

# **ETHICAL CONSIDERATIONS IN BUSINESS DECISION-MAKING: OPTIMIZATION, MULTIPLE CRITERIA, AND FAIRNESS**

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## **Abstract**

This paper examines the role of optimization in business decision-making. Business education at both undergraduate and graduate levels offers various courses on decision-making and analysis, emphasizing the importance of delivering optimal decisions based on specific objectives. Decision optimization is a mathematical approach that helps businesses make effective choices by optimizing input variables. It relies on data and models as inputs, applies mathematical algorithms for analysis, and generates outputs that guide businesses in improving their decision-making processes.

We first outline the algorithmic approach to decision-making within Operations Research (OR) and Game Theory. While quantitative methods and algorithms are widely used to optimize business decisions, it is equally crucial to consider their ethical implications, including fairness and broader societal impact. Following a discussion of algorithmic methods, we highlight key philosophical and ethical considerations. Additionally, we offer recommendations for integrating ethical perspectives into decision-making frameworks, which can ultimately shape optimal decisions. This is particularly relevant in educational settings where decision-making and analysis are taught. Two real business cases are described considering profit versus safety and two cases considering profit and health issues.

## **Keywords**

Ethics, Decision Optimization, Multiple Criteria Optimization, Fairness, Game Theory, Pedagogy

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## **Quantitative and Qualitative Analysis in Business Decision-Making**

Business decision-making involves analyzing, solving, and presenting solutions to various challenges across different areas, including finance, marketing, operations, and human resources. Effective decision-making requires the application of various methods and tools, applicable in both service and manufacturing sectors, such as:

- Formulating and solving business problems to maximize profit (or minimize costs) within given constraints
- Managing decisions involving potentially conflicting criteria
- Simulating business operations in complex environments
- Making decisions under uncertainty by incorporating probabilities
- Forecasting future trends and outcomes

In his seminal work, *Administrative Behavior: A Study of Decision-Making Processes in Administrative Organizations* Herbert A. Simon outlines the decision-making process as a sequence of four key phases: (Simon, 1947)

1. *Intelligence* – Gathering information and identifying problems or opportunities
2. *Design* – Developing and analyzing potential solutions or alternatives
3. *Choice* – Selecting the most appropriate course of action

#### 4. *Implementation* – Executing the chosen solution and monitoring its effectiveness

A similar structured approach to decision-making can be outlined as presented in (Camm et al, 2022)

1. *Problem Structure*: Defining the problem and preparing relevant data  
Identifying possible alternatives  
Establishing criteria for evaluation
2. *Problem Analysis*: Conducting quantitative analysis  
Conducting qualitative analysis
3. *Evaluation of Alternatives*
4. *Decision*: Implementing the solution and generating a report

Decision-making in business requires the application of both quantitative and qualitative analysis. Quantitative analysis relies on data, mathematical models, and statistical methods to optimize decision-making, whereas qualitative analysis draws on expertise, intuition, and contextual understanding. The balance between these two approaches depends on the complexity and nature of the problem. However, the most effective decisions consider all relevant aspects, integrating both analytical perspectives with critical thinking. Critical thinking is essential as it encompasses creativity, goal setting, and the broader impact of decisions.

By integrating both quantitative and qualitative approaches, businesses can enhance the robustness of their decision-making processes, ensuring a comprehensive evaluation of potential outcomes.

Business education increasingly emphasizes the ethical implications of decision-making. One notable course, *Business Ethics: Critical Thinking through Film* (Aspen Institute, 2018), was recognized with the 2017 Ideas Worth Teaching Award from the Aspen Institute (Aspen Institute, 2017). The accompanying book, *Professional and Business Ethics through Film: The Allure of Cinematic Presentation and Critical Thinking*, explores ethical dilemmas in professional and business contexts through narrative films (Skorin-Kapov, 2019). Additionally, the paper *Business Competition and Innovation: Business and Ethical Issues in Engineering Discussed via Narrative Films* highlights the role of film discussions in enhancing ethical awareness and behavior among engineers (Skorin-Kapov and Skorin-Kapov, 2023). These resources illustrate how critical thinking, normative ethical theories, and case-based learning can deepen ethical understanding in business decision-making.

