronger influence on safety culture and performance than ISO standards. By adhering to such frameworks, entrepreneurial engineers aim to engage with the community more responsibly.

2. Introducing only safe products to the society

Some entrepreneurs prioritize profit over public safety during the start-up phase (Khin et al., 2017). In contrast, most participants emphasized avoiding harmful products. Participant B stated, *"As a professional engineer, I always consider the safe use of the chemical products I supply for different projects."* Although industrial chemicals carry inherent risks, he ensures public safety through proper guidelines and thorough testing.

> *"If what we are going to do is not good for society, Right? So, those things we do not do. So whatever may be a big loss for us, we still say 'No'. That we maintain." E*

Participant E and his team are committed to avoiding products or designs that may endanger public safety. In cybersecurity, Participant G explained, *"We do not just take that technology and try to push it here. We adapt it based on the capabilities and technologies of Sri Lankan companies."* Recognizing that foreign technologies may not suit the local context, his team customizes solutions to reduce potential harm. He added, *"We show them, we prove them the capability of the product or service we are going to offer them,"* ensuring clients are fully informed and satisfied before implementation.

> *"In our field, actually, we cannot introduce harmful things. That is why I said earlier also, and we have to think about wastewater reuse. That is why we use high-tech things." H*

Engineers must avoid introducing harmful products, but effectiveness remains crucial. Participant H promotes high-tech machinery for wastewater treatment, valuing its superior performance. These narratives collectively demonstrate the participants' commitment to delivering safe, purpose-driven solutions to the community.

> *"We are assisting them (Electrical switch manufacturers) with...... University to improve the materials that local small-scale manufacturers use." T*

Some entrepreneurial engineers voluntarily contribute to public safety beyond their own products. Participant T, for example, supports small-scale manufacturers in improving the quality of electrical switches, using his expertise to enhance community welfare. Though unrelated to his business, these efforts reflect corporate social responsibility (CSR), which can strengthen a firm's image and long-term competitiveness (Newman et al., 2020).

3. Convincing People & Industry

To uphold the first clause, entrepreneurial engineers must assure clients and the public of their products' safety. A key challenge identified in this study is the general lack of awareness about safe practices. Consequently, these engineers actively educate clients on the true nature and safety of their offerings. According to Vesilind & Gunn (2011), educating the clients and the general public on safety matters can be considered as a part of the ethical responsibilities of professional engineers.

> *"By publishing some hand bills, leaflets, paper ads and announcements, I gave the knowledge of structural and electrical plans of housing and their values to the general public." K*

Participant K observed that structural, electrical, and plumbing plans were once uncommon in his area. Aiming to enhance public safety, he educated the community on their importance through leaflets, ads, and announcements. While this initiative expanded his business, K maintains that his primary goal is public health, safety, and welfare. Hamzah et al. (2011) also emphasize the need for accurate and consistent plans, as they directly affect construction quality and safety.

> *"We actively participate in improving the health and safety activities of government and professional bodies. So, we spend a lot of time helping a commission to do their job." T*

Participant T's main motivation for engaging in these projects is to enhance electrical safety using his expertise. Despite his demanding schedule, he dedicates time to these non-profitable tasks, which have earned him public recognition. As Littunen (2000) notes, such experiences contribute to continuous learning and skill development among entrepreneurs.

> *"We always try to convince the clients, convince them to reuse water because we make them aware of the importance of water." H*

Water pollution poses serious risks to public health and safety (Okokpujie et al., 2019). Participant H, an entrepreneurial engineer in water treatment, actively encourages industries to adopt wastewater treatment systems. While this may expand his business, his efforts also promote environmental responsibility. According to him, many major Sri Lankan industries now use advanced treatment plants, benefiting the public through safer waste discharge

By convincing industry stakeholders, some entrepreneurial engineers aim to comply with the first clause. While these activities may sometimes lead to additional business opportunities, they do not always result in that. Nevertheless, these efforts undeniably contribute to enhancing the health, safety, and welfare of the public.

5.2.3 Consequences of the 1st clause

Entrepreneurial engineers who participated in in-depth interviews have experienced both positive and negative implications on their entrepreneurial behavior and performance because of adhering to the first clause in their business activities.

5.2.3.1 Positive consequences

Adhering to the first clause is not only a professional obligation but also a strategic commercial advantage for entrepreneurial engineers. Key positive outcomes that emerged from the in-depth interviews include "increased long-term business opportunities and client recommendations."

1. Increased long-term business opportunities

Entrepreneurial engineers have received more business opportunities in long term basis as a result of adherence to the clause 1.

> *"My company would have lost more than twenty-five projects because I did not agree with certain terms and conditions laid by certain clients and I don't mind it. I would have got more number of projects from very decent clients knowing that my company and I are like this and decided to work with me." R*

While loss of business can deter profit-driven entrepreneurs (Guardia, 2016), Participant R has ultimately gained more work through his commitment to public health, safety, and welfare. Though he could have accepted unethical projects for profit, he chose not to. Unlike the typical risk-seeking entrepreneur (Kerr et al., 2017), R prioritizes ethical conduct over financial gain.

> *"You cannot sacrifice your engineering basics or safety like that just because you are a businessman. Then your business will be a failure. If your engineering is not successful, your business will fail." O*

Participant O places safety above all other operations. Entrepreneurs in engineering must not disregard ethical practices. Based on participants' experiences, those who uphold ethics are more likely to achieve long-term success. As Covin & Slevin (1991) note, ethical conduct contributes to stronger performance, including revenue growth, market share, customer satisfaction, and profitability..

2. Getting recommendations from clients

Prioritizing the safety of their products, designs, and services has led to an enhanced industry reputation for their companies over time.

> *"After giving the structural plans, we cannot stay in our offices. Sometimes, clients do not even like to pay for site visits. But, free of charge, I visited the sites. Because we have to think about responsibility and safety of the building. But in the final stage, clients understand the value of our visits. Finally, they recommend us to others." K*

Clients initially trust entrepreneurial engineers, and over time, public recognition of their safe solutions enhances their reputation and opens new business opportunities. According to social proof theory, client endorsements strongly influence others' decisions, encouraging entrepreneurs to innovate and take calculated risks (Cialdini, 2001). Network effects further amplify this impact, as client support broadens their reach, fosters collaboration, and increases market adoption. (Katz & Shapiro, 1985).

5.2.3.2 Negative consequences

The major negative consequences revealed in the extensive interviews include "losing business opportunities in the short term and incurring additional expenses."

1. Losing business opportunities in short term

Participants often require external expertise to expand into new fields while ensuring public health, safety, and welfare. This limits rapid diversification and short-term gains such as profit and market growth. Participant E declines projects that violate standards, sacrificing lucrative opportunities. Similarly, Participant J stated, *"Sometimes we are offered millions of dollars to do those kinds of unethical things, but we never accept."* Although adherence to the first ethical clause may limit short-term rewards, it fosters long-term business success through sustained ethical practice.

> *"Some of my clients are asking to reduce certain things, I very clearly say that I am following standards, you cannot change this. If you want to do something, go and find another person." M*

Participant M, an entrepreneurial consultant engineer, frequently receives requests from clients to violate engineering standards for various reasons while offering consulting services. As someone deeply committed to ethics, M rejects these requests without hesitation and advises clients to seek another service provider to meet their needs. This, however, represents a lost business opportunity for an entrepreneurial engineer like M. Participant R exhibits the same conduct.

> *"For example, my company would have lost more than twenty-five projects as I did not agree for certain terms and conditions laid by certain clients and I don't mind it." R*

Participant R also declined unethical client requests, resulting in lost business opportunities. While entrepreneurs are typically opportunity-driven (Chell, 2008), prioritizing public health, safety, and welfare can challenge this mindset. Despite the financial impact, R remains unconcerned. Studies in the U.S. suggest that ethical firms often achieve stronger financial performance (Verschoor, 1998). Ahmad & Ramayah (2012) argue that ethics, social responsibility, and profitability can coexist, encouraging firms of all sizes to uphold responsible business practices.

2. Incurring additional expenses

The ethical code influences entrepreneurial engineers' risk-taking, making them more cautious about introducing untested innovations. Despite this, Participant J, known for his creative designs, continues to pursue such opportunities. However, he accepts the risk of client compensation if these novel solutions cause harm.

> *"If something goes wrong or if in case one of our innovative things does not work, it will be bad; actually, it is a risk. Risk in the sense that we have to take the responsibility. Sometimes will have to pay the client back." J*

To ensure product quality and reliability, entrepreneurial engineers like B and D conduct extensive testing and collaborate only with field experts. While these practices are time-consuming and costly, requiring higher salaries, they help avoid repeated societal failures. According to McClelland's needs theory (Chepurenko, 2015), their achievement motivation is both supported and challenged by the trade-off between ethical rigor and reduced profit margins.

> *"All these safety arrangements are made for the benefit of everybody. By incurring these additional expenses, we managed to keep the sites and offices operational even during lockdown periods." S*

During the Covid-19 period, participant S invested additional resources to safeguard the health, safety, and welfare of his construction staff. While profit is essential (Wu et al., 2007), neglecting workplace safety can disrupt operations and impact earnings. However, prioritizing safety does not always reduce profits. As Tiba et al. (2018) argue, business success extends beyond financial gain. This was evident in Participant S's firm, which continued thriving post-pandemic, unlike many others that ceased operations (Vithana et al., 2020).

> *"While these are really simple things, implementation requires a lot of courage, persuasion, and sometimes getting the blame as well. So, that is our contribution to health and safety in the broad sense." N*

Entrepreneurial engineers need courage and persuasive effort to prioritize public health, safety, and welfare, even when facing societal criticism. Though such actions may temporarily affect their reputation, they are ultimately justified. Once the public acknowledges the benefits, these efforts enhance both the dignity of the engineers and the success of their businesses.

5.3 Clause 2: Upholding and enhancing honor, integrity and dignity of the engineering profession

5.3.1 Introduction

Engineering is a highly prestigious profession grounded in honor, integrity, and dignity. Professional associations, such as the NSPE, expect engineers to act in ways that preserve the field's reputation, treating everyone with fairness and respect. Upholding these ethical standards is essential to maintain the collective prestige of the engineering community, as lapses can damage the profession's image (Starrett et al., 2017). Aristotle's view, that integrity is developed through consistent moral behavior, supports the need for engineers to adhere strictly to ethical principles. Similarly, dignity is seen not only as a recognition of intrinsic worth and excellence (Dierksmeier, 2015), but also, as summarized by Hicks & Waddock (2016), "Dignity is an inherent value, worth, and vulnerability, a core aspect of humanity that anyone is born with." Thus, preserving and enhancing the dignity of the engineering profession requires all members to consistently uphold and promote these ethical values, as any breach can undermine the entire industry's reputation.

Entrepreneurial engineers, driven by an entrepreneurial mindset, often act differently from traditional employee engineers by prioritizing their own interests. This section examines how Sri Lankan entrepreneurial engineers uphold and enhance the honor, integrity, and dignity of the profession while pursuing business goals. Professional codes of conduct serve as ethical guides, reminding them of their duty to protect the profession's reputation and promote human welfare (American Society of Civil Engineers, 2020).

5.3.2 How is the 2^{nd} clause applied?

Based on a grounded theory analysis, five major categories of strategies have been identified that help entrepreneurial engineers comply with the second clause of the IESL code of ethics. They are: adhere to ethical guidelines, become an expert, deliver a proper service, avoid bribery & corruption, and adhere to professional behaviour.

5.3.2.1 Adhering to ethics

Most participants noted that adherence to ethical principles supports compliance with the second clause. They emphasized that aligning with engineering ethics and broader societal norms helps preserve and elevate the profession's honor, integrity, and dignity. According to Starrett et al. (2017), adhering to the respective code of ethics is essential for any engineer to achieve the 2^{nd} clause.

> *"Anyone running an ethical business in the industry will have no problem maintaining honour, integrity, and dignity as an honorable human being. Therefore, being an entrepreneurial engineer is no exception." Q*

He emphasized that ethical business practices enhance the honor, integrity, and dignity of the engineering profession. For entrepreneurial engineers, ethical standards must apply equally to business operations, as unethical conduct by leaders compromises the profession's standing (Hicks & Waddock, 2016).

> *"We have improved our business and we don't need to break engineering ethics and go beyond this limit, right? That is why we are at this stage." J*

Participant J believes ethical conduct is fully compatible with achieving business goals. Now a successful entrepreneur, he refuses to compromise his reputation or engineering values. Although not yet a mature entrepreneur, his prior ethical work as an employee earned him industry respect. Drawing on that foundation, he rejects unethical opportunities. As Ma et al. (2020) suggest, ethics may challenge early venture survival but support long-term growth. Similarly, Verschoor (1998) affirms ethics enhances performance in mature firms. Participant J's commitment has undoubtedly elevated the profession's dignity.

> *"I have been absolutely honest. I am sincere for the work. I have been honest with my work and I have been very loyal. Therefore, this is the ethical practice." R*

Participant R, known for his honesty and business acumen, leads a large construction firm with strong ethical principles, earning national recognition. His actions, observed beyond the interview, include mentoring younger engineers and promoting ethical practices. Participant S, also a senior engineer, affirmed this view: *"To be in business for eight decades, integrity and trust are two vital elements for me."* His long-term success reflects how ethical conduct sustains business longevity (Ma et al., 2020). Despite operating in a competitive industry, both participants have upheld ethics, reinforcing the profession's honor and dignity.

Truthfulness has supported adherence to the second clause. Participant G stated, *"So everyone trusts us because we never give them wrong information and we never lie to* *them."* As both an engineer and entrepreneur, he prioritizes honesty, gaining client trust in the competitive cybersecurity sector. While profit is often seen as the primary business goal, such thinking can create a conflict between ethical responsibility and financial gain (Radoilska, 2008). Participant G's ethical commitment has enhanced his reputation, secured long-term client relationships, and positioned him as a trusted professional in Sri Lanka.

> *'There are many aspects to honour, integrity & dignity of the profession. It is based on honesty, good quality work, personal attention to the client, and ethical. Our clients know that we will never recommend anything bad to them." T*

Participant T outlined several practices that have strengthened the honor, integrity, and dignity of the engineering profession. His clients regard him as a trusted and proven solution provider. By prioritizing the public interest in project design and execution, as required by engineering ethics (*The Institution of Engineers Sri Lanka - Code of Ethics*, 2013), his conduct exemplifies how entrepreneurial engineers can elevate the profession's standing.

Entrepreneurs are interested in achieving more profits as their final aim is to earn money for the sustenance in the business world (De Vries, 2007). Although entrepreneurial engineers are driven by this goal, there are instances where they refuse to fulfill client requests that violate ethical standards. Moreover, carrying out such requests would diminish the honor, integrity, and dignity of the engineering profession.

> *"Before doing anything else, it is our responsibility to check whether it has harmful effects on people or if we are jeopardising the safety of people. If the client asks us to do something against those rules, we don't do it." J*

Furthermore, he explained that accepting such requests solely for financial gain would negatively impact their reputation. Engaging in unethical business practices undoubtedly tarnishes both personal and professional reputations (Quapp & Holschemacher, 2016). Due to the professional status they uphold as engineers, every entrepreneurial engineer interviewed was reluctant to engage in unethical practices, which naturally led them to adhere to the 2nd clause.

5.3.2.2 Becoming an expert in the field

Most participants lead technology-driven ventures, leveraging their expertise to generate income while upholding the profession's values. Their specialized knowledge enables them to deliver high-quality services with minimal errors, thereby enhancing the honor, integrity, and dignity of engineering (Makings & Barnard, 2019). This dual role supports both their business reputation and the profession's advancement.

> *"We must provide our service in the area we know very well. Therefore, we must have sufficient confidence in that area. We should be aware of our subject area properly. Otherwise, it affects the engineering profession". M*

Participant M emphasized that entrepreneurial consulting engineers must have expertise in their fields. Without the required competence, they risk offering inaccurate advice, which can harm both their personal reputation and the profession's integrity. Thus, field-specific expertise is essential for entrepreneurial engineers.

> *"If we incorrectly estimate the quantity of water, the client can build the power plant. Then, there will be not enough electricity generation and then not enough income for the client. We will not hesitate to make a negative recommendation to our clients". T*

Participant T stressed the consequences of inaccurate advice in the power sector. As a consultant, recommending a mini hydropower project in a location with inadequate water flow could lead to client losses and damage trust. Entrepreneurial engineers must offer truthful, objective guidance, transparently presenting all relevant information. While financial incentives may tempt biased recommendations, such actions ultimately harm clients and the public.

> *"We are working at a level of expert advising capacity. So, you must know in which area you are an expert and then provide services only within the specialised area." D*

Participant D, a consultant entrepreneurial engineer, emphasized the role of expertise in sustaining ethical practice. As knowledge workers, they apply specialized knowledge to generate income, aligning with the Knowledge-Based View (KBV), which sees knowledge as evolving through use (Muzam, 2022). Participants consistently update their expertise to deliver high-quality services, gaining societal recognition and contributing to the honor, integrity, and dignity of the engineering profession.

> *"I am a civil engineer, and my experience is completely based on roads and bridges. So, then I have selected a field, only focused on this particular area". W*

Participant W stressed the importance of working strictly within one's area of expertise to ensure accuracy and reduce errors. This approach not only improves client outcomes but also safeguards public health and safety (Vesilind & Gunn, 2011). Practicing within one's technical specialization is essential in engineering (Starrett et al., 2017). By reliably delivering safe services, entrepreneurial engineers gain client trust and reinforce the profession's honor, integrity, and dignity, aligning with the second clause.

5.3.2.3 Delivering a proper product/services

Delivering quality service to clients helps safeguard the honor, integrity, and dignity of the engineering profession while enhancing the entrepreneur's reputation and societal recognition (Payne & Joyner, 2006). Positive reputation and recognition endorse the 2nd clause.

> *"Our clients know that we will not compromise with the quality of the final product / service to earn profits. This is the reason why clients come to us.". S*

Despite being profit-driven, participant S prioritizes product and service quality, consistently exceeding client expectations. His ethical conduct and dedication to excellence have earned lasting client loyalty and driven his business success.

> *"We ensure the quality of our work. So we make sure that they are of the highest quality, so we don't send any report to the client without being reviewed internally many times" T.*

Participant T ensures service quality through thorough internal reviews, resulting in error-free outcomes that build client trust and recognition. His consistent reliability enhances the honor, integrity, and dignity of the engineering profession.

> *"I believe we have to do the correct project pricing and we have to submit our price right? I don't mind whether the job is coming or not most of the time." N*

While price reductions can attract more customers, they are not always sustainable or profitable (De Toni et al., 2017). Participants noted that in engineering, low-cost offerings often compromise quality and fail to meet standards, causing client dissatisfaction. This, in turn, can damage the engineer's reputation and the profession's dignity. To uphold the second clause, it is essential to maintain quality while offering services at a fair and reasonable price.

> *"We are not going behind money. For most of the projects we are not doing like that. We have dropped certain projects that are not good for our name". M*

Participant M declined several projects to protect his reputation, despite the resulting loss of income. He values long-term credibility over short-term profit. As Pakura & Rudeloff (2020) note, reputation shapes stakeholder perceptions and reflects a firm's core values. Most participants avoided the passion-profit dilemma, as their passion aligned with engineering ethics. Johansson & Frisk (2018) explain this dilemma arises when entrepreneurial passion clashes with ethical conduct, which was not the case here.

5.3.2.4 Avoiding bribery and corruption

Bribery and corruption are widely practised in developing countries rather than developed countries (Ufere et al., 2012). Individuals with high moral commitment were identified as less likely to engage in corrupt behaviours and prefer foregoing financial benefits (Tanner et al., 2022). However, involvement in bribery and corruptive behaviour tarnishes the good name of any person (Di Zheng et al., 2021). Entrepreneurial engineers recognize that avoiding bribery and corruption is essential to upholding the honor, integrity, and dignity of the engineering profession.

The participants stated that they do not engage in bribery in any form as professional engineers. However, a few mentioned that they had to offer bribes to other parties in order to get certain work done.

> *"Our company culture doesn't accept bribery as a way of doing business. We believe in doing what is right. When you do the right thing, why should you give a bribe?" S*

Participant S believes that ethical business practices eliminate the need for bribery. As a prominent business owner, he has fostered a company culture rooted in integrity. Tanner et al. (2022) suggest that individuals with strong moral convictions are less likely to engage in corruption, an idea reflected in participant S's strict adherence to ethical principles and rejection of bribery in all business dealings.

> *"In my twenty-seven years of working history, I have never taken a commission or any other else money and I will not keep any employee if they do that." M*

Entrepreneurial engineers must ensure that bribery is not tolerated within their organizations, as such actions can damage both the company's and their own professional reputations. Di Zheng et al. (2021) emphasize that preventing corruption starts with individual responsibility. Participant M exemplifies this by not only rejecting bribery himself but also ensuring his employees do the same.

> *"I never take any commission from any person. That is my policy from the beginning. But I will give commission to others, but I never take commission" L*

Participant L differs from others by occasionally offering bribes to overcome systemic barriers, despite not accepting them. In industries rife with corruption (Herath et al., 2019), some entrepreneurial engineers resort to such practices. While bribery may yield short-term advantages, like fostering informal networks, it compromises ethical standing and long-term sustainability (Budak & Rajh, 2014; de Jong et al., 2012). In contrast, participants R and S, involved in large-scale public projects, have strictly avoided bribery, maintaining that such conduct is incompatible with professional integrity and damaging to the reputation of an engineer (Locatelli et al., 2017).

5.3.2.5 Adhering to professional behavior

As formally qualified professionals, entrepreneurial engineers are expected to maintain high standards of conduct. Society does not tolerate unprofessional or uninformed behavior from engineers (Whitbeck, 2011). Research confirms that professionalism and ethics enhance performance in the field (Syahputri et al., 2017). Participants acknowledged that upholding professional conduct is essential to fulfilling the second clause.

> *"I started my firm ………. Consultants after becoming a chartered engineer. We are bound to work as chartered engineers, professional engineers. Throughout the career, we maintain it." D*

Participant D, who manages a structural engineering consultancy, views adherence to professional standards as essential to his role. Like other fields, engineering is governed by a professional body and a code of ethics that guide ethical conduct and uphold the integrity of the profession (Syahputri et al., 2017).

> *"When we work with others, I always try to work as a professional. That is one of my marketing tool. If not, just say if we work as a 'Basunnehe', we cannot continue in the field. That is why I believe I am sixteen years in the field." H*

Participant H uses his professional engineering status to support his business success, recognizing that professionalism garners respect in Sri Lankan culture. His qualifications and conduct have attracted clients and reinforced the distinction between professional and lay behavior. By aligning his business practices with engineering standards, he has contributed to the profession's honor, integrity, and dignity. Participant L shared a similar view.

> *"Some engineers deviate from the profession. Sometimes they work as a contractor, sometimes they work as a 'Basunnehe' or something like that, not as an engineer actually. They create a big problem. After that, the client is unhappy." L*

The narratives reveal that some Sri Lankan engineers have deviated from professional norms, behaving more like laypersons and harming the profession's reputation. In contrast, Participant L maintains self-discipline to uphold professional standards. A strong corporate reputation, as observed, fosters client trust and positively influences business performance (Ewing et al., 1999).

> *"I always introduce myself as 'I am an engineer.' So, I always make sure that the label also really represents my ethics. I look at things, I observe things, I analyse things as an engineer.". V*

Participant V, who leads a diversified business group, continues to identify as an engineer, recognizing that this professional identity opens valuable opportunities. By consistently adhering to engineering standards, he earns client trust and secures additional business. The honor and integrity linked to the engineering profession serve as a distinct advantage for entrepreneurial engineers in the broader business landscape (Kohlert et al., 2013).

> *"To maintain the reputation, you have to have some guts to maintain your standards. So, people respect you as a consultant as an engineer" E*

Participant E acknowledges the challenge of upholding professional standards while running a business in a developing country like Sri Lanka (Senadheera et al. 2014). Nevertheless, he believes consistent ethical conduct earns public respect. His experience demonstrates how adhering to standards enhances the honor, integrity, and dignity of the engineering profession.

5.3.3 Consequences of the 2nd clause

Adhering to the second clause has had both positive and negative effects on the behavior and performance of the entrepreneurial engineers in this study. While some view them as businesspeople and others as engineers, their ethical duty compels them to uphold high professional standards. A strong reputation as a business owner or CEO enhances perceptions of capability, reliability, and integrity, making them more appealing to clients and partners (Weng & Chen, 2017).

5.3.3.1 Positive consequences

Adhering to the 2nd clause has enhanced the reputation and recognition of entrepreneurial engineers, leading to positive consequences for their professional standing and success in the industry.

1. Enhanced reputation & recognition

Enhanced reputation and recognition are the key positive consequences experienced by entrepreneurial engineers for the success of their entrepreneurial journey.

> *"I had built my image in the industry to a certain level. And even before actually lot of people in the industry knew about me to a certain level. So I really didn't have a problem. As a start-up business, I had enough jobs." M*

Participant M stated that his efforts to uphold the honor, integrity, and dignity of the engineering profession have earned him a strong reputation, which was key to securing early and ongoing business opportunities. Ethical conduct enhances opportunity-seeking behavior among entrepreneurs. Weng & Chen (2017) note that a CEO's reputation is enduring and influential across industries, especially when a company lacks broader corporate recognition. In consulting firms, CEO reputation and expertise are critical, as clients often base decisions on these factors. As Ewing et al. (1999) highlight, a strong reputation improves project marketability and boosts firm performance by attracting more clients.

> *"This firm was started by a group of engineers as an engineering firm. So there is a good respect comes with that. It had created confidence in the clients' mind." G*

Participant G, now CEO of a firm founded by senior engineers, preserved its trusted reputation. In Sri Lanka, engineers are highly respected, aiding client attraction. Recognition, a driver of entrepreneurial behavior (Littunen, 2000), reinforces ethical conduct aligned with Clause 2.

> *"Our clients know that we will not compromise the quality of the final product/ service to earn profits. This is the reason why clients come to us. Hence, they should not be disappointed or made to regret their decision to come to us. As such, professional service takes precedence. Such decisions may not always be in the best interest in the commercial aspect. We believe that a satisfied client is a good advertising / marketing tool. In the long run, the benefits accrued will be much greater than the financial loss suffered from such decisions." S*

This narrative highlights the long-term benefits of adhering to the second clause through professional conduct. Although Participant S faced short-term profit losses, he believes ethical practices build reputation and client trust, ultimately driving growth in large-scale projects. While marketing is vital for business success (Goldberg, 2006), satisfied clients often promote firms through referrals. As participant S noted, *"If we behave like any other businessman, there is no reason for a client to choose us for their project or service. Being a professional adds value to our service."* He emphasized that professionalism and engineering ethics are key to long-term sustainability, with technical expertise boosting entrepreneurial confidence (Chell, 2008).

5.3.3.2 Negative consequences

Adherence to the 2nd clause has also led to some negative consequences for the entrepreneurial engineers. However, most of them have accepted these drawbacks rather than compromising their ethical practices. The most notable negative consequences include the loss of business opportunities and increased costs.

1. Loss of business opportunities

Most participants experience a short-term loss of business opportunities when they attempt to comply with the 2nd clause. In many cases, they decline business opportunities that would compromise the honor, integrity, and dignity of the engineering profession.

> *"My company would have lost more than twenty-five projects as I did not agree to certain terms and conditions laid by certain clients. I don't mind it. I would have got a similar number of projects from very decent clients knowing that my company and myself are like this and decided to work with me." R*

Participant R, a large-scale construction company owner in Sri Lanka, has declined numerous business opportunities to uphold professional and ethical standards. Though he could have gained financially by accepting all client proposals, he prioritized his and his firm's reputation over short-term profits. This ethical stance has earned him a loyal client base and reinforced long-term business sustainability. However, like many entrepreneurial engineers, he has faced short-term losses due to his commitment to ethical practices.

> *"We are always try to prevent the bribery. We do not do that. It is our policy. If someone asks for a bribe, we stop the business." H*

Participant H adopts a similar stance, rejecting projects that involve unethical practices, even at the cost of profit. His firm strictly avoids bribery and maintains stable financial performance without compromising ethical standards. By prioritizing integrity, he preserves both personal and professional reputation. As McAdam & Cunningham (2019) note, autonomy is a key entrepreneurial trait. By refusing corrupt projects, entrepreneurial engineers like H enhance their independence, making values-driven decisions that uphold the honor, integrity, and dignity of the profession while reinforcing their business credibility

2. Incurring additional expenses

Analysis has revealed that trying to be ethical is not free of charge. Most of the entrepreneurial engineers sense the same for the 2nd clause. They had to spend more for some incidents of their earnings to maintain the reputation of the engineering profession. The narrative evidence stated by participant S exemplified this negative consequence.

> *"Often, we are held responsible even for decisions taken by others, despite our timely warnings against such decisions. To maintain goodwill, we are made to correct certain mistakes of other professionals, incurring unrecoverable cost for no fault of ours." S*

As a knowledgeable professional in the construction sector, Participant S felt compelled to correct mistakes made by other stakeholders, even though it was not his responsibility. In some cases, he covered the costs using his firm's funds, which negatively impacted profit margins. While entrepreneurs are typically profit-driven, Participant S prioritized the integrity of the engineering profession over financial gain (Kerr et al., 2017). Hence, profit-orientated behaviour is getting affected with the 2nd clause.

> *"Profits and losses are there. We cannot expect to make profits every time. Even sometimes, I had to use my personal, private money to pay the salaries of my employees to keep them with me." U*

While entrepreneurs aim to generate profit, losses are sometimes inevitable. During the Covid-19 pandemic, Participant U faced a severe downturn but chose to pay employee salaries from his personal funds. He felt a moral obligation, especially toward the engineers under his leadership, to support them through hardship. As a senior engineer, his actions reflect the qualities of an ideal entrepreneurial leader who prioritizes employee welfare in times of crisis (Chell, 2008).

The analysis revealed that applying the second clause of the code of ethics often has a short-term negative impact on the financial performance of entrepreneurial firms led by engineers.

5.4 Clause 3: Sustainability and environmental protection

5.4.1 Introduction

The 3rd clause of the IESL code of ethics emphasises the ethical obligations that are placed on professional engineers with regard to protecting the environment and maintaining a sustainable environment. The clause says "Engineers shall be committed to the need for sustainable management of the planet's resources and seek to minimize adverse environmental impacts of their engineering works or applications of technology so as to protect both present and future generations" (*The Institution of Engineers Sri Lanka - Code of Ethics*, 2013). Similar to the IESL, the ECSL and other worldwide professional engineering societies, such as FEANI, ASCE, and IEEE, have established guidelines for engineers on sustainability and environmental protection. (*Engineering Council Sri Lanka - ECSL Code of Ethics*, 2020; Hansen & Zenobia, 2011; Manion, 2002).

The concept of sustainability has been in use for nearly 300 years, initially in areas like forestry. In recent decades, it has gained prominence as a global policy concern. The Brundtland Commission (1987) defined sustainable development as "meeting the needs of the present without compromising the ability of future generations to meet their own needs" (Herkert, 1998).

Sustainability comprises three interdependent components: environmental, economic, and societal (Mensah, 2019). While often viewed narrowly as environmental, true sustainability requires balancing all three to ensure the well-being of future generations. Environmental sustainability urges businesses to minimize harm and emissions, while Khalili (2011) notes that sustainable business practices aim to enhance long-term social and shareholder value by reducing resource use and environmental impact. As global priorities shift toward sustainable living, entrepreneurs increasingly adopt eco-conscious policies in their operations.

The study revealed that entrepreneurial engineers demonstrated a strong commitment to environmental sustainability, influenced by both the engineering code of ethics and global sustainability trends. Grounded theory analysis identified three major categories: personal commitment to sustainability, sustainable practices adopted, and the resulting consequences of those practices.

5.4.2 Commitment to sustainability

All participants expressed strong commitment to sustainability, particularly in environmental policy. As MDs/CEOs, their personal dedication is essential for fostering a sustainability-focused culture within their firms (Spence et al., 2011). Personal commitment is more likely when individuals believe in the value of their goals. Thus, understanding how entrepreneurial engineers perceive sustainability is crucial. Participant A expressed this perspective as follows:

> *"The supreme profit of any project is the health of mankind and the rest of the ecosystem. Because when the rest of the ecosystem is not healthy, humanity automatically dies. But unfortunately, human beings assume that they are supreme and can control the rest of nature." A*

Although participant A did not explicitly use the term "sustainability," he emphasized the link between environmental health and human survival, while criticizing unsustainable human behaviors. Many professionals act contrary to accepted sustainability norms (Manion, 2002), and those who view nature as controllable often resist sustainable practices. Perception, therefore, plays a crucial role in achieving sustainability goals. Deeply passionate about environmental issues, Participant A has led numerous environmentally focused engineering projects through his business, as also reflected on his company's website.

> *"From our side now, the industry is a bit developed compared to those days, because now we also think about the green aspects, sustainability, and reducing waste." E*

Participant E noted a significant rise in engineers' awareness of sustainability, attributing it to its integration into engineering education, ethics codes, and institutional policies (Qureshi & Nawab, 2013). Given engineers' potential to impact sustainability, this increased understanding signals a promising step toward a greener future.

As owner-managers, entrepreneurial engineers have significant autonomy in decision-making and must personally embody the goals they set for their firms. Personal commitment is essential to achieving sustainability. Participant D stated, *"I always make sure it is sustainable. Even if you see my office, you can see how sustainable it is. Even this building, this is a sustainable building."* This reflects his genuine dedication to sustainable living. During the researcher's visit, it was evident that D's office design incorporates natural lighting, ventilation, and greenery to reduce environmental impact. His visible commitment increases the likelihood of influencing employees and clients to adopt sustainable practices.

According to social learning theory, individuals adopt behaviors by observing others, suggesting that society can learn sustainability by emulating participant D's practices (Bandura, 1969). Although his company website does not highlight sustainability due to its structural engineering focus, D remarked, *"Sustainability can occur in two ways. In your own life, you have to be a good example, that is number one. Then in practice.*" Eccles et al. (2012) emphasize that employee engagement is key to advancing sustainable practices. Participant D's pragmatic, example-driven approach fosters employee involvement and supports long-term environmental goals within his firm.

Participant J believes environmental responsibility should be integrated into all areas of engineering. He leverages business opportunities by offering innovative, eco-friendly technical services through his company.

> *"We are the people who should take the lead in preserving this world while becoming more and more aware. Therefore, without considering these actual cost benefits, I decided to change our style and convert the entire office to become more and more green." J*

Participant J reinforces his commitment to environmental sustainability by offering green engineering services, prominently featured on his company's website. His work reflects the ethical duty of engineers to promote sustainability across sectors (Rahimifard & Clegg, 2008). Prioritizing ecological responsibility over profit, he integrates green design principles into his entrepreneurial projects. His company's mission statement affirms a clear dedication to building a greener, sustainable future.

5.4.3 How is the 3rd clause applied?

Sustainability cannot be achieved without the full support of engineering practitioners (Qureshi & Nawab, 2013), making the role of entrepreneurial engineers particularly crucial. Unlike employed engineers, they possess greater autonomy to implement diverse eco-friendly policies within their firms, benefiting both clients and society. With the United Nations's 17 Sustainable Development Goals set for 2030, entrepreneurial engineers have numerous opportunities to advance sustainability (*THE 17 GOALS*, 2020). Interview findings indicate that Sri Lankan entrepreneurial engineers adopt diverse practices to fulfill the third clause of the code of ethics. Key categories include adhering to guidelines, protecting the environment, applying sustainable concepts, and promoting sustainability within society.

5.4.3.1 Working according to the guidelines

In today's highly industrialized world, governing bodies have introduced legal and ethical regulations to mitigate environmental degradation (Dean & McMullen, 2007). These guidelines apply to the general public and targeted groups, including business professionals.

> *"We have our own Environmental Protection Standards and Manual. Copies are available at sites and the responsibility of implementing the procedures is entrusted to the environment and safety officer at the site, under the supervision of the project manager." S*

Participant S has implemented strong environmental protection standards in his company, delegating responsibilities to environmental and safety officers under project manager supervision. Such measures are vital for large-scale firms due to their significant environmental impact. Gast et al. (2017) emphasize that sustainable entrepreneurship depends on adherence to societal environmental guidelines. Participant O supports this view, stating:

> *"Definitely, we follow all environmental standards. We always maintain them. For example, for most of these power plants and all projects, we have to do environmental impact assessment (EIA) reports to start the project." O*

In Sri Lanka, preparing Environmental Impact Assessment (EIA) reports is mandatory to minimize negative project impacts (Athapaththu et al., 2016). Participant O strictly follows this legal requirement, guiding his firm to meet ethical obligations in environmental sustainability. Such regulations help balance economic and environmental development, serving as policy guidance for responsible resource use. While they may raise business costs, they also drive technological innovation (Zhu & Zhao, 2022).

> *"We are working on projects in the electricity sector that have higher impact on society and the environment. Even if renewable energy projects have environmental impacts. So basically we ensure that it will abide by local regulations and if there are any requirements to abide by the international regulations, we will make sure that we will do all studies, analysis and advices to clients to abide by the regulations." T*

Participant T acknowledges that even renewable energy projects can have environmental and social impacts (Sebestyén, 2021). To mitigate these, he ensures compliance with both local and international environmental guidelines when advising clients. His primary motivation is to guide clients responsibly and encourage them to prioritize environmental sustainability in technical projects.

5.4.3.2 Protecting the environment

Since engineers are more environmental-conscious professionals in society (Manion, 2002), they can initiate a wide range of activities to protect the environment. Entrepreneurial engineers can do much more to protect the environment, as they have much more freedom to make decisions than typical employee engineers (Storey, 2017). Participants have taken numerous initiatives to protect the environment in the hope of uplifting environmental sustainability.

1. Energy saving

Entrepreneurial engineers have prioritized minimizing energy waste in their firms and clients' operations, recognizing the challenges of energy generation in Sri Lanka. Participant S stated, *"Where ever possible, we try to use solar-powered lighting*" reflecting a commitment to sustainable energy use. Solar power, a low-impact renewable source, is widely used in industrial settings but has limitations in reliability (Tong et al., 2021). Still, adopting such sources supports global resource sustainability.

"Before moving to this office, I had another office in another place, it was a four-story building. The electricity bill was about two thousand rupees. The reason was due to energy savings. We only used laptops and have taken many energy saving steps." D

Although some engineers did not adopt renewable energy sources, they focused on reducing energy consumption. Participant D, a structural consultant, minimized electricity use by encouraging employees to adopt energy-saving practices, such as using laptops instead of desktops known to consume less power (Menezes et al., 2014). Additionally, switching off unused devices is another common strategy, contributing to the sustainable management of global resources.

