

Ethical Behavior

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If the competency of the systems engineer is a matter of KSAA—knowledge, skills, abilities, and attitudes—then the word “attitudes” must have an ethical dimension. The ethical framework that guides the SE's actions ensures that the SE ultimately does good and not harm. Ethical standards apply both to individuals and to organizations. This section discusses the moral foundations of ethics, and the elements of ethical conduct that are especially relevant to systems engineering.



Contents

Ethics and Morals in Systems Engineering

- Data Confidentiality and Security, Surveillance, and Privacy

- Laws and Regulations

- Cultural Issues

- Ethical Considerations in the Systems Engineering Method

Codes of Ethics and Professional Conduct

Enforcing Ethics

- Responsibility to Society

References

- Works Cited

- Primary References

- Additional References

Ethics and Morals in Systems Engineering

Like other people, systems engineers have morals: guiding personal thoughts and feelings about what is right and wrong. All of us also share, with other members of various communities to which we belong, ethics: standards that say what conduct is appropriate and what is not (Whitbeck 2007).

Morals are part of a person's character, the result of upbringing, culture, and other environmental influences. **Ethics** apply morals within the frame of a social system, which could be professional, business, academic, recreational, cultural, political, religious, or even familial. While a person's moral code is usually considered immutable, one's ethics may need to account for new situations as one's profession or role in life changes. Tensions may exist between an engineer's responsibilities to society and those to the customer, the employer, or even the family, resulting in ethical dilemmas, and creating situations where morals come into play.

There is no shortage of discussion on ethics. Ethical codes are promulgated by professional and other organizations. **Professions** here refers to occupations that require learning and advanced knowledge and which safeguard or promote the well-being of others and of society as a whole.

Systems engineers have two ethical responsibilities over and above those of most other engineering professions:

- While engineers in general use their professional skills to address customer needs and desires, systems engineering (SE) helps *determine* those needs and desires in the course of defining and managing requirements. SEs have an obligation to ensure that problem or program definition is influenced solely by the interests of the customer or user, not by those of the systems engineer or the engineer's firm.
- Systems engineers typically integrate and oversee the work of others whose expertise differs from their own. This makes the obligation to widen one's understanding and to seek competent advice from other professionals more acute in SE than in other disciplines.

Caroline Whitbeck's *Ethics in Engineering Practice and Research* explains what ethical behavior means for engineering professionals. Like most books on ethics, this one starts by clarifying the differences between ethics and morals, which can seem somewhat obscure at times (Whitbeck 2007).

A sampling of areas where ethics figure in the engineering of modern systems are described below.

Data Confidentiality and Security, Surveillance, and Privacy

Privacy, confidentiality, and security in systems which touch Personally Identifiable Information (PII) have an ethical dimension for the systems engineers responsible for developing those systems.

Laws and Regulations

Systems are typically developed in societies, sometimes involving international communities, which have laws concerning contracts, intellectual property, freedom of information, and employment. The requirements and restraints of those laws govern the practice of the systems engineer, who must be aware of the laws and must consider their implications for the partnerships that system development entails.

Whether or not they are stated in the system requirements document or provided by the customer, laws and regulations do, in fact, impose system requirements. SEs are responsible for knowing and applying relevant laws and regulations. This means recognizing other people's proprietary interests by safeguarding their intellectual property (trade secrets, copyrights, trademarks, and patents), and giving them credit for performing work and making innovations.

Cultural Issues

Since systems engineers develop and maintain products used by humans globally, it is important that they understand the historical and cultural aspects of their profession and the related context in which their products will be used. System engineers need to be aware of societal diversity and act without prejudice or discrimination.

Ethical Considerations in the Systems Engineering Method

Naturally, SE approaches to meeting customer needs must integrate SE ethics.

Codes of Ethics and Professional Conduct

Codes of ethics are promulgated by the IEEE (IEEE 2009), the National Society of Professional Engineers (NSPE) (NSPE 2007), the International Council on Systems Engineering (INCOSE 2006) and other engineering organizations.

The INCOSE Code of Ethics enunciates fundamental ethical principles like honesty, impartiality, integrity, keeping abreast of knowledge, striving to increase competence, and supporting educational and professional organizations. Based on these principles, the code identifies the systems engineer's fundamental duties to society and the public, and the rules of practice that systems engineers should follow to fulfill those duties.

According to the INCOSE Code of Ethics, it is the systems engineer's duty to:

- guard the public interest and protect the environment, safety, and welfare of those affected by engineering activities and technological artifacts;
- accept responsibility for one's actions and engineering results, including being open to ethical scrutiny and assessment;
- proactively mitigate unsafe practice;
- manage risk using knowledge gained by applying a whole-system viewpoint and understanding of systemic interfaces; and
- promote the understanding, implementation, and acceptance of prudent SE measures.

Enforcing Ethics

Many organizations enforce ethics internally by means of ethics policies. These policies typically include rules such as the following:

- There shall be no exchange of favors between anyone in the organization and entities with which it does business, such as suppliers, customers, or regulatory agencies.
- Product information, for example, test data, shall be reported accurately and completely to the contracting agency.
- There shall be no conflict of interest between the organization and entities with which it does business.

Favors can consist of providing money, reimbursement of travel or entertainment expenses, other items of equivalent value, or inappropriate job offers. Conflict of interest can arise when the personal or professional financial interests or organizational ties of an engineer are potentially at odds with the best interests of the customer or the engineer's employer. Since conflict of interest and other ethical transgressions can be hard to define, care must be taken to design ethics policies that are observable and enforceable. Internal audit functions or external regulatory agencies may enforce ethical rules at the individual, team, organizational, or enterprise level. Punishment for violating ethics policies can include termination and other disciplinary actions.

Unlike self-employed physicians who may choose to not do something specific, many systems engineers are individuals employed by organizations. Depending on the organizational context, an issue in conflict with the company might result in giving up the job. This may result in additional ethical considerations.

Responsibility to Society

Engineers who create products and services for use in society have an obligation to serve the public good. Additionally, the IEEE Code of Ethics states that engineers have an obligation to foster the professional development and ethical integrity of colleagues (IEEE 2015). Because of the criticality and scope of many systems, systems engineers, operating in teams within projects and on behalf of the public in delivery of products, have special responsibility. Poorly designed systems or services can have calamitous effects on society. The INCOSE Code of Ethics asserts the responsibility of systems engineers to "guard the public interest and protect the environment, safety, and welfare of those affected by engineering activities and technological artifacts" (INCOSE 2006).

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< Previous Article | Parent Article | Next Article (Part 6)>

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