### The Role of Quantitative Analysis

Quantitative analysis is crucial for structuring and solving complex business problems, particularly when dealing with new or unfamiliar challenges. This approach defines decisions using mathematical models to optimize objectives while accounting for constraints. However, these models often represent simplified versions of reality, as not all aspects of the business environment can be captured in mathematical terms. A simple example of optimization in *Operations Research (OR)* could be as follows:

A company plans to sell  $n$  different products. For each product  $i$ , the production cost ( $c_i$ ) and selling price ( $s_i$ ) are known, leading to a profit per unit ( $P_i$ ). Production constraints, such as workforce availability and production time across departments, must be considered. A mathematical model can be developed to determine the optimal number of units to produce and sell for each product, aiming to maximize weekly profit while ensuring that constraints on workforce and production capacity are met.

By integrating both quantitative and qualitative analyses, businesses can make more informed and ethical decisions, balancing data-driven insights with critical thinking and ethical considerations. While mathematical models provide structured solutions to business problems, they often simplify reality by relying on predefined constraints. However, the actual business environment may involve complexities that are not fully captured within these constraints. In the above example production costs might overlook the expenses associated with toxic waste disposal, or available production time may not account for unexpected machine breakdowns. Thus, mathematical optimization serves as an initial decision-making tool, which managers must further refine by incorporating real-world considerations.

Business problems often involve multiple, sometimes conflicting, objectives that must be balanced rather than simply optimized. In such cases, decision-making can be approached as a *multicriteria problem* or a *goal programming problem*, where multiple goals are considered simultaneously. Examples include:

- Goals of different dimensions (e.g., maximizing profit vs. maximizing market share)
- Difficult-to-quantify goals (e.g., maximizing customer satisfaction)
- Conflicting goals (e.g., minimizing healthcare costs while maximizing the quality of healthcare services)

Unlike linear programming, which optimizes a single objective function, goal programming seeks the best feasible solution that minimizes deviations from multiple goals, considering the relative importance of each goal. When not all goals can be fully achieved, goal programming prioritizes certain objectives over others, ensuring a solution that aligns with strategic priorities.

Ethical considerations in business decision-making extend beyond optimization and into fairness, particularly in cooperative settings. *Cooperative Game Theory (CGT)* provides insights into how individuals or organizations collaborate while ensuring fair distribution of costs and benefits. A relevant example is found in communication networks, such as telecommunication, road traffic, or railway networks. In such systems, multiple users (nodes) require connectivity, with costs incurred to establish and maintain communication links. A cost-efficient solution connects all necessary nodes, but users who may have competing objectives must share the costs fairly.

Fairness in such a scenario implies that the gains from cooperation are distributed equitably, considering each participant's contribution to the total cost. Individuals or organizations will only support the network if they receive a *fair share* of the benefits, making fairness a key component of sustainable business cooperation. Cooperative Game Theory (CGT) introduces the concept of a cost allocation solution, specifically the *core* of a cooperative game. The core represents stable cost-sharing solutions where no coalition of users has an incentive to secede and form a subnetwork. This ensures fairness in cooperative arrangements, particularly in network-based services such as telecommunications, road networks, and shared infrastructure. Research on cooperative games has explored various aspects of this allocation problem (Skorin-Kapov 2018; Skorin-Kapov and Skorin-Kapov 2005; 2012; 2020).

By integrating optimization techniques, multicriteria decision-making, and fairness principles, businesses can develop solutions that are not only efficient but also ethically and strategically sound.

### Ethical Qualitative Analysis in Decision-Making

Quantitative analysis, based on mathematical models and data-driven decision-making, provides a systematic and efficient approach to business problem-solving. Models are beneficial because they require less time, lower costs, and reduced risk compared to real-world experimentation. However, they are inherently simplified representations of reality. The accuracy of conclusions and predictions depends on how well the model captures real-world complexities.

This limitation highlights the need for qualitative analysis, which draws on managerial experience, judgment, and intuition to address aspects that mathematical models may overlook. When assessing ethical situations in business, *qualitative analysis* can be integrated within the Simon framework (Skorin-Kapov, 2019):

1. **Intelligence:** - What issue is at stake?
  - What are the facts?
  - Who are the parties concerned (shareholders, stakeholders)?
  - What are the ethical considerations?
2. **Design:** - How should I act?
  - What are my core values?
3. **Choice:** - What criteria will I use to evaluate possible actions?
  - What decision should I make?
4. **Implementation:** Execute the decision and evaluate the outcomes if necessary.