"From our end, actually, whatever it is that we can do to save energy is doing. And also the AC and everything, if not used, we definitely make sure to turn off in our office." G

In many Sri Lankan offices, electrical equipment like ACs and fans are often left on unnecessarily. Participant G, however, promotes energy-saving by ensuring such equipment is turned off when not in use. As a leader, his actions set an example for staff, encouraging them to adopt similar habits. According to the theory of social construction of followership, followers influence and shape leadership through interaction (Ford & Harding, 2015). With collective support, G's leadership has effectively reduced energy waste within his firm, contributing to both sustainability and business success.

2. Planting trees

Engineering projects, even on a small scale, often cause environmental disturbances, such as the removal of trees and vegetation, which disrupts ecological balance. However, several entrepreneurial engineers have adopted the mindset of replanting vegetation to restore what was damaged and mitigate environmental impact.

"Once we remove a tree, we have to plant a new tree. So that is the main principle. So we will have to attend this one" W

Replanting vegetation has become a widespread practice among companies that damage natural ecosystems during operations. Environmental regulations have further encouraged this trend. However, some entrepreneurial engineers engage in replanting not merely due to compliance, but out of genuine concern for environmental protection and sustainability. The following narrative illustrates this commitment.

"We planted trees whenever we dredge streams, we never touch, I asked them (employees) to never touch streams, trees on the river banks like 'Vetakeiyya' (Pandanus). These are the trees that act as the safety lining of the river banks." A

Natural vegetation is vital for ecological balance, yet often damaged by engineering projects. Participant A, an environmentally conscious construction engineer, goes beyond his formal duties by protecting vegetation such as pandanus along canals to prevent soil erosion. He also regularly plants trees around project sites and highlights these efforts on his company website. In contrast to many businesspeople who overlook environmental responsibilities, Participant A stands out as a commendable example of ethical and sustainable practice.

> *"I am always looking for existing trees. I don't want to trim them even. If you are always in a compacted area, you will have a stressful mind, no? So with trees, you can create a friendly, cool, calm, and quiet environment."* K

Participant K, an entrepreneurial engineer in housing, aims to balance clients' desire for stress-free living with environmental preservation. He promotes planting and maintaining trees around homes, believing this natural setting enhances mental well-being and contributes to long-term personal and professional success. According to Hoogendoorn et al. (2019), participants A, K, & W can be considered sustainable entrepreneurs. Socially and environmentally conscious individuals play a crucial role by addressing complex issues often neglected by others. These entrepreneurial engineers focus not only on business success but also on environmental responsibility. Research shows that many sustainability pioneers operate in niche markets where sustainability is central to their business model (Schaltegger et al., 2016). The previous narratives illustrate how tree planting is used as a strategy to support environmental protection and comply with the third clause of the code of ethics.

3. Disposing the waste properly

Waste disposal has become an major environmental concern worldwide (Farooq et al., 2022). Several participants reported waste disposal challenges at their construction and manufacturing sites. As sustainability-oriented engineers, they recognize the need to manage industrial waste responsibly. Participant S, a large-scale contractor, stated, *"Debris and waste are collected and disposed in an environmentally friendly manner at designated locations, including waste / polluted water."* With multiple active sites, he ensures proper waste practices across all operations. Construction debris, if mismanaged, can cause severe and lasting environmental harm, posing risks to nearby residents and workers (Sapuay, 2016). Reuse and recycling, as noted by Dachowski & Kostrzewa (2016), are effective waste management strategies. While waste reduction is not always feasible, entrepreneurial engineers in Sri Lanka adopt reuse and recycling to mitigate environmental impact during their operations (Dutta & Sengupta, 2014).

> *"We had to demolish two hotels to construct one hotel there. All the demolished materials were reused. It was not taken out of the site. We crushed it and reused."* D

Engineers have the capacity to develop innovative methods for recycling waste, reflecting their ethical and social responsibility to the public (Fleddermann, 2012). For example, Engineer D demonstrated this commitment by constructing a new hotel using salvaged materials from an old one, thereby conserving natural resources for future generations and promoting sustainable resource management.

> *"We do whatever the things we can. We reuse the discarded one-sided printouts again for printing purposes. Such printouts are used for internal communications like things."* G

The widespread use of A4 and photocopy paper in offices contributes significantly to deforestation and paper waste. Participant G adopts simple yet impactful waste-reduction practices that can be replicated by anyone. Participant Q, who owns a large-scale manufacturing firm producing high-tech electrical components, also shared his approach to managing industrial waste, as revealed in the following interview excerpt.

> *"All our productions are environmentally friendly productions with very little waste. Most of the solid metal waste that we sell for recycling. A very small amount of liquid waste is treated before being released into the drainage." Q*

Participant Q noted that his manufacturing process generates minimal waste due to environmentally friendly strategies. Solid metal waste is sold to external recyclers, while wastewater is treated onsite before being discharged. These practices reflect his ethical commitment to environmental sustainability. Similarly, participant H, a consultant engineer, advises clients to treat and reuse wastewater, promoting responsible industrial practices.

> *"We always try to convince the clients, convince them to reuse water because we make them aware of the importance of water and how difficult it is to get the water." H*

Participant Q noted that his manufacturing process generates minimal waste due to environmentally friendly strategies. Solid metal waste is sold to external recyclers, while wastewater is treated onsite before being discharged. These practices reflect his ethical commitment to environmental sustainability. Similarly, Participant H, a consultant engineer, advises clients to treat and reuse wastewater, promoting responsible industrial practices.

While many entrepreneurial engineers expressed satisfaction with their environmental efforts, some, like participant P, voiced concern. He stated, His concern is valid, as no engineering project is entirely free from environmental impact. Environmental consequences are often an unavoidable part of engineering work.

5.4.3.3 Prioritizing sustainability

Most entrepreneurial engineers have taken into account the concept of sustainability in their business operations. Nevertheless, engineers have tremendous opportunities to create new products, technologies, tools, and methods, which can make the sustainable concepts into reality in this competitive world (Rahimifard & Clegg, 2008). Engineers are the people who can recognise the importance of the sustainable concepts for the betterment of the world.

Participant K stated, "I respect sustainability actually." While some business owners still overlook sustainability, its growing societal importance makes it difficult to ignore (Ye et al., 2020). When leadership neglects sustainability, employees often follow suit. Thus, Participant K's commitment to sustainability is both commendable and influential.

> *Do you know what my motto is? That is, 'Engineering leadership for sustainable development'. Whatever project I do, I always look at those three circles. When these three circles are only crossed, a sustainable product is produced.". V*

Participant V, who owns a diverse business conglomerate, prioritizes sustainability under the motto "Engineering leadership for sustainable development." His company websites reflect this commitment, confirming the accuracy of his interview claims. Unlike those who focus solely on environmental aspects, Participant V embraces all three dimensions of sustainability—environmental, economic, and social. As Andersén et al. (2020) note, sustainability-oriented CEOs tend to integrate these elements across their firms. Participant V clearly fulfills his ethical responsibility as a professional engineering leader committed to sustainable development.

> *I understood that the passion we were moving forward was wrong. The truth is that we have only one earth and it is our responsibility to preserve this as much as possible." J*

Participant J believes engineers, as knowledgeable citizens, should lead global sustainability efforts. His professional experience has shown that current practices are inadequate for safeguarding future generations, prompting him to prioritize sustainability. As Dutta & Sengupta (2014) note, sustaining a healthy environment requires collective action from individuals, organizations, businesses, and governments. Aware of this, Participant J conducts his entrepreneurial work with the understanding that we have only one planet. Engineers, under public and legal scrutiny, bear significant responsibility in advancing sustainable solutions (Okokpujie et al., 2019).

Entrepreneurial engineers working as designers and consultants integrate sustainable design concepts wherever feasible. Participant U stated, *"When we do these designs, we always go for sustainable and economically cheap methods."* Globally, there is a shift toward green, eco-friendly designs to support sustainable development. These approaches aim to reduce carbon emissions and conserve energy and water (Wang & Adeli, 2014) and are now applied across both construction and manufacturing sectors. Participant O also emphasized similar practices.

> *"You have to keep increasing your productivity and we also we must try to adapt to the new technologies available that are suitable for the environment." O*

Not all industrial technologies are environmentally friendly, which is why Participant O advocates for integrating eco-friendly technologies into entrepreneurial firms to reduce environmental impact. Gao et al. (2022) emphasize that green design and manufacturing strategies are essential for addressing current resource and environmental challenges, forming a foundation for national sustainability. However, some entrepreneurial engineers find it difficult to apply sustainable concepts in every design or consultancy project.

> *'So, whenever possible, we apply them (sustainable concepts) to the designs. Not directly, as this is sustainable or does not depend on the requirements of the clients". E*

The inclusion of sustainable features in designs or consultancy work often depends on client preferences. When clients resist due to cost or lack of awareness, entrepreneurial engineers may be unable to prioritize sustainability, despite their intentions (Lotfi et al., 2018). However, engineers running manufacturing firms have greater autonomy to adopt sustainable practices, as they control both decision-making and execution (Wang et al., 2022).

Sustainability can also be prioritised by optimising designs, which is another major technique adopted by entrepreneurs in Sri Lanka.

> *"Since we are engaged in consultancy work, you know that we are optimising designs. For example, if we are doing a design and if we are saving some materials, then that will be something saved for the whole world, right?" F*

Taking a proactive approach is of the utmost importance in any engineering work, as it is extremely challenging to make changes to things once they have been completed. Later changes may also cost time, money, and resources (Herkert, 1998). Including the sustainable aspects of the design itself while optimising is very important. As designers and problem solvers, engineers are professionals who can do it cleverly more than anybody else in society. Participant D also highlighted the same as *"In the design also you have to take many precautions, steps could be taken to ensure sustainability."* Participant P also optimises his engineering designs considering environmental sustainability.

The above evidences have revealed that the majority of entrepreneurial engineers who participated in this research study have attempted to give priority to sustainable concepts and practices.

5.4.3.4 Nurturing sustainability in society

Promoting sustainability within society is another approach to fulfilling the 3rd clause. While entrepreneurial engineers possess advanced knowledge on sustainability, public awareness is equally vital, as societal buy-in influences the adoption of sustainable practices. Without adequate understanding, clients may resist integrating these features into designs (Wang et al., 2022). Entrepreneurial engineers address this by persuading clients and actively promoting sustainability in their engagements.

1. Convincing clients

Several participants have tried to convince their clients to adopt sustainable practices. It was revealed that, based on their persuasive talks, many clients have adopted some sustainable practices.

> *"We always try to convince the clients, convince them to reuse the water. Because we are aware of the importance of water and how difficult it is to get water and those things." H*

Participant H, recognizing the value of wastewater treatment and reuse, actively persuades clients and industrial professionals to install treatment systems in their factories. While this benefits Participant H's firm, it also advances environmental sustainability. As Gast et al. (2017) emphasize, entrepreneurial firms should support societal and community development alongside business. Promoting sustainable options among clients fosters broader environmental responsibility.

> *"It is like this. If we are doing buildings, we always promote our clients to obtain green certificates." N*

Given their substantial environmental impact, buildings are central to sustainability efforts. Participant N, a consultant engineer, encourages clients to obtain green building certifications. Han (2019) notes that green buildings offer multiple benefits, including 30–80% energy savings, reduced material use, lower waste, and less traffic. These buildings also enhance surrounding aesthetics and improve residents' physical and mental well-being. Certification ensures compliance with specific criteria, thereby mitigating major environmental impacts (Han, 2019).

> *"We will assist the client in the process of getting approvals for sustainable matters. Say, if we are doing a feasibility study for a wind power plant, so we do a noise modelling to make sure that the closest house will be within the approved noise level." T*

Participant T supports clients in executing power generation projects sustainably, demonstrating his expertise in the field. Mensah (2019), drawing on systems theory, emphasizes that sustainable development requires collective action and broad stakeholder participation. The narratives show that entrepreneurial engineers maintain a positive stance on sustainability and actively persuade clients to adopt such practices. These efforts benefit both clients and engineers while aligning with the third clause's ethical obligations.

2. Promoting sustainability

Entrepreneurial engineers in Sri Lanka actively promote sustainability for society's collective benefit. As Mensah (2019) stresses, societal support is essential to realizing sustainability goals. Selected narratives led to the development of the focused code promoting sustainability as a strategy aligned with the third clause's objectives.

> *"So I am promoting timber as a construction material. Because the embodied energy in timber is almost nothing when compared to steel, aluminium and concrete is very high." D*

While modern efforts aim to replace timber with steel, aluminum, and concrete to protect forests, timber remains the most eco-friendly material. Steel, aluminum, and concrete require far more energy to produce (Griggs, 2013). Kumar et al. (2022) identify wood as the most sustainable building material due to its renewability. However, overuse leads to deforestation, prompting some experts to endorse nonrenewable alternatives to address this growing concern.

> *"So I started, I advised the workers to start the dredging operation from the downstream area and come. And not to cut any trees on the banks, right? That is how we planted the trees 'Kumbuk. Karanda, Mee' all along the stream banks as a strengthening". A*

Human activities negatively affect riverbanks and floodplains, where natural vegetation plays a crucial role in stabilizing banks and preventing erosion. Symmank et al. (2020) highlight the ecological importance of flora along canal banks. After dredging, replanting is vital. Participant A stressed the selection of appropriate tree species and has actively guided communities on protecting irrigation system banks, thus advancing sustainability efforts.

"As a further step, very special care can be taken with the environment and if somebody is willing to obtain a green building certification from a green building council in Sri Lanka, I think we always promote that type of thing." N

Participant N promotes green building by helping clients secure approvals from relevant authorities. As Han (2019) notes, such practices support sustainable resource management. Despite global and local resistance due to high upfront costs (Pandithawatta et al., 2020), trained professionals can guide clients toward adoption. For entrepreneurial engineers like Participant N, this offers a promising avenue to reduce the construction sector's environmental footprint.

3. Criticising unsustainable practices in society

Not everyone in society has adopted sustainable practices. There are people in society who follow unsustainable practices (Xing et al., 2022). As entrepreneurial engineers in Sri Lanka, many participants have criticised the existing unsustainable practices in society.

"I worked for the development of a few African countries focussing on fishing. Their resources were really taken care by Europeans. Because the Europeans had huge vessels and they were doing all kinds of fishing methods and they really took all the resources." V

Participant V extended his entrepreneurial ventures internationally, emphasizing that sustainability entails responsible resource use, not just environmental protection. In response to overfishing by European nations in African waters, he and his firm supported impoverished villagers in Africa's fishing sector, aiming to improve livelihoods through sustainable practices.

"In the Maldives, you cannot ask permission to cut a tree, unless you get permission to grow a tree. But at the end of cutting a tree, we are not planting a new tree. These are very simple things for sustainability." R

Participant V expanded his business abroad, recognizing that sustainability includes responsible resource use beyond environmental protection. Disturbed by European overfishing in African waters, he partnered with his firm to assist impoverished villagers in several African nations, enhancing their livelihoods through sustainable fishing practices.

"Now you know that we are involved in projects and we ruin the environment. But in the reports we write, this has no impact on the environment. That is the real situation." P

Participant P observed that official project reports often misrepresent environmental impacts, with real consequences emerging during implementation. He criticized this practice as harmful to sustainability. Schreck (2015) found that industry competition can compromise transparency in managerial reporting. Though not systematically studied in Sri Lanka, such rivalry may contribute to concealing environmental risks..

"We are working on projects in the electricity sector, and it is one of the sectors that has a great impact on society and the environment. Even renewable energy projects have environmental impacts. The truth is not that renewable energy projects are all clean right?" T

Participant T explains that while all renewable energy projects cause some environmental harm, their impact is significantly lower than that of non-renewable sources such as coal and diesel. Projects like hydropower and wind energy offer a more sustainable alternative (Owusu & Asumadu-Sarkodie, 2016). Participant T emphasizes that no renewable energy project is completely free from environmental impact. However, compared to coal and diesel power plants, renewable sources like hydropower and wind energy result in substantially lower environmental harm.

5.4.4 Environmental policy

An analysis of published data from corporate websites and other sources for entrepreneurial firms led by engineers in Sri Lanka further underscores their strong orientation toward sustainability. Most of the policy statements featured on their websites emphasize concepts such as sustainability, sustainable economic development, environmental protection, environmentally friendly technologies, and a greener, sustainable future. The triangulation of interview findings with secondary data available on these corporate websites confirms their commitment to sustainability. As professionals shaped by the principles of engineering ethics, these engineers are motivated to think and act beyond regulatory compliance, striving to achieve broader sustainability goals. According to Andersén et al. (2020), an organization's actions reflect the values and cognitive foundations of top management, which can influence both constructive and destructive behaviors. This concept is further explained through the theory of upper echelons. By demonstrating a commitment to sustainability in their business operations and incorporating it into corporate policy statements, entrepreneurial engineers can inspire their employees to adopt sustainable practices and principles.

5.4.5 Consequences of the 3rd clause

Accomplishing environmental sustainability as an ethical obligation has created mixed forms of implications on entrepreneurial behaviour and performance of entrepreneurial engineers.

5.4.5.1 Positive consequences

Adhering to the third clause has led to positive outcomes, including resource savings and an increase in customer base.

1. Resource savings

Sustainable practices by entrepreneurial engineers have contributed to resource and cost savings. For example, reusing one-sided printed A4 sheets during Sri Lanka's economic crisis helped offset rising stationery costs, improving the firm's financial performance through simple yet effective measures.

> *"When taking printouts for office use, if it is printed on one side of the paper for some requirement, then we will put them in the printer to use the other side for internal documentation, not actually for the customers. Like that we are reusing. We definitely make sure to switch off the ACs and lights when not in use." G*

The reuse of stationery is a common practice in Participant G's entrepreneurial firm. When quantified, this behavior has contributed to both environmental sustainability and the firm's financial performance, albeit on a smaller scale. Similarly, Participant D shared his past experience of reusing waste materials, which resulted in significant cost savings for his firm.

> *"We had to demolish two hotels to construct one hotel. All the demolished materials were reused. It was not taken from the site. We crushed it and reused it. It saved us some money for us" D*

Sapuay (2016) notes that when project owners prioritize sustainability, other stakeholders often follow. For Participant D, financial stability is vital. Despite risks, he confidently used crushed materials for hotel construction, relying on his structural engineering expertise. This reflects the entrepreneurial balance between profit and ethical commitment, encouraging innovation in line with the IESL code's third clause.

> *"We have some allowable limits for material wastage. As an example, in this project, for ABC (Aggregate Base Course), the allowable limit is ten percent. they (employees) have to adjust the work. If they could achieve, they are encouraging by giving some incentives for the month." W*

Participant W introduced internal regulations to reduce material waste, aligning with the third clause's focus on resource conservation. He noted that this practice improved firm profitability, with part of the gains shared as employee incentives. These efforts reflect his entrepreneurial leadership and autonomy (Wang et al., 2022). Aligned with the resource-based view (Barney, 1991), such practices enhance resource efficiency and support sustainable competitive advantage.

2. More customers

The sustainability orientation of several entrepreneurial firms has contributed to attracting more customers and increasing market share. As the current generation is more aware of the importance of sustainability, they are motivated to incorporate sustainable practices into their projects.

> *"Many come to us for design work or something related to sustainability. Since we are on that motto, clients are coming for us." V*

Sustainability-oriented clients seek consulting services from the firm due to its strong emphasis on sustainability, as reflected in its policy statements. This focus has attracted a significant number of clients, thereby increasing the firm's market share. The firm's commitment to sustainability has become a key competitive advantage.

5.4.5.2 Negative consequences

Interview transcripts highlighted several adverse consequences stemming from efforts to implement sustainability as an ethical obligation. The main challenges identified included higher costs, reduced profit margins, client resistance to sustainability concepts, and regulatory challenges.

1. Higher costs

Several participants emphasized the need to bear additional and higher costs to implement sustainable concepts. Entrepreneurs remain highly concerned about expenses and closely monitor their income and expenditure (Wu et al., 2007).

> *"Some clients are not ready to accept at a cost. Sustainability is not free. I mean you have to do certain investments for that and then certain clients are not ready to do that, and so we explain it to the client. It mostly depends on the client's decision". M*

Participant M consistently endeavors to persuade clients to embrace sustainable concepts. However, many clients resist these suggestions due to the substantial costs, which demand higher investments. As a result, entrepreneurial engineers encounter difficulties in incorporating sustainability into their projects. Despite their dedicated efforts to advocate for sustainability, the ultimate decision lies with the clients.

> *"But this green technology is little expensive. But it should be done. Our company always takes care of all these things". R*

While green technology is environmentally friendly and promotes sustainability, its implementation involves significant costs (Gast et al., 2017). The higher costs associated with these practices have deterred both clients and entrepreneurial engineers from adopting this approach. As mentioned earlier, Participant R integrates green technological concepts into his projects despite the expense. In follow-up discussions, Participant R highlighted that investing in green technologies offers limited financial returns for his company, with a notably low return on investment in financial services. Nevertheless, he and his team continue to absorb the higher costs, understanding the crucial importance of sustainable concepts for global well-being as responsible engineers.

2. Work on low profit margins

As identified previously, many clients hesitated to adopt sustainable concepts due to the higher cost, although entrepreneurial engineers recommend them. Because of that, entrepreneurial engineers who work as consultants lose some clients. It negatively affects the market share of the company. Therefore, several entrepreneurial engineers have reduced some percentage of their professional fees to motivate clients to adopt sustainable approaches.

> *"We generally promote green building certifications. Most of the time, we will reduce our consulting fee for green consultancy works to motivate the client to get the certifications. Sometimes, although we motivate, some clients are not adopting them due to cost and other restrictions". N*

The narrative shows that entrepreneurial engineers often accept low profit margins to promote sustainability. High implementation costs and client reluctance pose major challenges in Sri Lanka. Unlike start-up struggles noted by Hoogendoorn et al. (2019), Sri Lankan entrepreneurs risk losing business due to sustainability choices. As Han (2019) suggests, government incentives could encourage both entrepreneurs and clients to adopt greener solutions.

The profit margin is the measure of the profitability of the business. Although working in low profit margins may not impact the overall profitability of the firm, they lose a considerable amount of income with this practice. As Bork & Sidak (2013) stated, profit margins are not correspondent to market share. A firm can sustain in low profit margin with a higher market share.

> *"Because they try to do something for the environment. Especially in high-tech installations, we are going with a little margin." H*

The intention is the same as the participant N. Both reduce the margin to promote sustainable solutions. As achievement-orientated personnel, it is rare for entrepreneurs to intentionally go for low profit margins to adhere to ethics. Furthermore, the participants suffered a loss of business opportunities due to the participants because of trying to incorporate sustainability approaches to the clients.

> *"Profit in a sense, we have self-satisfaction. The very first profit is that and financially actually that converting into sustainability does not make much profit to us. But we are doing the correct thing by doing a minimum disturbance to the earth." J*

Self-satisfaction is the critical factor that motivates engineer J to carry out his activities in a sustainable manner. Most of the time, sustainability is one of the engineers' significant obligations towards society (Fleddermann, 2012). Hence, participant J is experiencing self-satisfaction with his work. However, sustainability approaches do not give considerable profits for his firm. In SMEs, the implementation of sustainable practices is not financially viable (Rajapaksha & Rajapakse, 2017). Confirming that, participant J gets lesser profits.

3. Unwillingness of clients to accept sustainability

Due to the higher costs associated with sustainability projects and other practical challenges, entrepreneurial engineers working as consultants face difficulties in securing projects from clients who are unwilling to adopt sustainability practices. While some entrepreneurial engineers, such as Participant V, have attracted more clients, as highlighted in Section 5.4.5.1, the majority struggle to find customers due to the high costs of sustainability approaches. Participant E emphasized the challenge of obtaining projects from clients when he insists on incorporating sustainable practices, as they are costly to implement.

> *"It's a bit difficult because we are not the only consultant in the building industry. So what clients try to do is try to meet their own requirements by moving to another consultant, neglecting our sustainability recommendations." E*

Sustainability orientation can lead to lost business opportunities, impacting entrepreneurial engineers who depend solely on their income. When clients lack awareness or face financial constraints, they often ignore sustainability advice, as noted by Participant E. Consequently, clients turn to professionals who meet their demands, causing sustainability-focused engineers to lose projects and face setbacks in business performance.

> *"Through our green department, we do a lot of innovative things. But those are, I mean innovative in the sense that we are having a kind of risk whether public will accept this kind of solutions or not. With that, actually we always take the risk". J*

Participant J's firm established a 'Green Department' to drive sustainability innovations. Despite limited public awareness and adoption risks, his team continues to pursue sustainable solutions. This risk-taking reflects Engineer J's entrepreneurial mindset. However, profit generation is uncertain due to unpredictable market responses in a complex business environment.

The evidence indicates that compliance with the third clause may not always enhance business performance. Nonetheless, such efforts underscore the entrepreneurial engineers' commitment to innovation and risk-taking.

5.5 Clause 4: Building reputation on merit and fair competition

5.5.1 Introduction

The fourth clause of the IESL code of ethics says 'Engineers shall build their reputation on merit and shall not compete unfairly' (*The Institution of Engineers Sri Lanka - Code of Ethics*, 2013). It is also a clause available in the code of ethics of other international professional bodies of engineers (American Society of Civil Engineers, 2020). In summary, it means relying on one's own achievement rather than doing unethical things to improve their reputation as professional engineers (Starrett et al., 2017). The engineering profession continues to strongly advocate for a qualification-based selection of engineers for projects. Professional reputation, in this context, refers to the collective perceptions of an engineer's professional habits, including strengths, weaknesses, technical competence, and demeanor. Clause 4 mandates that engineers build their reputations solely based on their work. By consistently producing solid results, engineers can cultivate a strong reputation. Unlike lawyers, engineers cannot rely on billboards, television ads, or similar techniques to promote their image; instead, they must depend entirely on the quality of their work and results (Starrett et al., 2017). In the context of fair competition, engineers must avoid embellishing their credentials, falsifying their resumes, or misrepresenting their level or range of expertise.

Unfair competition can jeopardize the safety, health, and welfare of the public. The more unqualified or underqualified engineers involved in a project, the greater the risk posed to the public (Vesilind & Gunn, 2011). In contrast, in the field of entrepreneurship, competition arises among entrepreneurs within the same industry, as they strive to capitalize on business opportunities (Urbig et al., 2020). The literature provides several examples where entrepreneurs have not relied solely on their own work and have competed unethically with their competitors. A grounded theory-based study focused on this area revealed several strategies for adhering to the 4th clause. However, the study also uncovered numerous instances where entrepreneurial engineers had to violate the 4th clause during their entrepreneurial journey.

5.5.2 How is the 4th clause applied?

The major strategies identified in this study fall under the categories of delivering proper services, adhering to ethics, refraining from bribery, avoiding unethical competition, charging standard fees, and marketing appropriately. In the following section, each strategy is discussed with supporting narrative evidence from the interview transcripts. However, contradictory evidence that does not align with the identified categories is also included to reflect the existing reality in this context.

5.5.2.1 Discharging a proper service

Most participants emphasized that delivering proper services is crucial for earning a merit-based reputation and maintaining fair competition. This aligns with professional ethical standards, which widely mandate engineers to serve clients competently, as reflected in most engineering codes of ethics.

Participant N stated that an engineer's or firm's reputation depends on consistently delivering quality products and services. Sustaining this reputation demands continuous commitment, as a single instance of proper service is inadequate.

> *"I think if an engineer did a good job for the client and if he continues that practice, then the reputation will come." N*

Participant S shared a similar view, noting that client trust leads to repeated business. He emphasized that compromising quality for profit is unwise, and in a profit-oriented world, few firms remain committed to consistently delivering high-quality service without causing client dissatisfaction.

> *"Our clients know that we will not compromise with the quality of the final product / service to earn profits. This is the reason why clients come to us." S*

Participant S echoed this view, stating that client trust, once established, ensures continued business. He cautioned against sacrificing quality for profit, noting that in today's profit-driven environment, few firms remain genuinely committed to consistently meeting client expectations without causing frustration (McGinn, 2022).

> *"We ensure the quality of our work. We do not send any report to the client without being reviewed internally many times. We definitely wanted to protect our name as a company that works within the law, advises the client within the law and performs good quality engineering studies." T.*

Participant T demonstrates diligence by thoroughly reviewing work before client delivery. As a business owner, he prioritizes legal compliance and high service standards, recognizing that a strong reputation is vital for business success. Ewing et al. (1999) noted that clients favor reputable consulting firms and that adherence to legal standards, as seen in Participant T's practice, enhances credibility.

Entrepreneurial engineers must also fully own their work to build client trust, an essential trait for sustained success (Williamson et al., 2013). Accepting responsibility is a crucial characteristic for entrepreneurs seeking business success.

> *"We have to make sure that we are responsible for whatever the things we do and also we have to make sure like we are a kind of respected organization". G*
>
> *"To maintain the reputation, you have to have some guts to maintain your standards. So, then people respect you as a consultant, as an engineer or whomever". D*

Entrepreneurial engineers gain public respect through standardized, ethical behavior, though Participant D notes that maintaining such standards is increasingly difficult amid current socio-economic challenges. Upholding ethics requires perseverance and strong commitment. Zahra & Wright (2016) identified five pillars supporting entrepreneurship's evolving social role; the first emphasizes contributions to improving quality of life and human progress. By delivering quality service, entrepreneurial engineers fulfill this role, thereby enhancing both societal well-being and their firm's reputation while promoting fair market competition.

5.5.2.2 Adhering to ethics

Entrepreneurial engineers in this study emphasized that ethical conduct is essential for establishing a merit-based reputation and ensuring fair competition. Ethical practices deter misconduct and serve the broader interests of clients and society. Research also indicates that entrepreneurial ethics significantly mediate the link between responsible management and organizational reputation (Ramos-González et al., 2017). The same is confirmed by the entrepreneurial engineers who participated in this study.

> *"So I am a person having policies. Under any circumstances, during my 43 years of experience after graduation, I never practised that kind of malpractices, I still adhere to these policies and this code of ethics". U*

Participant U enjoys widespread recognition and a strong reputation in the industry as both an ethical engineer and a businessperson, as confirmed during the interview. He prioritizes the code of ethics and avoids engaging in malpractice as an entrepreneurial engineer. Similarly, Participant O emphasized that, despite the prevalence of corrupt practices in society, he does not support such actions.

> *"There is corruption all over the place. That is a big problem in Sri Lanka, because most places are highly corrupted, and if you do not support corruption, you will not be able to start the project. But we still manage without getting caught by them." O*

According to Senadheera (2019a) and Marsoof (1999), Sri Lankan entrepreneurs often encounter systemic corruption and may feel pressured to conform in order to remain competitive. However, Participant O exemplifies integrity by rejecting such practices while achieving legitimate business success and substantial income. Upholding ethical standards not only earns client respect and positive recognition but also strengthens the firm's reputation and promotes fair industry competition.

"One day if I do something not ethical for you as a help, you might feel that I am good. But you know in your mind that I am a person that you can tell a story and make a small waiver. So that is not a good feeling for me from you. So, we try not to do it." E

Participant E avoids unethical behavior, even in minor situations, recognizing its potential to harm both his personal and firm's reputation. His commitment reflects a broader pattern among participants, who exhibit strong ethical awareness. Many are respected within Sri Lanka's industrial sector for upholding high ethical standards. As noted by Weng & Chen (2017), the reputation of the CEO plays a more significant role in the value of a firm than the corporate reputation itself.

5.5.2.3 Refraining from bribery

Bribery is a major form of corruptive practice that is heavily penetrate in today's competitive socio-economic environment (Wiramidjaja, 2011). This study has identified 'refraining from bribery" as a way to achieve the 4th clause. Most of the entrepreneurial engineers have tried their best to avoid bribery-related incidents.

"Bribery could only take place for people who work for the purpose of making money and not with the purpose of rendering a service. I have no experience with bribery, as from the inception we never used bribery as a tool to get our things done." P

Participant P maintains a strict stance against bribery, rejecting it as a means of gaining advantage or profit. Despite the profit-driven nature of entrepreneurship, he refuses to compromise ethical principles. Individuals with strong ethical values, like Participant P, are less likely to be targeted for unethical dealings. Similarly, Participant S also upholds this ethical commitment by avoiding bribery in business practices.

"Our company's culture doesn't accept bribery as a way of doing business. We believe in doing what is right. When you do the right thing, why should you give a bribe?" S

As the owner or manager of a company, an entrepreneurial engineer can foster an ethical culture within the organization. When everyone values ethics and consistently does the right thing, a culture is developed that does not tolerate bribery (Wientjes et al., 2011). Moreover, ethical decisions and actions should not require the backing of bribes from other parties to be effective or justifiable.

"We have not had any such requirement or bribery request in any of our work in Sri Lanka or abroad. We have not had experience of a request or anything like that." T

Bribery is widespread in many developing countries, not just Sri Lanka. However, Participant T reported never facing such situations, even across multiple countries. Participants S and T agreed that ethical business conduct reduces exposure to bribery, as corrupt actors are hesitant to approach principled leaders. Budak & Rajh (2014) found that corruption hampers business growth, and factors such as societal values and risk of punishment influence its prevalence. Nonetheless, entrepreneurs with strong ethics reject bribery regardless of perceived ease or opportunity.

Although Participants P, S, and T emphasized that they did not encounter any bribery-related issues in their entrepreneurial journey, a few other participants shared their experiences, as outlined below:

"When the whole system is corrupted, we cannot protect only the engineering field, right?' It is also like this. We cannot isolate the engineering field and keep it in a good way. It is common in engineering fields. We need to offer bribes. Sometimes we need to offer something. People are expecting. Without that, we cannot move forward, right?" J

Participant J acknowledged the widespread nature of bribery in Sri Lanka's engineering sector, which often pressures professionals into unethical practices. Herath et al. (2019) emphasized the endemic nature of corruption in the country and the need for systematic research to uncover its root causes. Despite ethical guidelines like the IESL code, Participant J has occasionally resorted to bribery to sustain operations. Participant W similarly confirmed the perceived necessity of bribery in specific contexts.

"In most of the sectors, I am also doing that. That means not hundred percent bribery. Let us say that at the end of the year, we are giving some presents, just like hampers. With the current situation, I think we will have to do this one. So they also expect this from us." W

Participant W provides hampers to stakeholders as a goodwill gesture, though literature (Harris et al., 2009a) identifies such actions as a form of bribery. Social norms often normalize these practices, even among entrepreneurs. While some view gift-giving as harmless, it can be strategically used to gain favor, inadvertently fostering unethical behavior and contributing to unfair competition.

Bribery is professionally unacceptable and can lead to legal consequences for both parties involved (Di Zheng et al., 2021). It damages reputations and creates unfair market competition. Interviewed entrepreneurs acknowledged that bribery violates the IESL code of ethics. While some maintain ethical standards due to business stability, others admit to offering bribes under competitive pressure. Notably, none reported accepting bribes from clients.

5.5.2.4 Avoiding the competition

Entrepreneurs face intense competition throughout their journey, and many are willing to engage in this competition to secure their position in the market (Shane, 2009). The literature provides ample evidence that some entrepreneurs engage in unethical behaviors to achieve success in a competitive environment (Tacke et al., 2023). Entrepreneurial engineers are obligated to follow the IESL code of ethics, which prohibits unfair competition. Most interviewees reported intentionally avoiding intense rivalry, choosing instead to sustain their businesses through strategies that minimize direct competition. Participant V exemplifies this approach:

"We always compete ethically. It is like this. If you are in ethics, you are given less opportunities. But you have to compromise, you have to accept it. You can't go out of your philosophy, no? your boundaries no? (Pause). We always be within our boundaries whether we have or not works." V

Participant V competes ethically, guided by personal moral values, even at the cost of lost business opportunities. He avoids ventures that conflict with his ethical standards. Contemporary entrepreneurs increasingly prioritize balancing profitability with ethical responsibility (Ma et al., 2020b). Through ethical frameworks and long-term value creation, as noted by Qureshi (2023), entrepreneurs like Participant V promote sustainable and responsible business practices.

> *"We are small; we are not that aggressive, not very well known. But people in the field know us. So we have the advantage that we provide a particular type of service that other engineering or energy consulting companies do not provide in Sri Lanka" T*

Participant T employs a unique strategy to avoid unethical competition by operating the only consulting firm in Sri Lanka within a specific niche. This market monopoly eliminates the need for rivalry, allowing him to uphold ethical standards. His experience highlights the strategic advantage of specializing in a distinct discipline, enabling entrepreneurial engineers to maintain integrity while securing market stability.

> *"We always update our knowledge without competing with others in an unfair way. We have to get the knowledge and market it" K*

Entrepreneurs often rely on their expertise to generate income, functioning as knowledge workers who offer consulting services (Goldberg, 2006; Wiramidjaja, 2011). Participant K stresses the importance of staying updated in one's field, noting that advanced knowledge and professional credentials enhance credibility and business prospects without relying on unethical tactics. As people prefer reputed experts (Storey, 2017), he actively builds his qualifications to attract clients ethically.

> *"We also look at areas where there is less competition and work on diversification. Irrigation is one such area where we have already ventured into." S*

Participant S avoids intense competition by diversifying into less contested sectors, such as irrigation. This strategic shift reflects an ethical approach to business sustainability. While entrepreneurs are often driven by achievement and competitiveness (Chell, 2008), unethical means of success are unjustifiable (Navarathne, 2017). Participant S exemplifies how entrepreneurial engineers can uphold ethical standards while avoiding unfair competition.

5.5.2.5 Charging standard fees

The IESL Code of Ethics mandates that engineers charge standard fees, avoiding rates that are excessively high or low. Participants affirmed adherence to this guideline, recognizing it as essential for ensuring fair competition and aligning with Clause 4.

> *"The number one is that you have to charge a reasonable fee, you should not charge less. No one is charging more. But you should not charge less" D*

Participant D emphasized that professional fees must be fair to both clients and engineers, preventing devaluation of engineering services. While price reduction is a common entrepreneurial tactic (Jayasekara et al., 2020), it is deemed unethical in engineering. Undercutting fees fosters unfair competition, challenges consulting firms, and shifts clients toward lower-cost providers, exacerbating concerns within the industry.

"I always say 'If you throw peanuts, you get monkeys.' That means if someone is giving lower-value solutions, there should be a reason for giving them for a lower value. It may be a copy-and-paste or just not a solution, or the problem is simple." V

Participant V noted that significantly underpriced services often compromise quality, as proper design and execution demand substantial time and expertise. This is especially true for engineering consulting projects, which require customized solutions, stakeholder collaboration, technical proficiency, on-site involvement, and strict compliance with safety and performance standards (Sheikh & Lim, 2012). Considering these factors, offering services or products at lower prices while maintaining quality is highly challenging. Engineers must ensure that the solutions they provide are both reliable and safe, meeting client requirements (van Gelder et al., 2021). This principle holds true for entrepreneurial engineers as well.

