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BUSINESS AND ENGINEERING ETHICS – SIMILARITIES, DIFFERENCES AND CHALLENGES

JEL classification: M19

Abstract

Issues of applied ethics and its influence on the behaviour of people in the wider social context have been investigated from many different aspects. The aim of this paper is to clarify the fundamental differences and similarities between business and engineering ethics, determine the areas which represent potential source of conflict and explore specific ethical dilemmas that occur with individuals who are engaged in the engineering profession in the business surroundings. Previous research lacks agreement. Practice has proved that the ethical dilemmas are integral part of engineering work due to various challenges such as: relationship between quality and safety, quality and costs, safety and costs; intellectual property issues, etc. Considering that in most cases engineers are employed by business subjects who adopt economic principles, engineering and business aspects of engineering decisions are inseparable. The empirical part of the paper will consist of research of the engineer's attitudes referring to: different domains of engineering in which ethical issues arise, conditions at work associated with ethical issues; common difficulties encountered and the level of support ensured by firm in dealing with ethical dilemmas, and the attitude toward engineering ethics as professional ethics. Theoretical and empirical research are expected to give an evaluation of key areas that determine the ethical challenges faced by engineers and open questions about

guidelines that will assist in solving specific engineering ethical dilemmas.

Key words: business ethics, engineering ethics, ethical dilemma

1. INTRODUCTION

Ethical requirements in the modern business environment are getting more pronounced. Good ethical practice and professional behaviour are expected in all forms of business activities. With this in mind, we could pose the question: "What are the key influences on the professionals to perform their work in accordance with ethical standards?" There is no simple answer to this question. Norms of ethical or socially responsible behaviour are a part of an individual and included in the organization; his attitudes, norms and beliefs, his own ethical standards, ethical decision-making framework and moral development greatly affects ethical behaviour (Aleksić, 2007, p. 423). The field of business and professional ethics are intertwined to clarify ethically acceptable behaviour in the workplace. The focus of this paper is a specific area of engineering ethics and ethical dilemmas that engineers face in their work.

In the theoretical part of this paper we will attempt to clarify the main differences and similarities between business and engineering ethics, determine the areas which represent potential source of conflict and explore specific ethical dilemmas that occur with individuals who are engaged in the engineering profession in the business surroundings.

The results of the research of ethics in engineering practice of Croatian engineers to determine the key ethical challenges they face and which affect business decision making are presented in the empirical part.

2. THEORETICAL OVERVIEW

Ethics is the philosophical discipline that examines the meaning and objectives of moral aspirations, fundamental criteria for moral evaluation, as well as the general foundation and the source of morality. Ethics can be defined as a system of principles, values and standards of conduct, viewed from the perspective of some basic values and criteria of a correct or incorrect, right or wrong. It provides the basis for the value judgment validity and desirability of certain forms of behaviour. It is the branch of philosophy that attempts to logically and systematically develop a series of principles that define ethical behaviour (Bahtijarević-Šiber, Sikavica, Pološki Vokić, 2007, p. 533). Scandals which more often appear in many economies affect the public questioning of desirable business principles. The public seeks responsibility for ethically questionable practices in the business context, especially with modern

information and communication technologies enabling a very rapid flow of information and more difficult cover-up of unethical practices.

Until relatively recently, it was thought that business and ethics should not be mixed (Velasquez, 1998, p. 35-38). Indeed, the more term „business ethics“ has been called as an *oxymoron* (Vee, Skatmore, 2003, p. 2, cited Ferguson, 1994, p. 1). However, it eventually became clear that the general concepts of ethics are necessarily applicable in business. Managing a business is not a function only of satisfying individual goals, it is a part of the social processes which should serve the interests of the entire environment (Vee, Skatmore, 2003, p. 3).

Business ethics can be defined as a system of core values and rules of individual, organizational and social behaviour associated with the business and achieving its objectives and with assessing the consequences of business conduct and decision-making for other participants in the business environment. Managerial ethics is often identified with business ethics because it is assumed that the manager significantly affects the application of ethical principles in the business context in which it operates. *Managerial ethics* is defined as a system of core values, rules and criteria applied by managers in decision-making, in evaluating the correctness of procedures and decisions, and in assessing the wider effects of those decisions and their impact on the other participants in the business and social environment (Bahtijarević-Šiber, Sikavica, Pološki Vokić, 2007, p. 534).