Morality reflects personal beliefs and contributes to one's character, whereas ethics focuses on actions aligned with those beliefs. *Ethical dilemmas* arise when decisions are complex, blurring the distinction between right and wrong. For example, while honesty is generally considered morally correct, certain situations may challenge whether telling the truth is always the best course of action.

### Ethical Issues in Business Decision-Making and Normative Approaches

Business ethics goes beyond financial consideration for shareholders and encompasses the interests of all stakeholders, including employees, customers, creditors, local communities, and governments. Ethical decision-making requires evaluating business actions from a broader social responsibility perspective. Common Ethical Challenges in Business include:

- Corporate and Financial Ethics – Greed, fraud, and corporate social responsibility in banking and finance
- Workplace Ethics – Issues of harassment, violence, inequality, and discrimination
- Professional and Business Practices – Corruption, whistleblowing, outsourcing, downsizing, and competition ethics
- Stakeholder Relations and Environmental Ethics – Climate concerns, resource management, human rights, and social inequality
- Personal and Technological Ethics – Privacy loss, cyber harassment, and job structure changes due to evolving technology

By integrating quantitative optimization, qualitative judgment, and ethical considerations, businesses can navigate decision-making processes more effectively, ensuring that their strategies are not only efficient but also responsible and sustainable. Normative ethics provides guidelines for ethical behavior by prescribing rules for moral conduct. Different normative ethical approaches include *virtue ethics*, *teleological (goal) ethics* and *deontological (duty) ethics* and emphasize distinct principles (Skorin-Kapov, 2019).

*Virtue Ethics* focuses on moral character and emphasizes the cultivation of good moral habits. Rooted in Greek philosophy, this approach highlights the importance of personal character in ethical decision-making. Plato's *cardinal virtues* include wisdom, courage, temperance, and justice. Other key virtues are fortitude, generosity, self-respect, sincerity, and good temper. Opposed to virtue are vices such as cowardice, insensibility, injustice, and vanity.

Virtue Ethics suggests that moral education plays a fundamental role in developing virtuous character. According to Aristotle, virtues are habits formed through repeated ethical actions. He argues that while actions are voluntary from beginning to end, habits start as voluntary but later develop without conscious reflection (Aristotle, 1975). Aristotle's concept of the "Golden Mean" states that ethical virtue lies between two extremes—excess and deficiency. For example, *courage* is the golden mean between recklessness (excess) and cowardice (deficiency), and generosity balances wastefulness (excess) and stinginess (deficiency).

Virtue Ethics underscores the importance of ethical leadership and corporate culture in shaping business behavior. Organizations that foster integrity, responsibility, and fairness through repeated ethical practices create sustainable and morally sound decision-making environments.

*Teleological Ethics* also known as *consequentialist ethics* evaluates actions based on their end results or consequences. The guiding principle is that the end justifies the means, meaning an action is morally right if its consequences are more favorable than unfavorable. There are different branches of teleological ethics, categorized by who benefits from the action:

- Ethical Egoism – Focuses on the individual's benefit.
- Ethical Relativism – Judges morality based on the values of a group or organization.
- Utilitarianism – Determines rightness based on the greatest benefit for everyone.

*Utilitarianism*, popularized by John Stuart Mill, advocates maximizing overall happiness. Mill proposed a *rule-based utilitarianism*, which suggests adopting general moral rules that consistently lead to positive outcomes. For example, the rule "*stealing is wrong*" has better consequences for society as a whole than allowing exceptions.

Thomas Hobbes (1588–1679) proposed the *Social Contract Theory* arguing that people act in their own self-interest, necessitating the creation of rules to govern behavior. These rules prohibit harmful actions such as lying, stealing, and killing, and must be enforced to prevent chaos (Hobbes, 1994).

*Deontological (duty) ethics*, in contrast to consequentialism, centers on moral obligations and responsibilities to society and asserts that actions should be guided by moral duty, regardless of the consequences. Duties are often linked to rights—meaning the rights of one person imply corresponding duties for others. John Locke (1632–1704) proposed fundamental rights: life, health, liberty, and possessions. Thomas Jefferson (1743–1826) refined these into: life, liberty, and the pursuit of happiness (as outlined in the *Declaration of Independence*).

The most influential duty-based ethical theory was proposed by Immanuel Kant (1724–1804) (Kant, 1996; Kant, 1997). He introduced the *Categorical Imperative*, which provides universal principles for ethical behavior:

- Universal Law Principle – “Act only according to that maxim whereby you can, at the same time, will that it should become a universal law.” Example: If lying were universally accepted, trust would collapse, making communication ineffective.