"We quote for reasonable. Otherwise, we cannot deliver the reasonable product. So, we always try to explain the mmm client. Don't try to go cheaper, you will get a cheap product. I generally explain it" C

Low pricing in consulting often leads to substandard outcomes, yet many Sri Lankan clients remain unaware and prioritize cost. Participant C addresses this by educating clients on associated risks. Instances of client dissatisfaction support this concern, which is exacerbated by unethical underpricing practices among some entrepreneurial engineers, violating IESL code of ethics.

"We should not always get the job by quoting a lower price. Then we are in trouble. I mean after we got the job, we cannot think of how we can do this job for this price, no? That is not accepted, right?" N

Participant N highlighted the impracticality of delivering quality outcomes under low-price contracts, noting that such strategies often compromise both profitability and service standards. Despite this, some entrepreneurial engineers continue to underbid to secure work, leading to poor results and client dissatisfaction. This issue is intensified by the "wear all hats syndrome" (Tanwar, 2013), where short-term fixes override long-term planning. Such pricing practices contravene the IESL Code of Ethics and undermine sustainable success for entrepreneurial engineers.

"Cybersecurity was not very famous matter at that time. Even the sale of our products and services was the main hassle. So somehow we have provided our services at a minimal price to make sure that we get into that market." G

Participant G initially offered services at minimal prices to gain market traction, noting the absence of competitors at the time, which mitigated ethical concerns. He linked this to the "liability of newness" (Tanwar, 2013), where startup challenges may prompt ethical missteps. While his firm has since grown a stable client base, he acknowledged that early-stage underpricing can blur ethical boundaries. As echoed by Participant N, such strategies, though common in startups, violate Clause 4 of the IESL Code of Ethics when they distort fair competition.

5.5.2.6 Marketing appropriately

Marketing, at its core, involves creating, communicating, and delivering valuable products and services to meet customer needs more effectively than competitors, by leveraging fundamental marketing principles (Dzogbenuku & Keelson, 2019). Entrepreneurs employ various marketing strategies to achieve business success. However, entrepreneurial engineers are selective in their marketing approaches, avoiding tactics that could violate the IESL Code of Ethics and lead to unethical competition with other professionals. As a result, entrepreneurial engineers hold diverse perspectives on marketing, with most adhering to appropriate practices that align with ethical standards, particularly avoiding violations of Clause 4.

> *"Without marketing, we cannot survive. We have a limited number of clients. There are a lot of draughtsmen and others in this industry. Therefore, we have to acknowledge our qualifications. These days I plan to market my name and business using that television programme.* K

Participant K emphasized the role of marketing in a competitive entrepreneurial environment, aligning with (Lam & Harker, 2013) Lam and Harker's (2013) view of its integration with entrepreneurship. He promotes his qualifications through public outreach, including a TV series on housing best practices, to enhance credibility and visibility. While he sees this as essential to success, studies (Jaafar et al., 2008) suggest clients often prioritize price over professional credentials. Other engineers adopt differing marketing approaches.

> *"Now you go and try to advertise your business. No one cares about it. Now if somebody recommends you, yes, of course, they are coming behind you. Of course, we advertise on various forums and so on. But it does not support at all. But if people recommend us here and there, it is actually good." P*

Participant P noted that client referrals are more effective than traditional advertising, which has yielded limited results for his firm. Understanding client purchasing behavior is essential for refining marketing strategies (Stankevich, 2017). Many entrepreneurial engineers avoid advertising, as clients often distrust conventional promotions compared to word-of-mouth endorsements.

> *"We do not do marketing for the consultancy firm, only networking. You know it is known people invite for us. We do one job for them, and then they do the recommendations for the other person."* V

Although Participant P markets for other firms, he relies on networking and referrals for his consultancy work. Jaafar et al. (2008) note that consultants often avoid marketing due to ethical concerns. Consistent service quality is essential, as networking remains a key strategy for securing client recommendations (Lam & Harker, 2013).

> *"I am not making much advertising on these web sites, only our progress and details are shown on the web site. But not doing much marketing." W*

Participant W uses the company webpage to showcase evidence of successfully completed projects. Other participants have also adopted this approach on their websites. Displaying client testimonials and proof of successful projects can create a positive impression among prospective clients, helping them make informed decisions. Instead of traditional advertising, entrepreneurial engineers often share their success stories and client feedback. Clients typically seek such evidence before making purchasing decisions (Stankevich, 2017). These narrative accounts demonstrate that entrepreneurial engineers employ various marketing strategies to attract clients. As knowledgeable business professionals, they adopt marketing approaches that align with their professional status and ethical standards.

5.5.3 Consequences of the 4th clause

Working to comply with the 4th clause has resulted in both positive and negative consequences for entrepreneurial engineers in Sri Lanka.

5.5.3.1 Positive consequences

Enhanced reputation, developed network, more job opportunities, and long-term survival have emerged as the positive consequences arise with the adherence to the 4th clause.

1. Enhanced reputation

As implied by the 4th clause, entrepreneurial engineers can enhance their reputation by conducting their business practices based on merit and avoiding unethical competition. A strong reputation is crucial for any entrepreneurial firm to remain sustainable in the industry.

> *"We abide by what we have told the client. So this is how we have established a kind of preference among clients out there in the local and international market." T*

Participant T noted that upholding principles and commitments has strengthened his firm's reputation, making it a preferred choice among local and international clients. This trust has led to increased opportunities, aligning with Müller et al. (2023)'s emphasis on entrepreneurial behavior in business success.

> *"Since starting my employment period, I followed all the ethical things and handled all the projects with professionals. I could improve my personal career with that. After that, when I started the business, the reputation is the main reason. All the people on the client side and everyone know that this guy will handle things this way." W*

Participant W upheld ethical and professional standards even before founding his firm, despite the challenges of maintaining such values in a competitive environment (Weil, 2014). His consistent integrity earned him a strong reputation, which later translated into client trust and business success. As noted by Jaafar et al. (2008), clients value firm reputation, something Participant W had already established as a personal brand (Sheikh & Lim, 2012).

> *"I mean if you are going through our company profile, you can see that we have completed so many projects. With that, we have a competitive advantage when it compares with the new organisations." N*

Showcasing completed projects and working on merit are not unethical practices. By displaying project evidence and client testimonials on his company website, Participant N gains broader visibility and a competitive advantage. His decade of successful project delivery demonstrates consistent service quality, enabling him to compete with newer firms by leveraging his extensive experience. High service quality remains a key success factor for entrepreneurial engineers (Tan & Trevelyan, 2009).

2. Developed network

Developing a professional network is essential for any entrepreneurial engineer (Goldberg, 2006; Guardia, 2016; Uchino, 2010). Several participants have identified that they could develop a good professional network as a positive consequence of adhering to clause 4.

> *"To tell you frankly, I am actually parachuted to Colombo. I didn't have contacts with any businessmen or anybody. So, I have built up all my relationships and contacts by doing my job properly." D*

Participant D relocated to Colombo and built a strong professional network by consistently delivering quality work, which helped him forge valuable community connections. Entrepreneurial engineers possess specialized technical expertise (Goldberg, 2006), yet success in today's dynamic business environment depends as much on networking as on knowledge (Mazzei, 2023). Similarly, Participant T expanded his social capital through voluntary university involvement.

> *"More or less voluntary work for the university also helps us maintain our contacts. We participated in many professional bodies in many voluntary works, through which we keep our name known." T*

Many senior engineers support university events like conferences and guest lectures, sharing expertise while expanding networks. Although entrepreneurs usually prioritize profit, Participant T volunteers without financial gain, strengthening his professional connections. These voluntary efforts have positively impacted his business growth and development.

> *"I had to leave the country due to the unethical ways of conducting business by others. So, of course, I took it as a challenge. So I went out and established myself, no?". V*

Participant V leveraged a strong network built on consistent quality to overcome unethical business challenges in Sri Lanka by expanding his entrepreneurial ventures internationally. His robust global connections enabled successful establishment abroad, significantly enhancing his professional reputation and net worth despite the difficulties of entering foreign markets.

3. Receiving job opportunities

Entrepreneurial engineers who build a reputation based on merit and avoid engaging in unfair competition are more likely to earn the trust of clients. This trust translates into increased job opportunities, which are crucial for generating sufficient income to sustain and successfully operate an entrepreneurial firm.

> *"Whatever the job we undertake, we should do it properly. That is the way we need to maintain with the people. The first thing when we do properly, the second thing will come, the next thing will come. Like that, it goes." F*

Receiving numerous opportunities to generate income is a significant advantage for any entrepreneur (Müller et al., 2023). For entrepreneurial engineers, word-of-mouth communication within the customer base and broader society plays a pivotal role in securing business opportunities. As Peter Drucker aptly stated, "It is the customer who determines what a business is" (Drucker, 1985). Firms with strong reputations among their customers tend to attract more opportunities within the industry. Participant W exemplified this, reaping the benefits of his well-earned reputation as an engineer when he established his entrepreneurial firm.

> *"It was the first job for me. It was a huge project. So, without any guarantees, because the only guarantee I had was my reputation in the industry and my fifteen years of experience in the industry, and all the people aware of my career and they know about our team performance. Then they have given me the opportunity to enter this business." W*

Participant W's reputation for quality work as an employee engineer earned him client trust when launching his entrepreneurial firm. This trust helped overcome typical startup challenges in customer acquisition due to newness in the market (Khin et al., 2017). His established goodwill effectively mitigated early-stage business risks.

4. Long term survival

Participants have stated that they can survive in the industry for a long term as a result of adhering to the 4th clause.

> *"Without a good reputation, we won't be here for more than thirteen years as a cyber-security consultancy firm." G*

Participant G attributed his long-term success to a strong reputation, noting that unethical individuals struggle to earn societal respect (Belás et al., 2020). His ethical conduct fostered brand loyalty and customer retention, a trend echoed by other participants (Nawaz & Usman, 2011). According to Ma et al. (2020), ethical practices improve firm performance and reputation, a pattern evident among entrepreneurial engineers.

5.5.3.2 Negative consequences

In addition to positive outcomes, the interview participants also reported experiencing certain negative consequences. Although some participants have mentioned that they could get more business opportunities by adherence to the 4th clause, few participants have lost job opportunities due to this, also.

1. Losing job opportunities

Entrepreneurial engineers recognize that offering or accepting bribes violates the IESL Code of Ethics. However, strict adherence to this principle has resulted in adverse consequences for some entrepreneurial firms, as demonstrated in the following cases.

> *"If I consider about my income, I'm not a very rich person. I think because I am getting little businesses per year. The main reason for that is that we always try to prevent the bribery". H*

Participant H receives limited business opportunities annually due to his firm stance against bribery. Clients involved in corrupt practices prefer collaborators who share their values, making ethical entrepreneurs less favorable. As a result, he operates with reduced profit margins.

> *"I work in a limited area because I don't want to beg politicians to get projects. If I am paying politicians to get projects or to meet top management in higher authorities to pay some percentage to get jobs, I will be able to get more jobs. But I don't want to do that." W*

Participant W refrains from paying bribes to secure employment opportunities, a practice that has resulted in fewer job opportunities compared to others who engage in such unethical behavior. Despite this, Participant W remains confident in his ability to secure more projects through fair competition and ethical practices. Corruption remains a significant issue in Sri Lanka, not only causing political resignations but also mobilizing people and movements against corrupt political leaders (Herath et al., 2019).

> *"Too many players on the market have created competition for survival. Therefore, unacceptable practices are quite common now. Companies that respect values cannot drop to that level. Therefore, turnover and profitability drop, affecting the growth and investment plans." S*

Participant S noted that intense competition drives some firms to adopt unethical practices such as bribery, leading ethical entrepreneurs to lose business opportunities. As a result, he has experienced declining profits. Entrepreneurs who refuse to engage in unfair competition often face disadvantages, highlighting a major downside of ethical adherence in the industry.

5.6 Clause 5: Performing professional services only in the area of competence

5.6.1 Introduction

The 5th clause of the IESL Code of Ethics states, "Engineers shall perform professional services only in the areas of their competence." This emphasizes the fundamental commitment of engineers to offer services strictly within their areas of expertise, ensuring that they maintain high standards of competence and ethical responsibility in their professional practice (Harris et al., 2009). Like professionals in other fields, engineers undergo formal education, training, and assessment, gaining practical knowledge across a wide range of complex domains. During their undergraduate studies, engineering students acquire foundational knowledge and skills, which form the basis for their future academic and professional growth. Following their education, engineers apply this knowledge and technical expertise to address real-world challenges. They utilize their professional judgment and experience to analyze situations and propose appropriate solutions. However, knowledge and competence are not static; they continuously evolve and, ideally, improve over time (Trevelyan, 2019). When an engineer transitions into an entrepreneurial role, can they continue to perform professional services within their areas of competence while also pursuing business-oriented goals? This section explores the perceptions of entrepreneurial engineers regarding this clause.

Interviews revealed that while the majority of entrepreneurial engineers support the 5th clause, several have expressed differing viewpoints based on their experiences and observations. The analysis identifies two key perceptions held by entrepreneurial engineers regarding this clause.

Engineers should not undertake work in incompetent areas

Twelve participants in this study strongly believe that engineers should refrain from undertaking work outside their areas of competence, even when they transition into entrepreneurial roles. This viewpoint was particularly emphasized by those entrepreneurial engineers working as consultants.

> *"As consultants, we are not involved in all trades no? We are mainly concentrated in the road or building sector. If something happens in the water sector, we are not competent. As the code of ethics emphasises, we must not go for areas where we are not specialized." U*

Participant U strictly adheres to Clause 5 as an entrepreneurial engineer managing a consultancy firm. He provides professional services exclusively within his area of specialization. This commitment is reflected on the firm's website, which clearly demonstrates that he does not practice outside his expertise. Furthermore, his team is composed of professionals with specialized knowledge in the same field.

> *"I believe that if we are not competent in any area, then we cannot make a proper judgement or we cannot give a proper advice to the client. If we do that, it will be a disaster to the client or a problem to the general public." N*

Participant U stresses that engineers lacking competence may make poor decisions with serious consequences, including property damage or loss of life. Given the technical complexity of consultancy work, services must be delivered by qualified professionals. Preez (2019) notes that consulting engineers often serve in advisory and managerial roles, but also engage in research, design, and technical specialization. Therefore, expertise is essential. This view is supported by all ten other participants, who affirm their agreement with the principles in Clause 5.

Engineers are competent for any work.

Seven participants held the view that engineers, when functioning as entrepreneurial engineers, are competent to take on any work, regardless of their specialization.

> *"I think it is not a problem to undertake engineering activities that are not relevant to the field of specialisation of someone. We have a responsibility towards the safety of our projects. If we*

have that concern, we can work in different fields. If we say that we should perform only in the area of our specialisation, then there will be no entrepreneurial engineers in Sri Lanka." B

Participant B argues that entrepreneurial engineers should be allowed to undertake any type of work, regardless of their specialization, provided they take full responsibility for the outcomes. He views Clause 5 as restrictive to entrepreneurial growth. While safety is acknowledged, he believes versatility is essential, especially in small and medium-sized construction firms where engineers must handle diverse responsibilities. Garmendia et al. (2019) support this view, noting that engineering education often favors specialization, which does not align with the multifaceted demands faced by engineers in smaller enterprises (Starrett et al., 2017).

"It is correct that we have very good knowledge in engineering subjects. It does not mean that we can't do other things. Basically, engineers have a very good brain and capacity. That kind of capacity improves other businesses as well. If others can do it, we can also do better than them." J

Participant J believes that engineers, despite their technical specialization, can excel in business due to the analytical and problem-solving skills gained through their education. Craps et al. (2022) note that competencies beyond technical knowledge—such as communication, persuasion, and understanding non-technical factors—are critical for engineering success and highly transferable to entrepreneurship. These abilities enable engineers to manage businesses effectively. Thus, even a technically specialized engineer can thrive as an entrepreneurial engineer, particularly within the industrial sector.

"After school education, the cream of students enters the engineering faculty. In the faculty, they are taught to be analytical. With an analytical and sharp mind, why cannot engineers become good businessmen? They are the most suitable candidates for doing business. They are geared to analyse a situation well and make appropriate decisions." S

Participant S believes engineers can succeed as entrepreneurs due to their analytical thinking and decision-making abilities, even in unfamiliar business settings. Along with Participant J, he argues that formal business training is not essential, as engineers can acquire managerial skills through experience (Guardia, 2016). Their strong problem-solving capabilities enable them to navigate business challenges effectively. As Solymossy & Gross (2014) emphasize, these skills are valuable in managerial roles, making engineers well-suited for entrepreneurship.

It is evident from the above evidence that the majority of entrepreneurial engineers align with clause 5. However, some participants hold contradictory viewpoints regarding this clause. Participant B, in particular, strongly believes that clause 5 acts as a barrier to the development of entrepreneurship among engineers.

5.6.2 How is the 5th clause applied?

A constructivist grounded theory-based analysis has identified three major strategies employed to adhere to the 5th clause: "Giving priority to the competent area, diversifying the business with experts, and improving competencies." A detailed discussion of each strategy is presented below.

5.6.2.1 Giving priority to the competent area

In alignment with the guidance of clause 5, entrepreneurial engineers prioritize their areas of competence throughout their entrepreneurial journey. Most of their businesses are closely related to their areas of expertise as engineers. According to Guardia (2016), having a well-defined speciality, one in which an engineer can differentiate them from the competition, is extremely important. Most of the participants have identified a well-defined speciality and have performed well in that area.

> *"I am not going to give instructions on bridges or roads. Because I do not have sufficient practical experience with bridges and roads. I have expertise in buildings." K*

Although both construction areas mentioned by Participant K fall under civil engineering, not all civil engineers are qualified to offer expert services in both without adequate theoretical and practical knowledge. Participant K is actively expanding his knowledge in building construction to better serve clients. Research highlights that complex construction projects require specialists, even from abroad, if in-house expertise is lacking (Lapidus et al., 2023). The same thing was highlighted by participant W as follows.

> *"I am a civil engineer, and my experience is completely based on roads and bridges. So, then I have selected a field, focused only on this particular area." W*

Participant W specializes exclusively in road and bridge construction, focusing on his area of expertise despite being a civil engineer. Like Participant K, he exemplifies how entrepreneurial engineers prioritize their specialization, aligning with intellectual-type activities (Luchkina, 2023). Participant F adds that engineers cannot perform tasks effectively without regular practice, reinforcing the need to work within one's specialized discipline for quality and reliability.

> *"If you tell me that I am doing five or six disciplines alone, that's a lie, right? You can do something. But, you can't do it properly right? If you are specialised in some engineering discipline, you should follow that discipline." F*

Participant F emphasizes that reliable service can only be delivered within one's field of specialization. He rejects the idea that a single engineer can competently consult across multiple domains, citing safety and reliability concerns. While entrepreneurial engineers in consulting prioritize specialization, interviews indicate that this principle is less strictly followed in other types of businesses.

5.6.2.2 Diversifying the business with experts

Business diversification is a widely adopted strategy among entrepreneurs, though some argue that specialization leads to better performance. Le (2019) notes the ongoing debate over diversification's impact on corporate outcomes. In this study, entrepreneurial engineers pursue diversification while complying with Clause 5 of the

IESL Code of Ethics. Consultant engineers, in particular, enhance performance by employing necessary experts to support their diversification efforts without violating ethical standards.

> *"We are slowly moving to other areas. But it does not mean that I am doing electrical work. We recruit the correct people for those areas. When we have only qualified persons, we will do it." C*

Participant C, a civil engineering graduate, is diversifying his consulting business but avoids offering services in fields like electrical engineering until he hires qualified experts. He also refrains from bridge design projects due to insufficient qualifications. Participant M confirms the strategy of employing specialists to support ethical business expansion.

> *"When I am a managing director of a company, if I am an electrical engineer, I can do electrical engineering. If I want to do mechanical engineering, I should get the support of a mechanical engineer. I can still grow my business this way." M*

Entrepreneurial engineers can ethically provide services within their expertise while managing their firms. To expand into other disciplines, they must hire qualified professionals, as recruiting skilled experts is essential for business success and high performance (Adeosun & Ohiani, 2020). Moreover, by employing qualified experts, entrepreneurial engineers can ensure compliance with clause 5 of the IESL Code of Ethics.

> *I am doing a consulting business right? If I want to diversify my business, I can start a poultry making company. Is there any harm? I am not an electrical engineer, but I can still start an electrical engineering service providing company by hiring a correct professional right?" N*

Participant N believes professionals should be free to pursue entrepreneurship in any field or diversify their ventures, as long as they comply with legal regulations. Despite not being an electrical engineer, he asserts that hiring qualified experts allows him to establish a consultancy in that discipline. This view underscores the importance of competent project execution to protect public welfare and safety (Starrett et al., 2017).

> *"I have a small hotel near my boat manufacturing plant and the power plant, a ten bed room resort. So it is another business. So with that I think I have slowly set up so many businesses." V*

Participant V illustrated that entrepreneurial engineers face no barriers in pursuing diverse business ventures. Besides owning an engineering consultancy, he hires qualified professionals to ensure ethical compliance with Clause 5. His business acumen, applying the blue ocean strategy, allows him to identify profitable opportunities. This case shows that diversification is feasible when supported by skilled experts.

5.6.2.3 Improving competencies

Interviews revealed that some entrepreneurial engineers actively work to enhance their competencies to meet evolving business requirements. They strive to balance adherence to clause 5 with the need to operate their businesses successfully by continuously improving their expertise.

> *"Now the trend in most consulting jobs is for MEP (Mechanical, Electrical, and Plumbing). We were doing only electrical work those days and outsourced the rest. But that is demanded as a whole package on the international market as MEP. So we are now doing MEP." P*

Participant P expanded his consultancy firm into mechanical, electrical, and plumbing engineering to meet international market demands. He hired qualified experts in these disciplines and enhanced his own competencies through workshops and courses. As the firm's owner, he views technical understanding across all service areas as essential for informed and strategic decision-making, reducing vulnerability in a competitive business landscape. According to Li et al. (2020), it is a success strategy for an entrepreneur. Participant P has worked to improve his competencies in other disciplines later on.

> *"As professional engineers, we have to continue our professional development throughout our life. So, we can learn new things in engineering, even those that are not specifically relevant for the discipline. With that approach, I think it is not a problem to undertake engineering activities not relevant to the field of specialisation of someone." B*

Participant B emphasized that entrepreneurial engineers can expand into other specializations through Continuing Professional Development (CPD), in line with Clause 8 of the ethical code. CPD enables structured, accountable learning that enhances professional competencies. In many countries, CPD formalizes self-directed learning, linking it to professional responsibilities, with non-compliance potentially resulting in sanctions (Friedman, 2023).

Participants acknowledged that Clause 5 restricts engineers from offering services outside their expertise, which safeguards work quality and prevents failures. However, some viewed it as a constraint on entrepreneurial growth. Despite this, most entrepreneurial engineers have effectively navigated these limitations by adopting the previously discussed three strategies.

5.6.3 Consequences of the 5th clause

The analysis of the interviews revealed both positive and negative consequences experienced by entrepreneurial engineers when adhering to Clause 5.

5.6.3.1 Positive consequences

As positive consequences, motivating to get additional qualifications, experiencing the success and enhanced self-confidence can be highlighted.

1. Motivating to get additional qualifications

Clause 5 has encouraged entrepreneurial engineers to pursue additional qualifications and competencies that align with their business needs. This not only enhances their skill set but also increases their value, enabling them to leverage these qualifications throughout their entrepreneurial journey.

"During the start-up stage, I only practised electrical engineering. I didn't do plumbing and air conditioning. Then I got qualifications for other areas as well" M

Participant M, originally an electrical engineer, expanded into the MEP sector by formally acquiring additional qualifications. Motivated by Clause 5, he chose to pursue proper credentials rather than operate outside his expertise. This strategic compliance enabled him to diversify his consulting services and gain a competitive business advantage.

"We gave training to our own staff. I also got accreditation from the Green Building Council to do more and more sustainable projects". J

Participant J enhanced his qualifications to specialize in sustainable projects and supported staff development in the same area. Although already qualified, he pursued further credentials, reflecting a commitment to lifelong learning. His efforts align with Rînciog (2017) view that entrepreneurial success relies on continuous improvement. Like Participant M, Clause 5 motivated him to formalize his expertise, contributing to his success as an entrepreneurial engineer.

2. Experiencing the success

Working within their area of competence has significantly contributed to the business success of entrepreneurial engineers. This adherence to expertise has proven to be a positive factor influencing both entrepreneurial behavior and overall performance.

"I believe success comes because we work in the same field. That success came because my attention was paid to my specialised area, that is, project management. In this business also, I am focussing on that area". W

Before launching his consulting firm, Participant W had a successful career in project management. Continuing in this domain, he attributes his entrepreneurial success to operating strictly within his area of expertise. His experience and technical proficiency in project management have been central to his achievements. He also noted the potential risks of violating Clause 5, which are discussed in the following section.

"Some of our businessmen don't have the technical knowledge in the area of their practice. Therefore, some people are misleading them. Then they go in other directions." W

Entrepreneurial engineers who launch businesses outside their expertise risk making poor early decisions that may hinder firm performance. While some eventually learn and adapt, this risk-taking approach is suboptimal, though not necessarily indicative of failure (Taipale-Erävala et al., 2019). In this study, most participants operate within their areas of competence, while others have expanded their expertise through further qualifications to effectively manage and grow their ventures.

"I was involved in the design of the structure of a communication tower. With that experience, I started the company. At that time, so many tower constructions were commenced in Sri Lanka." L

Participant L capitalized on his technical expertise to establish a successful entrepreneurial engineering firm in Sri Lanka. His focus on working within his competence enabled him to secure and complete numerous projects during the startup phase. This supports Garmendia Mora et al. (2019), who found that technical skills are key to entrepreneurial success in the construction sector. The findings suggest that adherence to Clause 5, by operating within one's expertise, enhances business success for entrepreneurial engineers.

5.6.3.2 Negative consequences

As negative consequence, higher expenditure has been identified in the analysis.

1. Higher expenditure

Most of the interview participants confirmed that they could start and run an entrepreneurial firm in areas where they lack expertise by recruiting the necessary expert professionals. This approach is ethical and aligns with clause 5. However, Participant C shared the following experience from his startup stage.

> *"At the beginning, it was a challenge because I am trying to do many things on my own because of, I could not afford outside consultancies. Now, after coming to a certain level, I don't need to do other things by myself." C*

During the startup phase, Participant C faced financial limitations that prevented him from hiring external experts, compelling him to undertake consultancy tasks outside his specialization. This practice violated Clause 5, reflecting an ethical compromise driven by financial necessity. Now financially stable, he recruits qualified professionals for such tasks. His experience underscores the ethical dilemmas entrepreneurial engineers may face early in their ventures, where resource constraints can pressure them into breaching professional standards (Tacke et al., 2023).

5.7 Clause 6: Acting as faithful agents and trustees for the clients

5.7.1 Introduction

The 6th clause of the IESL code of ethics is "Engineers shall apply their skills and knowledge in the interest of their employer or client for whom they shall act, in professional matters, as faithful agents or trustees, so long as they do not conflict with the other requirements listed here and the general public interest" (*The Institution of Engineers Sri Lanka - Code of Ethics*, 2013). This clause emphasizes that engineers must remain loyal to their clients and employers while also considering the public interest. These responsibilities can sometimes conflict, especially when client expectations do not align with public welfare (Starrett et al. 2017). The obligations of engineers are usually based on agreements, whether formal or informal, and are shaped by their professional expertise and the specific requirements of their clients or employers. Starrett et al. (2017) explain that an agent follows the interests of another, while a trustee acts in that party's best interest. Engineers often serve in both roles, fulfilling client directives as agents while also exercising independent judgment as trustees to ensure the success and integrity of a project (Tan & Trevelyan, 2009). Employers and clients must place significant trust in an engineer's judgment, given the highly technical nature of engineering work (Fleddermann, 2012). Engineers are tasked with sorting through complex data and making decisions that require specialized knowledge. The correct solution to a technical problem is often neither obvious nor predetermined, which leaves room for personal bias to influence the decision-making process and potentially distort the outcomes (Bielefeldt, 2018). Therefore, it is crucial for engineers to minimize or eliminate conflicts of interest. Failure to do so could undermine their ability to act as faithful trustees and to demonstrate that they are genuinely making decisions in the best interests of their clients or employers.

When engineers become entrepreneurs, they no longer have employers but instead oversee staff and manage client relationships. Under Clause 6, their loyalty must shift toward clients and customers. However, this loyalty must not override their duty to protect the public interest, creating a potential conflict between business obligations and broader ethical responsibilities.

5.7.2 How is the 6th clause applied?

Grounded theory-based analysis of in depth interviews with the entrepreneurial engineers have revealed how they have adhered to the clause 6 during their entrepreneurial journey. Categories like "giving priority for the public interests, delivering appropriate products and services, rejecting unlawful & unethical requests from clients, and having truthful cooperation with clients" were constructed from the interview transcripts as strategies to comply with the clause 6.

5.7.2.1 Giving priority for the public interests

Entrepreneurial engineers stressed the need to consider public interest when providing services to clients. While some may be tempted to prioritize client profit over public welfare, most participants reported striving to uphold public well-being in line with Clause 6 in their business practices.

> *"Our main aim is to make a better life, to uplift the life of general public. We came to this position because of general public. It is our sole responsibility to serve them right? Whatever the designs we do, the first thing we do is maintaining the safety. The other thing is we should not harm or affect the people." J*

Participant J aims to enhance public well-being through his business activities. As an MEP consultant, he delivers client services that avoid safety risks and contribute positively to society. Although client-focused, his innovative designs ultimately serve the public interest, and he remains mindful of their broader impact.

> *"We must see that how the public is getting that interaction with the construction. When we are doing high rise buildings, we have to be very careful with the public. That is why we close*

the total project with thin nets to ensure that workers cannot throw anything. But some of these contractors don't do that." R

Participant R, a large-scale contractor, prioritizes public safety in his projects. He mandates the use of protective nets across construction sites to prevent debris hazards, despite the added cost. This safety measure, often neglected by others, reflects his adherence to Clause 1 of the IESL Code of Ethics, which places public health, safety, and welfare above all other obligations (Wijesinghe et al., 2021). Participant R's proactive safety measures safeguard public interests and help minimize potential disputes between the public and the client. As the contractor exits after project completion, the client, as the building owner, remains accountable for ongoing public interactions, making early consideration of public welfare essential.

"We are giving the first priority to public interests. Almost all chances are given to the people living in the villages around the project site. All the laborers are taken from the same area, not hired from outside, no suppliers for that." W

Participant W emphasized addressing public needs amid economic hardship by offering income-generating opportunities to rural communities near his project sites. This strategy has enhanced public cooperation and mutual benefit. His case illustrates how entrepreneurial engineers can meaningfully prioritize public interests through socially responsive business practices.

5.7.2.2 Delivering proper products and services

Participant W emphasized addressing public needs amid economic hardship by offering income-generating opportunities to rural communities near his project sites. This strategy has enhanced public cooperation and mutual benefit. His case illustrates how entrepreneurial engineers can meaningfully prioritize public interests through socially responsive business practices (Hoe & Mansori, 2018). To achieve customer satisfaction, entrepreneurs should loyally serve their clients in all aspects (Virues et al., 2019).

"Our clients know that we will not compromise with the quality of the final product / service to earn profits. This is the reason why clients come to us." S

Participant S consistently delivers high-quality products and services, establishing a reputation in Sri Lanka for uncompromising standards. This commitment fosters strong client trust, which Widyaningrum & Halim (2019)Widyaningrum and Halim (2019) identify as key to customer loyalty. Therefore, entrepreneurs must reciprocate client loyalty by maintaining excellence in their offerings, meeting client expectations for quality and integrity.

"We definitely wanted to protect our name as a company that works within the law and advises the client within the law and perform good quality engineering work." L

Participant L prioritizes maintaining his firm's strong reputation by consistently delivering quality products and services that comply with client needs and legal standards. This approach helps prevent issues during later project stages. Non-compliance with legal or engineering standards, even in innovative designs, can cause serious client repercussions, which clients do not anticipate (Bielefeldt, 2018). Despite the entrepreneurial drive for innovation, Participant L stresses adherence to these standards (Johnson, 1992). Furthermore, he believes entrepreneurial engineers must refuse client requests for illegal products or services, thereby demonstrating true loyalty by safeguarding clients' long-term interests.

> *"We are there to satisfy the clients within our professional framework, no? Professional framework defines with the regulations, code of practice, and so many other things. Within our framework, we provide the optimum solution to the client based on what client want. So, we are bound to do that." V*

Participant V asserts that entrepreneurial engineers must satisfy clients by applying their expertise, but within professional and ethical limits. As a prominent engineer, he provides solutions that strictly comply with professional standards, ensuring they are legal and standardized regardless of financial gain. He emphasizes loyalty to clients while upholding these frameworks, thereby protecting both his firm's integrity and reputation. This approach balances meeting client needs with contributing positively to society and the broader public interest.

5.7.2.3 Rejecting unlawful and unethical requests of clients

Participants noted that clients do not always make legal or ethical requests, often assuming entrepreneurial engineers will accept any task for profit. However, several participants emphasized that they have rejected such requests, even when accompanied by financial incentives, underscoring their commitment to ethical standards over monetary gain.

> *"I mean just because of if someone said that I will give you money and you do that and If I believe that if it will be harmful to another person or especially for the environment, I will not do that one."* N

Participant N stressed that he refuses client requests that could endanger the public or the environment, regardless of financial incentives. He argued that accepting such offers would undermine the credibility and integrity of engineering judgment, diminishing its professional value (Starrett et al., 2017).

> *"My company would have lost more than twenty-five projects as I did not agree for certain terms and conditions laid by certain clients and I don't mind it."* R

articipant R reported turning down over twenty-five projects due to misalignment with legal, engineering, or firm policy standards. Despite the potential for profit, he declined all non-compliant proposals, prioritizing adherence to national laws and professional regulations. As Fleddermann (2012) emphasizes, entrepreneurial engineers are not exempt from legal and ethical obligations, regardless of their business ownership status (Schuelke-Leech, 2018). Even though entrepreneurs are profit oriented in nature (Wu et al., 2007), participant R has rejected illegal and unethical work requests of clients without worrying about the financial losses happened with such rejects.

> *"We used to refuse some requests of clients, but we always give explanations and the outcomes of them to clients. There are so many such examples." V*

Participant V rejected client requests that violated legal or industry norms, maintaining transparency by clearly justifying his decisions. His actions highlight a strong ethical stance. While entrepreneurial engineers aim to meet client demands, they must refuse work that breaches ethical or regulatory standards. Even when financially motivated, these engineers prioritize legal compliance, professional integrity, and risk assessments covering safety, environmental, and social concerns (Didier, 2009). Ethical engineers proactively address potential issues and work to minimize any adverse effects on the general public. Similarly, entrepreneurial engineers follow this approach by refusing illegal or unethical requests from clients, ensuring that their actions align with both legal and moral standards.

5.7.2.4 Having truthful cooperation with clients

Entrepreneurial engineers in this study adhere to Clause 6 of the IESL Code of Ethics by fostering honest, transparent relationships with clients. They openly communicate when client requests are unfeasible, offering viable alternatives to ensure project success. This practice reflects their loyalty to clients' long-term interests rather than pursuing short-term profit. Rather than accepting flawed projects and later justifying failures, these engineers act with integrity, prioritizing informed, ethical decision-making.

> *"If we are going to construct a house in a marshy land, it will cost more money for the foundation. I have explained that situation to the client and instruct him to buy a land from another place." K*

Entrepreneurial engineers in this study adhere to Clause 6 of the IESL Code of Ethics by fostering honest, transparent relationships with clients. They openly communicate when client requests are unfeasible, offering viable alternatives to ensure project success. This practice reflects their loyalty to clients' long-term interests rather than pursuing short-term profit. Rather than accepting flawed projects and later justifying failures, these engineers act with integrity, prioritizing informed, ethical decision-making.

> *"Technical wise as well as legal wise, we always advice our clients and we are not unhappy to recommend to a client that your project is not good, right? In technically, commercially, financially, or legally whereas there could be other consultants who will do his part". T*

Participant T advises clients based on realistic assessments, using his expertise to discourage unviable projects and prevent financial loss. He contrasts this with other consultants who knowingly proceed with impractical projects to earn money, often concealing risks and leading clients to poor returns. Citing local examples, he highlights how such unethical practices cause ongoing losses. Participant T stresses that, in line with Clause 6 of the IESL Code of Ethics, deceiving clients for short-term profit violates the trust placed in engineers and undermines professional loyalty. (Starrett et al., 2017).

> *"The main ethical principle is we will be truthful to the clients Okay? We will advise our clients to abide by the law. If there is anything that is not worthwhile being done, because the legal provisions are against the project, we would advise clients accordingly." S*

Participant S, like Participants K and T, prioritizes honesty in client interactions. He ensures that all client requests align with legal and industry standards and advises against deviations, explaining potential long-term consequences. Citing Jensel et al. (2009), he highlights that while some entrepreneurs might lie for perceived greater good, such actions can damage trust and lead to failure. The entrepreneurial engineers in this study consistently maintain transparency, guiding clients away from risky or non-compliant projects to uphold ethical standards and long-term success..

Above narratives taken from the interview transcripts supports the emerging categories on how to apply the clause 6 of the IESL code of ethics in the entrepreneurial journey.

5.7.3 Consequences of the 6th clause

Adhering to clause 6 of the IESL code of ethics has created very less consequences which are positive and negative in nature towards the entrepreneurial behaviour and performance.

5.7.3.1 Positive consequences

It was revealed that entrepreneurial engineers have experienced enhanced reputation as the only positive implication arose with the adherence to clause 6.

1. Enhanced reputation

Loyalty to clients enables entrepreneurial engineers to strengthen their firms' reputations and personal professional standing. As previously discussed, a strong ethical reputation is a key benefit for entrepreneurial engineers, serving as a vital factor in securing future business opportunities and contributing to long-term success (Ramos-González et al., 2017). This is further confirmed in the literature, as newly started entrepreneurial tech firms are motivating to borrow reputation from other organisations by developing partnerships (Prashantham et al., 2020). It reveals the significance of having a greater reputation by entrepreneurial firms for their success, since some firms are trying to borrow reputation.