The scope of business and managerial ethics is closely linked to the question of professional ethics. But there is no general agreement about what actually makes professional ethics and how it is separated from business ethics. Sikavica et al. (Bahtijarević-Šiber, Sikavica, Pološki Vokić, 2007, p. 534) define professional ethics as a set of standards that define the members of a profession, and they pertain to the way they should behave in performing activities associated with their job. Generally known professions related with the use of ethical principles are, for example, medicine, law, journalism, finance, engineering. The area of this study is the relationship between business ethics and engineering ethics.

Engineering has been regarded profession in the West since the nineteenth century. The major engineering societies issue codes of professional ethics and certify many engineers. At a time when engineers enter the business, ethical issues become even more challenging (Hooker, 2000, p. 1). Engineering ethics is defined as: (1) the study of moral issues and decisions confronting individuals and organizations involved in engineering and (2) the study of related questions about moral conduct, character, ideals and relationships of peoples and organizations involved in technological development (Martin, Schinzinger, 2005). According to Božićević (2012, p. 83) the engineering’s ethics is a common notion for values respected by engineers who face moral problems in solving

various technical tasks. These values are connected to cultural norms, life experience and practice, thus creating an awareness of responsible acting.

Many view engineers as professionals and business persons as nonprofessionals. The professional duties of business managers are less clear, and there is no certification. It is debated whether management is a profession at all. To date, there is no complete agreement about the definition of the profession. According to Hooker (2000, p. 2) professionals can be defined by three characteristics: they are experts, they use their expertise responsibly, and they mark themselves as professionals. Professional obligations are usually summed up in a professional code of ethics. The task of code of ethics is not to derive obligations, but *to spell out what the public expects from the profession.* There is no standard code of ethics for business, although at the websites of some corporations their ethical codes can be found. Frederick Taylor tried to establish management profession in the United States a century ago, using the example of engineering, his own profession. He argued that business management has its own domain of expertise and encouraged the development of a science to support it. In early research, the duty of business managers was quite narrowly determined as maximizing the wealth of the owner, by any legal means. Kenneth Goodpaster (1991) suggested that managers and directors are beholden only to the owners, but with a key proviso: they must assume responsibility for both the financial interests and the business-related ethical obligations of the owners. The business-related obligations of the owners become professional obligations of their fiduciaries (Hooker, 2000, p. 3).

Bowie (1985) contends there are no important differences between problems in business ethics and problems in engineering ethics. *Professionalism* best refers to a set of attitudes rather than to a specific job. Attitudes that differ the professional from the nonprofessional are: (1) the professional does not see the job as simply a means for making money, (2) the professional emphasizes the moral obligations that attend the job, (3) the professional emphasizes competence, (4) the nonprofessional is more concerned about himself than about competence, (5) the unprofessional job is the incompetent one, (6) the professional is more concerned about the quality of his/her work than about personal advancement, (7) the professional sees his/her work job as providing a useful service to society, (8) the professional is always seeking ways to do his/her job better, (9) the professional seeks to develop a set of professional virtues (Bowie, 1985, p. 44).

The study conducted by Al-Kahtani (2007) yielded some interesting research results. Focus of his study was the difference in perceptual ethical values of students majoring in business and engineering in three selected Saudi Universities. The results confirmed significant difference in perceptual ethical values between major business students and engineering students as well as within each major based on students' level of education. Level of education of business and engineering students showed a significant difference in their perceptual ethical values. Contrary to the expectations business students scored a higher level of perceptual ethical values than engineering students on all

statements. These results can be explained by the usual inclusion of business ethics in the regular curriculum of this field of study. This suggests the importance and potential of the education system to promote ethical values in decision-making in the workplace. Accordingly, O'Clock and Okleshen (1993) assert that engineering major students need to take courses in business ethics to prepare themselves for real world after they graduate and join the workforce. Likewise, Kienzler and David (2003) think that honest and ethical business practices must be integrated into the entire curriculum because engineering major students as well are faced with the same business environment challenges. Therefore, they need to apply ethics in their work (O'Clock, Okleshen, 1993).