- Humanity Principle – “Act in such a way that you treat humanity, whether in your own person or in the person of any other, never merely as a means to an end, but always at the same time as an end.” Example: Employers should treat employees as individuals with dignity, not merely as tools for maximizing profit.

Teleological Ethics suggests that businesses should prioritize outcomes—maximizing benefits while minimizing harm. This approach is often used in corporate social responsibility (CSR) and cost-benefit analysis. Deontological Ethics demands that businesses uphold ethical duties and moral principles, even if it conflicts with profit motives (e.g., maintaining fair labor practices despite increased costs). By integrating both ethical perspectives, businesses can balance profitability with moral responsibility, ensuring long-term sustainability and trust.

John Rawls (1921–2002) developed a theory of *distributive justice*, which focuses on fairness in the distribution of goods and opportunities within a society. In *A Theory of Justice* (1971), he introduced the concept of *justice as fairness*, emphasizing equal basic rights for all citizens, equal opportunities in economic and social systems, and fair distribution of wealth and resources (Rawls, 1971). Rawls' approach helps move beyond Kant's purely moral approach and toward a practical model for justice in democratic institutions. Rawls' justice as fairness suggests that businesses should operate in a way that respects equal rights and opportunities for all stakeholders, that ensures fair distribution of economic benefits and burdens, and that balances profit motives with ethical responsibilities, ensuring sustainability and trust in society (Rawls, 1985). By integrating Rawls' principles with applied business ethics, organizations can align ethical behavior with long-term success, creating a just and sustainable business environment.

*Applied ethics* deals with real-world ethical issues, including business ethics, medical ethics, and environmental ethics. *Business ethics* examines moral dilemmas in business practices, covering topics such as:

- Insider trading
- Deceptive advertising
- Corporate social responsibility (CSR)
- Environmental sustainability
- Employee rights and workplace ethics
- Whistleblowing and corruption

Key questions in business ethics include:

- Should companies prioritize shareholders or consider broader stakeholders (employees, communities)?
- What ethical responsibilities do companies have towards customers and society?
- Should firms engage in political and social activism?
- How should businesses balance profit motives with ethical obligations?

*Ethical dilemmas* often arise in situations where different options are available, but none are entirely ethically acceptable, leaving the decision-maker to choose. Ethical dilemmas in business settings arise when business decisions involve conflicts between competing values, such as:

- Truth vs. Loyalty – Should employees disclose company secrets to expose unethical practices?
- Justice vs. Mercy – Should a firm strictly enforce policies or show compassion for employees?
- Individual vs. Community – Should personal ambition take precedence over social responsibility?
- Short-Term Gains vs. Long-Term Consequences – Should companies cut corners for immediate profit at the risk of long-term harm?

Ethical dilemmas could also emerge from behavior and the relationships between various stakeholders, such as: employee versus employer, employee versus employee, company versus customers, and company versus competitors.

In many for-profit organizations, the focus on maximizing profit can become the primary factor guiding business decisions, potentially leading to unethical actions. This paper presents cases that highlight breaches of ethical standards and examines the ethical challenges associated with balancing profit against safety and health concerns. These cases are also discussed in (Skorin-Kapov, 2019), and here we further explore the ethical issues presented in those examples. We describe two cases where corporate profit maximization did not consider safety issues. The cases are *Flint, Michigan: lead-tainted-water (2014-2017)* and *Woburn, MA v. W. R. Grace & Co. and Beatrice Foods, Inc. (1980s)*. We also describe two cases where corporate profit maximization did not consider safety issues. The cases are: *The Ford Pinto and product safety (1977-78)* and *Volkswagen Emission scandal (2015)*.

#### **Case: The Ford Pinto and Product Safety (1977-78)**

The Ford Pinto case is a well-known example of ethical issues in business, highlighting the stark calculation of costs and benefits when addressing car design flaws, including the pricing of human life.

In the late 1960s, the American auto industry faced competition from imported subcompact cars, such as the Volkswagen Beetle. In 1968, Ford began designing a new subcompact car, the Pinto, to compete in this market. Ford's CEO at the time, Lee Iacocca, pushed for Pinto's production under strict constraints, keeping the car's

weight under 2,000 pounds and the price under \$2,000. As a result, the Pinto was developed in less time than usual, with a rushed market release in 1971. A critical safety issue arose when Ford placed the gas tank under the rear floorplan, behind the rear axle, increasing the risk of fires in rear-end collisions.