> *"There are occasions, people in these institutions gone up to the board level and got special approval to work with us, since they don't have trust with other organizations to share those highly critical information." G*

Participant G noted that repeat clients frequently seek his firm's services due to its reputation for loyalty and dedication. This strong reputation has attracted both government and private sector clients. As Ali et al. (2015) suggest, clients are naturally drawn to trusted and reputable firms. Such trust significantly increases business opportunities and enhances the success prospects of entrepreneurial engineers.

“If someone wants to safeguard the business by sacrificing quality and ethics and so on towards clients, he will end up with the bad reputation.” U

Participant U, reflecting on his extensive experience in Sri Lanka’s industrial sector, stressed that compromising quality or ethics hinders the development of a firm’s reputation. Dissatisfied clients rarely return, whereas a strong reputation attracts those seeking innovative, high-quality solutions (Pakura & Rudeloff, 2020). He emphasized that client satisfaction not only ensures repeat business but also drives word-of-mouth referrals, which are essential for expanding business opportunities.

“Most of the time, our customers are becoming good friends with us, very friendly with us. Once we have provided a good service, so I think we can create the popularity and whatever the things are like reputation.” N

Participant N’s loyalty and service quality have earned him not just client satisfaction but lasting relationships, boosting his firm’s reputation in Sri Lanka’s industrial sector. This recognition has led to increased business opportunities and entrepreneurial success. As Weng & Chen (2017) highlight, a strong reputation builds stakeholder trust and credibility, which are essential for reducing perceived risks and encouraging engagement. For entrepreneurial engineers, especially those in technically complex fields, reputation for reliability and expertise is crucial for long-term success.

5.7.3.2 Negative consequences

The most emphasised negative consequence experienced by the participants in this study with the adherence to clause 6 is loss of job opportunities.

1. Losing the job opportunities

Many participants have chosen to reject certain client requests that did not comply with applicable legal frameworks and industry standards. They recognize that engaging in unviable or illegal projects would ultimately lead to negative consequences for all stakeholders involved over time. As a result, they prioritize ethical decision-making and refuse to participate in such projects, ensuring that they uphold both legal and professional standards in their work.

“I very clearly say that I am following standards, so you can’t change the standards, if you want to do such thing in your project, go and find another person. It is very clear.” M

Participant M rejects any project that compromises industry standards, even at the cost of revenue. His unwavering stance reflects a deep commitment to ethical practice and long-term stakeholder welfare over short-term gain.

“Sometimes, customers say ‘you don’t worry about the approvals; I will get the approvals. You do the feasibility study; you do the engineering part right? Why are you worried about how I get the approvals?’ But sadly, we have to advise them correctly” T

Participant T’s account reveals that some clients lack technical awareness and seek favorable feasibility reports solely to secure government approvals, even for unviable projects. He consistently declines such requests, prioritizing ethical responsibility and long-term stakeholder interests over financial incentives. While this stance may lead to lost business in a competitive consulting environment, Participant T upholds the IESL code of ethics and remains committed to promoting feasible, sustainable engineering solutions.

> *"We cannot hold everything in our hands. So, that is the nature as we cannot work with all the clients. If some client tries to cheat us, that means that he is not a good client. So, it is better not to work with them than to try hard to work with." E*

Participant E has encountered clients attempting to deceive his firm and chooses to disengage from such relationships, despite the potential impact on business growth. Acknowledging that not all clients uphold ethical standards, he deliberately prioritizes integrity over short-term gains, underscoring the ethical dilemmas entrepreneurial engineers often face in client relations (Robinson et al., 2003). Entrepreneurial engineers should seek to ethically reform unviable projects rather than simply rejecting them and forfeiting opportunities. Although entrepreneurs are typically opportunity-driven (Kerr et al., 2018), this approach is less evident in applying Clause 6. Nonetheless, participants did not perceive missed projects as a major threat to firm sustainability. Instead, they emphasized that upholding ethical standards is essential for long-term success.

5.8 Clause 7: Being objective and truthful

5.8.1 Introduction

7th clause of the IESL code of ethics is "Engineers shall give evidence, express opinions or make statements in an objective and truthful manner" (*The Institution of Engineers Sri Lanka - Code of Ethics*, 2013). Engineers are often seen primarily as problem solvers focused on design and technical tasks, yet their responsibilities include substantial communication. Rather than working in isolation, engineers function within communities and must clearly convey complex solutions to a range of stakeholders (Fleddermann, 2012). Since their work can affect thousands or even millions of people, ethical communication grounded in clarity, honesty, and transparency is essential to ensure public trust, safety, and responsible practice (Starrett et al., 2017).

Since engineers convey information that significantly impacts others' decisions, it is essential for the engineering profession to enforce stringent and precise standards of honest communication (Poel & Royakkers, 2011). Accordingly, clause 7 mandates that engineers must communicate "truthfully" in their professional interactions. However, Clause 7, demands not only truthfulness but also objectivity. Communicating objectively means to be unbiased and minimally influenced by personal desires or intended perceptions. Objectivity is essential in science, as someone cannot determine whether a piece of evidence supports a conclusion unless the evidence has been gathered accurately and the reasoning from the evidence to the conclusion is conducted logically (Starrett et al., 2017).

When engineers transition into entrepreneurial roles, they remain bound by Clause 7, which requires them to be truthful and objective. However, the question arises: Can entrepreneurial engineers remain truthful and objective throughout their entrepreneurial journey? How can they uphold Clause 7 while pursuing their entrepreneurial endeavors? This section will address these questions. According to Radoilska (2008), some scholars argue that truthfulness is not a core principle in business. However, the consequences of failing to uphold truthfulness and objectivity are evident in the case of the tech start-up "Theranos." Despite its initial success, the company collapsed due to unethical practices and a lack of transparency (McGinn, 2022).

5.8.2 How is the 7th clause applied?

Data analysis has revealed the emergence of 4 categories of strategies practice by the entrepreneurial engineers in Sri Lanka to adhere clause 7 during their entrepreneurial journey. They are "prioritizing the truth, explaining the truth to clients, handling information responsibly, and working properly".

5.8.2.1 Prioritizing the truth

As Clause 7 implies, participants prioritize truth and present it objectively when communicating statements and opinions to their stakeholders, including clients.

> *"I don't see any difficulty in giving evidence, expressing opinions, or making statements objectively and truthfully because one is running a business. I do that quite often. You may even have seen articles & video clips in the media where I have expressed my opinions openly." Q*

Participant Q, who leads a large manufacturing firm, stated that entrepreneurship has not hindered his adherence to Clause 7. He has authored numerous media articles addressing socioeconomic issues in engineering and topics related to his products. These writings reflect his commitment to honest expression and a strong regard for truth.

> *"Even not considering the higher price of us, some clients offer projects to us. I prefer if no one is asking from us whether you are the lowest in the quotation? Sometimes, we have to say "Yes". That puts us in a difficult situation. But wherever you can, best thing for an engineer is to tell the truth, because you don't need to carry them (lies) home and you can have a nice sleep." R*

Participant R, a large-scale construction contractor, described a situation where he felt compelled to mislead competitors after being awarded a project despite submitting a higher quotation. Although clients often consider factors beyond price, such as firm reputation and qualifications, Participant R sometimes claimed to have submitted the lowest bid to avoid conflict. He emphasizes that truthfulness is essential for long-term business integrity, yet acknowledges that rivalry can pressure entrepreneurs to withhold or distort information to maintain competitive advantage (Schreck, 2015).

> *"In urban areas, we closely monitor the pollutant emission levels from our activities and take all practical precautions to control them within the recommended levels. If we are compelled to exceed due to inevitable reasons, we explain our need to the neighbours, obtain their concurrence and then carry out our work so that they are aware of the possible disturbance and are ready to manage." S*

Participant S maintains transparency with the local community by openly sharing project-related information, aiming to build support for successful implementation. For entrepreneurial engineers, honesty must extend beyond clients to all stakeholders. Evidence indicates that some professionals have, at times, attempted to mislead stakeholders during business activities, highlighting the importance of broader ethical responsibility (McGinn, 2022). Participant S's commitment to truth in managing his large-scale firm is notable. In contrast, academic research shows that many entrepreneurs often withhold or distort information when dealing with stakeholders, including investors (Pollack & Bosse, 2014). According to the literature, stakeholder theory argues that entrepreneurs can significantly benefit by establishing trusting and cooperative relationships (Freeman, 1984). Despite ethical concerns, some entrepreneurs still engage in deception to gain advantages. Research indicates that lying can help maintain effective investor relationships, challenging stakeholder theory and social norms (Pollack & Bosse, 2014). While this may apply in specific contexts, the broader implications across other stakeholder relationships require further study. Nevertheless, entrepreneurial engineers generally aim to uphold truthfulness in their professional conduct.

5.8.2.2 Explaining the truth to clients

The interviews reveal that entrepreneurial engineers employ a strategy of explaining the truth to their clients. Clearly communicating the technical factors behind any situation in an honest and transparent manner is a key aspect of the interaction between entrepreneurial engineers and their clients.

> *"We have to give truthful reports. Otherwise we will suffer in the latter stages. Everything I am telling to my clients. If you do this kind of thing, you will suffer, like that we are instructing them." K*

Participant K provides truthful reports and offers clear explanations to clients. This approach helps clients understand the importance of each aspect, especially since they may not have the same technical knowledge as an entrepreneurial engineer. This strategy aligns with the loyalty towards clients, as outlined in clause 6, and demonstrates the commitment of entrepreneurial engineers to their clients' needs.

> *"We didn't experience any business loss due to telling the truth. We have always explained the truth to the customer and the customer accepts and like that. It is not a problem for us." O*

Participant O, similar to Participant K, emphasizes truthfulness in client interactions and reports no negative impact on his firm as a result. His experience illustrates that transparency can foster client trust, reinforcing the role of mutual trust in sustaining successful entrepreneurial ventures (Radoilska, 2008). Truthful behaviour is the driving force of trust for both the entrepreneur and the client (Welter & Smallbone, 2006). In the Sri Lankan context, entrepreneurial engineers must communicate truthfully while navigating personal biases that can affect word choice. Effective communication involves clearly outlining potential challenges and uncertainties, enabling clients to make informed decisions. This approach minimizes misunderstandings, reduces project risks, and protects firms from legal and financial consequences (Luo, 2002).

> *"Some clients ask us to check designs done by other engineers. In such a situation we have to look after the designer as well. Sometimes there might be mistakes. I mean anybody can do the mistakes, generally we will speak to that person who did the design and we will have a discussion. If there is no problem, then there won't be any arguments. But if there is any mistake, we have to convey that in very professional manner to the clients. We are highlighting the issue to the client, but not criticizing the person who did the design right?" N*

Participant N resolved an ethical dilemma by maintaining objectivity and balancing the interests of all parties. He identified errors in a previous engineer's work but communicated them professionally, avoiding conflict and protecting reputations. His approach reflects a commitment to transparency, which research has shown to be essential for building trust in business relationships (Welter & Smallbone, 2006). Here, participant N has attempted to maintain that transparency with his clients and other respective stakeholders.

In the context of engineering entrepreneurship, explaining the truth to clients about project feasibility, potential risks, and realistic outcomes fosters a reputation for reliability. This transparency builds trust, which can lead to increased client loyalty and repeat business key factors for the long-term sustainability of entrepreneurial ventures (Morgan & Hunt, 1994).

5.8.2.3 Handling information responsibly

In engineering entrepreneurship, transparent communication about project feasibility and risks fosters a reputation for reliability. This openness builds client trust, encouraging loyalty and repeat business, which are essential for long-term success and sustainability.

> *"We normally provide evidences of calculation and other details if the client requested them. At that time, we are providing whatever we have. Even if we provide some false information, they will find. So, there is no point of providing false information unless we don't know that". F*

Participant F ensures transparency by providing accurate calculations and information on his firm's innovative designs. This commitment to honesty reduces the risk of project failures, legal disputes, and financial losses. Clear, accurate communication enables entrepreneurial engineers to protect their firms from potential liabilities (Luo, 2002).

> *"Once we do a job to one person, we don't disclose that to other people. That is, maintain. When a client asks me to do a particular design, I do the design. Give him right? If I have signed a contract with him, an exclusive consultancy for that job, I don't do the same job for the next client. If it is not exclusive, then I do the job. It can be the same design. But I don't tell that it is same for the previous design." P*

Participant F ensures transparency by providing accurate calculations and information on his firm's innovative designs. This commitment to honesty reduces the risk of project failures, legal disputes, and financial losses. Clear, accurate communication enables entrepreneurial engineers to protect their firms from potential liabilities (Maxwell & Lévesque, 2014). Clause 6 of the IESL Code of Ethics mandates client confidentiality. Studies indicate that start-up entrepreneurial firms often prioritize consumer privacy more than mature firms, using confidentiality as a means to build trust and credibility during early-stage operations (Xu et al., 2023).

> *"In my entire career, I didn't lie. But there are places, I did not give all the information. There are places, in business you sometimes have to do that. But I never lie to people." G*

Participant G emphasized his commitment to truthfulness, noting that while he has never lied, he has occasionally withheld information when necessary for business management. He believes selective disclosure can support regulatory compliance and risk mitigation, helping entrepreneurial engineers safeguard both legal standing and professional reputation (Harris et al., 2009). This compliance is not only a legal obligation, but also a critical component of maintaining professional integrity and public trust.

5.8.2.4 Working properly

Several participants emphasized that adherence to industry standards and legal regulations supports compliance with Clause 7. They asserted that proper working practices eliminate the need for dishonesty, reinforcing truthfulness as a core element of ethical engineering entrepreneurship.

> *"If we make claims that we are not entitled, wasting others' time and creating disputes is not good. All these things are unnecessary if we do our job sincerely and according to the terms and conditions." U*

Participant U stressed the importance of adhering to agreed terms and standards in engineering entrepreneurship. Following structured processes and effective project management improves efficiency, reduces errors, and ensures timely, cost-effective project delivery. This approach strengthens client satisfaction and overall business performance (Drucker, 1985). This creates an environment where entrepreneurial engineers have fewer incentives to engage in deceitful actions, ultimately reducing the need to lie to their clients and stakeholders.

> *"We have to cheat others if we are not maintaining the systems. What will happen if we do not keeping the records? When we wanted to prepare claims, at that point, we do not have witnesses or evidence. So at that time, we tend to cheat." W*

Participant W noted that entrepreneurial engineers may resort to dishonesty when they fail to follow established systems and processes, often driven by the pressure to ensure business survival. However, maintaining proper work practices reduces the likelihood of unethical behavior and supports integrity in the industry (Lynch & Kline, 2000). In a competitive market, the ability to work according to the proper work practices can serve as a significant differentiator. Clients are more likely to choose engineering firms that demonstrate transparency, reliability, and ethical practices (Ma et al., 2020). This competitive advantage can lead to increased business opportunities and market share.

> *"I always advise our young engineers to do things in a proper manner. They have to follow proper procedures and perform all the design calculations. Further, they should record them, and so on." D*

Participant D emphasized that maintaining thorough records is essential to prevent unethical behavior such as misleading stakeholders. He enforces this practice strictly and advises future engineers to do the same. Recalling a client inquiry about a decade-old project, he noted that accurate records allowed him to respond professionally. In entrepreneurial engineering, credibility and trust are key to client retention. Adherence to transparent communication, proper documentation, and ethical standards fosters a reputation for professionalism and long-term success (Mayer et al., 1995b). These narratives illustrate that proper work practices are critical for entrepreneurial engineers, integrating ethical, operational, and strategic aspects. As engineering entrepreneurship advances, sustained adherence to sound practices will be vital for both professional excellence and long-term business viability.

5.8.3 Consequences of the 7th clause

Adherence to clause 7 has also created positive and negative consequences to entrepreneurial engineers in Sri Lanka. As positive consequences, "Enhanced reputation and trustworthiness" emerged from the analysis of extensive interviews. "Loss of job opportunities, difficulty to being truthful during the startup stage and misunderstandings" have been identified as the negative implications experienced by entrepreneurial engineers.

5.8.3.1 Positive consequences

Enhanced reputation and trustworthiness have been identified as the positive consequences emerging with the adherence to the clause 7.

1. Enhanced reputation

Truthfulness and objectivity have significantly strengthened the reputations of entrepreneurial engineers and their firms. Operating at the intersection of innovation and strategy, these professionals rely on reputation to shape client perceptions, attract opportunities, enhance competitiveness, and support long-term sustainability.

> *"If they cheat on test reports, sometimes it can sometimes be revealed during an audit. Once such something is found, that person cannot maintain his or her personality." W*

Participant W noted that falsifying reports risks public exposure and loss of integrity. For entrepreneurial engineers, dishonest conduct can quickly damage their reputation. Conversely, consistent honesty and objectivity strengthen both personal and organizational credibility.

> *"Objective statements and being truthful are not tolerated in a competitive environment. Due to the rampant corruption practices in the industry, there will always be a hidden agenda behind such issues. Hence, it can affect your business to some extent. However, it will be for a short period, and when they realise the truth, clients will respect you for what you have said. It pays in the long run", S*

Participant S emphasized that despite the corrupt environment, ethical engineers gain long-term respect from stakeholders. He views credibility as closely linked to reputation. Entrepreneurial engineers who consistently deliver quality work, uphold ethics, and communicate transparently build trust, attract clients, encourage repeat business, and secure referrals through a reputation for reliability and competence (Fombrun & Shanley, 1990).

> *"I think the truthful manner is totally, hundred percent dependent on our job actually. If we work truthfully, definitely it is a positive mark for us. I am sure", L*

Participant L stated that truthfulness has a lasting positive impact and strengthens a firm's reputation. In a competitive market, reputation serves as a key differentiator. Firms with a record of ethical conduct and client satisfaction are more likely to attract business and increase profitability (Indiatsy et al., 2014). A strong reputation enhances client relationships by encouraging open communication, constructive feedback, and collaboration. This improves project outcomes and fosters long-term partnerships, reducing the effort and cost of acquiring new clients (Indiatsy et al., 2014). A strong reputation promotes open communication, feedback, and collaboration with clients, leading to improved project outcomes. These relationships often develop into long-term partnerships, reducing client acquisition costs and supporting sustained business growth (Morgan & Hunt, 1994). A strong reputation attracts high-profile projects, partnerships, and ventures, facilitating growth and market expansion (Freeman & Auster, 2011). Studies show a positive link between reputation and financial performance, with reputable firms achieving higher sales, better profit margins, and greater stability due to client loyalty and project success (Roberts & Dowling, 2002).

2. Trustworthiness

Trustworthiness is another positive outcome experienced by the participants in this study as a result of adhering to clause 7. By maintaining truthfulness and objectivity with their clients and stakeholders, they have established themselves as reliable entrepreneurial engineers. This trustworthiness plays a crucial role in helping entrepreneurial engineers achieve their business goals.

> *"People can hide the truth and be successful in the cheating and working without any problem. Some people put the materials technician's signature for the test reports fakely and get approvals." W*

Participant W noted that although some individuals may temporarily benefit from deceitful practices, exposure often leads to severe reputational harm. Such damage erodes trust, making clients less likely to continue relationships with professionals whose integrity is compromised.

> *"When you are truthful to the client and explain the 'pros and cons', often clients do not hesitate to compensate for financial losses, if any, realising the benefits they have gained. If we also behave like any other businessmen, there is no reason for a client to come to us for his project / service. Being a professional adds value to our service." S*

Participant S emphasized that transparently communicating both benefits and risks strengthens client relationships and supports business sustainability. His professional conduct has enhanced the perceived value of his services, making it essential for attracting and retaining clients and achieving long-term success (Welter & Smallbone, 2006). In a competitive market, trustworthiness serves as a crucial differentiator. Clients are more likely to select engineering firms that demonstrate transparency, reliability, and truthfulness (Freeman & Auster, 2011). Prioritizing truthfulness gives entrepreneurial engineers a competitive edge, fostering a reputation that attracts long-term clients and partners. This reputation enhances business opportunities and supports sustained growth and market presence (Gallo, 2014).

5.8.3.2 Negative consequences

The tension between maintaining truthful communication and achieving business objectives can sometimes lead to negative consequences. A few such consequences, arising from adherence to clause 7, were identified in the interview transcriptions. However, only a limited number of participants mentioned these negative outcomes.

1. Loss of business opportunities

Attempting to adhere to clause 7 has led to a few entrepreneurial engineers losing business opportunities. However, this negative implication was not experienced by the majority of participants in this study.

> *"One of my client ask to construct a house in a marshy land. Since it will cost more money for the foundation, I have explained that situation to the client and instructed him to buy land from another place. Otherwise, the client will be suffering. There are occasions when we missed such plans due to being truthful." K*

Participant K advised a client against building on marshy land due to potential foundation issues and higher costs. While some valued this honesty, others turned to less candid providers, resulting in business loss. In competitive, tech-driven sectors, truthful communication about product limitations may disadvantage entrepreneurial engineers compared to those offering overly optimistic projections (McGinn, 2022).

2. Difficulty of being truthful during the startup stage

Studies have shown that adherence to ethical standards varies across different stages of an entrepreneurial firm's life cycle (Tanwar, 2013). A few entrepreneurial engineers have encountered similar challenges during their journey when trying to adhere to clause 7. For example, Participant A violated clause 7 by submitting fabricated evidence of previous work experiences to a client company in order to secure consultancy projects at the early stage of his career.

> *"When I started my business, for example, there was a condition for our consulting services that I have to have previous experience right? So I did not have previous experience. Fortunately, there was an unethical boss, right? He said you fabricate something and apply. That's how I enter." A*

The above narrative suggests that participant A, as a budding entrepreneurial engineer, felt compelled to fabricate his previous experience in order to enter the consultancy field. Additionally, a superior advised and encouraged him to violate clause 7, engaging in unethical behavior according to the code of ethics. Similarly, Participant J experienced comparable challenges in adhering to clause 7 during the early stages of his startup.

> *"Once we come to a kind of a certain standard, yes, we can adhere. But I am not sure of the engineers who work under somebody, whether they can follow the same rule or not. And we have a kind of business status and we have developed our company, and therefore no body, especially on the client side, can't do anything for us. Therefore, we follow it strictly." J*

Participant J believes that being truthful and objective during the startup stage is challenging for entrepreneurial engineers. He explains that, during this phase, a firm is vulnerable, and clients may take action against an unestablished company if its claims are questioned. As a result, adhering strictly to clause 7 is difficult for new firms. However, once his firm became stable and successful, participant J no longer faced issues with adhering to clause 7.

He also highlights that subordinate engineers face challenges in being truthful and objective, particularly when they must go against the orders of their superiors. According to participant J, telling the truth during the startup stage may create disturbances that hinder the firm's growth, thus presenting a negative implication of adhering to clause 7. However, no similar experiences were reported by other participants during their interviews when asked about such challenges.

3. Misunderstanding by the society

Participant S has shared that providing evidence and expressing opinions, even when done truthfully, can sometimes be problematic. He advises future entrepreneurial engineers to be cautious, as different groups in society may misinterpret or misunderstand the opinions they present. This highlights the complexity of communication, especially in engineering, where technical explanations can be misconstrued by audiences without the necessary expertise.

> *"Giving evidence is best avoided especially in the Sri Lankan context as it is usually taken as personal, and this can affect your business. Expression of opinions in your field of expertise is not unethical. If your opinion is sought, it means that your knowledge and expertise are respected by the party seeking your opinion. However, this too can be taken personal and lead to business rivalry/animosity." S*

In a highly competitive business environment, even truthful opinions and statements can provoke business rivalry. Participant S exercises caution when expressing opinions within his area of expertise, aiming to avoid unnecessary complications for himself and his large-scale firm. Increased rivalries within the business community can hinder the growth and survival of entrepreneurial firms (Fath et al., 2021). Therefore, entrepreneurial engineers must carefully navigate such situations, ensuring their opinions and statements are truthful and objective while minimizing the risk of societal misunderstandings.

Truthfulness is a fundamental principle of engineering ethics, yet in the entrepreneurial context, it often presents significant challenges, as highlighted above. Entrepreneurial engineers must skillfully navigate the inherent tension between upholding truthfulness and addressing the pressures of a competitive business landscape. By implementing strategies to adhere to clause 7, they can effectively balance these competing demands, promoting ethical integrity while achieving business success.

5.9 Clause 8: Life-long learning

5.9.1 Introduction

Clause 8 of the IESL code of ethics is "Engineers shall continue their professional development throughout their careers and shall actively assist and encourage engineers under their direction to advance their knowledge and experience" (*The Institution of Engineers Sri Lanka - Code of Ethics*, 2013). It is all about Lifelong Learning (LLL) or continuing professional development (CPD). Similar clauses are available in the ECSL code of ethics and other international professional engineering associations such as FEANI, ASCE, & IEEE (*Engineering Council Sri Lanka - ECSL Code of Ethics*, 2020; Hansen & Zenobia, 2011; IEEE, 2004). In the past, an individual's skills, knowledge, understanding, and competence were predominantly evaluated based on their initial education and training. LLL was regarded as an optional pursuit, often undertaken by those with a strong personal interest in continuous development. However, over time, LLL has evolved into an indispensable approach, recognized as essential for staying relevant and up-to-date in one's professional domain. (Guest, 2006). For entrepreneurs, lifelong learning serves as the foundation for long-term success, as it fosters openness, creativity, and innovation in leadership (Ibrahim et al., 2022).

According to the IESL Code of Ethics, the ethical responsibility toward LLL has two key facets. Engineers must engage in LLL for their own professional development, ensuring they remain competent and up-to-date in their field. Additionally, they have an obligation to support the professional growth of their subordinate staff, including junior engineers. Given that LLL is crucial for both engineers and entrepreneurs in their professional journeys, it is valuable to explore how entrepreneurial engineers adhere to Clause 8.

5.9.2 Own professional development

The first part of Clause 8 emphasizes the importance of engineers taking responsibility for their own professional development through engagement in LLL practices. An ethical engineer should consistently seek to expand their knowledge and skills to remain competent in their profession. This study revealed that Sri Lankan entrepreneurial engineers maintain an attitude of humility, recognizing that they do not know everything necessary for their professional journey. Such open-mindedness is a crucial trait for fostering a commitment to LLL and ensuring continuous growth and adaptability in a dynamic professional landscape.

> *"I have to learn, because as a technical guy, I didn't even know to read a financial statement in an early stage. There are people who talk about taxation and all those things. I had to learn a lot of things". G*

As an engineer, Participant G initially lacked sufficient knowledge of the financial aspects of running a business. Recognizing this gap, he proactively pursued learning in the necessary subject areas to successfully manage and grow his firm. Similarly, Participant J echoed this sentiment, emphasizing the importance of acquiring knowledge beyond technical expertise to navigate the challenges of entrepreneurship effectively.

> *"The more we study, the more we understand that we have a lot to learn. We continue to study, as we do not know everything required to run the firm". J*

According to Participant J, continuous learning reveals the vast scope of knowledge yet to be explored. He believes that this realization serves as a powerful motivator for engaging in lifelong learning (LLL). For entrepreneurial engineers, managing a firm successfully requires a diverse skill set that extends beyond technical expertise. While business knowledge is critical, technical proficiency remains equally essential, particularly since many entrepreneurial engineers participating in this study operate firms closely tied to their fields of expertise. This dual focus on improving both business acumen and technical skills underscores the importance of a comprehensive approach to LLL. According to Starrett et al. (2017), that engineering itself, as a practice and a body of specialised knowledge, is constantly growing. So, no engineer can say that he has finished learning.

5.9.3 How is the 1st part of the 8th clause applied?

This section examines how entrepreneurial engineers achieve their professional development throughout their entrepreneurial journey, supported by narrative evidence from their interviews. A constructivist grounded theory-based analysis has identified four key categories of strategies: "acquiring educational and professional qualifications, upgrading knowledge and experience, networking, and sharing knowledge." Each category is discussed in detail below.

5.9.3.1 Acquiring educational & professional qualifications

The interviews revealed that participants actively pursued various educational and professional qualifications throughout their entrepreneurial journey. Within this major category, two prominent subcategories emerged: "Acquiring postgraduate qualifications and Acquiring chartered engineer status. These efforts reflect the participants' commitment to enhancing their expertise and credibility in their professional and entrepreneurial pursuits.

1. Acquiring post graduate qualifications

Many participants expanded their educational qualifications by pursuing academic courses such as diplomas, master's degrees, and PhD programs. Notably, one participant's entrepreneurial firm offers consultancy services in the specific field of his PhD research. This demonstrates how advanced academic qualifications not only enhance technical expertise but also provide a strategic advantage in aligning business offerings with specialized knowledge.

> *"I started doing MSc and continued to work in the same company for six and half years. For my MSc, I got very good results. Then I thought of doing higher studies. Then I started doing the PhD while doing the work." C*

Participant C earned an MSc and PhD while employed, but his professional development extended beyond these qualifications. His pursuit of continuous learning reflects the view that education is a lifelong process, reinforcing its importance in the entrepreneurial engineering journey.

> *"I have done a post graduate diploma in Singapore. Like that I have developed my academic background. Thereafter I did not do any academic activity. But recently I have completed my MBA for business purposes. As an entrepreneur it is good to know how to change everything." H*

Participant H completed a postgraduate diploma in Singapore and later pursued an MBA, recognizing the importance of business management knowledge for engineers leading entrepreneurial ventures, despite not undertaking further technical qualifications (Bosman & Fernhaber, 2017). Not like other entrepreneurial engineers, participant W has come across a different situation in his entrepreneurial journey, as explained in the following narrative.

> *"Actually, I wanted to complete a MSc and especially an MBA in addition to my charter. Unfortunately, I was busy and wanted to build this business." W*

Although participant W intended to pursue both an MSc and an MBA, time constraints and firm development delayed his plans, which were further impacted by the pandemic. However, he recently attained chartered engineer status. Unlike most participants, he has not yet completed postgraduate studies, though many entrepreneurial engineers pursue advanced qualifications in both technical and management fields.

2. Acquiring Chartered engineer status

This study focused on entrepreneurial engineers in Sri Lanka who hold the "Chartered Engineer" status. Participants emphasized obtaining this status as a key strategy for achieving professional development. The Institution of Engineers, Sri Lanka (IESL) grants the Chartered Engineer status, which signifies the highest standards of professionalism, leadership, up-to-date expertise, quality and safety, as well as the ability to conduct independent practice (*Professional Review Rules*, 2018). The Chartered Engineer status is awarded to engineers who complete a prescribed amount of training and work experience. According to the interviews, holding this credential is crucial for practicing as a consultant engineer while running a consulting firm.

> *"I have also done my charter in a minimum time as I had an exemption for my MSc work. One-year exemption. Then I got that charter also". C*

Participant C, who holds both an MSc and a PhD, also achieved Chartered Engineer status early in his professional journey. Similarly, participant W, despite being unable to pursue postgraduate studies due to the demands of his business, has also attained Chartered Engineer status, as highlighted below.

> *"I have completed my design works especially in the road design sector and got the charter in two thousand sixteen." W*

Participant W planned to pursue an MSc and MBA, but time limitations and the pandemic delayed his goals. He has since achieved chartered engineer status. Unlike most participants, he has yet to complete postgraduate studies, though many entrepreneurial engineers obtain advanced technical and managerial qualifications.

5.9.3.2 Upgrading the knowledge & experience

Participant W planned to pursue an MSc and MBA, but time limitations and the pandemic delayed his goals. He has since achieved chartered engineer status. Unlike most participants, he has yet to complete postgraduate studies, though many entrepreneurial engineers obtain advanced technical and managerial qualifications.

1. Participating in CPD activities

CPD is a widely used concept in professional engineering practice. The definition of CPD is the "systematic maintenance, improvement, and broadening of knowledge and skill and the development of personal qualities necessary for the execution of professional and technical duties throughout the practitioner's working life" (Pennoni, 1993). There are various ways to participate in CPD. Participant Q, who leads his own manufacturing firm in electronic items, has highlighted his approach as follows.

> *"Every professional need to engage in professional development always irrespective of age. As a professional engineer, I take part in many such activities including reading,*

communication & leadership development, being up to date with evolving technologies, R&D, etc.," Q

The approach for CPD is compatible with the definition given by Pennoni (1993) for CPD. Professional development should be a lifelong pursuit, regardless of age. According to the participants, some entrepreneurial engineers are over 60 years old yet continue to engage in business activities, such as serving as MD/CEO of their firms. Despite their age, they remain committed to participating in various formal and informal CPD activities, demonstrating that professional growth is essential throughout one's career. According to Kochekseraii (2019), lifelong learning is a crucial characteristic for both novice and seasoned engineers to excel in their future responsibilities and improve their career prospects.

"I came here as just a normal design engineer to CEO level. Even now, although I am the CEO, it is an engineering company. So, professional development should be continuous. O

Participant O, CEO of a leading Sri Lankan manufacturing firm, supports lifelong learning but believes his role requires only staying informed on relevant technological trends. He relies on his team for detailed decisions. As Somani (2016) notes, continuous learning, formal or informal, is key to professional success, which in O's case contributes to his firm's achievements.

"I participated in seminars, lectures, workshops, training sessions, etc. and continued to improve my knowledge." S

Entrepreneurial engineers can expand their knowledge through seminars, workshops, and training sessions organized by professional bodies to support lifelong learning (Dawe et al., 2021). Regular participation enhances skills and field-specific knowledge. However, as Participant L suggests, CPD should extend beyond purely technical domains.

"All entrepreneurial engineers should learn about accounts. Because the accounting part is very important for engineers according to my experience. So I actually learn something and I did Project Management Professional exams." L

Participant L recommends that entrepreneurial engineers learn accounting, emphasizing its importance for business success (Rachapaettayakom et al., 2020). He also advocates for broader management knowledge. Although CPD is vital for lifelong learning, research indicates that many engineers attend formal sessions infrequently due to time constraints (Aerts et al., 2015).

2. Getting updated with new technologies

Attending CPD activities from time to time is a formal way of LLL. Interviews have revealed that most of them also engage in LLL by updating themselves with new technologies. To stay up to date with new technologies, they follow informal learning and self-directed approaches. The following narratives exemplify those approaches.

"Nowadays, I am learning "Revit". Generally, in our office, we use AutoCAD. Today we want to convert our office operations into Revit, because we believe that is the future. Therefore, before I reach our junior engineers, I am learning it these days." N

Anticipating industry trends, Participant N began learning Revit, a widely used building information modeling software, through self-directed study. He demonstrated leadership by mastering the tool before directing his team to follow. Like engineers adapting to new technologies, entrepreneurs must continually update their skills to align with changing market demands and customer expectations (Rînciog, 2017). Hence, participant N, as an entrepreneurial engineer, is doing what both an engineer and an entrepreneur should do.

> *"I do not belong to this computer era. But there are so many instances that I got the support of my junior engineers for computer-related stuff. They come and say 'no, this is the way to do these things' and like that. So they help me to learn that." U*

Participant U, a senior engineer, is improving his computer skills with help from junior staff, reflecting his commitment to lifelong learning. Despite managing his firm, he values learning from subordinates, showing that age does not hinder professional growth. Though informal, this learning supports LLL, which is essential for adapting to technology, sustaining businesses, and fostering growth (Rînciog, 2017).

> *"It's really the building up experience and being in touch with what is going on, not only in engineering, but in other areas as well." T*

Participant T emphasizes the importance of learning beyond engineering, including politics, economics, and marketing, for effective business management. As Froehle et al. (2021) note, real-world lifelong learning often occurs through informal means rather than passive methods like lectures and seminars. Informal learning helps entrepreneurial engineers stay updated and meet LLL requirements.

3. Acquiring more practical experience

Entrepreneurial engineers enhance their knowledge through practical exposure to diverse tasks, whether intentional or not. On-the-job learning strengthens problem-solving and innovation, especially in complex projects. This experiential approach is vital for professional growth, offering real-time learning and practical insight (Goldberg, 2006). Participant T has shared his experience in acquiring more practical knowledge as a mechanism to achieve LLL.

> *"For me, after my PhD, I don't have any paper qualifications. It was only the experience. I am a hands-on engineer, I am not afraid of instruments and fixing them and getting into trouble and trouble shooting them in the power sector. So that improves my knowledge as well." T*

Participant T, though not pursuing further formal education post-PhD, values practical experience in power engineering as a key driver of knowledge. Real-world projects allow entrepreneurial engineers to apply theory, solve complex problems, and foster innovation. This experiential learning promotes continuous growth and confidence while expanding their technical expertise (Guardia, 2016; Uchino, 2010).

> *"In each and every second, we are always developing our profession with respect to experience." V*

Participant V believes that entrepreneurial engineers can enhance their knowledge and advance their professional development by gaining practical experience. The more they work, the more their professional growth is fostered. This behavior aligns with David Kolb's "Experiential Learning Theory," which emphasizes learning through experience and explains how concrete experiences contribute to the acquisition of new skills and knowledge (Gammell & Kolb, 2013). Furthermore, as this learning occurs within specific environments and is closely tied to the activities, culture, and social interactions of those environments, it also corresponds to the "Situated Learning Theory" developed by Jean Lave and Etienne Wenger (Jones et al., 2021).

4. Reading

Reading is another strategy employed by entrepreneurial engineers to enhance their knowledge and experience. Widely regarded as one of the most traditional and effective methods of learning, reading remains a fundamental approach for personal and professional growth.

> *"I read a lot and I engaged with various project reports and so on. I put my hands and learn a lot. You know I am learning. Now with these projects, I have learnt a lot about many things." P*

Participant P has a habit of reading a wide range of resources, including not only books but also project reports, to expand their knowledge base. According to the participants, reading any material deemed relevant to their work allows them to enhance their understanding and improve their expertise.

> *"Even now actually, I can show you these two books (showing two books). I am doing acoustics. Because that has to be our interest. Then only we can improve our knowledge day by day." J*

In this case, participant J presented two books on Acoustics to the researcher, demonstrating his enthusiasm for reading materials related to allied fields of his practice. Even the renowned business magazine Forbes highlights the benefits of reading for entrepreneurs, noting that it can save time in the long run by providing valuable information that helps avoid future mistakes (Felber, 2021).

5.9.3.3 Networking

Networking has emerged as a key strategy for fostering lifelong learning (LLL) among entrepreneurial engineers in Sri Lanka. The subcategories contributing to this strategy include "connecting with people," "working with professional institutions," and "international travel." Entrepreneurial engineers operate in dynamic environments where innovation and adaptability are essential. Networking, defined as the process of establishing and utilizing connections to exchange information, resources, and support, plays a critical role in helping these engineers achieve their goals (Stuart & Sorenson, 2007). It facilitates knowledge sharing and learning, both of which are crucial for innovation and growth. Through their networks, entrepreneurial engineers gain access to a wealth of ideas, best practices, and technical expertise.

1. Connecting with people

Connecting with various individuals is a primary form of networking for entrepreneurial engineers. The main goal of these connections is to secure work opportunities or establish valuable personal relationships with potential clients (Guardia, 2016).