Regardless of whether it is believed that the business, managerial and engineering ethics are different areas of applied ethics or one is inclined to the attitude which ethical principles considers not a part of the specifics of someone's job, but his personal views, it is clear that the ethical challenges in today's business context are notably highlighted. Engineering has always been related to business, but now more than ever. Engineers are increasingly involved in start-up companies in which they make business decisions as well as engineering decisions. Often, at the same time they are entrepreneurs, managers and engineers. Even in large firms engineers are often directly involved in the business processes and decisions. The project management which is often associated with the engineering profession in fact brings together management skills and engineering competence with the purpose of producing successful project results. It is evident that engineers must now think about ethical issues that were once the provenience of business managers (Hooker, 2000, p. 1).

In continuance some of the most recognizable ethical issues in engineering work will be elaborated.

Engineering ethical dilemmas

Engineers face many ethical dilemmas in a business context. An ethical dilemma occurs when all alternative choices or behaviours are considered undesirable because of possible negative effects, therefore it is difficult to distinguish between right and wrong or good and bad (Daft, 2006, p. 157). An issue of great concern to engineers is how to balance quality and safety against cost. Engineers want do design high-quality product, but business managers want to keep the cost down. The business issue center around what firms *must* do to compete in marketplace. The legal and ethical issues concern what they *should* do (Hooker, 2000, p. 3). Further, different views and situations in the context of the ethical dilemmas resulting from the relation between the quality and safety will be described.

The Business View – The task of business managers is to make sure the firm survives and prospers in a competitive environment. The business environment has become steadily more competitive. To be competitive, a firm must generate new products as quickly and responsively as possible. Some of

these factors, such as small lot sizes and inventory levels, enhance quality and safety. But others, such as international competition, rapid product development and general cost cutting, can force compromise. Ideally, customers know at the time of purchase how much quality and safety they are buying. They can decide for themselves how much they want to pay for them and the market works. However, the very characteristic of engineering that calls for professionalism can undermine market mechanisms: the defects may not appear until long after purchase (Hooker, 2000).

The Legal View – Engineers who are asked to cut corners should first understand the company's legal obligations to its customers. According to common law, a product must be fit for the purpose for which it is sold. The firm also has a legal obligation to provide a safe product. The standard of care is defined by generally accepted norms in the engineering profession. Professional associations often publish manuals that specify constraints, such as minimum tolerances, in order to ensure safety (Hooker, 2000, p. 4). The legal framework will not always solve the engineering dilemma. It may leave unclear what the engineer should do when the firm acts illegally or when it acts legally but concurrently it creates an ethical dilemma for an engineer.

Public expectations – The public has different expectations in terms of safety products and services. What is somewhere acceptable or expected, elsewhere will not meet the requirements of users. For example, The U.S. public expects a product to be absolutely safe in normal use. The European public expects the product to meet specifications. This expectation varies across cultures (Hooker, 2000, p. 5). The question is whether it is ethical to balance between safety and costs due to the expectations of the public?

In addition to safety issues engineers are often faced with ethical dilemmas in the field of *intellectual property rights*. Engineers should be very familiar with this domain to be able to assess the decisions that they will have to make. Often they do not have enough knowledge about it and sometimes perhaps they do not really recognize their actions as unethical. On the other hand, knowledge of the subject can help them to recognize and ensure the rights of intellectual property of their solutions which meet the criteria for protection.

International Business Ethics is a field of applied ethics, which in practice often has an impact on the engineering decisions. In global economy, engineering projects are often international. They bring together people from different traditions who have different values and do business in different ways. Considering that ethical issues are directly related to some core values, but also personal moral assessment, it is clear that different traditions resulted in somewhat different fundamental values and moral issues. People who work globally should be aware of these differences in order to be able to adapt to the specifics of other traditions and their value beliefs.