In 1972, the National Highway Traffic Safety Administration (NHTSA) mandated that cars should withstand a rear-end impact at 20 MPH, later raising the requirement to 30 MPH in 1973. Ford, whose Pinto failed these safety tests, lobbied to delay the standard for seven years. Ford could have corrected the issue by altering the fuel tank design, which would have added only \$11 to the production cost per vehicle. However, Ford opted not to implement these changes to stay on schedule and within budget.

What made the Ford Pinto case notorious in business ethics was the internal cost-benefit analysis presented in a report titled "Fatalities Associated with Crash-Induced Fuel Leakage and Fires," signed by Ford's Director of Automotive Safety. The report applied the 1972 NHTSA cost-of-life estimate of \$200,725 per fatality. (Mother Jones, 1977)

The calculations projected that adding safety features would prevent 180 burn deaths, 180 serious burn injuries, and 2,100 burned vehicles, amounting to a total benefit of \$49.5 million. In contrast, making the safety modifications would increase the production cost by \$137.5 million (Dowie, 1977). As a result, Ford decided to continue production without the safety modifications, leading to numerous deaths and injuries.

From 1971 to 1978, Ford faced numerous lawsuits, with critics estimating 500-900 deaths, while Ford claimed only 23 Pinto-related fatalities. In February 1978, a lawsuit resulted in \$3 million in compensatory damages and \$125 million in punitive damages (later reduced to \$3.5 million). In another case in August 1978, involving the deaths of three teenage girls, Ford was charged with criminal homicide, although the charges were later dismissed in 1980. Nonetheless, the case significantly tarnished Ford's reputation, and by July 1980, Ford ceased production of the Pinto.

When analyzing the Ford Pinto case through various normative ethical theories, we observe clear breaches of ethical standards.

- *Virtue Ethics:* From a virtue ethics perspective, one could question Lee Iacocca's moral character. As CEO, Iacocca pushed for a design that compromised safety for the sake of cost savings, demonstrating a disregard for virtues such as honesty, integrity, and responsibility to the public.
- *Deontological Ethics:* Kantian ethics would strongly oppose Ford's decision, as it involves assigning a monetary value to human life. According to Kant's categorical imperative, individuals should never be treated merely as a means to an end, which Ford's decision clearly violated. Other deontological theorists, such as D.W. Ross and John Rawls, would also condemn Ford's actions. Ross's duty of non-injury would have required Ford to act to prevent harm, and Rawls' principle of justice as fairness would demand that Ford ensure the safety of all individuals, not just prioritize profits.
- *Utilitarianism:* Utilitarian thinkers may agree with the basic cost-benefit analysis approach but would likely challenge Ford's values, as the calculation undervalues human life by assigning a lower price than what many would consider appropriate. The disproportionate weight given to repair costs compared to human fatalities and injuries may also be ethically questionable from a utilitarian standpoint.
- *Ethical Egoism and Relativism:* Ford's decision may have been influenced by ethical egoism, where the company, viewed as a moral agent, acted in its self-interest, prioritizing profit over safety. Alternatively, from an ethical relativism perspective, Ford may have acted with consideration only for the interests of shareholders and the company, neglecting the broader responsibility to all stakeholders, including drivers and bystanders who were potentially harmed in accidents.

In conclusion, the Ford Pinto case illustrates a clear ethical breach where corporate interests were prioritized over human safety, highlighting significant issues in decision-making and ethics in business.

### ***Volkswagen Emission Scandal (2015)***

In 2015, it was revealed that the German automaker Volkswagen had engaged in deceptive practices to manipulate emissions tests for their diesel cars. Specifically, Volkswagen installed software designed to deceive the Environmental Protection Agency's (EPA) regulatory testing by showing that emissions of nitrogen oxide were within permissible limits during testing. However, in real-world driving conditions, the actual emissions were 40 times higher than allowed. Nitrogen oxide is a harmful pollutant that can cause serious health issues, including asthma and bronchitis. The scandal affected around 11 million diesel cars globally, produced between 2009 and 2015, which were equipped with this cheating software.