> *"I am the organiser of the ……….. trade society. Then I am the initiator of the inter-trade society of …………… district. I gathered all the mercantile unions in this district. Then set up one. So, we have to build relationships with others. We market ourselves within that." K*

Participant K has unified all the mercantile unions in his district, positioning himself as a leading figure among local traders. This has proven advantageous, as it allows him to promote his business within that network. As an entrepreneurial consultant engineer specializing in building and housing design, connecting with people and raising awareness of his business is an effective marketing strategy to achieve his business goals.

> *"I am developing the company as well as my career. From the beginning I want to do that. So now everyone in the industry knows me as there is a person called.............(Name of the participant) who is heading this company, that is what I wanted to build also." G*

According to participant G, both his firm and he have gained significant recognition in their field of practice, particularly among clients. This popularity has helped his firm secure numerous job opportunities in the market. A study by Stuart & Sorenson (2007) demonstrated that networking plays a crucial role in increasing the likelihood of obtaining venture capital funding, underscoring the practical benefits of networking for entrepreneurial engineers. While participant G is not currently seeking venture capital, he continues to secure job opportunities through the connections he has built within the community.

2. Working with professional institutions

In addition to connecting with people, working closely with various professional institutions has also helped entrepreneurial engineers expand their networks, thereby supporting their LLL. Many participants engage with the IESL, the country's leading engineering body, as part of their professional development.

> *"First, I worked with the Institution of Civil Engineers UK. So, they wanted to train us in Hong Kong on how to conduct professional review examinations. So with that experience, I came to Sri Lanka and started working with IESL. Before that, I did not participate in IESL activities." U*

Working with professional institutions has enabled participant U to enhance his knowledge and experience, particularly in professional development. The insights he gained from the Institution of Civil Engineers (ICE), UK, on conducting professional review examinations have been instrumental in improving the procedures for professional review activities at the Institution of Engineers, Sri Lanka (IESL). Participation in such activities has further contributed to his professional growth. According to Starrett et al. (2017), being a professional entails taking on responsibilities that exceed those of a typical employee. A professional represents not only themselves but also the broader profession. As a professional engineer, participant U provides valuable services to the community while continuously developing his own skills.

> *"Then I got memberships with so many other professional bodies." V*

Participant V holds memberships with several professional bodies, and these networks have played a crucial role in helping him share and acquire knowledge for his professional development. As an entrepreneurial engineer managing businesses across various domains, he leverages these networks to identify market gaps and emerging trends, which can be used to develop new products or services. Shane & Venkataraman (2000) emphasize that opportunities are not always immediately apparent and require a deep understanding of the market environment, which can be gained through network interactions. For engineers, staying connected with industry peers, customers, and thought leaders offers valuable insights into unmet needs and potential areas for innovation.

3. International travel

International travel has helped entrepreneurial engineers expand their networks, which in turn supports their LLL. Visits to other countries for various professional purposes broaden their knowledge and contribute to their professional development by allowing them to connect with a wide range of professionals and experts.

> *"I travelled to Dubai and Europe countries, eight countries, I learnt a lot of things from them. Here you can see the evidence (shows some photographs taken during the foreign tours). Always, we have to refresh our knowledge. See these things (show some albums)". K*

Participant K applies the knowledge and experiences gained from international travel to his business activities. Traveling to different countries exposes entrepreneurial engineers to new ideas, technologies, and perspectives, which can stimulate creativity and innovation. This exposure allows engineers to encounter unique challenges and solutions not found in their home countries. The concept of "creative abrasion," introduced by Leonard-Barton (1995), suggests that diverse thoughts and experiences can lead to more innovative outcomes. By engaging with different engineering practices and entrepreneurial ecosystems, engineers can incorporate novel approaches into their own work.

> *"I have a habit of going to conferences. Two years ago, I went to Germany again for an energy-related thing. As a habit or most of the time, it may not always be to gain knowledge, but as an opportunity to network with other engineers and just to have fun, I am always participating." N*

In addition to networking and enhancing knowledge, Participant N views international travel as an opportunity to have fun and enjoy life, all while engaging in LLL. Networking on a global scale offers access to a broader range of resources, including potential partners, investors, customers, and mentors. According to Granovetter (1973)'s strength of weak-ties theory of Granovetter (1973), weak bonds, or acquaintances from different networks, can provide valuable new information and opportunities that strong bonds or close contacts, might not offer. Engaging with peers and industry leaders worldwide opens doors to collaborations and ventures that may not be achievable through local networks alone. Additionally, exposure to different cultural contexts broadens an engineer's understanding of global markets and consumer behavior. According to Hofstede (1980), cultural dimensions such as individualism vs. collectivism and power distance influence how business is conducted in different regions. By immersing themselves in various cultural settings, entrepreneurial engineers can develop cultural intelligence (Earley & Ang, 2003), which enhances their ability to navigate and succeed in international markets.

5.9.3.4 Sharing knowledge

The interviews revealed that entrepreneurial engineers actively share knowledge with the community. To do so, they invest significant effort in acquiring knowledge throughout their entrepreneurial journey, reflecting their commitment to LLL. They share this knowledge by engaging in activities such as research and development and lecturing.

1. Research & development (R & D)

Engaging in R&D activities is vital for the lifelong learning of entrepreneurial engineers. This involvement not only keeps engineers at the cutting edge of technological advancements but also fosters continuous innovation, enhances problem-solving skills, and cultivates an adaptive mindset, all of which are essential for successful entrepreneurship.

> *"We are doing lot of research. Every year you can see that there are two papers, at least two papers in the ………… sessions and some other conferences or in international conferences, we are doing research." C*

Participant C regularly participates in R&D activities relevant to his field and disseminates the findings to the broader community by presenting at conferences with his team of engineers. R&D activities often involve exploring cutting-edge technologies, methodologies, and scientific discoveries. According to Tushman & Anderson (1986), technological discontinuities create opportunities for innovation and highlight the need for engineers to continuously update their knowledge base.

> *"Last three-four years we were doing lot of research on how to extract Silica from the ash of paddy husk? I did not stop at looking at the findings of these researches. But I had to learn chemical engineering & many things relevant for that process." V*

Participant V conducted R&D on waste from his eco-friendly power plant and developed a method to extract silica, which he later shared publicly. R&D plays a critical role in innovation by enabling the continuous development and refinement of ideas to meet changing market needs. According to Schumpeter (1934), his theory of creative destruction highlights the pivotal role of innovation in economic development and competitive advantage. R&D fosters experimentation and enables entrepreneurs to introduce transformative innovations. Participant V is currently working to commercialize his recent discovery.

> *"I try to simulate that ancient system using our technologies. In the ancient system, water was available to consumers on demand. I try to simulate that 'on demand' service basis for this canal network. So I have a published news article on two thousand twelve for that." A*

Participant A used his innovative mindset to address a major issue affecting farmers in the dry zone. R&D enhances engineers' analytical and critical thinking by fostering problem-solving through navigating uncertainty and applying scientific principles to complex, real-world challenges. This approach aligns with Gammell & Kolb (2013), experiential learning theory, which suggests that learning is a process in which knowledge is created through the transformation of experience

2. Teaching

The interviews revealed that many participants teach various groups of students to share their expertise. As knowledgeable professionals, they are often invited by higher education institutions and professional organizations to conduct lectures, seminars, and participate in panel discussions. Delivering a lecture is a challenging task that requires significant preparation and effort.

> *"I am doing lecturing. For that, course contents need to be updated. I learnt a lot by that". P*

Participant P, a visiting lecturer at multiple Sri Lankan universities, emphasized the need to stay current in his field. Teaching fosters professional development by reinforcing core concepts and requiring clear explanations. This process deepens understanding and often leads to new insights through the refinement of complex ideas. Shulman (1987) highlights the importance of pedagogical content knowledge, where the act of teaching enhances both the teacher's expertise in the subject matter and their instructional methods.

> *"I am a resource person for many training courses for the last thirty-four years. To teach in these courses, I have to find a lot of new knowledge. You know the efficiency course we have taught in nineteen eighty-three is not the same today" T*

Participant T stressed that lifelong learning is essential for teaching consistently over time. Teaching deepens subject mastery, as preparing lectures demands familiarity with current research, trends, and technologies. Engaging with both new material and core concepts strengthens the engineer's knowledge base. This aligns with the "learning-by-teaching" effect, as noted by Bargh & Schul (1980), which suggests that the act of teaching enhances the teacher's understanding and retention of information.

Teaching supports lifelong learning by deepening knowledge, reinforcing core concepts, and improving communication skills. By engaging in education, entrepreneurial engineers advance both personally and professionally. Institutions and industry should support their dual role as practitioners and educators to promote continuous learning and innovation**.**

5.9.3.5 Consequences of the 1st section of the 8th clause

Extensive interviews with the participants revealed only positive consequences on entrepreneurial behavior and performance from engaging in LLL practices, as stated in Clause 8. No negative consequences were identified.

5.9.3.5.1 Positive consequences

Entrepreneurial engineers have experienced business sustainability, enhanced business opportunities and enhanced reputation as positive implications by adhering to the first part of clause 8.

1. Business sustainability

Focusing on their own professional development and lifelong learning (LLL) has contributed to the sustainability of entrepreneurial engineers' ventures. It is the goal of every entrepreneur to build a long-lasting and successful business (Taipale-Erävala et al., 2019).

> *"Without CPD, we cannot sustain. Even technology is changing, systems are changing, so it is a must. Now it has become a must. If we don't understand the next generation things, if we don't develop, we will be a dinosaur." E*

Given the rapid pace of technological change, entrepreneurial engineers must update their knowledge accordingly (Uchino, 2010). Clients expect innovative and up-to-date solutions, and failing to meet these expectations can jeopardize a business. As participant E noted, providing outdated solutions leads to client dissatisfaction, which ultimately hinders the sustainability of the business.

> *'This is not something to feel shy or anything to enhance knowledge that I do not know. So, without knowing that if I am going to implement something and make a mistake, that will create some embarrassing situations in public." U*

Insufficient knowledge can jeopardize client outcomes and business sustainability. Advanced knowledge enhances problem-solving, innovation, and decision-making, enabling entrepreneurial engineers to deliver higher-quality solutions and scale operations effectively. As Goldberg (2006) suggests, lifelong learning is essential for sustained business performance and customer satisfaction.

2. Enhanced business opportunities

LLL has helped entrepreneurial engineers enhance their business opportunities. The ability to design and develop innovative products and solutions through LLL has opened many new business avenues for them.

> *"At the end of the day, I have come out with the business. In this power plant, I can extract silicate from this paddy husk ash in the form of sodium silicate or Potassium Silicate, which is very useful to industry, a highly demanded raw material for manufacturing various things." V.*

As mentioned earlier, participant V conducted extensive research to find an innovative method for extracting silica from paddy husk ash. He successfully developed this process and is now running a business that sells silica extracted from the ash, a byproduct of his mini power plant. This new venture adds to his diverse portfolio of businesses, enabling him to further diversify his entrepreneurial activities and generate additional revenue.

> *"All engineers should learn about Accounting. Because Accounting is very important for engineers according to my experience. So also learnt it and I did PMP (Project Management Professional) exams. That is more attractive, and more jobs can be done if we know the accounting and financial aspects and can provide solutions to clients." L*

LLL extends beyond technical expertise for entrepreneurial engineers. Expanding knowledge in areas such as accounting has created additional job opportunities for participant L. Entrepreneurs, constantly seeking new opportunities, leverage this broader knowledge to maximize profits and ensure business sustainability (Chell, 2008).

3. Enhanced reputation

Reputation is a vital asset for entrepreneurial engineers aiming for business success. Engagement in LLL has significantly enhanced the reputation of entrepreneurial engineers, both among their subordinate staff and within the broader business community, as expert business leaders. Participant G highlighted how continuing professional development enabled him to establish credibility and respect among his subordinate staff members.

> *"It was one of the leading and tough certifications in cyber security. So, I have done it. Now I am the only one here who has done that. I have done that, not because I want it. As CEO, I don't want to do any certifications, but I wanted to show my team that I am also capable." G*

Participant G pursued certifications to demonstrate technical expertise and leadership to his team. He believes that a reputable CEO manages tasks more effectively and with less resistance. His engagement in lifelong learning has strengthened his credibility, while networking further enhanced his reputation among stakeholders (Weng & Chen, 2017). A positive reputation plays a pivotal role in attracting customers, who are more inclined to choose companies known for delivering high-quality, innovative solutions (Prashantham et al., 2020). A strong reputation attracts clients seeking dependable, innovative services and fosters loyalty. Satisfied customers often return and provide referrals, which are essential for long-term business growth (Hoe & Mansori, 2018).

5.9.4 Assisting the professional development of subordinates

The second part of the clause 8 of the IESL code of ethics is "Engineers shall actively assist and encourage engineers under their direction to advance their knowledge and experience". Since human capital is an essential asset in any organisation that contributes to its success, employee development should not be neglected (Rajendran & Dharan, 2018). Baron & Armstrong (2007) also highlighted that investing in human capital adds value to any firm. Large-scale organisations have established supporting procedures, including allocation of funds for employee development. However, small- and medium-scale entrepreneurial firms (SMEs) lack such established procedures (Cardon & Stevens, 2004; A. Gamage & Sadoi, 2008; Rajendran & Dharan, 2018). According to a survey conducted by Gamage & Sadoi (2008), focussing SMEs in the manufacturing sector in Japan has identified that the owner/manager's attitude toward training is the most influential factor in deciding the amount of training & development for the employees. Mangaleswaran (2015) has identified, based on a study conducted in the Hambanthota district in Sri Lanka, that SME holders provide on-the-job training for their employees once they are recruited. However, they do not have established policies for various HRM practices.

An analysis of the interview transcripts revealed that all participants demonstrated a strong commitment to supporting the professional development of their subordinate engineers. As Gamage & Sadoi (2008) emphasised, implementing effective training and development programs is challenging without the active commitment of the firm's owner or manager. In this context, the influence of the code of ethics has played a significant role in positively enhancing the dedication of entrepreneurial engineers to assist their subordinates in advancing their professional capabilities.

5.9.5 How is the 2nd part of the 8th clause applied?

The grounded theory-based analysis has revealed several strategies which are used by entrepreneurial engineers to accomplish the professional development of subordinate engineers. The major strategies are "training, teaching, coaching and mentoring".

5.9.5.1 Training

Training in a business context involves developing existing skills or introducing new ones to enhance business performance (Jones, 2004). Entrepreneurial engineers face the challenge of developing their subordinates' skills to drive innovation and productivity. Interview findings show that participants actively organized in-house and external training programs, supporting comprehensive skill enhancement and professional development within their teams.

> *"We are always giving them some kind of training for their technical development. As examples, Civil 3D works, Microsoft 3D Visio and AutoCAD can be highlighted." C*

Participant C, an expert in key technologies, has conducted training to build his staff's proficiency in essential software for civil engineering consultancy. Technical competence is vital for engineering roles (Carthy et al., 2018; Guardia, 2016). Several participants also utilized external experts to deliver comprehensive training aligned with industry needs.

> *"I used to get down some senior engineers and my known friends to have some kind of discussion on various topics with my junior engineers in my organisation." U*

raining solely by one senior engineer is insufficient for comprehensive staff development. Exposure to diverse senior professionals enhances knowledge sharing and broadens perspectives (Hirudayaraj et al., 2021). Pairing experienced and junior engineers facilitates learning and growth. Participant U invited external experts to train his team, while many entrepreneurial engineers also support staff participation in CPD programs, such as those offered by IESL (*Professional Review Rules*, 2018).

> *"Always my target is sending one engineer for a CPD course every year. That's what I have given them." M*

Similarly, to Participant M, many entrepreneurial engineers have indicated that they offer opportunities for their subordinates to attend and receive training through CPD programmes. These programmes provide an excellent opportunity for young engineers to engage in lifelong learning practices (Guardia, 2016). Maintaining competitiveness in engineering requires a culture of continuous learning. Entrepreneurial engineers can support this by offering access to workshops, seminars, and certifications, and by encouraging involvement in professional networks and engineering societies to foster growth and development (Tynjälä et al., 2003).

> *"We give more and more chances them to go abroad and attend with various kind of trainings". J*

Participant J's practice of sending subordinate engineers to foreign countries provides an excellent opportunity for the professional development of young engineers (Rooney et al., 2014). Foreign exposure gives engineers access to advanced technologies and innovative methods unavailable locally. International education and work placements enhance technical skills by introducing cutting-edge research and diverse problem-solving strategies, improving their capacity to address complex engineering challenges (Mittelmeier & Yang, 2022).

> *"Our organisation is one of the very few recognized by the Institution of Engineers Sri Lanka for professional engineering experience." Q*

Participant Q's firm is widely recognized as a top training ground for aspiring Chartered Engineers. Likewise, many participant-led firms are known for their strong commitment to staff development. Despite their demanding roles, these entrepreneurs invest time in training, acknowledging its importance in keeping pace with evolving engineering and technological demands.

5.9.5.2 Teaching

Teaching has several scholarly definitions, and Rajagopalan (1973)'s study contains the below definition given by Edmund Amidon in 1967. Teaching is defined as 'an interactive process, primarily involving classroom talk that takes place between teacher and the student and occurs during certain definable activities'. Most entrepreneurial engineers in this study are experts in their fields and actively teach their subordinates to enhance technical knowledge. Senior engineers play a key role in staff development through ongoing instructional support within their firms.

"As a lecturer, I have some teaching sessions once a week for my subordinates. We are working on that for two to three hours. So junior engineers have benefitted by both knowledge and experience." C

Participant C, a PhD holder and visiting lecturer, also teaches within his firm. Senior engineers serve as key sources of knowledge, facilitating its transfer to junior staff. As noted by Nonaka & Takeuchi (1995), this transfer supports organizational learning and innovation, enhancing junior engineers' understanding and firm performance.

"I gave a transmission maintenance lecture online mode to postgraduate students from a particular university. For that, my staff members also joined and learnt from that" P

Although informal, the lecture delivered by Participant P enhanced his subordinates' technical knowledge. By sharing his expertise, he fostered a collaborative learning environment, which is essential for engineers' professional development. Senge (1990) highlights that learning organizations rely on continuous improvement and knowledge sharing. Senior engineers contribute to this culture through teaching. As Starrett et al. (2017) note, professional development extends beyond technical skills, making this approach vital for mentoring future engineers.

"In addition to that, engineers should give more opportunities to investigate alternative aspects of road construction, such as bitumen and so on. I am thinking of allowing a few of my engineers to carry out research activities in the such areas in future to develop their knowledge." W

Participant W plans to mentor his subordinates in research, recognizing its value for professional growth. Research builds skills in literature review, experimental design, data analysis, and scientific writing. Through guidance, senior engineers help juniors grasp scientific rigor and foster innovation, preparing them for roles in academia or industry R&D. Amabile (1996) suggests that a work environment conducive to creativity significantly enhances problem-solving abilities. Entrepreneurial engineers can stimulate innovation by encouraging junior engineers to think critically, challenge assumptions, and explore unconventional solutions.

5.9.5.3 Coaching & mentoring

Coaching and mentoring are two distinct HRM tools for employee development (Truitt, 2011). However, these terms often cause confusion among the general public due to their nuanced differences. According to Zust (2017), coaching is primarily performance-driven, with the aim of improving professionals' on-the-job performance. In contrast, mentoring is more development-driven, focussing on a holistic approach to career development that extends beyond the functions of the current job. The interviewees have used both methods to support their subordinate engineers' professional development, recognising that soft skills, management skills, and ethics are integral components of this process (Starrett et al., 2017).

"I do so many mentoring to people those who are doing the charter". N

Chartered engineer status is a key professional milestone. All interviewees in this study hold this designation and actively mentor junior engineers in achieving it (Professional

Review Rules, 2018). Participant N and others also extend support beyond their firms, reinforcing the crucial role of senior engineers in professional development (Levy, 2000). Through the transfer of technical knowledge, professional skill development, ethical guidance, and support throughout the application process, senior entrepreneurial engineers contribute significantly to the professional journey of their subordinates.

> *"We recruit engineers, not for projects, but for long-term employment. Therefore, the right candidate is assured of a long career with a structured career development path." S*

Participant S employs engineers long term, offering strong career development opportunities, unlike firms favoring short-term hires Nejatyan et al. (2023). He provides psychosocial support through encouragement and motivation, which strengthens confidence during the chartership process. Kram's mentoring theory highlights the value of such dual support in professional growth (Kram, 1985).

> *"Our company has a policy to encourage all our staff to obtain formal post-graduate degrees. Of course we have many international contacts. So we use those contacts for find placements to our staff. Our company, at most exactly for all of them, would have given leave." T*

Participant T encourages all of his subordinate engineers to pursue formal post-graduate degrees and further supports them by assisting in finding suitable universities and providing study leave. Postgraduate education in engineering is a significant step toward advanced expertise and career advancement (Fasano, 2015). Postgraduate programs can be demanding, and entrepreneurial engineers play a key role in mentoring subordinates through them. Their support extends beyond academic guidance to include career mentorship, helping junior engineers identify goals, choose suitable programs, and build networks aligned with industry trends and career aspirations. Research by Allen et al. (2004) shows that mentoring significantly enhances career satisfaction and progression, emphasising the importance of professional guidance in post-graduate success.

> *"We allow them to work independently. Because engineers after sometime, they have to be independent. So, we make them independent, we allow them to take decisions. At the beginning, they can take the decisions, but they have to report us. Slowly we make them independent." C*

Autonomy in the workplace is essential to foster innovation, job satisfaction, and professional growth (Johannsen & Zak, 2020). Autonomy for junior engineers must be carefully managed. Participants often adopt a gradual approach, allowing autonomy to increase as competence develops. This ensures skill acquisition aligns with task complexity. Based on Vygotsky's zone of proximal development, gradually reducing guidance fosters independence while preparing junior engineers for complex responsibilities (Vygotsky, 1978).

The scaffolding approach helps junior engineers build skills systematically and prepares them for complex tasks. Since limited experience often affects their confidence, gradual autonomy fosters self-efficacy through mastery experiences (Bandura, 1997). Organizationally, this approach ensures a competent and capable engineering workforce. According to Senge (1990), learning organisations thrive by continuously developing their employees' skills and capabilities. Gradual autonomy is a critical component of this continuous development process.

> *"From my senior engineers, I asked why don't you start your own company. First, I will allow you to work with us as a subcontractor. Then you do it yourself, right? If you fail, I will employ you back at my company. Now there are few companies starting like that. Of course, I have helped them by doing their first work." R*

Some participants, including Participant R, mentor subordinates in launching startups by sharing experience and offering guidance. This mentorship fosters an internal entrepreneurial ecosystem with access to networks, resources, and collaboration. By supporting new ventures, senior engineers promote innovation, job creation, and economic growth. Their role in mentoring future entrepreneurs contributes to industry advancement and a culture of innovation within engineering (Goldberg, 2006). Schumpeter's theory of economic development emphasises the role of entrepreneurs in driving economic progress through innovation (Schumpeter, 1934).

5.9.5.4 Consequences of the 2nd section of the 8th clause

Extensive interviews with the participants have revealed both positive and negative consequences by assisting the professional development of subordinate engineers, as the clause 8 stated.

5.9.5.4.1 Positive consequences

Analysis has revealed "empowered subordinates, retention of subordinates, more collaborative opportunities & self-satisfaction" as the positive consequences of adhering to the second section of the clause 8.

1. Empowered subordinates

Entrepreneurial engineers support the professional growth of subordinates, resulting in empowered engineers across various fields. As venture success often relies on team capability (Dagdeviren, 2018), expert staff enhance innovation, problem-solving, and performance. Investing in their development builds a skilled workforce and strengthens competitive advantage.

> *"If I have knowledgeable people and skillful people, it is definitely a gain for me. I can use their knowledge actually. Otherwise, I have to do everything. People who joined me five years ago now handling certain areas on their own. Otherwise, you cannot grow your business." M*

Participant M emphasized that empowered staff foster innovation through their expertise and creative input. Their competence improves efficiency, allowing entrepreneurial engineers to focus on strategy and growth (Guardia, 2016). Delegating to capable subordinates enhances operations, resource use, and cost management, aligning with Drucker's (1985) principles of effective venture management.

> *"When they train only we will get something and they will get something. That expense is not a big thing since we gain something." F*

According to McClelland's achievement theory, entrepreneurs are highly achievement-orientated (Chepurenko, 2015). Entrepreneurial engineers pursue business success by investing in staff development, aligning with ethical standards and achievement theory. Participant F views employee development as beneficial, with returns outweighing costs. Competent team performance is essential for achieving profitability in entrepreneurial ventures (Chen et al., 2023). Empowered staff enhance team performance and morale by feeling valued for their expertise. This recognition increases job satisfaction and motivation, fostering a high-performing, innovative environment. According to Herzberg’s two-factor theory, utilizing one’s abilities is a key workplace motivator (Herzberg, 1966). Entrepreneurial engineers who leverage expert subordinates build motivated, high-performing teams. This synergy between strategic leadership and technical expertise drives growth, enabling organizations to seize opportunities, address challenges, and sustain long-term success (Uchino, 2010). The combined strengths of strategic vision and specialised expertise enable the firm to capitalise on opportunities, overcome challenges, and achieve sustained growth (Herzberg, 1966). Entrepreneurial engineers who leverage expert subordinates foster high-performing teams. The synergy between strategic leadership and specialized expertise drives organizational success, enabling firms to seize opportunities, navigate challenges, and sustain long-term growth (Uchino, 2010).

2. Retention of subordinates

Only a few entrepreneurial engineers have mentioned the long-term retention of their subordinate staff. In entrepreneurial firms, retaining talented and expert subordinates is crucial for maintaining organizational momentum and achieving sustained growth. (Xuecheng et al., 2022).

> *“We have not lost a single employee except people who have gone abroad for post-graduate degree programmes. So, no one has resigned and joined another company. They are happy to stay with us because we are a professional company” T*

Participant T’s focus on staff development and a positive work environment has supported high employee retention. Retaining trained staff ensures project continuity and operational consistency, which are vital for stability and performance (Kotter, 1996). Social exchange theory explains this behavior, as employees tend to reciprocate support with loyalty and commitment. High turnover, by contrast, incurs significant recruitment and training costs (Nda & Fard, 2013). By retaining trained subordinates, entrepreneurial engineers can reduce these costs and allocate resources more effectively toward business development and growth initiatives.

3. More possibilities for collaboration

Subordinate engineers do not always stay with the firms of entrepreneurial engineers for various reasons. After gaining sufficient expertise, they may move to other positions or even start their own firms. However, several entrepreneurial engineers have recognized the potential for collaboration with their former subordinate engineers in future business activities, as outlined below.

> *"We can't run the businesses forever. Sometimes, after five-six years later, I may not able to do. I may be an entrepreneur, but I may not have the strength to do the designs and my memory will be lost. At that time, I could have so many joint ventures with these people (previous subordinates) and run my business." U*

Subordinate engineers do not always stay with the firms of entrepreneurial engineers for various reasons. After gaining sufficient expertise, they may move to other positions or even start their own firms. However, several entrepreneurial engineers have recognized the potential for collaboration with their former subordinate engineers in future business activities, as outlined below.

> *"Even if it happens, I have no problem with that. We will be the happiest and sometimes we may even cooperate with them and will do joint works." T*

As achievement-orientated entrepreneurs (Kerr et al., 2017), both participants T and U have identified additional collaborative opportunities with their former subordinate engineers, which may help sustain their entrepreneurial ventures.

4. Self-satisfaction

Self-satisfaction derived from helping subordinates can significantly impact the success of firms led by entrepreneurial engineers. Several participants have highlighted the personal fulfillment they experience from assisting subordinate engineers in their professional development.

> *"We have a self-satisfaction that we have helped them (subordinate engineers) a lot. We have helped them as well as the engineering field." J*

When entrepreneurial engineers derive satisfaction from helping their subordinates, it creates a positive feedback loop of motivation and engagement. According to self-determination theory, intrinsic motivation is a key driver of employee performance. When leaders are motivated by the intrinsic rewards of helping others, it enhances their ability to inspire and engage their teams, leading to higher productivity and job satisfaction (Deci & Ryan, 1985). Entrepreneurial engineers who are satisfied with helping their subordinates create empowered teams capable of driving business growth. Empowered employees take initiative, make informed decisions, and contribute to the strategic goals of the organization. According to Spreitzer (1995), empowerment leads to increased organizational effectiveness and performance. Ultimately, satisfaction fosters happiness in the minds of entrepreneurs (Lauto et al., 2020), motivating them to accomplish their goals successfully.

5.9.5.4.2 Negative consequences

The analysis has revealed the 'Additional costs and departure of empowered subordinates' as the negative consequences with the adherence to the second section of clause 8.

1. Incurring additional costs

Investing in the professional development of subordinate staff is generally perceived as a positive strategy for organisational growth. However, for entrepreneurial engineers, such investments can sometimes have unintended negative consequences.

> *"Per year we send several engineers to get that kind of training and we spend them and for engineers who want to do MScs, we offer them. We bear their all expenses." J*

Participant J invests firm revenue in staff development, though such spending can strain limited budgets. Allocating funds to training may divert resources from key areas like R&D or marketing. Drucker (1985) emphasizes that managing scarce resources effectively is vital for entrepreneurial success, and overspending may disrupt this balance.

> *"I arrange for them to attend various seminars conducted by IESL and other organisations for CPD activities. The company spends money on them. Big amounts are there. When the financial situation of the company is not sound, I asked them to share some percentage from their side also." U*

Participant U invests significantly in staff development but acknowledges that budget constraints can make such spending unfeasible. These investments involve opportunity costs, as funds could be allocated to initiatives like technology upgrades or product innovation, which may offer higher returns (Tversky & Kahneman, 1981). Heavy investment in employee development can increase turnover, as skilled staff may pursue better opportunities, leading to lost investment and added recruitment costs. Becker's human capital theory suggests employees leave if their enhanced value is not adequately rewarded (Becker, 1964). Therefore, entrepreneurial engineers must balance development efforts with financial stability.

2. Departure of empowered subordinate staff

Entrepreneurial engineers invest heavily in empowering staff, expecting long-term returns. While some, like Participant T, retain employees long term, many face turnover. The loss of empowered staff can disrupt organizational stability and negatively impact entrepreneurial performance and continuity.

> *"The problem is that we help them develop their professional skills and some of them unfortunately leave the company after getting the experience. Most of them leave the company and do not join another company, but leave the country." O*

Participant O expressed concern over the loss of skilled staff migrating abroad, depriving both the firm and the country of vital expertise. These trained engineers possess critical knowledge essential for operations and innovation. As Nonaka & Takeuchi (1995) state, knowledge loss can hinder organisational performance and disrupt growth and continuity

> *"I know after five years' time, sixty or seventy percent of engineers will go away and will start separate businesses. That's how I also did." J*

Participant J noted that many subordinates leave to pursue ventures, as he once did. While natural for ambitious engineers, this trend creates financial strain. Recruiting and training replacements is costly and time-intensive, diverting resources from core activities such as research, development, and market expansion, and limiting overall firm growth (Becker, 1964). Losing key engineers may create a risk-averse culture, discouraging innovation. This conservatism weakens the entrepreneurial drive essential for breakthroughs and competitiveness, potentially limiting the firm's ability to seize emerging opportunities in dynamic markets (Urbig et al., 2020).

> *"Lot of people joined this company and some of them have left. It is the nature. I don't take it as a threat or something like that and that is nature." F*

Participant F views staff departures as natural, though he recognizes challenges in retention. Losing skilled engineers may lower team morale, create instability, and increase workloads. According to Herzberg's two-factor theory, such conditions can reduce job satisfaction, leading to decreased motivation and productivity among remaining employees (Herzberg, 1966).

The interviews revealed a tendency among subordinate engineers to establish similar entrepreneurial firms after leaving their current employment. Armed with the knowledge and experience acquired while working under an entrepreneurial engineer, these individuals are well-equipped to embark on their entrepreneurial journey, potentially emerging as competitors in the same industry (Goldberg, 2006). However, the majority of participants do not consider the startups ventured by their subordinate engineers as a challenge. Participant M's view is as follows.

> *"Actually, I don't have that fear. Actually, they will have to do a lot of things to come to my position. So I don't have that problem. And also I am always open." M*

Entrepreneurial engineers view staff ventures as a natural result of development efforts. In line with Knight's risk-bearing theory, they accept such risks as part of entrepreneurship, enabling long-term goal achievement and sustainable business success (Chell, 2008; Chepurenko, 2015). While entrepreneurial engineers embrace risk, startups by former subordinates may pose direct competition, reducing market share and threatening growth. Balancing staff development with protecting market position becomes a key strategic concern for ensuring business sustainability and competitive advantage.

To mitigate the negative impact of losing skilled staff, entrepreneurial engineers should prioritize retention. Kanchana & Jayathilaka (2023) emphasize aligning employee interests, career goals, and business plans. This approach fosters mutual understanding, supports firm success, and upholds ethical responsibilities outlined in the professional code of ethics.

5.10 Strategies of application & consequences

5.10.1 Strategies to apply the IESL code of ethics

Participants have employed various strategies to comply with each clause of the IESL code of ethics, which the researcher identified as initial codes using grounded theory methodology. Comparing and contrasting these initial codes contributed to the development of several focused codes, which were subsequently refined into three theoretical codes.

The table 5.2 below presents the findings organized under these three theoretical codes.

Table 5.2

Strategies of applying the IESL code of ethics

Initial Codes	Focused Codes	Theoretical Codes
Prioritizing health & safety, Minimising mistakes, Reducing profit margins, Criticising malpractices, Sharing knowledge.	Committing individually for safety	
Individual commitment for sustainable practices, Giving priority for sustainable concepts when doing businesses, Having an environmental policy,	Committing individually for sustainability	
Following ethics, being honest & truthful, Not doing harmful things even clients requested, Priority for public interests, Not having conflicts of interests,	Adhering to ethics	
Working in the specialized area, Giving accurate advices, Learning from mistakes, Teaching others, Knowing the subject properly, Learning unknown things, Enhancing management knowledge, Learning fast, Trying things which lack previous experiences,	Becoming an expert	Internalising
Working as a professional engineer, Taking the responsibilities of the works, Respecting others, Maintaining professional standards, Supporting, Listening, Doing voluntary works, Following policies, Doing CSR,	Adhering to professional behavior	
Not competing for jobs, Moving to less competitive areas, Getting the competitive	Avoiding the competition	

advantage, Facing the competition ethically, Giving proper knowledge to the clients to attract them, Creating own opportunities		
Selecting the competent area, Not trying everything, Giving priority for competent area,	Giving priority for the competent area	
Acquiring post graduate qualifications, Acquiring charter qualification,	Acquiring educational & professional qualifications	
Reading books, Participating in the CPDs, Getting updated with new technologies, Getting more practical knowledge	Upgrading the knowledge & the experience	
Giving priority for truth, Using facts always,	Prioritizing the truth	
Advising employees, facilitating knowledge updating, employing competent people, Organizing CSR & welfare activities.	Achieving safety through employees.	
Recruiting necessary experts, Planning to diversify the business,	Diversifying the business with expertise	
Training employees on sustainable practices, getting qualifications to do sustainable designs,	Improving competencies	
Giving trainings to employees, Giving foreign exposure, Allowing to participate in CPDs, Giving opportunities to work with outside experts, Recruiting senior engineers for trainings, Becoming a recognized place for trainings	Training	Employee Engagement
Teaching, Guiding for research activities	Teaching	
Mentoring young engineers, Guiding to for professional development, Identifying the weaknesses of subordinate engineers, Facilitating higher education process, Advising young engineers, Setting examples by own	Coaching & Mentoring	

Following standards, introducing safe products, improving the health & safety conditions in the industry, convincing the people, not cheating the clients.	Reaching the public safely	
Not accepting bribes, Not giving bribes, Avoiding from corruption, No experience in paying bribes, Refraining from taking government projects to avoid from bribes,	Avoid bribery & corruption	
Setting rules & regulations for environmental protection, Following guidelines & procedures,	Working according to guidelines	
Sustainable energy use, Planting trees, Handling waste materials sustainably, Continuous monitoring for environmental protection, Doing detailed analysis of designs,	Taking actions to protect environment	
Promoting sustainability, Criticizing the unsustainable practices in the society, Convincing clients to use sustainable concepts, Adopting new techniques of sustainability, Incorporating sustainable concepts in project proposals, Using resources sustainable, Optimizing designs, Producing environmental friendly products,	Practicing sustainable concepts & nurturing sustainability	Outreaching the public
Giving priority for public interests	Giving priority for the public interests	
Not reducing the prices to get more jobs, Not offering products at lower prices, Charging reasonable fees, Educating the clients about standard charges,	Charging standard fees	
Not doing marketing at all, Doing some sort of marketing, Satisfied clients do the marketing,	Marketing appropriately	
Satisfying clients within frameworks, Giving appropriate solutions, Following established procedures, Delivering quality products, Working properly, Maintaining proper systems for record keeping	Delivering proper products and services	
Rejecting unlawful requests, Rejecting unethical requests, Giving explanations to the refused requests,	Rejecting unlawful and unethical requests of clients	

Being truthful to clients, Advising clients truthfully, Explaining the truth to clients	Having truthful cooperation with clients	
Sharing experiences, teaching others, Training the staff, Writing books, Research & Development,	Sharing knowledge	
Working with professional institutions, Visiting other countries, Getting the support of experts, Networking	Networking	
Assuring the confidentiality, Not revealing all information to other parties, Not using the wrong information, Refraining from telling the truth sometimes,	Handling information responsibly	

Source: Developed by the author based on the analysis conducted

Finally, below three theoretical codes have been constructed to describe the process of adhering IESL code of ethics.

- Internalising
- Employee engagement
- Outreaching the public

While this study used the IESL Code of Ethics as a sensitising framework to shape interview prompts, the analysis progressed well beyond thematic grouping. Through a systematic CGT process, categories such as Internalising, Employee Engagement & Outreaching the public were constructed as abstract, explanatory concepts that transcend specific clauses and demonstrate interrelated ethical processes embedded in entrepreneurial practice of Sri Lankan engineers.

In accordance with the CGT methodology, memo writing was employed throughout the coding process to document emerging conceptual patterns, analytic decisions, and reflexive insights.

5.10.1.1 Memos on "Internalising"

- **From initial to focused coding – Internalising**

The following memo captures the analytical shift from descriptive initial codes to more abstract and conceptually refined focused codes within the theoretical category Internalising. This process involved constant comparison of participant statements, identification of recurring patterns, and early theoretical sensitivity to ethical self-regulation. The memo demonstrates how ethical behaviors initially described as isolated actions, such as refusing bribes, prioritizing safety, and working within one's area of expertise, were reinterpreted as manifestations of a deeper process of internal ethical commitment.