There are many different areas where potential engineering and ethical challenges can be found. Some of the practical situations in which an engineer

might find himself are: sharing or selling confidential information, cover-up of errors, avoiding presenting unwanted results, performing a less than complete analysis, failing to properly test, failing to properly inspect, charging for work not done, charging for unnecessary work, not treating others fairly etc. Their personal way of conduct will be influenced by the ethical principles which derive from the business environment of their operations, but it is also largely influenced by personal moral attitudes and ethical principles. There is no universal solution for situations considered unethical by engineers. Whistle-Blowing described as the act of an employee of informing the public or higher management of unethical or illegal behaviour by an employer or supervisor (Johnson 1991., p. 32). If an engineer decides that current practice is unethical, there are at least three basic responses: „blow the whistle", either internally or publicly, resign, or keep quiet and do what the company wants. But, it will ultimately be his personal decision.

Following, the results of the empirical research conducted among engineers in Croatia will be presented.

3. RESEARCH METHODOLOGY AND RESULTS

The aim of this research is to explore the ethics in engineering practice of Croatian engineers.[1] This survey was intended to engineers working in engineering companies or in companies that employ a significant number of engineers. The purpose of the study is to gauge level of awareness of the ethical issues relevant to engineers and the level of support available for engineering professionals in industry when they are faced with ethical issues.

One part of the survey was performed among part-time students at specialist professional graduate studies of transport and occupational safety at the Polytechnic of Rijeka, who are employed as engineers. The second part of the research was carried out using an e-mail as the communication channel on randomly selected companies in the County of Primorje and Gorski Kotar. Due to the sensitivity of research, respondents were ensured absolute anonymity, there was no question marked as mandatory, very little personal information was required; name of the firm was not required. The final research sample consisted of 63 engineers from various fields of engineering, of which 13.4% were employed in micro enterprises (up to 9 employees), 32.7% in small enterprises (10-50 employees), 21.1% in medium-sized enterprises (51-250 employees) and 32.7% in large enterprises.

Research results

At the first question *As an engineer, do you feel that ethical issues arise in the course of work?* 54 (85.7%) of respondents answered positively, 4 (6.3%) answered negatively, and 5 (7.9%) of respondents did not know whether they encountered with ethical issues in the course of their work.

[1] The questionnaire is adapted from the study carried out by Royal Academy of Engineering and UK Engineering Council's Statement of Ethical Principles, http://www.raeng.org.uk/policy/ethics/principles.htm. (10.03.2013.)

The following table shows the responses to the question which respondents marked as the ethical issues relevant to their work.

Table 1

Selected ethical issues relevant to work of respondents (engineers)

Ethical issues	Frequency response	%
1. Avoiding bribery, corruption and facilitation payments	32	50,1
2. Preventing discrimination, harassment or bullying	29	46
3. Health and safety of workers and the public	38	60,3
4. Dealing with conflicts of interests	25	39,7
5. Fair and honest quotes and costing	38	60,3
6. Preventing or controlling pollution	16	25,4
7. Security of information	33	52,4
8. Appropriate handling of intellectual property	14	22,2
9. Addressing human rights issues	23	36,5
10. Ensuring ethical standards through the supply chain	8	12,7
11. Cross-cultural issues	13	20,6
12. Working within competencies	8	12,7

Source: research

According to the results listed in the table above the highest number of engineers marked *health and safety of workers and the public (*60.3%), *fair and honest quotes and costing (*60.3%), *security of information (*52.4%) and *avoiding bribery, corruption and facilitation payments* (50.1%) as most present ethical issues in performing their work. *Ensuring ethical standards through the supply chain and working within competencies* the smallest number of engineers considers relevant from the ethical aspect in performing their work (12.7%).

In assessing the highest importance of the above ethical issues respondents rated most important ethical issue *health and safety of workers and the public* (27 or 42.8%), in second place they put *fair and honest quotes and costing* (12 or 19%) and third place was given to *avoiding takes bribery, corruption and facilitation payments* (9 or 14%).

The following table contains answers to the question whether circumstances within their company make it easy for them to work in certain ways which are considered ethical.

Table 2

Do circumstances within your company make it easy for you to work in the following ways?