After the scandal came to light in 2015, Volkswagen admitted to using the software to cheat on emissions tests, publicly apologized, and pledged to spend approximately \$7.3 billion to fix the affected cars and bring them

into compliance with pollution standards (Edwing, 2015). As a result, Volkswagen's stock price plummeted by 35%, and both the CEO and U.S. CEO resigned.

Volkswagen ultimately agreed to pay \$4.3 billion in civil and criminal penalties as part of a larger \$22 billion settlement. Several executives were indicted, including James Liang, an engineer who helped develop the software, becoming the first employee sent to prison. Another executive, Oliver Schmidt, the former head of Volkswagen's environmental and engineering center in Michigan, pleaded guilty to deceiving the federal government and violating the Clean Air Act. He received a seven-year prison sentence (Vlasic, 2017).

In summary, the actions of Volkswagen's engineering team, who developed and installed software that allowed the cars to cheat on emissions tests, were illegal and deeply unethical. This behavior aligns with consequentialist ethics, such as ethical egoism and ethical relativism, where the focus is on self-interest and situational morality. From a virtue ethics perspective, an engineer who knowingly used their expertise to produce a deceptive product acted against the virtues of honesty and integrity. Additionally, this decision also contradicts deontological ethics, which emphasize adherence to moral duties.

### ***Flint, Michigan: Lead-Contaminated Water Crisis (2014-2017)***

The Flint water crisis began in March 2013, when the city council decided to stop purchasing treated water from Detroit, sourced from Lake Huron and the Detroit River, and instead switched to using water from the Flint River starting in May 2014. This change was made with the goal of saving the city \$19 million over eight years (Winston, 2015). However, the water from the Flint River was not properly treated and, due to aging pipes, became contaminated with lead from corrosion.

Shortly after the switch, residents began complaining about the taste and smell of the water, but officials assured them it was safe. However, four months later, fecal bacteria were found in the water, prompting the city to advise residents to boil their water. In January 2015, it was revealed that the water contained chemicals that could cause liver, kidney, and nervous system issues, as well as an increased cancer risk (Winston, 2015). Despite this, the city rejected an offer from Detroit to reconnect and purchase water from Lake Huron.

In October 2015, the city's Technical Advisory Committee recommended returning to the Detroit water system, a decision that Governor Rick Snyder announced. By January 2016, a federal state of emergency was declared, and residents were advised to use bottled water. Although the water quality was declared acceptable in early 2017, residents were still advised to use bottled water until the lead pipes were replaced, a process expected to be completed by 2020. It's estimated that over 100,000 residents, including 6,000-12,000 children, were exposed to harmful lead levels (Gerstein, 2017).

In November 2015, Flint residents filed a class-action lawsuit against Governor Snyder and 13 other state and city officials, accusing them of depriving citizens of their 14th Amendment rights by replacing safe drinking water with a toxic, cheaper alternative (Wang, 2015).

In October 2017, 21 law firms filed consolidated class-action lawsuits against Governor Snyder, city and state officials, and two engineering firms, accusing them of "deliberate, reckless, and negligent misconduct." The public health crisis was exacerbated by the defendants' actions of concealing the crisis, failing to address it adequately, and lying to cover up their misconduct (Gerstein, 2017).

The Flint water contamination case led to several criminal prosecutions. As of October 2017, 15 current and former state and local officials had been charged in connection with the crisis. These charges also involved a Legionnaires' disease outbreak that killed 12 people from 2014 to 2015, with many of the accused facing potential jail time (Talley, 2017). Trials were expected to begin in 2018. By 2020, it was reported that 12,000 children had been exposed to dangerous lead levels, and at least 12 people died because of the water contamination. Winchester writes:

It was April 2014 when the city moved from using water from the Detroit Water and Sewerage Department to water from the Flint River. After this change, lead leached from pipes into the water. That change resulted in 12,000 children being exposed to dangerous levels of lead, and at least 12 people dying. While years have passed and tests show the water quality in most areas is now acceptable to drink, many people are scared to drink it. The city has inspected more than 25,000 service lines and has replaced 85 percent of the pipes. However, the coronavirus (COVID-19) pandemic has put work on hold. (Winchester, 2020)

As of 2024, Flint's water infrastructure projects continue under Mayor Sheldon Neeley's commitment to transparency. This is stated in "*Progress Report on Flint Water – 2024*":

As part of Mayor Sheldon Neeley's commitment to transparency in keeping residents and businesses informed on progress around the city's multi-million-dollar water infrastructure projects. Information on Flint's water quality, construction project status updates, financial

reports, public comment opportunities and meeting notices may be found below. (FLINT, Progress report, 2024)