The initial coding phase produced a wide range of descriptive codes that captured specific ethical behaviors and personal practices shared by entrepreneurial engineers. These included actions such as prioritizing safety, rejecting unethical client demands, operating within areas of expertise, and regularly updating knowledge. At first, these codes appeared as discrete practices; however, through constant comparison, recurring meanings began to emerge across interviews. As analysis progressed, these detailed codes began to cluster into conceptually meaningful groups, indicating that many participants were describing a common pattern of internal moral commitment to ethical conduct. This prompted the development of focused codes such as Committing Individually for Safety, Committing Individually for Sustainability, Adhering to Ethics, Becoming an Expert, and Giving Priority for the Competent Area.

These focused codes reflect a shift from observing what participants were doing to understanding why they were doing it: not due to fear of sanctions or institutional pressure, but because of deeply held professional values. The data revealed that these engineers were integrating ethics into their business decisions through self-discipline, reflection, and proactive learning. This consolidation of initial codes marked the analytic movement toward the theoretical category Internalising, which would later become a core component of the grounded theory. This transition illustrates a key methodological moment where grounded theory moved beyond surface description and began to explain how ethical adherence was constructed and sustained internally, particularly in the absence of consistent external accountability.

- **Construction of theoretical code – Internalising**

The development of the theoretical code Internalising was grounded in focused codes derived from multiple interviews. The following memo articulates how a pattern of self-regulated ethical behavior, described by participants across diverse business contexts, was conceptually synthesized as a core process through which engineers internalize professional ethics. The memo highlights the conceptual leap from practical ethical choices to a deeper identity-driven commitment, marking a pivotal stage in the abstraction and integration central to CGT methodology.

As data analysis progressed from initial to focused coding, it became evident that a group of entrepreneurial engineers in Sri Lanka demonstrated a consistent pattern of ethical conduct driven not by external enforcement, but by internal conviction and professional self-regulation. This pattern was captured and conceptualized through the theoretical code "Internalising"- a key dimension of how these engineers adhered to the IESL Code of Ethics within their business settings. The theoretical code Internalising was constructed by integrating several focused codes developed from rich initial codes. These include:

- *Committing individually for safety: grounded in initial codes such as prioritizing health and safety, minimizing mistakes, and sharing knowledge, highlighting engineers' personal responsibility toward public welfare.*

- *Committing individually for sustainability: derived from codes like having an environmental policy and giving priority to sustainable concepts, showing a values-based orientation toward long-term societal benefit.*
- *Adhering to ethics and professional behavior: built from initial codes such as being honest, not doing harmful things even when clients requested, and respecting others, indicating internal moral boundaries.*
- *Becoming an expert and giving priority to the competent area: reflecting a commitment to professional development and ethical limitations of practice, as seen in acquiring qualifications, learning fast, and selecting the competent area.*
- *Avoiding the competition ethically: from codes like not competing for jobs, moving to less competitive areas, and educating clients, revealing a preference for integrity over aggressive competition.*
- *Upgrading knowledge and prioritizing truth: representing engineers who actively pursue CPD, value fact-based communication, and emphasize honesty in client relations.*

  The conceptual thread linking these focused codes was the idea of ethics being internalised as a personal and professional identity, rather than imposed through compliance mechanisms. Participants' narratives revealed that these values were often cultivated through self-reflection, personal experiences, early mentoring, or a strong sense of professional duty.

5.10.1.2 Memos on "Employee engagement"

- **Initial to focused coding – Employee engagement**

The following memo illustrates the analytic development from initial codes to focused codes within the emerging category Employee engagement. In line with CGT procedures, this transition involved synthesizing participant narratives that described how entrepreneurial engineers train, guide, and influence their employees to uphold professional values. Through constant comparative analysis, early descriptive codes such as "training staff," "setting standards," and "leading by example" were conceptually clustered into more abstract focused codes reflecting mechanisms of ethical diffusion within the organization. This memo traces that conceptual refinement, setting the groundwork for the theoretical category "Employee engagement" as an ethical practice embedded in leadership and internal culture.

> *During the initial coding phase of this study, a range of descriptive codes were generated based on participants' narratives regarding how they involve and guide employees within their entrepreneurial engineering firms. These codes included actions such as advising employees, giving training, recruiting experts, mentoring juniors, and facilitating higher education. At first glance, these seemed to reflect diverse aspects of people management and knowledge sharing. As analysis progressed through constant comparison, these initial codes began to cluster around conceptually meaningful patterns. The first pattern related to how employees were used to uphold safety and ethical standards, giving rise to the focused code "Achieving safety through employees." This included not just technical training, but also value-based guidance and ethical reinforcement through CSR and workplace culture.*

Another cluster emerged around building employee capabilities, including training on sustainable practices, CPD opportunities, and foreign exposure, which formed the focused code "Training." What distinguished this from general HR practices was the emphasis participants placed on these actions as ethical obligations, not just business needs. Similarly, codes related to mentoring young engineers, setting examples, and advising on professional growth were conceptually grouped into the focused code "Coaching & Mentoring." These reflected a deliberate intention to transfer ethical standards and professional values to the next generation, often through informal yet impactful interpersonal relationships.

Other initial codes, such as recruiting experts and diversifying the business through qualified staff, formed the focused code "Diversifying the business with expertise." This reflected an ethical commitment to competence and quality, aligning with the IESL Code's emphasis on working within areas of qualification. Finally, the repeated mention of enhancing employee competencies, qualifications for sustainability, and technical improvements contributed to the focused code "Improving Competencies," which emphasized the strategic development of employees as a vehicle for upholding ethical engineering practice.

- **Construction of theoretical code – Employee engagement**

This memo explains the emergence of the theoretical code Employee Engagement, which evolved from focused codes concerning the engineers' efforts to instill ethical values in their teams. It captures how ethical leadership, internal training, and value alignment with staff were reinterpreted as part of a broader organizational ethic. This theoretical development illustrates how individual ethical adherence becomes operationalized through structured internal influence, aligning with CGT's emphasis on social processes and collective meaning making.

The theoretical code "Employee Engagement" was developed as a core dimension of ethical adherence among entrepreneurial engineers in Sri Lanka. It emerged from a set of focused codes that illustrated how participants actively involve their employees in upholding ethical principles embedded in the IESL Code of Ethics. Unlike passive ethical compliance, Employee Engagement reflects a deliberate, systemic approach through which engineers shape their internal organizational culture to reinforce professionalism, safety, sustainability, and integrity. This theoretical code was constructed from the following focused codes.

- *Achieving Safety Through Employees: Entrepreneurs described how they maintain ethical responsibility for public safety by advising employees, hiring competent individuals, updating their knowledge, and organizing welfare or CSR activities. These practices ensured that the entire team contributed to creating a safe and ethical engineering environment.*

- *Training: Many engineers highlighted the ethical importance of continuous employee development. They offered training opportunities, foreign exposure, CPD participation, and collaboration with external experts to ensure that their teams possessed not only technical competence but also ethical awareness in practice.*

- *Improving Competencies: This focused code captured actions aimed at building sustainability-related qualifications and design capabilities within the workforce. By investing in such competencies, engineers aligned their businesses with long-term environmental and professional standards.*

- *Coaching & Mentoring: Participants consistently described ethical mentoring practices, including guiding junior engineers, facilitating higher education, setting examples, and identifying areas for improvement. These practices were framed not only as leadership responsibilities but also as moral imperatives for cultivating future professionals with integrity.*
- *Diversifying the Business with Expertise: Some engineers explained how expanding into new business areas was done by recruiting domain experts to ensure technical and ethical compliance. This showed a conscious avoidance of overstepping professional boundaries and upheld the IESL Code's emphasis on working within one's area of competence.*

  Together, these focused codes contributed to the theoretical understanding of Employee Engagement as a proactive, values-driven strategy for maintaining ethical standards within an entrepreneurial setting. It reveals that ethical adherence is not restricted to individual behavior (as captured under Internalising), but also deeply embedded in how engineers manage, mentor, and develop their teams.

5.10.1.3 Memos on "Outreaching the public"

- **From initial to focused coding – Outreaching the Public**

In CGT, the analytic process moves beyond description toward constructing abstract conceptual categories. The memo that follows documents how initial codes derived from interview data, such as "not accepting bribes," "educating clients," and "promoting sustainability", were analytically elevated into focused codes representing outward-facing ethical practices. These focused codes formed the basis for the emerging theoretical concept Outreaching the Public, which conceptualizes how entrepreneurial engineers extend their ethical commitments into client relationships, public communication, and environmental responsibility. The memo exemplifies the shift from surface-level behaviors to a more integrated understanding of ethics enacted through public engagement.

> *During the initial coding phase, participants frequently described a wide range of externally focused ethical behaviors aimed at engaging with the public, clients, and the broader industry. These behaviors extended beyond internal operations and revealed how entrepreneurial engineers strive to demonstrate ethical conduct visibly and socially.Through constant comparison and memo writing, these descriptive actions were conceptually grouped into focused codes, based on their underlying ethical purpose and alignment with the IESL Code of Ethics.*
>
> *Initial codes such as following standards, introducing safe products, not cheating clients, and convincing people led to the focused code "Reaching the Public Safely." This reflects engineers' deliberate efforts to ensure public safety, transparency, and trustworthiness through product quality and responsible communication. Narratives that included not giving or accepting bribes, avoiding corruption, and refusing government contracts to avoid ethical risks were organized under "Avoid Bribery & Corruption," representing ethical distancing from systemic malpractices as a public-facing stance.*

Actions like setting environmental protection rules, handling waste sustainably, and monitoring environmental performance contributed to the focused code "Taking Actions to Protect the Environment." This indicated a strong alignment between professional responsibility and environmental ethics. A related but more proactive dimension emerged in "Practicing Sustainable Concepts & Nurturing Sustainability," which encompassed initiatives like optimizing designs, adopting sustainable materials, and convincing clients to accept eco-friendly solutions. The code "Giving Priority to the Public Interest" synthesized practices where engineers made decisions that favored social benefit over short-term personal or business gain. Other client-oriented behaviors, charging fair fees, marketing ethically, rejecting unethical client requests, and advising truthfully, formed focused codes such as "Charging Standard Fees," "Marketing Appropriately," "Rejecting Unlawful and Unethical Requests of Clients," and "Having Truthful Cooperation with Clients."

Additionally, codes like sharing experiences, teaching, networking, and maintaining confidentiality contributed to focused codes such as "Sharing Knowledge," "Networking," and "Handling Information Responsibly." These focused codes reflect a collective theme of outward ethical engagement, how entrepreneurial engineers communicate and uphold ethical standards in ways that influence or protect clients, communities, and the public

- **Construction of theoretical code – Outreaching the Public**

The next memo details how the theoretical category *Outreaching the Public* was constructed from a range of focused codes that captured external-facing ethical practices. These included client education, transparency, nurturing sustainability, and delivering proper products and services. The memo demonstrates how ethical adherence is not only an internal or organizational matter, but also one extended into broader public engagement, thereby reinforcing the social role of the engineer. This represents a key example of CGT's strength in building theory that connects individual meaning with broader societal processes.

The theoretical code "Outreaching the Public" was developed to explain how entrepreneurial engineers in Sri Lanka adhere to the IESL Code of Ethics by consciously extending ethical practices beyond internal operations to include interactions with clients, communities, professional networks, and the environment. This code emerged from a diverse set of focused codes that reflect public-oriented, transparent, and socially responsible behaviors aimed at fostering ethical impact at the societal level.

Key focused codes contributing to this theoretical category include:

- *Reaching the Public Safely: Engineers described practices such as introducing safe products, following standards, and improving health and safety conditions in the industry as ways to ensure their work upheld public trust and welfare. These efforts demonstrate adherence to the IESL Code's emphasis on public safety and responsibility.*
- *Avoiding Bribery & Corruption: Participants highlighted their refusal to engage in corrupt practices, often at the cost of lucrative contracts, as a visible commitment to ethical engineering. This not only reinforced their own integrity but also served as an ethical message to clients and peers.*
- *Taking Actions to Protect the Environment and Practicing Sustainable Concepts & Nurturing Sustainability: These focused codes captured proactive environmental ethics, such as waste management, sustainable design, and convincing clients to adopt green solutions. Such*

practices exemplify engineers' alignment with global sustainability goals and their sense of duty to future generations.

- *Giving Priority to the Public Interest: Participants often described choosing long-term social benefit over immediate profits. This included rejecting requests that could harm users, educating clients about ethical limitations, and delivering durable, safe products.*
- *Charging Standard Fees, Marketing Appropriately, and Rejecting Unlawful and Unethical Requests of Clients: These codes show how engineers maintain ethical boundaries in business-client relationships. Fair pricing, truth-based marketing, and refusal to compromise standards illustrate their outward-facing ethical discipline.*
- *Having Truthful Cooperation with Clients, Sharing Knowledge, Networking, and Handling Information Responsibly: These focused codes reflect how engineers extend ethical communication and professional conduct to clients, peers, and the wider engineering community.*

  The overarching theme across these codes is that ethical adherence is not confined to internal reflection or employee development but is publicly performed, communicated, and institutionalized through responsible external practices. In this way, Outreaching the Public reveals that entrepreneurial engineers engage the public not only as clients or consumers, but as stakeholders deserving honesty, safety, sustainability, and ethical transparency. This theoretical category complements Internalising and Employee Engagement by emphasizing that ethical engineering involves outward accountability. It reinforces the IESL Code's principles related to public welfare, truthfulness, professional dignity, and sustainable development.

5.10.2 Consequences of the IESL Code of Ethics for entrepreneurial engineers

The overall summary of the consequences encountered by the entrepreneurial engineers due to their adherence to the IESL Code of Ethics is as follows.

Table 5.3

Summary of consequences

Clause	Positive Consequences	Negative Consequences
1. Health, safety & welfare of the public	More business opportunities in long term, Recommendations from the clients	Losing business opportunities short term, Incurring additional costs
2. Upholding and enhancing honor, integrity and dignity of the engineering profession	Enhanced reputation and recognition	Losing business opportunities, Incurring additional expenses
3. Environmental sustainability	Resource saving, more customers	Higher costs, low profit margins, unwillingness of clients to embrace

		sustainability concepts, and regulatory concerns
4. Building reputation on merit and fair competition	Enhanced reputation, developed network, more job opportunities, and long-term survival	Lost job opportunities
5. Performing professional services only in the area of competence	Motivating to get additional qualifications, experiencing the success, enhanced self-confidence	Higher expenditure
6. Acting as faithful agent and trustees for the clients	Enhanced reputation	Loss of job opportunities
7. Being objective and truthfull	Enhanced reputation, trustworthiness	Loss of job opportunities, difficulty to being truthful during the startup stage and misunderstandings
8. Life long learning	Business sustainability, enhanced business opportunities, enhanced reputation, empowered subordinates, retention of subordinates, more collaborative opportunities, self-satisfaction	Additional costs, departure of empowered subordinates

Source: Developed by the author based on the analysis conducted

It is clear from the above table, that the adherence to the IESL Code of Ethics can significantly enhance the professional reputation of entrepreneurial engineers. Ethical behavior and decision making supports build trust with clients, investors, and regulatory bodies. It can be identified that the clients are more willing to participate with businesses that are dedicated to integrity, safety, and fairness, ensuring long-term client relationships and repeat business. A reputation for ethical behavior can serve as a competitive advantage, distinguishing entrepreneurial engineers from less scrupulous competitors.

It can be seen from this study that the entrepreneurial engineers who comply with the IESL Code of Ethics are often more attractive to public and private projects. Governments and large enterprises tend to place the priority of ethical companies when awarding contracts because they want to minimize the risks of legal problems and reputational damage. By maintaining high ethical standards, entrepreneurial engineers can secure high-level projects and partnerships, thereby expanding the scope of their business. Further, in accordance with the IESL Code of Ethics, the firms of entrepreneurial engineers can cultivate a culture of accountability. Employees and stakeholders may model their actions on the ethical standards of the owner of the company, which reduces the risk of ethical conduct or conflicts of interest. This internal culture not only reduces legal risks, but also improves operational efficiency and teamwork, as employees clearly understand the ethical expectations set by leaders. Hence, this is a remedy to reduce the unethical behaviours prevalent in the society.

While ethical compliance enhances reputation, it can limit the potential for maximizing profits in certain situations. As this study indicates, entrepreneurial engineers have encountered business opportunities that promise substantial short-term gains but violate engineering ethics. Consequently, engineers adhering to the Code may find it challenging to compete with less ethical competitors willing to take shortcuts for financial gain. Moreover, strict adherence to the IESL Code of Ethics may restrict certain business decisions that, while considered unethical or risky, could lead to significant innovations. Entrepreneurial engineers must stay within their professional expertise and avoid projects where they lack sufficient knowledge. This caution prevents them from diversifying into new businesses or taking calculated risks that could lead to technological advancement or greater profits.

Compliance with ethical principles often results in higher operational costs. To ensure public safety and welfare, significant investments are required in quality materials, rigorous testing standards, and accurate reporting. While these practices are crucial for maintaining moral integrity, they can reduce profit margins and increase project costs, as identified in this study. For small and medium-sized engineering firms, these additional expenses can place considerable pressure on businesses, particularly when competing with larger companies or those operating without such strict ethical controls. Moreover, entrepreneurial engineers frequently collaborate with stakeholders such as investors, contractors, and clients. Adherence to the IESL Code of Ethics may sometimes lead to conflicts, especially when business partners or clients prioritize profit over ethical considerations. Engineers who refuse to compromise their ethical principles may lose contracts or face tensions with clients who do not share the same commitment to ethics.

Furthermore, the analysis of consequences experienced by the entrepreneurial engineers with the adherence to the clauses of IESL code of ethics have revealed the below findings.

Table 5.4

Consequences as codes

Initial Codes	Focused Codes	Theoretical Codes
Enhanced reputation & recognition	Lasting benefits	Enduring prosperity
Long term survival		
More business opportunities		
Short term business loss	Short term losses	
Situational higher expenses		

Source: Developed by the author based on the analysis conducted

Thus, the researcher developed the theoretical code "Enduring Prosperity" to capture the overall consequences of adhering to the IESL Code of Ethics for entrepreneurial engineers. This code provides a comprehensive understanding of the outcomes faced by entrepreneurial engineers when following the IESL Code of Ethics. While entrepreneurial engineers experience both positive and negative consequences by complying with the Code in their ventures, the positive consequences tend to be long-lasting and significantly contribute to the firm's success. In contrast, negative consequences are generally temporary and situational, as revealed in this study. Therefore, entrepreneurial engineers should strive to adhere to the IESL Code of Ethics throughout their journey to ensure long-term sustainability, as underscored by the concept of 'enduring prosperity.'

5.10.2.1 Memos on "Enduring Prosperity"

- **From initial to focused coding – Enduring Prosperity**

In line with CGT practices, this memo documents the analytic progression from initial descriptive codes to conceptually integrated focused codes related to the consequences of ethical adherence. Drawing on participants' reflections about the long-term outcomes of upholding the IESL Code of Ethics in their entrepreneurial ventures, the memo demonstrates how recurring ideas were grouped into two key focused codes "Lasting benefits" & "Short term losses". These focused codes formed the analytical scaffolding necessary for the subsequent development of the theoretical category Enduring Prosperity.

> *This memo captures the analytic development from initial codes to focused codes that underpin the theoretical category Enduring Prosperity, which represents the long-term outcomes experienced by entrepreneurial engineers who adhere to the IESL Code of Ethics. These initial*

codes were developed by closely examining participants' narratives around the consequences, both positive and negative, of ethical practice in their entrepreneurial journeys.

The initial codes included expressions such as enhanced reputation & recognition, long-term survival, and lasting benefits, which pointed to cumulative advantages associated with sustained ethical behavior. These codes reflected engineers' perceptions of intangible yet powerful returns earned over time, such as trust, reliability, and social prestige, that contributed to Enhanced Reputation, a key focused code. Participant accounts consistently highlighted that clients and society rewarded ethical engineers with respect, credibility, and repeated opportunities, particularly in competitive industries where integrity stood out. Another cluster of initial codes, long-term survival, lasting benefits, and more business opportunities, illustrated how ethical consistency translated into stable business growth and resilience over time. These were synthesized into the focused code "Lasting Benefits". Engineers spoke of how their refusal to engage in unethical shortcuts gradually earned them loyal clients, professional endorsements, and a reputation for quality, which in turn opened new opportunities and ensured business continuity.

Conversely, engineers also described the short-term disadvantages they encountered due to their ethical stance, captured in the initial codes short-term business loss and situational higher expenses. These accounts revealed how rejecting unethical deals, refusing bribes, or sourcing higher-quality (and often more expensive) materials could temporarily place them at a commercial disadvantage. These insights were grouped under the focused code Short-Term Losses, signifying that ethical commitment often came with initial costs that required resilience and long-term vision to overcome.

The transition from these descriptive codes to focused codes allowed for a more abstract understanding of the tension between immediate sacrifice and future gain. These focused codes- Lasting Benefits, and Short-Term Losses—together formed the analytical foundation for constructing the theoretical code Enduring Prosperity, which conceptually explains how ethical entrepreneurship contributes to sustainable success within the Sri Lankan engineering context.

- **Construction of the theoretical code – Enduring Prosperity**

This memo outlines the analytic construction of the theoretical code Enduring Prosperity, which emerged from integrating two earlier focused codes. It conceptualizes how entrepreneurial engineers in Sri Lanka achieve long-term business value and professional credibility through adherence to ethical principles, even when facing short-term disadvantages. In alignment with Constructivist Grounded Theory (CGT), this memo demonstrates the progression from mid-level categories to a more abstract, explanatory theoretical construct.

The theoretical code "Enduring Prosperity" was constructed through the abstraction and integration of the focused codes Lasting Benefits, and Short-Term Losses. These focused codes emerged from participants' reflections on the consequences of adhering to the IESL Code of Ethics within their entrepreneurial engineering practices in Sri Lanka. While the ethical behavior of participants often required immediate sacrifices or created operational limitations, their narratives revealed a consistent long-term trajectory of stability, credibility, and professional growth, conceptualised in this Enduring Prosperity. The focused code "Lasting Benefits" further emphasized that ethical behavior fostered sustainable business *outcomes, such as recurring client contracts, word-of-mouth referrals, and long-term survival, even when short-term gains were forgone. These benefits were seen not as immediate rewards but as the cumulative result of values-driven decision-making, patience, and integrity.*

In contrast, the focused code "Short-Term Losses" represented the reality that ethical entrepreneurs often operate at a disadvantage in the early stages. Participants reported rejecting potentially profitable but ethically questionable projects, absorbing higher operational costs to comply with regulations, or losing clients unwilling to meet ethical standards. Despite these setbacks, they expressed a strong belief that these sacrifices ultimately strengthened their business and moral standing. Through constant comparison, these focused codes were conceptually integrated into the theoretical category Enduring Prosperity, which captures a processual relationship between ethical commitment and entrepreneurial success over time. This theoretical code illustrates how participants' experiences reflect a long-view perspective in which prosperity is not defined solely by immediate financial performance, but by accumulated trust, sustainability, and peace of mind rooted in professional integrity. Enduring Prosperity therefore represents a grounded theoretical insight that ethical adherence, while costly in the short term, generates meaningful and lasting value for entrepreneurial engineers in the Sri Lankan context.

5.11 Chapter summary

This chapter discussed how entrepreneurial engineers comply with the IESL Code of Ethics throughout their entrepreneurial journey. The analysis revealed that entrepreneurial engineers have employed various strategies to adhere to the eight clauses of the IESL Code of Ethics. The strategies used by entrepreneurial engineers to comply with each clause, along with their consequences, were examined and supported by narrative evidence derived from the interview transcriptions. By comparing and contrasting the identified strategies, the researcher constructed three theoretical codes related to adherence to the IESL Code of Ethics. They are 1). Internalizing, 2). Employee engagement, and 3). Out reaching the public. The researcher could uncover that there are both positive and negative conseuquences belong to two major focused codes as 1). Lasting benefits, and 2). Short term losses, respectively. Finally, both types of consequences come under the theoretical code 'Enduring prosperity'. Hence, the term 'enduring prosperity' describes the consequences arise with the adherence to the IESL Code of Ethics (i.e: engineering ethics). By integrating ethical principles of IESL Code of Ethics into their core business strategies, entrepreneurial engineers can not only uphold the standards of their profession but also build sustainable, successful businesses that benefit both society and the engineering industry.

CHAPTER 6

RESULTS & DISCUSSION PART III

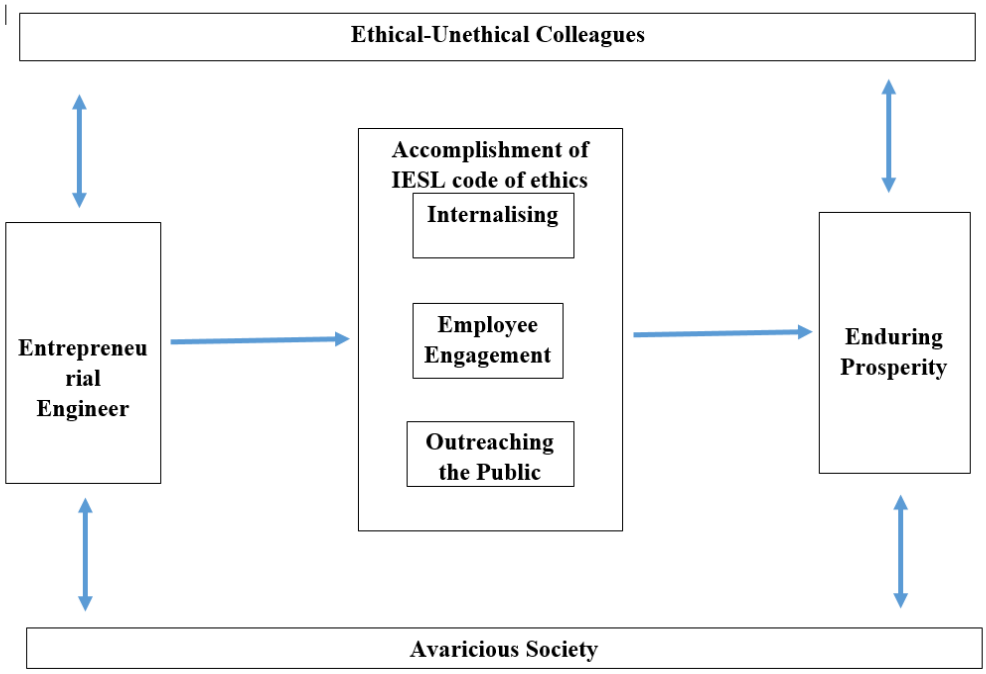
6.1 Introduction

The central focus of any study conducted using constructivist grounded theory methodology is the development of a substantive theory, supported by data collected through participant interviews. In grounded theory research, the goal of a theoretical model is not to prove or disprove existing theories. Instead, its purpose is to extract meaning from the data, enabling others to apply the resulting theory or model in their own research. Another purpose of constructing a theory within the grounded theory methodology is to uncover a process rooted in the data. Accordingly, the resulting grounded theory synthesizes the notion that past experiences and external influences must be considered by entrepreneurial engineers, as these factors significantly impact the success of entrepreneurial ventures through ethical behavior aligned with engineering ethics.

6.2 Substantive theory – Theory of enduring prosperity

Figure 6.1

Proposed substantive theory of Enduring Prosperity



Source: Developed by the author based on the analysis conducted

The researcher developed a substantive theory based on the current study to guide entrepreneurial engineers in Sri Lanka in adhering to the IESL Code of Ethics within an entrepreneurial context. This theory, referred to as the "Theory of Enduring Prosperity," aims to guide future generations in achieving business success by emphasizing the importance of engineering ethics and their practical implications.

outlines how various processes interrelate in ensuring compliance with the IESL Code of Ethics, ultimately fostering long-term business success.

6.2.1 Entrepreneurial engineer

This study focused exclusively on entrepreneurial engineers operating within the domain of technology entrepreneurship in the Sri Lankan context. Consequently, the substantive theory is centered on the individual referred to as an "entrepreneurial engineer." Drawing from the insights of owner-managers who serve MDs or CEOs of technological business ventures, this theory provides a framework for such professionals to achieve success through ethical practices. The ethical conduct of MDs and CEOs is particularly critical in promoting ethical behavior among employees, especially in the highly competitive and materialistic landscape of modern business (Weng & Chen, 2017). This study reinforces the finding that ethical behavior, as outlined in the IESL Code of Ethics, should originate from and be cultivated by the entrepreneurial engineer. As the primary driver of key entrepreneurial operations within the firm, the entrepreneurial engineer plays a pivotal role in establishing and upholding ethical practices.

6.2.2 Ethical-unethical colleagues

Entrepreneurial engineers must collaborate with other engineering professionals in the field of technology entrepreneurship throughout their entrepreneurial journey. These interactions are inevitable and integral to their work. In today's society, entrepreneurial engineers frequently encounter both ethical and unethical colleagues. Engaging with colleagues who consistently adhere to engineering ethics serves to reinforce the ethical behavior of entrepreneurial engineers, as guided by the IESL Code of Ethics. However, interactions with unethical colleagues can occasionally challenge and undermine the ethical foundation of entrepreneurial engineers, potentially leading to unethical behavior. Despite encountering colleagues who violate the IESL Code of Ethics, the majority of entrepreneurial engineers have successfully navigated such situations without compromising their ethical standards. The constructed substantive theory emphasizes that entrepreneurial engineers must interact with both ethical and unethical colleagues throughout their entrepreneurial journey, starting from the initial stages of a startup. Even well-established entrepreneurial engineers acknowledge facing similar challenges during their early stages. Therefore, adherence to the IESL Code of Ethics is essential for entrepreneurial engineers to navigate these interactions effectively and achieve success in their entrepreneurship journey in an ethically sound manner.

6.2.3 Avaricious society

The theoretical code "Avaricious Society" was developed to capture the experiences of many entrepreneurial engineers who encountered numerous unethical scenarios throughout their entrepreneurial journey. The term "avaricious" refers to an intense or excessive greed for wealth or material gain. The concept of greed has been a subject of moral and philosophical discourse for centuries. Aristotle, for instance, viewed greed as a vice that corrodes both the soul and society. He asserted that “the life of earning money is one of forced labor, and wealth is clearly not what we desire, as it is merely a means to an end”(Aristotle, 2009). Max Weber's analysis of Protestant work ethics demonstrates that cultural and religious values can be linked to economic behaviour and promotes a social movement towards material accumulation (Weber, 2005). Joseph Stiglitz, in ‘The Price of Inequality’, believes that avaricious societies aggravate economic inequality and undermine social cohesion and economic growth. Such inequalities can reduce social mobility and undermine trust in organisations

(Stiglitz, 2013). Piketty (2013) highlighted the inherent tendency of capitalism to drive wealth accumulation and inequality, often resulting in social and economic instability. The psychological consequences of living in a greed-driven society are significant. Research, such as that presented in The High Price of Materialism, has shown that individuals who prioritize wealth and material possessions frequently experience poor mental health outcomes and diminished interpersonal relationships (Kasser, 2003). He argues that material values are linked to lower levels of well-being and higher levels of stress and anxiety. On a societal level, the relentless pursuit of wealth can lead to a decline in both the value and social capital of communities. Hampden-Turner & Trompenaars (2000) emphasized that societies marked by high inequality and materialism tend to exhibit low levels of civic engagement and community trust. This erosion of social bonds leads to fragmented societies, where individuals become more isolated and less inclined to support collective well-being. Klein (2014) argues that the capitalist pursuit of sustainable growth and profit maximization contributes to climate change, biodiversity loss, and resource depletion in an avaricious society. This unsustainable trajectory threatens the Earth's ecological balance and jeopardizes the well-being of future generations.

The root of the unethical scenarios experienced by entrepreneurial engineers is linked to the money-driven and materialistic nature of contemporary society, making the term ‘avaricious’ particularly apt to describe its character. As revealed in the interviews, entrepreneurial engineers operate within this avaricious society. Since they are part of the same societal fabric, it is inaccurate to view entrepreneurial engineers as a separate group immune to money-driven behavior. Additionally, entrepreneurs, by nature, are achievement-oriented and motivated by profit to ensure the survival and success of their ventures (Chell, 2008). Therefore, entrepreneurial engineers are undeniably part of the avaricious society. As revealed in the interviews, these engineers must navigate numerous unethical incidents at various stages of their entrepreneurial journey within this materialistic society. Importantly, the entrepreneurial engineers who participated in this study consistently sought to engage with the avaricious society ethically, adhering to the IESL Code of Ethics in most instances. However, there were a few occasions where some of the engineers felt compelled to violate the code when interacting with the broader society. The pursuit of uncontrolled material wealth presents significant challenges, ranging from economic inequality and social fragmentation to psychological distress and environmental degradation.

6.2.4 Applying the IESL code of ethics

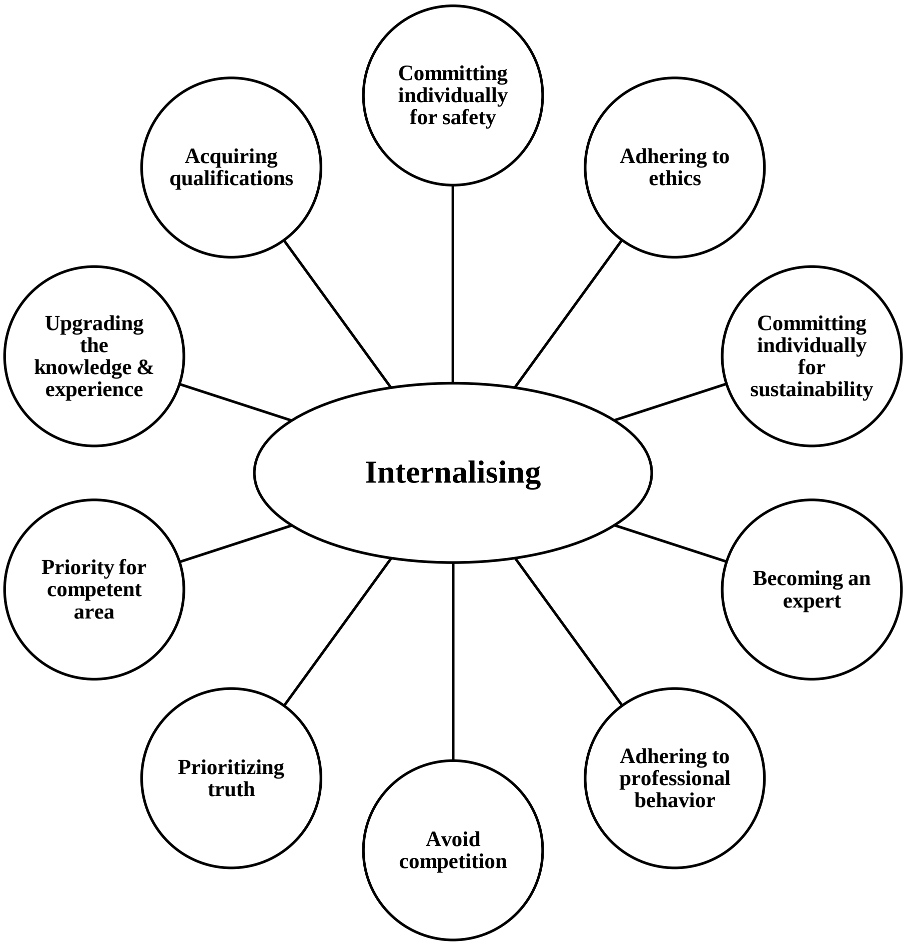
Grounded theory analysis revealed various strategies employed by entrepreneurial engineers to adhere to the eight clauses of the IESL Code of Ethics during their entrepreneurial activities. Three major theoretical codes—internalizing, employee engagement, and outreaching the public—were developed to explain how entrepreneurial engineers comply with the IESL Code of Ethics in an entrepreneurial context. The study also found that most entrepreneurial engineers view the IESL Code of Ethics as a "guideline." Engineers generally regard ethical codes as essential to their professional identity, as they help maintain public trust, guide ethical decision-making, and reinforce their professional standing (*Code of Ethics | National Society of Professional Engineers*, 2019; Fleddermann, 2012; Harris et al., 2009). Despite their significance, some engineers perceive ethical codes as overly idealistic or not entirely applicable in real-world scenarios. This perspective can foster skepticism regarding their effectiveness and enforcement, as practical limitations often necessitate compromises (Bucciarelli, 2008). Confirming this, only a few entrepreneurial engineers reported violating certain clauses of the code of ethics in specific situations during their entrepreneurial journey. However, this does not imply that they consistently violated the same clauses. These violations were situational and have been discussed in detail in previous sections of this thesis.

6.2.4.1 Internalising

Entrepreneurial engineers strive to internalize the IESL Code of Ethics within their own character. Internalization refers to the process of incorporating external beliefs, attitudes, standards, and norms into an individual’s internal belief system, values, and behaviors. This process involves the adoption and integration of external influences into one’s personal framework, becoming an integral part of their guiding principles. (Ryan & Deci, 2000; Vygotsky, 1978). This process includes the adoption of social norms, cultural values, and parental guidance, integrating them into an individual's personal belief system. It plays a crucial role in shaping one's identity, self-conception, and worldview (Deci & Ryan, 1985; Ryan & Deci, 2000). The identity, self-conception, and worldview of entrepreneurial engineers are shaped by the IESL Code of Ethics, guiding them to demonstrate moral behavior as individual entrepreneurs. It is a deeply personal, value-driven process where entrepreneurial engineers adopt the IESL Code of Ethics as part of their professional identity. The figure below illustrates the strategies individually employed by entrepreneurial engineers to adhere to the Code of Ethics through internalization.