	Always %	Usually %	Some of the time %	Often not %
Work within competencies	20,0	41,7	18,3	20,0
Give realistic cost estimates	17,2	27,6	37,9	17,2
Minimise health and safety risk	25,0	35,0	30,0	10,0
Communicate information of public interest	17,5	26,3	35,1	21,1
Avoid bribery	67,2	19,7	4,9	8,2
Keep within planning and building regulations	25,0	65,0	6,7	3,3
Keep within environmental regulations	20,0	41,7	18,3	20,0

Source: research

Results in the table show that a large number of respondents said that circumstances within their company allowed them to *always* (67.2%) and *usually* (19.7%) *avoid bribery* while 8.2% of them assessed that *often* are not able to *avoid bribery*. Closely to 20% of respondents hold that their company *often* does *not* allow them to *work within competencies, communicate information of public interest* and *keep within environmental regulations.* Companies whose employees are respondents *sometimes* prevent them to *give realistic cost estimates,* marked by 37.9% of respondents. Also, *sometimes* they make it impossible to *communicate information of public interest* rated by 35.1% of respondents. Respondents predominantly evaluated that *always* or *usually* in their companies operate in circumstances described as *keep within planning and building regulations* and *keep within environmental regulations.*

The following table presents the evaluation of the pressures that make it difficult for respondents to act ethically in the workplace.

Table 3

In your experience, do any of the following pressures make it difficult to behave ethically?

	Always %	Usually %	Some of the time %	Often not %	Never %
Cutting costs	10,0	31,7	40,0	5,0	13,3
Cutting timescales	5,1	32,2	42,4	11,9	8,5
Winning contracts	11,9	18,6	42,4	11,9	15,3
Meeting client's demands	13,3	21,7	41,7	13,3	10,0

Source: research

In assessing the pressures to which they are exposed when carrying out their work 31.7% of respondents marked that they are *usually* exposed to *cutting costs*, while 40% responded *some of the time*. Similarly they assessed *cutting timescales:* 32.2% are *usually* exposed to that pressure, and 42.4% *some of the time*. Concerning *winning contracts* respondents expressed somewhat smaller pressure so 18.6% of respondents selected that they *usually* feel the pressure and 42.4 of them said that *some of the time* experience pressure in obtaining contracts. While *meeting client's demands*, 41.7% of respondents stated that *some of the time* are under pressure in the workplace. It is evident that they feel more pressure in the ethical context in the domain of cost reduction and shortening deadlines than in satisfying customer requests.

Other pressures to which they are exposed and make it difficult for them to operate in an ethical manner indicated 18 (28.5%) of respondents. They specified: employee relations, poor working atmosphere, prohibition of commenting current issues concerning work tasks, lack of time, employees' salaries, loopholes in the law, constant sanctioning, rarely rewarding, forcing the working methods that are not in accordance with the regulations, administrative procedures at border crossings, pressure due to deadlines, forcing people, too much stress, wishes of the superiors, performing work without adequate protective clothing and footwear which can threaten safety, compensations for the effort getting smaller while employees are existential threatened, fulfilment of norms, too low salaries, orders of the boss who is "always" right, withholding information about actual state to the client, the financial pressure in every aspect of the business, too much work etc.

To the question *have you ever been in a situation in the course of your work where you felt you were faced with an ethical dilemma?* 48 (76.1%) persons responded positively, 7 (11.1%) negatively and 8 (12.7%) does not know.

Those who responded positively to the previous question had to state whether they feel that their company gives them guidance or support in dealing with the problem. 16 of them (33.3%) reported that they have great support, 16 (33.3%) of them have support, but it is not adequate, 10 (20.8%) have no support, and 6 (12.5%) do not need support or advice when evaluating ethical dilemmas.

In appraising engineering relative to other professions concerning the attitude towards ethical issues 23 (36.5%) of respondents assessed that the engineering is at least equal, if not a leader in a way they deal with ethical issues, 22 (24.9%) rated medicine as a leading profession in the area of ethical conduct, followed by finance and accounting, law and journalism. At the back with support from only 5 (7.9%) of the respondents was business as an ethical profession.

When asked about the need to support professional organizations 52 (82.5%) of respondents indicated that engineering professional organizations could do more to promote engineering ethics and support engineers; 5 (7.9%) of

respondents believe that sufficiently is being done, and 3 (4.7%) think that it is not such an important issue.