About the *Lead Service Line Replacement* project (approximate Investment: \$97,019,659) the report states that “*This massive project replaces lead and galvanized steel residential water lines from the home to the curb and the curb to the street throughout the City of Flint. Over 97% of lead service line replacements have been completed.*” (FLINT, Progress report, 2024)

### **Woburn, MA v. W.R. Grace & Co. and Beatrice Foods, Inc. (1980s)**

The Woburn, Massachusetts water contamination case of the 1980s, involving W.R. Grace & Co. and Beatrice Foods, became widely recognized and generated several class action lawsuits. The case, known as *Anne Anderson, et al. v. W.R. Grace and Beatrice Foods* (1986), is named after the first plaintiff, Anne Anderson. (<https://www.encyclopedia.com/law/law-magazines/anne-anderson-et-al-v-wr-grace-and-beatrice-foods-1986>)

In 1979, signs of water contamination in Woburn began to surface, with a notable increase in cancer and leukemia cases. In 1981, families of eight leukemia victims began considering a joint lawsuit against W.R. Grace and Beatrice Foods for allegedly dumping toxic chemicals into the river that supplied the town's water. The lawsuit was officially filed in May 1982, with the discovery phase starting in 1984.

The lead attorney for the plaintiffs, Jan Schlichtmann, faced off against Beatrice's skilled lawyer, Jerome Facher. Schlichtmann took on the case in 1982 and formed his own law firm, Schlichtmann, Conway & Crowley. The legal battle was lengthy and financially draining for Schlichtmann and his small firm. Schlichtmann argued that W.R. Grace's chemical plant and Beatrice Foods' John J. Riley Tannery had contaminated the drinking wells by disposing of hazardous waste on the property, which then leached into the water supply. To support his claims, Schlichtmann had to secure costly scientific evidence from the fields of geology and epidemiology, totaling \$2.6 million in expenses for his firm. (Kix, 2009)

When the trial commenced in 1986, it attracted significant media attention, with coverage from *60 Minutes* and *Nightline*. The trial lasted 79 days and featured numerous expert witnesses. After nine days of deliberations, the jury did not find Beatrice Foods liable. W.R. Grace negotiated an \$8 million settlement, which covered the costs of the lawsuit and provided minor compensation to the affected families, though Schlichtmann and his firm were left in severe financial distress, essentially bankruptcy. Furthermore, W.R. Grace did not admit any wrongdoing, which angered the plaintiffs (Kix, 2009).

The case went through multiple appeals, but in 1990, the U.S. Court of Appeals denied a request for a rehearing. A critical turning point in the case came before the trial when W.R. Grace had been willing to offer a substantial settlement. However, Schlichtmann sought an even larger amount, and the settlement was never finalized.

In 1991, the U.S. Environmental Protection Agency (EPA) ordered Beatrice Foods and W.R. Grace to spend approximately \$70 million to clean up the contaminated site. The events surrounding the case were later chronicled in the 1996 book *A Civil Action* by Jonathan Harr and adapted into a 1999 film of the same name, directed by Steven Zaillian. (Harr, 1996)

## **Conclusion**

In this paper, we argue that while quantitative methods and algorithms are frequently used to optimize business decisions, it is equally crucial to address the ethical implications of these decisions, such as their impact and fairness. We offer recommendations for integrating ethical considerations into decision-making processes, as these factors may ultimately affect the optimal outcome. This is particularly important in educational contexts when teaching courses on decision-making and analysis.

Regarding *quantitative analysis* relying on available data and using mathematical models, we described simple examples from *Operations Research (OR)* and from *Cooperative Game Theory (CGT)*. After presenting these quantitative methods, we emphasized the importance of qualitative analysis and normative ethical approaches, drawing from philosophical ethics. To illustrate business decision-making where profit calculations overlooked ethical concerns, we examined four cases where profit maximization ignored the consequences of safety or health risks. Two cases where corporate profit maximization disregarded safety issues are *The Ford Pinto and product safety* (1977-78) and *Volkswagen Emission scandal* (2015). The two cases where corporate profit maximization overlooked health hazards are *Flint, Michigan: lead-tainted-water* (2014-2017) and *Woburn, MA v. W. R. Grace & Co. and Beatrice Foods, Inc. (1980s)*.

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