Figure 6.2

Construction of the theoretical code 'Internalising'



Source: Developed by the author based on the analysis conducted

The ten focused codes, as depicted in the figure above, which contribute to the development of the theoretical code 'Internalizing', represent self-directed strategies that demand significant individual commitment. For instance, the focused code on 'Acquiring qualifications' highlights the hard work and dedication demonstrated by entrepreneurial engineers. Moreover, the adoption and integration of the IESL Code of Ethics into their internal belief systems and behaviors have enabled them to commit to moral conduct. Internalized ethical principles ensure consistency in actions, even under pressure or when tempted to cut corners. This consistency is essential for building sustainable businesses that uphold public trust and loyalty (Harris et al., 2009). As businessmen, entrepreneurial engineers are profit-orientated in nature. Therefore, they come across a lot of situations to cut corners and work under intense pressure to achieve their targets. It is clearly visible from the above figure that the individual behaviours of entrepreneurial engineers comply with the IESL code of ethics with less space to violate them. For example, they are individually committed to uplifting safety and sustainability through their entrepreneurial operations. Furthermore, this behaviour fosters an organisational culture that prioritises ethics among the employees (Wu et al., 2015). The internalization of the IESL Code of Ethics by entrepreneurial engineers aligns with Vygotsky's sociocultural theory. This process influences the cognitive aspects of individuals, as Vygotsky's theory emphasizes that cognitive development is fundamentally shaped by social and cultural contexts. Vygotsky highlights the importance of social interaction and cultural tools in the development of mental functions (Lantolf, 2000). A key concept of Vygotsky's sociocultural theory is scaffolding, which refers to the support provided by more knowledgeable individuals to help others achieve higher levels of understanding. Research has shown that scaffolding and peer interactions play a crucial role in promoting cognitive development and the internalization of knowledge (Danniels, 2001). In the process of attaining chartered engineer status, entrepreneurial engineers are required to pass an engineering ethics examination. This examination represents a significant form of interaction that facilitates the internalization of the Code of Ethics, in line with Vygotsky's sociocultural theory.

6.2.4.2 Employee engagement

Entrepreneurial engineers prioritize effective employee engagement to ensure compliance with the IESL Code of Ethics. As revealed in the interviews, they delegate responsibilities to promote moral behavior both within the firm and in interactions with the public, while simultaneously empowering their employees. A knowledgeable and skilled group of subordinate engineers and staff members is essential to fulfilling the requirements of the Code of Ethics. Under the theoretical code 'Employee Engagement', entrepreneurial engineers place significant emphasis on empowering employees by fostering their technical expertise and supporting their professional development.

Figure 6.3

Construction of the theoretical code 'employee engagement'

Source: Developed by the author based on the analysis conducted

Employee engagement is a crucial driver of ethics and corporate integrity in the business world. It is defined as the emotional and cognitive commitment of employees to their organizations, and it plays a vital role in promoting ethical behavior (Bakker & Demerouti, 2008). Employee engagement is influenced by various factors, including leadership, organizational culture, and work design. When employees are engaged, they are more likely to internalize the values and ethical standards of the organization. According to social exchange theory, employees reciprocate the support and trust provided by their employers with a commitment to ethical behavior (Cropanzano & Mitchell, 2005). Self-determination theory also suggests that fulfilling employees' psychological needs for autonomy, competence, and relatedness enhances intrinsic motivation and ethical behavior (Ryan & Deci, 2000). As leaders in firms, entrepreneurial engineers create an indelible impact on subordinate staff to achieve ethical behaviour. As transformational leaders, entrepreneurial engineers inspire and motivate employees with compelling visions, including ethical standards (Bass & Avolio, 1993). They have served as role models and demonstrated ethical behaviours in their actions and decisions through the internalisation process. According to Goldberg (2006), ethical leaders establish clear ethical expectations, provide guidance, and hold employees accountable for their ethical behavior. Their actions set a standard that employees strive to emulate. This study reveals that entrepreneurial engineers function as both transformational and ethical leaders within the entrepreneurial context. The focused codes contributing to the development of the theoretical code 'Employee Engagement' also include employee empowerment. According to Ye et al. (2022), by empowering employees to make decisions within an ethical framework, they are better equipped to take responsibility for and ownership of ethical outcomes. Empowered employees are more likely to internalize and enforce ethical codes. Additionally, entrepreneurial engineers support the professional development of their subordinate staff, as outlined in the 8th clause of the IESL Code of Ethics, empowering them to make technically accurate and ethically sound decisions within their techno-entrepreneurial firms. Therefore, it is clear that employee engagement is a crucial tool for entrepreneurial engineers seeking to uphold and implement the IESL Code of Ethics in their entrepreneurial businesses.

6.2.4.3 Outreaching the public

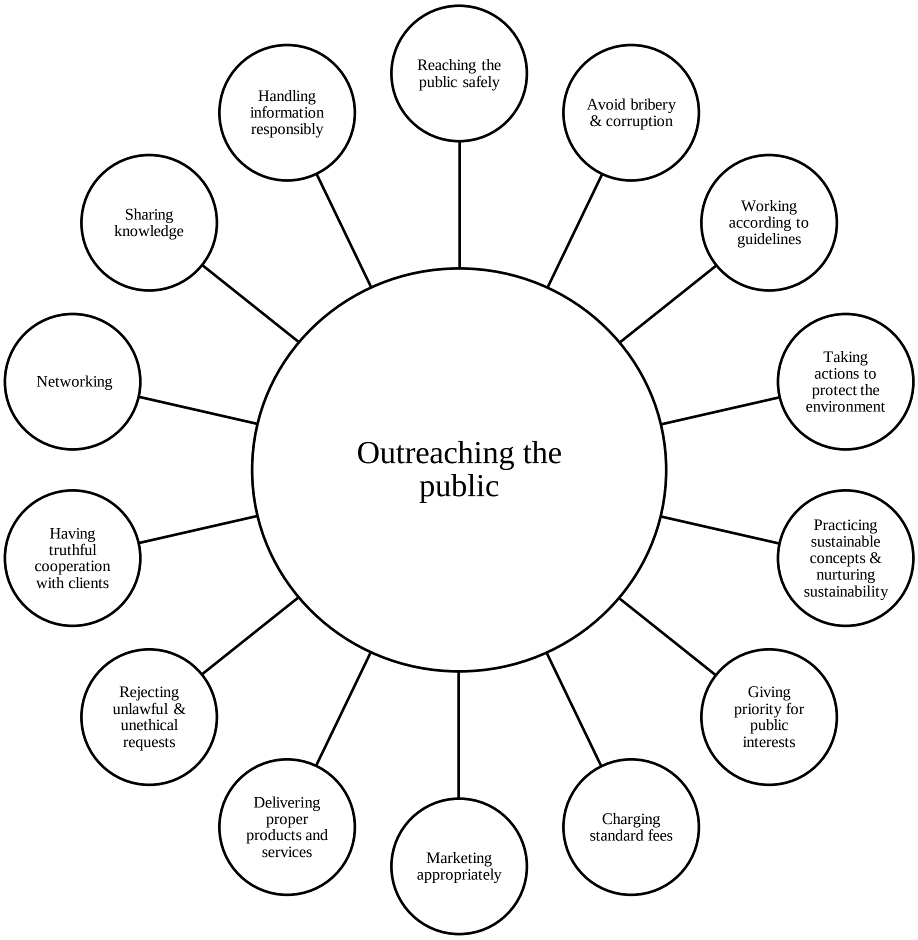
The third theoretical code, derived from analyzing the strategies employed by entrepreneurial engineers in Sri Lanka to uphold the IESL code of ethics during their business operations, is termed 'Outreaching the Public.' Entrepreneurial engineers have implemented various strategies aligned with the code of ethics when engaging with clients and the general public, ensuring that their actions remain morally justifiable within a competitive business environment. The figure below illustrates the focus codes that contributed to the development of the theoretical code, 'Outreaching the Public.

In this context, the term 'public' encompasses both clients and members of society who directly or indirectly influence the business operations of entrepreneurial engineers. Most of the focus codes developed in this study on adherence to the IESL code of ethics are aimed at addressing interactions with the general public. Entrepreneurial engineering firms operate within highly dynamic and competitive environments, where public outreach is defined as an organization's commitment to engage and communicate effectively with the public. This outreach plays a critical role in reinforcing the application of the IESL code of ethics. The strategic use of public outreach by entrepreneurial engineers to elevate ethical standards is grounded in several theoretical perspectives, including social exchange theory, stakeholder theory, and corporate social responsibility (CSR).

Social exchange theory suggests that a positive interaction between a company and the public promotes trust and mutual benefit (Cropanzano & Mitchell, 2005).Stakeholder theory considers that companies have responsibility towards various stakeholders, including the public, and ethical behaviour is essential to meet these responsibilities (Freeman, 1984). CSR focusses on the role of enterprises in contributing to social well-being beyond profit making (Carroll, 1991). In their entrepreneurial journey, entrepreneurial engineers engage with the public through ethical practices guided by the IESL code of ethics. Examples of such practices include ensuring public safety, charging standardized fees, and prioritizing public interests.

Figure 6.4

Construction of the theoretical code ‘Outreaching the public’



Source: Developed by the author based on the analysis conducted

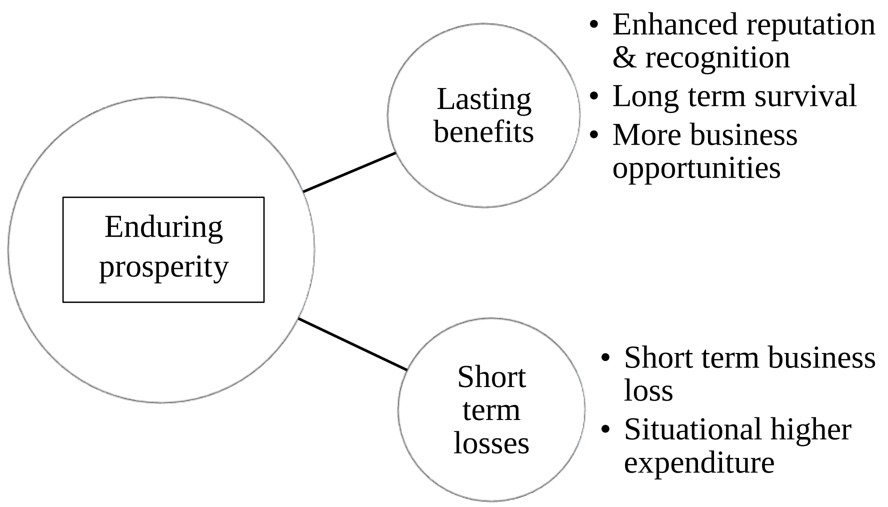
Additionally, they consciously avoid unethical behaviors such as engaging in bribery or corruption and reject unlawful or unethical client requests to maintain positive interactions between their firms and the general public. The entrepreneurial engineers who participated in this study affirmed their commitment to many of these strategies as part of their adherence to the IESL code of ethics in their business endeavors. The findings of this study suggest that, through effective public outreach, entrepreneurial engineers not only fulfill their ethical responsibilities but also contribute positively to society and achieve sustainable long-term success.

6.2.5 Enduring prosperity

Adherence to the IESL code of ethics has resulted in both positive and negative implications for the entrepreneurial behavior and performance of entrepreneurial engineers throughout their journey. Through the analysis of these implications using grounded theory techniques, as highlighted by entrepreneurial engineers during the interviews, the theoretical code ‘Enduring Prosperity’ was developed. This code is constructed from the focused codes 'Lasting Benefits' and ‘Short-Term Losses.’ Questions posed during the latter stages of the interview process revealed that the positive implications of adhering to the IESL code of ethics outweighed the negative implications experienced by entrepreneurial engineers. From a holistic perspective, the term ‘Enduring Prosperity’ aptly captures the overall impact of these implications. The figure below illustrates the focused codes and initial codes that contributed to the construction of the theoretical code ‘Enduring Prosperity’.

Figure 6.5

Construction of the theoretical code ‘Enduring Prosperity’



Source: Developed by the author based on the analysis conducted

The phrase 'Enduring Prosperity' denotes a sustained and long-lasting state of wealth, success, and economic well-being. It signifies a period of stability and continuous growth, where prosperity transcends temporary achievements to become a persistent condition. This concept encompasses not only financial stability but also overall quality of life, including aspects such as health, education, and social well-being. For entrepreneurial engineers, this notion extends to the life satisfaction derived from adhering to the IESL code of ethics. By upholding these ethical standards, entrepreneurial engineers experience not only professional and financial benefits but also personal fulfillment and societal contribution. Consequently, it can be concluded that adherence to the IESL code of ethics enables entrepreneurial engineers to achieve 'Enduring Prosperity' in their entrepreneurial journey.

Achieving enduring prosperity in a techno-entrepreneurial business is neither a convenient nor straightforward process for entrepreneurial engineers. As discussed in previous sections of this chapter, implementing the IESL code of ethics does not exclusively yield positive outcomes. Various negative implications are associated with ethical behavior, which can, at times, adversely affect the entrepreneurial behavior and performance of engineers.

Notably, entrepreneurial engineers often face business losses due to rejecting unethical business contracts and incurring higher expenditures associated with implementing ethical practices. Furthermore, there are instances during their entrepreneurial journey where they have had to make unethical decisions that violated the IESL code of ethics. However, such practices were not sustained over the long term, indicating a commitment to ethical principles despite occasional deviations. For instance, a small number of entrepreneurial engineers reported having resorted to bribery to secure job opportunities during the startup stage of their businesses. However, they discontinued such practices once their businesses achieved a certain level of stability and growth. Conversely, several entrepreneurial engineers highlighted during their interviews that they refrained from engaging in bribery or other unethical practices even during their initial stages of business development. Despite these challenges, entrepreneurial engineers emphasized that the negative implications, such as business losses, are often short-lived in the ever-changing competitive environment. They also noted that the positive outcomes of adhering to the code of ethics, such as sustained professional credibility, enhanced client trust, and long-term success, far outweigh the temporary setbacks. These positive implications are enduring and contribute significantly to the overall success and ethical standing of entrepreneurial engineers.

Enduring prosperity represents the ultimate outcome of the substantive theory developed in this study, following the constructivist grounded theory methodology. As previously discussed, enduring prosperity transcends mere financial success for entrepreneurial engineers. A more comprehensive understanding of enduring prosperity includes not only financial stability but also good health, strong personal relationships, and a sense of purpose and fulfillment. It reflects the presence of happiness and contentment across various aspects of an entrepreneurial engineer's life, rather than simply the absence of financial hardship. According to this study, enduring prosperity is not something that can be achieved overnight in the entrepreneurial journey. It is contingent on the extent to which engineers adhere to the IESL code of ethics in their business operations over time. Once a certain level of success is attained, entrepreneurial engineers must continue to operate in accordance with the IESL code of ethics to sustain enduring prosperity in the future. This broader perspective ensures that enduring prosperity is seen as a holistic state of flourishing across all dimensions of life.

6.2.6 Theory of enduring prosperity & the literature

Through extensive interviews with selected entrepreneurial engineers in Sri Lanka, conducted according to the CGT methodology, the researcher developed the theory of enduring prosperity. This theory provides a framework, particularly entrepreneurial engineers can follow to achieve a sustainable and thriving entrepreneurial life. Central to this theory is the requirement for entrepreneurial engineers to adhere to the IESL code of ethics throughout their business journey. The theory outlines how entrepreneurial engineers can uphold the IESL code of ethics by sharing strategies followed by the study participants. Furthermore, this substantive theory offers insights into the societal context surrounding entrepreneurial engineers in Sri Lanka, highlighting the typical challenges they face, particularly in relation to the unethical actions of their stakeholders.

- **Memo on the Construction of the substantive theory**

  This memo reflects the final theoretical integration and abstraction process in the CGT study titled How entrepreneurial engineers in Sri Lanka adhere to the IESL Code of Ethics in their techno-entrepreneurial businesses while managing the consequences. The resulting substantive theory, titled "The Theory of Enduring Prosperity," was developed through systematic coding, constant comparison, memo writing, and theoretical sampling consistent with the CGT methodology. The core proposition of the theory is that entrepreneurial engineers can achieve sustained business success, termed Enduring Prosperity, by consistently adhering to the IESL Code of Ethics, despite operating within a broader context marked by an avaricious society and a professional environment with both ethical and unethical colleagues.

  Core Theoretical Structure and Linkages:

  Entrepreneurial Engineer:
  This figure serves as the central actor in the theory. Entrepreneurial engineers are not only technical professionals but also business decision-makers. They operate within challenging socio-economic and professional conditions, navigating client demands, market competition, and ethical dilemmas.

  Accomplishment of IESL Code of Ethics:

  The adherence to ethics by entrepreneurial engineers is enacted through three theoretical mechanisms.

- ***Internalising** – A deep personal commitment to ethical values, manifesting through personal reflection, professional identity, and a refusal to compromise one's integrity even under pressure.*

- ***Employee Engagement*** *– A leadership strategy through which engineers develop, train, and mentor their teams to uphold ethical practices, ensuring safety, competence, and professionalism throughout the organization.*

- ***Outreaching the Public*** *– The external expression of ethical commitment, including responsible client relations, environmental accountability, transparency, and the promotion of sustainable practices.*

Enduring Prosperity:

The culmination of ethical adherence, Enduring Prosperity reflects the long-term rewards gained through principled business conduct. Participants described these rewards as lasting trust, stable business growth, professional recognition, and reputational capital. This concept also integrates the understanding that short-term sacrifices often precede long-term ethical gains, particularly in a market where corruption or undercutting is normalized.

Contextual Influences:

- ***Avaricious Society:*** *The broader social environment is characterized by greed, unethical shortcuts, and a commodification of professional services. This poses moral and operational challenges to ethical engineers.*

- ***Ethical–Unethical Colleagues:*** *Within the engineering community, participants face tension from peers who do not uphold professional standards. This dichotomy creates competitive disadvantage for ethical engineers but also reinforces their resolve.*

Theoretical Integration:

The theory integrates multiple dimensions of the entrepreneurial engineering experience into a coherent explanation of ethical resilience. The engineer's journey is framed as a dynamic process of ethical action (through internal, organizational, and public means) within a challenging external environment, leading ultimately to sustainable and principled prosperity. This theory not only provides a grounded understanding of ethical behavior in Sri Lankan engineering entrepreneurship but also contributes conceptually to literature on professional ethics, ethical decision-making in engineering, and leadership in techno-entrepreneurial settings.

Given the emphasis on constructivist grounded theory methodology, the researcher deliberately refrained from referencing existing literature during the theory construction phase to avoid influencing the development of the substantive theory. Instead, the theory was developed based on the insights provided by the study participants throughout the interviews. After finalizing the substantive theory with the support of the participants, a literature review was conducted to situate the developed theory within the existing body of knowledge in the relevant field.

The literature does not feature a well-established economic or social theory specifically called "Enduring Prosperity". However, there are frameworks and concepts that align with this idea, such as the Manifesto for Enduring Prosperity by the Partnership for Enduring Prosperity. This Declaration advocates principles of design aimed at creating a sustainable and equitable economic system. It emphasizes the importance of environmental, social, and governance (ESG) performance and supports holistic system design principles, including circular economy, renewable energy, and equitable resource allocation (*Home | Enduringprosperity*, n.d.). Business and branding experts have introduced a related concept of 'enduring prosperity,' which focuses on long-term success and sustainability. They argue that true prosperity is achieved through generation-wide visionary thinking and planning, rather than through short-term gains. This approach involves making strategic, broad-based decisions that ensure the sustainability and longevity of enterprises, as well as their continued positive contribution to society (Maxwell, n.d.). Both these approaches have the following commonalities.

- Sustainability: Ensuring that economic activities are environmentally sustainable.
- Equity: Creating systems that are fair and equitable for all stakeholders.
- Long-Term Thinking: Planning for the future and making decisions that will have long-lasting positive impacts.
- Holistic Design: Considering the full lifecycle of products and services, from creation to end-of-life, to minimise waste and maximise value

When comparing the above characteristics with the substantive theory, it can be seen that the clauses of the IESL code of ethics also have similar meaning. Each clause directly or indirectly guides entrepreneurial engineers to work on the sustainability, equity, long-term thinking, and holistic design approach in the entrepreneurial setting as business leaders. Hence, the result of this scholarly study supports the frameworks mentioned above which were developed previously in the business domain.

Another study explored the relationship between entrepreneurial ethics, the visibility of enterprises, and entrepreneurial performance in China. It emphasizes that while ethical practices can incur costs and negatively impact short-term financial performance, they are crucial for building long-term trust and sustainability. Research indicates that ethical behavior not only enhances customer trust and loyalty but also contributes to improved long-term performance (Ma et al., 2020). Similar to the Ma et al. (2020) study, the theory of enduring prosperity has identified that ethical behaviour of entrepreneurial engineers in Sri Lanka according to the IESL code of ethics has contributed to long-term trust among clients and survival of the techno-entrepreneurial firm in an environment where uncertainty, scarce resources, and intense competition prevail. The theory of enduring prosperity too further confirmed that ethical practices are bit expensive to carry out and adversely affect the short-term financial gains. Anderson & Smith (2007) found that the ethical practices of entrepreneurial enterprises positively affected both financial and nonfinancial performance and competitive performance, but that the impact of social responsibility was not significant. According to the theory of enduring prosperity, ethical behaviour of entrepreneurial engineers aligns with the IESL code of ethics, making an overall positive financial and non-financial performance, even with some minor financial losses. The difference in both scenarios was that entrepreneurial engineers have adhered to the IESL code of ethics in techno-entrepreneurial business environment while entrepreneurs have adhered to the entrepreneurial ethics in general.

The theory of enduring prosperity connects with different disciplines such as sociology, economics, ethics and sustainability. The following summarizes the existing theories and frameworks relating to the enduring prosperity.

The concept of sustainability is an important consideration in the world today and the whole world is moving forward with the objective of achieving sustainable development (Gast et al., 2017). Most engineering codes of ethics have paid attention to address sustainability concerns through engineering functionaries (Harris et al., 2009). Integrating the principles of sustainable development into the practices of entrepreneurial engineers within the business sector significantly contributes to enduring prosperity. Sustainable development fosters innovation, enhances resource efficiency, promotes social responsibility, ensures compliance with regulatory frameworks, and supports community development. These principles collectively strengthen the resilience, competitiveness, and long-term success of entrepreneurial enterprises (Dutta & Sengupta, 2014; Lüdeke-Freund, 2020; Ye et al., 2020). These practices not only benefit companies, but also contribute to a broader objective of sustainable and equitable economic growth (Wang et al., 2022) and are further confirmed through this study.

A prominent sociological framework, known as 'social capital theory,' underpins the concept of enduring prosperity. This theory examines how networks, shared norms, and trust among individuals and communities promote mutual cooperation and effective coordination (Burt, 2000). For entrepreneurial engineers, social capital plays a pivotal role in ensuring long-term survival and sustainability, aligning with the theory of enduring prosperity. Social capital highlights the importance of professional networks, including connections with mentors, investors, customers, and other professionals. These networks provide access to essential resources, critical information, and opportunities for innovation and business growth. Adherence to the IESL Code of Ethics further strengthens networking, trust, and reputation, as identified in this study. Trust within professional networks is particularly crucial for entrepreneurial engineers. It facilitates seamless transactions, reduces operational costs, and enhances cooperation. Moreover, trust attracts investors and customers, contributing significantly to a company's reputation and long-term sustainability (Valadbigi & Harutyunyan, 2012). Engineers with strong social capital are often considered more credible and reliable (Goldberg, 2006). This study highlights that a strong reputation fosters greater opportunities for business growth, partnerships, and client retention, ultimately supporting sustainable prosperity. Additionally, entrepreneurial engineers engage with the public as part of their commitment to the code of ethics. By collaborating with their communities, they can garner local support, promote goodwill, and cultivate customer loyalty. Community involvement also enables a deeper understanding of local needs, which can inspire more relevant and sustainable innovations. Through social networks, entrepreneurial engineers actively participate in knowledge-sharing activities, ensuring they remain informed about the latest technological advancements and industry best practices. Furthermore, the interviews emphasized that learning and knowledge-sharing are essential for adhering to the code of ethics, reinforcing the importance of professional and community engagement in achieving ethical and sustainable engineering practices (Nahapiet & Ghoshal, 2013). Experienced mentors within a professional's social network offer guidance, advice, and support that are crucial for both personal and professional growth. (Burt, 2000). Entrepreneurial engineers also benefit from the support of experienced engineers in the field. As discussed, the theory of enduring prosperity aligns with the principles of social capital theory, which underscores the pivotal role of networks, trust, and community engagement in fostering the long-term success and sustainability of entrepreneurial engineers.

Another prominent theory supporting the substantive theory is Max Weber’s cultural theory of prosperity. This theory provides a framework for understanding how cultural values influence economic success, particularly through the concepts outlined in The Protestant Ethic and the Spirit of Capitalism (Weber, 2002, 2005). Max Weber’s cultural theory of prosperity provides a framework for understanding how cultural values contribute to economic success, emphasizing the role of hard work, discipline, and rationalization in achieving prosperity. By adhering to the IESL Code of Ethics, entrepreneurial engineers channel their efforts into merit-based achievements and disciplined practices within entrepreneurial settings. Weber’s concept of rationalization promotes a systematic and methodological approach to business. Entrepreneurial engineers who follow relevant standards in accordance with the IESL Code of Ethics can optimize processes, minimize inefficiencies, and enhance productivity, ultimately leading to business success (Kalberg, 1980). Trust is a fundamental aspect of Weber’s theory (Valadbigi & Harutyunyan, 2012). Adherence to the IESL Code of Ethics enables entrepreneurial engineers to build trust and establish a strong reputation within society. This trust fosters the development of reliable networks with key stakeholders, including clients, partners, and investors. Enhanced trust promotes collaboration and attracts long-term business relationships, reinforcing the principles of the theory of enduring prosperity. Moreover, Weber’s theory emphasizes that ethical conduct and reliability bolster reputation, paving the way for sustainable business success and expanded opportunities (Lin, 2012). Moreover, Weber’s ascetic values reinforce sustainable growth by fostering reinvestment and ethical business practices, confirming lasting prosperity without exhausting resources. Carroll (1999)' s work on corporate social responsibility affiliates with Weber's emphasis on ethical behavior and sustainability. As entrepreneurial engineers assimilate CSR into their business processes, they could build robust community relationships and enrich their long-standing viability. Porter & Kramer (2006) discuss how CSR strategies contribute to sustainable competitive advantage that ensures the enduring prosperity. By analyzing the features of the Weber's theory of prosperity, it can be concluded that theory of enduring prosperity also consists with few commonalities as explained above.

Another theory that supports the concept of enduring prosperity is the Dynamic Capability Theory (DCT), which emphasizes an organization's ability to intentionally create, extend, or modify its resource base in response to rapidly changing environments (Teece et al., 1997). This is especially relevant for entrepreneurs, as it underscores the importance of adaptability and innovation in maintaining a competitive advantage over time. Since the IESL Code of Ethics encourages entrepreneurial engineers to engage in lifelong learning, adherence to this principle enables them to remain adaptable and innovative by acquiring new knowledge. By fostering a culture of continuous learning and innovation, dynamic capabilities facilitate the long-term growth and sustainability of entrepreneurial ventures (Augier & Teece, 2009). Staying updated with new knowledge further enhances the innovative behavior of entrepreneurial engineers. Dynamic capabilities are crucial for entrepreneurial success, as they enable engineers to adapt to changes in market conditions and technological advancements. The Dynamic Capability Theory offers a valuable framework for understanding how entrepreneurs can gain and sustain a competitive advantage in rapidly changing environments. By focusing on opportunities, effectively utilizing them, and continuously transforming their businesses, entrepreneurial engineers and other business leaders can ensure long-term success and adaptability, all while adhering to the IESL Code of Ethics.

However, theories such as Schumpeter's theory of creative destruction and Christensen's theory of disruptive innovation challenge the substantive theory of enduring prosperity. Schumpeter's theory of creative destruction posits that innovation leads to the continuous demise of old industries and the emergence of new ones (Caballero, 2008; Schumpeter, 1942). Adherence to the code of ethics often presents entrepreneurial engineers with difficult situations, particularly as they continually innovate their products and services while prioritizing the health, safety, and welfare of the public. The study found that entrepreneurial engineers do not view the emergence of industry competitors as a significant threat to their survival in the business domain. Instead, the quality of their products and services, the reputation and trust built over time, and ethical business practices have enabled them to withstand competition and thrive in the industry for extended periods. Christensen's theory of disruptive innovation posits that established entrepreneurs and companies are often overtaken by new entrants who introduce disruptive technologies. Initially targeted at niche markets, these technologies eventually dominate the mainstream and displace established players (Christensen, 1997). Even successful first-generation entrepreneurs may struggle to maintain long-term prosperity if they fail to recognize and adapt to these disruptive forces. While Christensen's theory of disruptive innovation emphasizes the challenges and failures faced by established firms, this study delves into the business journeys of entrepreneurial engineers who have sustained success for over 40 years and continue to thrive.

In conclusion, the literature does not contain a widely recognized economic or social theory specifically referred to as “enduring prosperity”. However, seminal theories such as the concept of sustainability, social capital theory, Max Weber’s cultural theory of prosperity, and dynamic capability theory provide strong support for the grounded theory developed in this study: the theory of enduring prosperity. This theory demonstrates how entrepreneurial engineers can achieve long-term business success by adhering to the IESL Code of Ethics, with particular emphasis on the implications experienced by these engineers. Nevertheless, prominent theories such as Schumpeter’s theory of creative destruction and Christensen’s theory of disruptive innovation challenge the substantive theory of enduring prosperity. Therefore, further systematic investigations are needed to explore and address the conflicts between these theories and the theory of enduring prosperity.

6.3 Interplay among engineering, entrepreneurial & business ethics

Entrepreneurial engineers operate at the intersection of technology and business, navigating a complex landscape of ethical considerations. The researcher’s observations, supported by existing literature, emphasize that techno-entrepreneurial companies led by these engineers play a crucial role in driving innovation and fostering economic growth within the country. (Guardia, 2016; Schuelke-Leech, 2018). However, the convergence of engineering, entrepreneurship and business is a unique ethical challenge for them.

Entrepreneurial engineers operate at the intersection of technology and business, navigating a complex landscape of ethical considerations. The researcher’s findings, corroborated by existing literature, underscore the pivotal role of techno-entrepreneurial companies led by these engineers in driving innovation and fostering economic growth within the country (Harris et al., 2009). The entrepreneurial engineers participating in this study highlighted their strong commitment to aligning technological innovations with the principles of public safety and environmental sustainability, as outlined in engineering ethics. For instance, during the development of new technologies, they undertake rigorous testing to ensure compliance with safety standards while minimizing environmental impact. Insights from the interviews indicate that this ethical adherence not only enhances stakeholder trust but also effectively mitigates potential risks.

Entrepreneurial ethics addresses the ethical challenges encountered by entrepreneurs, with a focus on personal integrity, ethical decision-making, and social responsibility (Solymossy & Masters, 2002). In techno-entrepreneurial business settings, the study revealed that entrepreneurial engineers face ethical dilemmas, including balancing innovation with ethical considerations, ensuring equitable resource allocation, and maintaining transparency with key stakeholders such as clients and the public. Ethical entrepreneurship transcends mere profit generation; it involves creating value that fosters societal well-being and environmental sustainability (Harris et al., 2009; Tipu, 2015). Entrepreneurial ethics give solutions to more immediate and personal ethical dilemmas confronted by entrepreneurs (Qureshi, 2023). For instance, ethical fundraising practices and transparent communication of product capabilities and limitations are evident in the behavior of ethical entrepreneurs. Analysis of the interview transcripts revealed that entrepreneurial engineers consciously avoid bribery and corruption and maintain truthful communication with clients, guided by the IESL Code of Ethics, which closely aligns with principles of entrepreneurial ethics. Additionally, the following evidence further supports the adherence to entrepreneurial ethics.

- Integrity and Honesty: By adhering to the clauses of the IESL code of ethics relevant to the integrity & honesty, entrepreneurial engineers oblige to honesty in all professional and entrepreneurial interactions as ethical engineers, which affiliates with the core values of entrepreneurial ethics.
- Public Safety & Welfare: The IESL code of ethics' emphasis on holding paramount health, safety and welfare of the public has ensured that entrepreneurial engineers contemplate the societal impact of their innovations, endorsing social responsibility.
- Competence and Continuous Learning: Since the IESL's code of ethics emphasize for upholding competence has ensured the entrepreneurial engineers are knowledgeable enough to make informed and ethical decisions, which is a critical aspect of entrepreneurial ethics.

This grounded theory study identified three focus codes that explain how entrepreneurial engineers adhere to the IESL Code of Ethics: internalizing, employee engagement, and outreaching to the public. In summary, both the internalizing and employee engagement components encompass theoretical codes that align closely with the principles of entrepreneurial ethics. Thus, it can be concluded that adherence to the IESL Code of Ethics supports entrepreneurial engineers in promoting and enhancing entrepreneurial ethics within their business environments.

Similar to the entrepreneurial ethics, business ethics also essential for the moral conduct of the entrepreneurs. Business ethics applies to the whole organization's behaviour, including policies, procedures and behaviour of all employees. It focuses on how companies ensure fair practices, comply with legal standards and address ethical issues associated with their operations and their impact on stakeholders. According to the literature, corporate governance, CSR, compliance & legal issues, employee relations and fair trade practices can be identified as the key components of the business ethics (Ferrel & Fraedrich, 2015). Business ethics concerned with a wide array of stakeholders, including shareholders, employees, customers, suppliers, and the broader community (Weil, 2014). As entrepreneurs lead their businesses, they are required to implement robust corporate governance structures, comply with regulatory requirements, and engage in CSR initiatives (Sabir et al., 2019). This includes establishing ethical codes of conduct, conducting regular ethical audits, and cultivating a culture of ethical behavior within the organization. By integrating business ethics into their operations, entrepreneurs promote sustainable practices and foster positive relationships with stakeholders (Ojukwu et al., 2023). In techno-entrepreneurial settings, where engineers transition into entrepreneurial roles, insights from the interviews indicate that entrepreneurial engineers place significant emphasis on adhering to the IESL Code of Ethics.

- Corporate Governance: As IESL code of ethics constantly emphasise on responsibility of engineers, it has supported entrepreneurial engineers to develop strong corporate governance structures, ensuring transparency and fairness in their business operations.
- Corporate Social Responsibility: With the priority given for the public welfare, the IESL code of ethics has encouraged entrepreneurial engineers to involve in CSR initiatives which affiliate with business ethics principles.
- Legal Compliance and Fair Practices: The focus of the IESL code of ethics on honesty and integrity has ensured the entrepreneurial engineers' adherence to applicable industry standards and legal standards. It has promoted the fair business practices of entrepreneurial engineers which is an essential element of business ethics.

This study identified that two of the three major strategies followed by entrepreneurial engineers—employee engagement and outreaching to the public—include several focused codes that share common characteristics with business ethics. Additionally, the codes of conduct, as well as the vision and mission statements of most techno-entrepreneurial firms represented by the participants, were developed with reference to the IESL Code of Ethics, demonstrating its significant influence. Thus, it can be concluded that adherence to the IESL Code of Ethics has played a pivotal role in helping entrepreneurial engineers elevate business ethics within their firms.

Adhering to the IESL Code of Ethics enables entrepreneurial engineers to align their business operations with both entrepreneurial and business ethics. The principles of integrity, public welfare, competence, and responsibility foster ethical decision-making, responsible innovation, and sustainable business practices. By integrating these ethical frameworks, entrepreneurial engineers have ensured the success and ethical integrity of their techno-entrepreneurial ventures.

6.4 Theoretical strengths & limitations with CGT standards

6.4.1 Theoretical strengths

The theory developed through this study, titled The Theory of Enduring Prosperity, demonstrates strong alignment with the methodological standards of CGT (Charmaz, 2014). It is grounded in rich empirical data collected from 22 entrepreneurial engineers in Sri Lanka, ensuring that all conceptual categories emerged inductively from participants' lived experiences. Through a systematic and iterative process of initial coding, focused coding, and theoretical coding, the study moved beyond thematic description to construct an integrated explanation of how entrepreneurial engineers adhere to the IESL Code of Ethics and the consequences of such adherence. The theory offers conceptual depth through its core categories like Internalising, Employee Engagement, Outreaching the Public, and Enduring Prosperity, each of which captures distinct processes of ethical enactment and resilience in a challenging sociocultural context marked by an avaricious society and ethical–unethical colleagues.

Furthermore, the theory reflects strong theoretical integration, linking mechanisms of ethical behavior to both contextual influences and long-term business outcomes. It is methodologically robust, as theoretical saturation was achieved by the 20th interview, with no new properties emerging in the final stages of data collection. Reflexivity was actively maintained throughout the study; the researcher's dual role as an engineering ethics lecturer and practicing engineer was critically acknowledged to manage subjectivity and enhance transparency. Finally, the theory makes an original contribution to the understanding of ethical decision-making in engineering entrepreneurship within developing contexts, offering both practical implications and conceptual advancement. As a summary, the theory meets the key criteria of CGT by being grounded, conceptually rich, theoretically integrated, reflexive, saturated, and contextually relevant.

6.4.2 Theoretical limitations

While this study was rigorously conducted in accordance with the principles of CGT (Charmaz, 2014), several minor limitations are acknowledged. First, the use of the IESL Code of Ethics as a sensitizing framework during data collection, where participants were asked questions aligned with specific clauses, may have introduced a degree of pre-structuring to the data. Although this approach helped to explore ethical adherence in a structured manner, it may have constrained the emergence of more unexpected or unconventional ethical interpretations. Second, all participants were Sri Lankan entrepreneurial engineers, and while this enhances contextual depth, it may limit the transferability of the theory to different national or cultural settings without further empirical testing. Third, the researcher's professional background in engineering and ethics education, while offering valuable insight, also carries the potential for interpretive bias. Reflexivity strategies such as memo writing and critical self-positioning were employed to mitigate this influence. Despite these limitations, the study's methodological transparency, theoretical coherence, and analytic depth ensure that the findings remain credible and valuable within the scope of CGT.

6.5 Chapter summary

This chapter presents the substantive theory developed through the constructivist grounded theory methodology, termed "The Theory of Enduring Prosperity." This theory provides a framework that guides entrepreneurial engineers toward success by adhering to the IESL Code of Ethics while managing its implications. Notably, the literature does not include a well-established economic or social theory specifically called Enduring Prosperity. However, seminal theories such as the concept of sustainability, social capital theory, Max Weber's cultural theory of prosperity, and dynamic capability theory provide supporting insights for Enduring Prosperity. In contrast, leading theories like Schumpeter's theory of creative destruction and Christensen's theory of disruptive innovation present challenges to this new theory. Furthermore, it is evident that the IESL Code of Ethics has enabled entrepreneurial engineers to align their business operations with both entrepreneurial and business ethics.

CHAPTER 7

CONCLUSIONS

7.1 Introduction

This chapter seeks to review, summarize, and integrate the findings and insights of the study, utilizing them to explore how entrepreneurial engineers adhere to engineering ethics. These insights serve as a foundation for guiding decision-making both at the individual level, as entrepreneurial engineers, and at the macro level, within the broader context of decision-making in Sri Lanka's techno-entrepreneurial business ventures. The first section of this chapter briefly examines the research results in relation to the objectives and goals of the study. The subsequent sections discuss and evaluate these results, focusing on their implications for practice and their contribution to theoretical knowledge. Finally, the chapter addresses the study's limitations, provides recommendations, and identifies opportunities for future research.