Based on the study it can be concluded that the ethical issues appear in everyday work of Croatian engineers. A large number of different ethical issues delineate the areas encountered in their work. When assessing the circumstances in which they operate in the workplace it is encouraging that they highly evaluated the conditions in which they can always or usually "avoid bribe"; relatively highly was rated "minimizing health and safety risks and acting in accordance with the rules and regulations". They evaluated less favourably "realistic cost estimates and communicating information of public interest". In the domain of ethical pressures large number of respondents (over 40%) stated that sometimes they feel pressure in "cutting costs", "cutting timescales", "winning contracts" and "meeting client's demands". It is interesting that the respondents who declared that they were faced with an ethical dilemma, relatively highly rated support of companies in such situations (66% of them), with half of them stated that this support is inadequate. In assessing various professions engineering and medicine are rated as ethical profession, while business received the least support of respondents. The majority of respondents (82.5%) claimed that professional organizations could do more in promoting engineering ethics and supporting engineers. On the one hand it indicates the awareness of the respondents of the importance of use of ethical principles in engineering decisions, and on the other hand it points out the commitment of respondents to specific engineering ethics.

4. CONCLUSION

The basic goal of applied ethics is to establish the desirable principles of conduct in specific areas to which it relates. Business ethics deals with the desirable principles of business while professional ethics is engaged in determining specific values that characterize a particular profession. It is difficult to make a clear distinction between the ethical principles that apply in general to business decision-making as opposed to the principles that describe the professional decision-making. The focus of this paper was specificity of ethical problems faced by engineers in the business context. The theoretical examination of this area indicates the inconsistency in attitudes towards similarities and differences between business and engineering ethics. Analysis of the most common ethical dilemmas in engineering points to some specifics eg. ratio between safety and costs, or quality of engineering solutions. Identified engineering ethical dilemmas in the domain of intellectual property, international business ethics or specific ethically questionable situations in practice such as sharing or selling confidential information, cover-up of errors, avoiding presenting unwanted results, performing a less than complete analysis etc., raise the question would those same ethical dilemmas appear in any profession, or in performing any kind work?

There is general agreement around the growing demand for good ethical practice and professional behaviour in all forms of business activities, including the engineering profession. In order to have a positive impact on these processes, it is necessary to explore ethics in the specific work practices and then through the available mechanisms raise awareness of the importance of the application of ethical principles in work related decisions.

Empirical part of this paper contains the analysis of the study of ethics in engineering practice of Croatian engineers. Research results indicate that Croatian engineers show a high level of awareness of the presence of ethical challenges in their daily work. They stated that they are in their work exposed to a variety of ethical issues with the greatest emphasis given to the ethical issue *health and safety of workers and the public* considering it to be the most often encountered ethical issue. This ethical issue can be classified in a specific area of engineering ethics. They also noted a number of personal examples of ethically questionable situation. In assessing the pressures that could affect the ethics of their actions most of them expressed that they feel different intensity of pressure in cutting costs, cutting timescales, winning contracts and meeting client's demands. Most of them stated that they have support of their organizations in situations when they are faced with an ethical dilemma, although the half suggests that this support is not adequate. Most respondents expect greater help from professional organizations, which means that they should be more involved in raising ethical awareness in the engineering profession. It can be concluded that Croatian engineers are exposed to a variety of ethical challenges in performing the engineering work and that greater effort should be made in further raising ethical awareness on individual, organizational and social level. Organizations are required to promote corporate social responsibility that is based on the fundamental ethical principles (Aleksić, 2007, p. 428), but apart from them professional organizations and society at large also have a responsibility to promote ethical values and thus affect our individual actions.

Research findings are limited by the small survey sample (63 respondents) and a relatively small number of questions in the questionnaire. In the future a possible research stream could be an analysis of professional and engineering ethics in detail. Some of the features to be studied in the future are the attitudes of engineers with regard to: the desirable characteristics of engineers in terms of work ethic, moral standards, technical competence, relationships with people (...), responsibilities of engineers in terms of safety and social responsibility; criteria determining professional engineers in terms of personal qualities, external recognition and tangible standards and detailed analysis of the key sources of ethical problems in the workplace of engineers.

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