7.2 Findings of the study

As the literature review indicates, further empirical studies are needed to gain deeper insights into how professional codes of ethics are applied in the decision-making processes within engineering practice. This is particularly important because codes of ethics alone cannot provide guidance for every ethical dilemma engineers may encounter. When engineers transition into entrepreneurial roles, where they frequently navigate uncertainties and risks within a profit-oriented framework, adhering to engineering codes of ethics becomes particularly challenging. This adherence may influence their entrepreneurial behavior and practices in complex ways. The limited availability of existing research on this topic underscores the importance of this study, which aims to explore these dynamics from the perspectives of entrepreneurial engineers in Sri Lanka. Therefore, this study was conducted to explore "**How do Sri Lankan entrepreneurial engineers adhere to engineering ethics while managing its implications on behavior & performance?"**

The first research question of this study was '**What perception do Sri Lankan entrepreneurial engineers possess regarding engineering ethics?'** The aim of this question was to explore the fundamental opinions of entrepreneurial engineers in Sri Lanka regarding engineering ethics. Notably, all participants were chartered engineers, having completed a compulsory course and an examination on engineering ethics as part of the requirements for obtaining their chartered status. As a result, all participants were familiar with engineering ethics and the IESL Code of Ethics. The majority of entrepreneurial engineers perceived the IESL Code of Ethics primarily as a "guideline" for ethical behavior in their roles as entrepreneurs. However, two participants expressed the view that if individuals are aware of their social responsibilities, a formal code of ethics becomes unnecessary. Additionally, all of their perception of the ethical behavior of other entrepreneurial engineers in Sri Lanka was mixed, characterized as "ethical-unethical colleagues."

The second research question of this study was **'What ethical challenges have Sri Lankan entrepreneurial engineers encountered from society as entrepreneurs?'** The analysis revealed that entrepreneurial engineers in Sri Lanka have encountered several ethical challenges stemming from societal interactions. These challenges include bribery & corruption, going behind money, charging lesser fees, practicing in inexpert areas, professional jealousy, unfair competition and hiding the truth. The primary underlying cause of these behaviors was identified as the profit-driven mindset of competitors and other stakeholders. Therefore, entrepreneurial engineers are surrounded by an avaricious society, whose actions have negatively impacted the success of the participants throughout their entrepreneurial journey. Moreover, it can be inferred from these observations that if all competitors and stakeholders involved with entrepreneurial engineers were to adhere to the IESL Code of Ethics, or any similar ethical framework, the unethical experiences encountered during their entrepreneurial journey could be significantly reduced. However, the study further revealed that entrepreneurial engineers in Sri Lanka are required to interact with this avaricious society at every stage of their business journey. In summary, through the lens of several prominent entrepreneurship theories, including Schumpeter's innovation theory, Knight's risk-bearing theory, McClelland's need for achievement theory, and the Exposure theory of entrepreneurship, it becomes evident that an 'avaricious society' can have several detrimental effects on the behavior and performance of entrepreneurial engineers. These effects include stifling innovation, creativity, and entrepreneurial motivation, increasing the frequency of ethical dilemmas, and prioritizing short-term financial gains. To address these issues, policy-level decisions should aim to transform the avaricious society into a business-friendly environment by reducing corrupt practices, fostering a transparent regulatory framework, and providing ethics training across various sectors of society.

The third research question of this study was **'How do Sri Lankan entrepreneurial engineers adhere to engineering ethics?'** The aim of this question was to explore the various mechanisms employed by entrepreneurial engineers to adhere to the different clauses of the IESL Code of Ethics within an entrepreneurial business environment. The participants revealed three strategies they use to uphold the IESL Code of Ethics as business leaders. Analysis based on CGT identified three major theoretical categories: **internalizing, employee engagement,** and **outreaching the public**.

Within each category, numerous subcategories of strategies were identified, which entrepreneurial engineers implement to adhere to the IESL Code of Ethics in the best possible manner, as outlined in Table 5.2.

Entrepreneurial engineers strive to internalize the IESL Code of Ethics into their personal values and behaviors. Internalization refers to the process by which external beliefs, attitudes, standards, and norms are integrated into an individual's internal belief system, values, and actions. This process involves adopting and incorporating external influences into one's personal framework and guiding principles, shaping their identity, self-conception, and worldview. For entrepreneurial engineers, their identity, self-conception, and vision of the world are influenced by the IESL Code of Ethics, which, in turn, guides their moral behavior as individual entrepreneurs. These are self-directed strategies that demand significant individual commitment. Internalized ethical principles provide consistency in actions, even under pressure or in situations where there is temptation to cut corners. This consistency is essential for building sustainable businesses that maintain public trust and loyalty. The study reveals that entrepreneurial engineers make individual efforts to comply with the IESL Code of Ethics, minimizing the possibility of violating them. Furthermore, this behavior helps foster an organizational culture that emphasizes ethics among employees. The process of internalizing the IESL Code of Ethics by entrepreneurial engineers aligns with Vygotsky’s sociocultural theory, which highlights the role of social interactions and cultural context in shaping individual behavior and development.

Entrepreneurial engineers prioritize effective employee engagement to ensure compliance with the IESL Code of Ethics. As revealed in the interviews, they delegate responsibilities to promote ethical behavior in line with the IESL Code, both within the firm and toward the general public, while simultaneously empowering employees. A knowledgeable and skilled team of subordinate engineers and other staff members is essential for upholding the Code of Ethics. Under the theoretical category of **Employee Engagement**, entrepreneurial engineers focus on empowering employees by enhancing their technical expertise and supporting their professional development. According to social exchange theory, employees reciprocate employers' support and trust with a commitment to ethical behavior. Self-determination theory further suggests that addressing the psychological needs of employees—such as autonomy, competence, and interdependence—enhances intrinsic motivation and ethical behavior. This study reveals that entrepreneurial engineers exhibit transformational and ethical leadership within the entrepreneurial context. Among the key factors contributing to the development of the theoretical code ‘**Employee Engagement**’, employee empowerment plays a significant role. Therefore, it is clear that ‘**employee engagement**’ is a vital tool for entrepreneurial engineers seeking to uphold and implement the IESL Code of Ethics within their techno-entrepreneurial businesses.

Most of the focused codes developed in this study regarding adherence to the IESL Code of Ethics are directed toward the general public, which ultimately led to the category of **‘Outreaching the Public’**. In this context, "the public" refers to clients and members of society who, directly or indirectly, influence the business operations of entrepreneurial engineers. Public outreach is defined as an organization's commitment to engage with and communicate to the public, and it plays a crucial role in reinforcing adherence to the IESL Code of Ethics. The use of public outreach by entrepreneurial engineers to elevate ethical standards is grounded in several theoretical frameworks, including social exchange theory, stakeholder theory, and corporate social responsibility (CSR). This study demonstrates that through effective public outreach, entrepreneurial engineers not only meet their ethical obligations but also make meaningful contributions to society, ultimately fostering long-term success.

In conclusion, entrepreneurial engineers demonstrate adherence to the IESL Code of Ethics through processes of **‘internalization, employee engagement, and outreaching the public’** throughout their entrepreneurial journey. However, a limited number of entrepreneurial engineers were found to have violated certain clauses of the Code of Ethics, primarily during the startup phase of their ventures. These violations were not habitual but rather situational and isolated incidents.

The fourth research question of this study was **‘What positive and negative consequences do Sri Lankan entrepreneurial engineers encounter by applying engineering ethics in their entrepreneurial journey?’** The objective of the research question was to examine the positive and negative consequences experienced by entrepreneurial engineers in adhering to the IESL Code of Ethics within a highly competitive entrepreneurial context. In response to this research question, the theoretical code **"Enduring Prosperity"** was developed, grounded in the focused codes "**Lasting Benefits**" and "**Short-Term Losses**." Positive consequences encountered by entrepreneurial engineers are ‘enhanced reputation & recognition, long term survival and more business opportunities’ which come under the focused code ‘lasting benefits’. As negative consequences, ‘short term business loss and situational higher expenses can be highlighted and they come under the focused code ‘short term losses’. The analysis reveals that the positive consequences significantly outweigh the negative consequences encountered during the entrepreneurial journey. The study indicates that the negative consequences are temporary and situational in nature. Considering the broader context, the term "**enduring prosperity**" aptly encapsulates the overall impact of the consequences experienced by entrepreneurial engineers. The phrase **"enduring prosperity"** denotes a sustained and long-lasting state of wealth, success, and overall economic well-being. It signifies a period characterized by stability and continuous growth, encompassing not only financial stability but also improvements in quality of life, including aspects such as health, education, and social well-being. Furthermore, this concept extends to the personal satisfaction entrepreneurial engineers derive by adhering to the IESL Code of Ethics. As this study demonstrates, entrepreneurial engineers who uphold these ethical standards experience the multifaceted benefits associated with "enduring prosperity" throughout their entrepreneurial journey. Therefore, it can be concluded that adherence to engineering ethics contributes significantly to long-term sustainability and overall success. Accordingly, entrepreneurial engineers are encouraged to prioritize ethical practices to ensure sustained growth and prosperity, as emphasized by the concept of "enduring prosperity."

Research question five, "**What substantive theory can demonstrate the adherence of entrepreneurial engineers to engineering ethics in an entrepreneurial business environment and its consequences in the Sri Lankan context?**" was designed to develop a substantive theory derived from interview findings. This theory aims to provide guidance for future entrepreneurial engineers, enabling them to uphold engineering ethics while achieving business success within the unique context of Sri Lanka. Using the constructivist grounded theory methodology, a substantive theory titled **"Theory of Enduring Prosperity"** was developed, as illustrated in figure 5.1. This theory provides a comprehensive perspective on enduring prosperity, encompassing financial stability, good health, strong personal relationships, and a profound sense of purpose and fulfillment. It highlights that enduring prosperity extends beyond the mere absence of financial hardship, encapsulating the presence of happiness, contentment, and well-being across various dimensions of the entrepreneurial engineer's life. According to this study, enduring prosperity is not a quick achievement; it cannot be attained within a short span of one or two nights in an engineer's entrepreneurial journey. Instead, it is a gradual outcome, closely tied to the extent to which entrepreneurial engineers adhere to the IESL Code of Ethics in their business operations over time. By embracing the theory of enduring prosperity, technological entrepreneurs, particularly entrepreneurial engineers, can build a sustainable and thriving entrepreneurial life. This theory provides practical guidance on applying the IESL Code of Ethics, incorporating strategies shared by the study participants to navigate ethical challenges and achieve long-term success. Furthermore, this substantive theory outlines the societal context surrounding entrepreneurial engineers in Sri Lanka, highlighting the common challenges they face due to unethical practices by their stakeholders. The theory draws support from seminal frameworks in the literature, such as the concept of sustainability, social capital theory, Max Weber's cultural theory of prosperity, and dynamic capability theory, which align with its principles. However, leading theories like Schumpeter's theory of creative destruction and Christensen's theory of disruptive innovation present challenges to the theory of enduring prosperity. These theories emphasize transformative change and disruption, which may contrast with the stability and ethical adherence central to the concept of enduring prosperity. This tension underscores the nuanced interplay between sustaining ethical practices and navigating the dynamic, competitive nature of entrepreneurial environments.

Extensive interviews with entrepreneurial engineers, coupled with comparisons to existing literature, reveal that adherence to the IESL Code of Ethics has enabled these engineers to align their business operations with both entrepreneurial and business ethics. By upholding both ethical frameworks simultaneously, they have successfully integrated the IESL Code of Ethics into their entrepreneurial practices. This integration has allowed entrepreneurial engineers to maintain the ethical integrity and long-term success of their techno-entrepreneurial ventures.

In conclusion, it can be asserted that Sri Lankan entrepreneurial engineers should apply engineering ethics, specifically the IESL Code of Ethics, to achieve enduring prosperity in their business ventures within the socio-economic context of Sri Lanka. The greater their adherence to these ethical standards, the more likely they are to experience long-term success, ensuring the sustainability of their businesses.

7.3 Implications for practice & policy

This research has significant implications both for individual entrepreneurial engineers and at the macro level, influencing decision-making in the techno-entrepreneurial ventures of Sri Lanka. The study uniquely reveals how entrepreneurial engineers adhere to engineering ethics within a profit-driven business environment in the Sri Lankan context. It challenges the prevailing notion in the field of engineering entrepreneurship that the IESL Code of Ethics or engineering ethics in general, cannot be effectively applied in a business-oriented entrepreneurial setting while developing a successful techno-entrepreneurial firm. Therefore, emerging entrepreneurial engineers should not hesitate to embark on their entrepreneurial journey by prioritizing engineering ethics as professionally qualified engineers, even from the startup stage. It is evident that entrepreneurial engineers have actively integrated engineering ethics into their entrepreneurial practices. This integration includes developing products and providing services that prioritize safety and sustainability, adhering to relevant industry standards, maintaining objectivity and truthfulness with stakeholders, and making decisions that align with engineering ethics without compromising business objectives. This ethical approach should be further reinforced among entrepreneurial engineers in Sri Lanka.

Moreover, entrepreneurial engineers can adopt the substantive theory developed in this study, which incorporates ethical considerations alongside technical and financial factors, to navigate the complex ethical dilemmas they encounter. The theory of enduring prosperity can serve as a guiding framework for emerging entrepreneurial engineers in the Sri Lankan context, especially if they aim for long-term sustainability in their field. By following this theory, entrepreneurial engineers can significantly impact their practices and operations, ensuring adherence to the IESL Code of Ethics in a more achievable and practical manner.

As engineers with chartered status, the study participants received training in engineering ethics, with a particular focus on the IESL Code of Ethics, during their chartering process. This training enabled them to apply engineering ethics effectively in their entrepreneurial operations, contributing to their achievement of enduring prosperity. Therefore, all entrepreneurial ventures should strive to cultivate a culture that values ethics as much as innovation and profitability. If the owner or manager of an entrepreneurial firm lacks the commitment to uphold proper ethical behavior, fostering an ethical culture among employees will not be feasible. Therefore, owners/managers of entrepreneurial firms should first receive training in ethics, similar to the training received by entrepreneurial engineers. Subsequently, entrepreneurs can focus on establishing clear ethical guidelines, promoting transparency, and encouraging open discussions about ethical issues within the organization as part of their ongoing practice.

This study identifies a few limited incidents in which entrepreneurial engineers had to violate certain clauses of the IESL Code of Ethics during their entrepreneurial journey, with most of these violations occurring during the startup stage. These observations can serve as valuable lessons for future entrepreneurial engineers, guiding them to avoid such ethical violations in the techno-entrepreneurial business sector within the Sri Lankan context. Based on this study, it is recommended that entrepreneurial engineers should not feel compelled to violate ethical standards, even during challenging times, as many others have successfully achieved their business goals without doing so. Furthermore, this study highlights both the positive and negative consequences of adhering to the IESL Code of Ethics. The positive implications significantly outweigh the negative ones. With this understanding, entrepreneurial engineers can consistently make ethical decisions as part of their regular practice, ensuring long-term success and integrity in their ventures.

Entrepreneurial engineers often operate in dynamic and, at times, poorly regulated environments, necessitating more robust ethical frameworks capable of keeping pace with innovations in groundbreaking technologies. Policymakers should consider developing flexible ethical guidelines that effectively address emerging ethical challenges while fostering an environment conducive to innovation. Notably, some study participants reported encountering difficulties in fulfilling their entrepreneurial roles due to the constraints imposed by the IESL Code of Ethics. Policy-level interventions are necessary to draft a dedicated code of ethics specifically tailored for entrepreneurs operating in technological domains, such as entrepreneurial engineers. Currently, the IESL Code of Ethics is designed for professional engineers and, while applicable to entrepreneurial engineers, it cannot be imposed on other technology entrepreneurs who lack engineering backgrounds. Therefore, a distinct code of ethics is essential for all entrepreneurs in the technological sector. Such a framework would support the growth and sustainability of entrepreneurial tech firms within the Sri Lankan business landscape while contributing significantly to the country's economic development. Furthermore, the entrepreneurial engineers who participated in this study demonstrated a strong commitment to complying with the IESL Code of Ethics, largely due to their thorough understanding of its principles. However, technology entrepreneurs from non-engineering backgrounds, as well as entrepreneurial engineers without chartered status, may require additional support to make ethically sound decisions in entrepreneurial environments. This is due to their lack of access to a structured ethical framework such as the IESL Code of Ethics. To address this gap, policy-level initiatives should include the establishment of training programs on ethical behavior specifically tailored for technology entrepreneurs, including entrepreneurial engineers. Additionally, the study highlights that entrepreneurial engineers often operate within an avaricious society where unethical practices, primarily by stakeholders and competitors, are prevalent. Providing ethical awareness training to these stakeholders and competitors could significantly reduce the challenges entrepreneurial engineers face, enabling them to conduct their operations more effectively. Such policy interventions would foster a culture of ethical practices across the technological and entrepreneurial sectors, reducing the risk of catastrophic business failures like Theranos, which stemmed from the unethical use of technology.

7.4 Contribution for theoretical knowledge

1. Theory building

Numerous studies have investigated the ethics of technology entrepreneurs on a global scale. However, there is a notable gap in scholarly research addressing the ethics of technology entrepreneurs in Sri Lanka. Addressing this gap, the present study represents the first systematic investigation into the ethical practices of entrepreneurial engineers in Sri Lanka, contributing to the advancement of theoretical knowledge in this area. Furthermore, no prior research has explored how a code of ethics, originally formulated for professional engineers, is adapted and applied within entrepreneurial business settings, which differ significantly from traditional workplace contexts.

This study addresses a critical gap in the literature by examining how a code of ethics can be effectively applied in fast-paced, innovation-driven environments where ethical guidelines frequently conflict with business objectives. Conducted within the unique socio-cultural and economic context of Sri Lanka, the study provides valuable insights into reconciling ethical adherence with entrepreneurial success in dynamic and challenging conditions.

This research introduces a novel substantive theory, the Theory of Enduring Prosperity, to the existing literature, offering guidance to entrepreneurial engineers on upholding engineering ethics while navigating their implications within entrepreneurial business contexts. This theory, absent from prior studies, constitutes the study's primary theoretical contribution. Moreover, the research identifies unethical challenges encountered by entrepreneurial engineers as context-specific barriers to their success. These findings further reinforce existing observations that ethical behavior among entrepreneurs is a critical determinant of the long-term success and sustainability of business enterprises.

2. Holistic study

This research integrates theories and perspectives from a wide range of disciplines, including entrepreneurship, ethics, engineering practice, management, and social sciences. In contrast to most previous studies in the technology entrepreneurship domain, which often adopt a unidimensional focus, this study embraces the contemporary trend of multidisciplinary research. It examines adherence to engineering ethics by exploring the interplay between entrepreneurial, socio-cultural, engineering, ethical, and managerial dimensions. Consequently, this study makes a significant contribution to the literature on the ethics of technology entrepreneurs by conceptualizing a multidimensional framework centered on a code of ethics. It holistically evaluates the substantive theory developed in this research through the lens of existing empirically-based theories, thereby broadening the scope of inquiry and directing future research in technology entrepreneurship and ethics toward previously underexplored areas.

3. Comprehensive methodology

The current study advances the understanding of philosophical and methodological perspectives in researching the ethics of entrepreneurial engineers. While much of the entrepreneurship research in Sri Lanka is underpinned by implicit meta-theoretical assumptions, often leading to modest or limited conclusions, this study adopts explicit meta-theoretical assumptions. By doing so, it addresses the complex and multifaceted realities associated with the application of a code of ethics by entrepreneurial engineers. These philosophical foundations account for the interplay between entrepreneurial behavior and performance in the technological domain, the nature and role of ethical codes, socio-cultural influences, and the overarching objectives of the research.

The study's methodology is grounded in these holistic meta-theoretical foundations, ensuring alignment between the research philosophy, design, and methods. In contrast to the limited body of qualitative studies on entrepreneurship and ethics, where meta-theoretical assumptions are often inconsistently applied, and philosophies, methodologies, and methods are conflated (e.g., phenomenology, social constructionism, interactionism, grounded theory, and case studies), this research avoids such pitfalls. These inconsistencies in prior studies have led to confusion and compromised the validity of qualitative approaches in entrepreneurship research. By clearly articulating its philosophical assumptions and adopting a rigorous methodological framework, this research provides a comprehensive approach to understanding the complex, dynamic, and multifaceted realities of entrepreneurship. This contribution strengthens the rigor and clarity of qualitative research in the fields of entrepreneurship and ethics.

4. Reality of consequences of ethics

The outcomes of adhering to ethical standards are often perceived as ambiguous and do not always yield positive implications for entrepreneurs. Similar confusion and hesitation were observed among entrepreneurial engineers, who are required to comply with the Code of Ethics of the Institution of Engineers, Sri Lanka (IESL) as a condition of their professional membership. This study reveals that adherence to the IESL Code of Ethics results in a complex interplay of both positive and negative consequences.

On the positive side, compliance with ethical standards has enhanced the reputation and recognition of entrepreneurial engineers, contributed to long-term business sustainability, and opened new business opportunities. However, adherence has also imposed certain limitations, including constraints on innovation, short-term financial losses, and occasionally higher operational costs in specific situations. The detailed findings of this study address and clarify the ambiguities surrounding the implications of ethical adherence in existing literature, offering a nuanced understanding of its multifaceted outcomes.

5. Ethical challenges

This study identifies several unethical challenges faced by entrepreneurial engineers during their entrepreneurial journey within the Sri Lankan context. Many of these challenges have negatively impacted their progress, influenced by the socio-cultural and economic frameworks prevalent in the country. While the existing literature extensively discusses various barriers to entrepreneurship, this study uniquely emphasizes how unethical behaviors exhibited by stakeholders and competitors can also pose significant obstacles to entrepreneurial success.

The underlying motivation for these unethical actions by stakeholders and competitors was found to be rooted in the materialistic greed and profit-driven mentality of contemporary society. These findings offer a deeper understanding of the societal dynamics that impede the success of entrepreneurial engineers, underscoring the need for strategies to address such challenges. This study introduces a conceptual characterization of the society surrounding entrepreneurial engineers as an 'avaricious society.' The qualitative nature of the research, which accommodates multiple interpretations of reality, highlights the pervasive unethical experiences faced by entrepreneurial engineers and situates them within this conceptual framework. The findings, derived from extensive interviews, offer a nuanced and realistic definition of contemporary society, highlighting its materialistic and greed-driven tendencies. This new characterization provides a valuable perspective for understanding the socio-cultural environment in which entrepreneurial engineers operate, thereby enriching the discourse on ethics and societal dynamics within entrepreneurial contexts.

7.5 Limitations of the study

This study has certain limitations. Most participants were based in Colombo and its suburbs, where the business environment is more competitive and diverse. Only three operated outside Colombo, limiting the generalisability of findings to non-urban contexts. Additionally, most participants ran service-oriented consultancy firms, with few representing the manufacturing sector. Despite efforts, the researcher could not include more manufacturing-based engineers due to their scarcity and the requirement of chartered engineer status. Consequently, the findings primarily reflect the experiences of service-oriented entrepreneurial engineers.

Furthermore, this study focused exclusively on entrepreneurial engineers with chartered engineer status, who possess a greater awareness and understanding of the code of ethics due to compulsory training in engineering ethics during their professional development. In contrast, non-chartered engineers typically receive ethics education during their undergraduate studies, where they may lack industry experience to fully recognize ethical dilemmas. As a result, the study participants adhered to the code of ethics with a well-rounded understanding. However, non-chartered entrepreneurial engineers may approach the application of the code of ethics differently in their entrepreneurial journeys, a factor that was not investigated or included in this study.

The literature identifies that women tend to internalize morality into their identities more strongly than men. Unfortunately, all study participants in this research were male entrepreneurial engineers within the Sri Lankan context. During the data collection and analysis phase, female entrepreneurial engineers with chartered engineer status could not be located due to the scarcity of such professionals and the limited networking capacity of the researcher at that time. As a result, the findings of this study are significantly influenced by gender bias, as only male entrepreneurial engineers participated in the data collection. To address this limitation, it is recommended that future research incorporate a substantial number of female entrepreneurial engineers during the theoretical sampling process to provide a more comprehensive understanding of their ethical behaviors.

This study is based solely on the perspectives of entrepreneurial engineers who have lived with these experiences for years. Their adherence to ethical behavior, as outlined by the IESL Code of Ethics, is shaped entirely by their own viewpoints. To validate this information, the researcher employed data triangulation, using publicly available sources such as news articles and company websites that provide secondary information on their ethical compliance. However, this study could be enhanced by incorporating personal perspectives from stakeholders of entrepreneurial engineers, which would offer a more comprehensive analysis of ethical adherence among entrepreneurial engineers in Sri Lanka.

7.6 Recommendations for future research

1. The role of the code of ethics

This study focuses exclusively on the adherence of entrepreneurial engineers to the IESL Code of Ethics. However, the recently introduced ECSL Code of Conduct for engineering practitioners may also impose restrictions on entrepreneurial behavior and performance, as part of engineering ethics. A more comprehensive study that considers both codes of ethics (i.e., IESL and ECSL) could provide a deeper understanding of how entrepreneurial engineers navigate ethical compliance within an entrepreneurial context.

2. The role of gender

This study relies solely on insights from male participants, with the sample being largely homogeneous, as all participants were male entrepreneurial engineers. Given that gender plays a significant role in the study of ethics, the findings of this study are impacted by gender bias. Therefore, further research could explore the influence of gender on the adherence to engineering ethics by entrepreneurial engineers in Sri Lanka.

3. The influence of the ethics education

As noted in the limitations of this study, it is based solely on the perspectives of engineers with chartered engineer status. However, many non-chartered engineers are also working as entrepreneurs in the country. Therefore, further research could explore how non-chartered entrepreneurial engineers adhere to engineering ethics in their entrepreneurial journeys. Such studies would provide a more holistic understanding of the entire group of entrepreneurial engineers in Sri Lanka. Additionally, a comparison between chartered and non-chartered engineers could reveal the influence of ethics education on adherence to engineering ethics.

4. Stakeholders’ insights

A study analyzing stakeholders' perceptions of entrepreneurial engineers' behavior and performance could further extend the current understanding, which is limited to the perspectives of the entrepreneurial engineers themselves. Such a study would provide additional insights and refine the substantive theory of 'enduring prosperity' with more comprehensive input.

5. Ethical theories and code of ethics

This study primarily focused on the adherence to engineering ethics by entrepreneurial engineers in Sri Lanka. However, entrepreneurial engineers may also consider major ethical theories, such as utilitarianism, deontology, and virtue ethics, in their decision-making processes alongside engineering ethics. This aspect was not investigated in the current study, and future research could explore how entrepreneurial engineers integrate engineering ethics with ethical theories to make ethically sound decisions in their entrepreneurial practices.

6. Technology entrepreneurship in Sri Lanka

As entrepreneurial engineers operate within the technological domain, they are part of the broader group of technology entrepreneurs. Ethical dilemmas related to technological innovations are not exclusive to entrepreneurial engineers; they are common across the entire group of technology entrepreneurs worldwide. Therefore, technology entrepreneurs also require ethical guidelines, such as the IESL Code of Ethics, to effectively deliver their products and services to the market while maintaining the highest ethical standards. Future studies could build upon the findings of this research to develop a flexible, context-specific code of ethics for technology entrepreneurs in Sri Lanka, helping to prevent failures of emerging tech firms, like Theranos, that resulted from unethical behaviors.

7. Sustainable development goals

The world is advancing with the goal of achieving the 17 Sustainable Development Goals (SDGs). Consequently, nearly all endeavors should align with these goals. It would be valuable to extend this study to explore how the adherence to engineering ethics by entrepreneurial engineers contributes to the achievement of each SDG through their techno-entrepreneurial ventures. Future research in this area could yield numerous empirically and theoretically significant findings, further expanding the existing body of knowledge on technology entrepreneurship, ethics, and sustainable development.

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Appendix-A: Initial, focused & theoretical codes

Initial Codes	Focused Coding	Theoretical Coding
Bribing	Bribery & Corruption	Avaricious society
Corruption		
Political influence		
Undercutting		
Monopoly in business		
Money mindedness	Going behind money	
Earning from commissions		
Reducing the cost		
Unethical part time businesses		
Charging lesser fees	Charging lesser fees	
Practicing in inexpert areas	Practicing in inexpert areas	
Mudslinging	Professional jealousy	
Opposing		
Trying to get down the business		
Not teaching the younger generation		
Creating an unfavorable business environment		
Unfair competition	Unfair competition	
Lying	Hiding the truth	
Avoiding telling truth		
Prioritizing health & safety, Minimising mistakes, Reducing profit margins, Criticising malpractices, Sharing knowledge.	Committing individually for safety	Internalising
Individual commitment for sustainable practices, Giving priority for sustainable concepts when doing businesses, Having an environmental policy,	Committing individually for sustainability	
Following ethics, being honest & truthful, Not doing harmful things even clients requested, Priority for public interests, Not having conflicts of interests,	Adhering to ethics	
Working in the specialized area, Giving accurate advices, Learning from mistakes, Teaching others, Knowing the subject properly, Learning unknown things, Enhancing management	Becoming an expert	

knowledge, Learning fast, Trying things which lack previous experiences,		
Working as a professional engineer, Taking the responsibilities of the works, Respecting others, Maintaining professional standards, Supporting, Listening, Doing voluntary works, Following policies, Doing CSR,	Adhering to professional behavior	
Not competing for jobs, Moving to less competitive areas, Getting the competitive advantage, Facing the competition ethically, Giving proper knowledge to the clients to attract them, Creating own opportunities	Avoiding the competition	
Selecting the competent area, Not trying everything, Giving priority for competent area,	Giving priority for the competent area	
Acquiring post graduate qualifications, Acquiring charter qualification,	Acquiring educational & professional qualifications	
Reading books, Participating in the CPDs, Getting updated with new technologies, Getting more practical knowledge	Upgrading the knowledge & the experience	
Giving priority for truth, Using facts always,	Prioritizing the truth	
Advising employees, facilitating knowledge updating, employing competent people, Organizing CSR & welfare activities.	Achieving safety through employees.	Employee Engagement
Recruiting necessary experts, Planning to diversify the business,	Diversifying the business with expertise	
Training employees on sustainable practices, getting qualifications to do sustainable designs,	Improving competencies	
Giving trainings to employees, Giving foreign exposure, Allowing to participate in CPDs, Giving opportunities to work with outside experts, Recruiting senior engineers for trainings, Becoming a recognized place for trainings	Training	
Teaching, Guiding for research activities	Teaching	
Mentoring young engineers, Guiding to for professional development, Identifying the weaknesses of subordinate engineers, Facilitating higher education process,	Coaching & Mentoring	

Advising young engineers, Setting examples by own		
Following standards, introducing safe products, improving the health & safety conditions in the industry, convincing the people, not cheating the clients.	Reaching the public safely	Outreaching the public
Not accepting bribes, Not giving bribes, Avoiding from corruption, No experience in paying bribes, Refraining from taking government projects to avoid from bribes,	Avoid bribery & corruption	
Setting rules & regulations for environmental protection, Following guidelines & procedures,	Working according to guidelines	
Sustainable energy use, Planting trees, Handling waste materials sustainably, Continuous monitoring for environmental protection, Doing detailed analysis of designs,	Taking actions to protect environment	
Promoting sustainability, Criticizing the unsustainable practices in the society, Convincing clients to use sustainable concepts, Adopting new techniques of sustainability, Incorporating sustainable concepts in project proposals, Using resources sustainable, Optimizing designs, Producing environmental friendly products,	Practicing sustainable concepts & nurturing sustainability	
Giving priority for public interests	Giving priority for the public interests	
Not reducing the prices to get more jobs, Not offering products at lower prices, Charging reasonable fees, Educating the clients about standard charges,	Charging standard fees	
Not doing marketing at all, Doing some sort of marketing, Satisfied clients do the marketing,	Marketing appropriately	
Satisfying clients within frameworks, Giving appropriate solutions, Following established procedures, Delivering quality products, Working properly, Maintaining proper systems for record keeping	Delivering proper products and services	
Rejecting unlawful requests, Rejecting unethical requests, Giving explanations to the refused requests,	Rejecting unlawful and unethical requests of clients	

Being truthful to clients, Advising clients truthfully, Explaining the truth to clients	Having truthful cooperation with clients	
Sharing experiences, teaching others, Training the staff, Writing books, Research & Development,	Sharing knowledge	
Working with professional institutions, Visiting other countries, Getting the support of experts, Networking	Networking	
Assuring the confidentiality, Not revealing all information to other parties, Not using the wrong information, Refraining from telling the truth sometimes,	Handling information responsibly	
Enhanced reputation & recognition	Lasting benefits	Enduring prosperity
Long term survival		
More business opportunities		
Short term business loss	Short term losses	
Situational higher expenses		

Appendix-B: Consent form

DEPARTMENT OF INDUSTRIAL MANAGEMENT, FACULTY OF BUSINESS, UNIVERSITY OF MORATUWA

CONSENT TO PARTICIPATE IN RESEARCH

THIS CONSENT FORM WILL BE HELD FOR A PERIOD OF SIX YEARS

Title of research: "Engineering Ethics & Entrepreneurship; Implications on Behavior & performance of Technological Entrepreneurs".

Researcher: Eng. D.P.S Wijesinghe, 188088L, Faculty of Business, University of Moratuwa.

Supervisors: Eng. Dr. (Mrs) V.P.T. Jayawardane – Senior Lecturer, University of Moratuwa.
Dr. S.W.S.B. Dasanayake – Senior Professor, University of Moratuwa.

I have been given and have understood an explanation of this research project. I have had an opportunity to ask questions about the project, and have them answered. I know that my participation in this project is entirely voluntary.

I understand that I can withdraw from the interview at any point, and that I am under no obligation to answer any particular questions. I also understand that I may withdraw any or all of the information I provide at any time up to [……………………………………..] without giving a reason.

- ☐ I agree to take part in this research
- ☐ I agree for the interview will be audio taped
- ☐ I agree that D.P.S. Wijesinghe may keep the interview material for use in future research and publications not strictly within the scope of the current project
- ☐ I agree that D.P.S. Wijesinghe can utilize the interview materials either anonymously or using a pseudonym in his thesis/reports and publications so as not to reveal my identity.

Signed: ……………………………………………………………………………………

Name: ……………………………………………………………………………………

Date: ……………………………………………………………………………………

This research was approved by the University of Moratuwa, Ethics Review Committee on 24th August 2019 under the Ethics Declaration Number EDN/2019/007.

Appendix C: Participant information sheet

Researcher's Profile

Eng. D.P.S. Wijesinghe
PhD Student
Department of Industrial Management
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Occupation: Lecturer in Engineering Ethics
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Supervisors' Profile

Eng. Dr. (Mrs). V.P.T. Jayawardane
BSc Eng, LLB (Hons), MA, MPhil, PhD
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thesarai@uom.lk

Dr. S.W.S.B. Dasanayake,
BA (Hons), MSc, PhD
Senior Professor
Department of Management of Technology
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PARTICIPANT INFORMATION SHEET

'Engineering Ethics & Entrepreneurship; Implications on Behavior & Performance of Technological Entrepreneurs'

I am Praneeth Wijesinghe, lecturer in the Faculty of Engineering at the University of Ruhuna. Currently, I am reading for my PhD degree in the Faculty of Business at the University of Moratuwa. My PhD research aims to examine Implications of Engineering Ethics on Entrepreneurial Behavior and Corporate Performance of Chartered Engineers working as Technological Entrepreneurs in Sri Lanka.

I will be interviewing a range of Chartered Engineers, currently run their own technological businesses as technological entrepreneurs in Sri Lanka. Since, you fit these criteria, I would like to invite you to participate in my research and contribute for the advancement of Engineering Ethics discipline.

Participation would involve one or two confidential interviews, conducted by myself. This would last between one and two hours of duration, and take place at a time and place that suits you. Interviews will cover a range of topics related to your entrepreneurial journey and Engineering Ethics, including discussion of applicability of Engineering Ethics in entrepreneurial business environment. As this will be an in-depth discussion of a personal topic which will be a guidance for younger generation of engineers, I hope you will find it enjoyable and interesting. The interview would, with your consent, be audio-recorded, and will be transcribed by myself for the analysis.

Participation in this research is entirely voluntary, and you would be able to withdraw from the research, without giving reasons, prior to, and during, the interview. You would also have the opportunity to withdraw all or part of your interview material from the study for up to one month after the interview has taken place. All information you provide in an interview is confidential. Identifying information will be changed, and a pseudonym given to any of your data used in publications arising from this research. As I have an ongoing research interest in the area of Engineering Ethics, with your consent, I would like to keep your interview material for use in future publications and research not strictly within the scope of this project.

If you do wish to be interviewed, please let me know by phoning me, or I will contact you again in about a week to see if you are interested. Thank you very much for your time and help in considering to take part. If you have any queries, or wish to know more, please contact me on 071-1347066 or send an email to praneeth@is.ruh.ac.lk .

Thank You.

Eng. D.P.S. Wijesinghe

Appendix D: Interview questions

The below questions are examples of questions used in the interview process. Additional questions were used when further elaborations were necessary. However, the formats of these additional questions were determined by flow of each of the interviews.

1. Managing a business entity by an engineer may not an easy task. What kind of difficulties do you face when managing this company as a professional engineer?
2. What kind of ethical principles guides you in managing this company?
3. Overall what can you tell about the ethical behaviour of all entrepreneur engineers in Sri Lankan industrial sector?
4. What are your contributions towards uplifting the health and safety of the employees and clients of your company?
5. What things do you and your company do for environmental protection and sustainability?
6. You are a reputed professional engineer in Sri Lanka. Sametime, you are a leading businessman. How do you enhance the engineering profession's honour, integrity, and dignity while working as a businessman?
7. What place have you given to the public interests (General public & customer concerns on your company) in your agenda when working as a businessman?
8. The industry has become more competitive nowadays with the emergence of similar companies locally and internationally. Let me know how do you face that competition with your guiding principles of ethics?
9. What is your opinion on "Engineers shall perform professional services only in the areas of their competence". Is it possible in competitive businesses?
10. When running a business, is it possible to give evidence, express opinions, or make statements objectively and truthful? Please share your experiences or concerns on this.?
11. What have you done for your own professional development throughout this journey?
12. How do you support the professional development of your subordinate engineers?
13. Bribery is deteriorating the ethical behaviour of professionals. What are your experiences related to bribery during this business journey?
14. Let me know your honest opinion on this. Is it possible to run an engineering-related business in Sri Lanka while adhering to ethical guidelines (Maybe Engineering Ethics)?
15. Please explain what positive and negative outcomes did you experience on your business due to your ethical behavior during this entrepreneurial journey.
16. What is your advice for emerging entrepreneur engineers in Sri Lanka?