Paper 78. Educating future engineer-managers about ethics, corporate social responsibility and sustainable development

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Abstract

Professionals and scholars have adhered to the ideas of ethical engineering and social responsibility of engineers, and more recently, to the principles of sustainable engineering. Since more engineers are getting management training; and since business schools are offering specialized courses and programs for students having a background in science and engineering, we assume that management educators have some role to play in educating future engineer-managers about ethics, corporate social responsibility, and sustainable development (EC&S). The main objective of our paper is to discuss whether and how business schools can respond to such a challenge. Relying on an assessment of EC&S education in business schools and our teaching experience at the specialized MBA in Science and Engineering at the School of Management of the University of Québec in Montreal, we argue that a critical approach, which includes a reflective inquiry, has become imperative and can be implemented using participatory pedagogical strategies.

1 Introduction

As the call for contributions for the EESD 2013 Conference[1] reminded, although progress has been made in introducing concepts of sustainable development into engineering curriculum, engineers still need to be educated about extra-technical issues and be reflective about their role and contribution in society. We consider that such an imperative is even greater for engineer-managers. Engineers and scientists holding management positions in corporations and other businesses need to be equipped with the knowledge and the skills which will allow them to navigate the challenges of ethics, corporate social responsibility, and sustainable development (EC&S) as well as to reflect on the interactions between business and society. In most of the sectors that hire engineer-managers (healthcare, manufacturing, information technology or IT, pharmaceutical, biotechnology, construction, energy), many issues are so critical at the system level that they need to be understood beyond their technical realm and addressed beyond the personal duties of engineers toward their profession.

This paper discusses the role of business schools (or management schools[2]) in educating engineer-managers about EC&S. We do not pretend that business schools are the only or the most effective institutions to get engineers educated about EC&S. However, the following trends allow us to state that these schools have at least some role to play in such an endeavour:

[1] Source: http://www-eesd13.eng.cam.ac.uk/conference

[2] We will use «business schools» and «management schools» interchangeably.

- More engineers and students with other scientific backgrounds are getting graduate management training (Master of Business Administration or MBA and Master of Science or MS); and top management schools are multiplying their specialized program offerings.
- Engineers are expected to be educated about EC&S. The pressure is even greater for those holding management positions in large corporations and public organizations. However, extending the domain of EC&S beyond engineer's ethics and beyond the techno-environmental aspect seems to remain an unfulfilled agenda.

In this paper, we first review the above-mentioned trends (Sections 2 and 3). Then, we discuss whether and how EC&S teaching in business schools could meet the challenge of extending the domain of EC&S taught to engineer-managers and thus contribute to what is called the critical turn. Such a turn implies that EC&S education be founded on a reflective inquiry, instead of solely focused on utilitarian and normative quests. Our discussion is based on an assessment of EC&S education in business schools (Section 4.1), and our experience as teachers of a EC&S course for the specialized MBA in Science and Engineering at the School of Management of the University of Québec in Montreal (Section 4.2).

2 The training of engineer-managers at business schools

Proficiency in Management has long been recognized as an added value to engineers' training. The first Management courses were taught to engineers in the first decade of 1900 (Kocaoglu and Cleland 1981; Kotnour and Farr, 2005, Kocaoglu, 2009). Most of the engineering-management (EM) programs had been embedded within an industrial engineering or a system-engineering department (Farr and Buede, 2003). Later, as more major corporations expected the higher education institutions to train leaders not only to design technical and engineered systems but to manage them so that engineering-management could induce a better strategic position in the industry (Kocaoglu, 1989), the EM education has come to be considered as a source of competitive advantage in the job market for engineers (Omurtag, 2009). In the highly-ranked business schools[3], around third of full-time MBA students have an undergraduate degree in science and engineering[4]. Management schools have seized that opportunity by offering EM-type programs. For the last ten years, concentrations within master programs (MBA and MS)[5], hybrid programs offering dual or joint degrees with other schools[6], and elective courses in science and engineering[7] areas have been pullulating in top business schools.

[3] Top business schools according to rankings such as the Financial Times Global MBA and QS Global Business Schools Report.

[4] For example, according to the latest-published data on the full-time MBA class profile (found on the respective website of each of the business schools): 34 % of the class of 2014 at Harvard Business School, 37 % of the class of 2014 at Stanford University Graduate School of Business, 31 % of the class of 2013 at the University of Chicago Booth School of Business, 42 % of the class of 2013 at INSEAD in France and in Singapore, 36 % of the class of 2013 at the IESE Business School in Spain, 26 % of the class of 2012 at Sauder Business School in Canada, 48 % of the class of 2011 at CEIBS in China.

[5] For example, concentrations in the MS in Management Studies at the MIT's Sloan School of Management include: technology-based entrepreneurship and product development. At UCLA's Anderson School of Management, among the MBA specializations are: technology leadership and healthcare management. SDA Bocconi in Italy offers specializations in innovation management, food and beverage, and healthcare. At HEC Paris, it is possible to be specialized in digital innovation, and aviation & aerospace.

[6] For example, the Kellogg School of Management offers a dual degree (MBA and MMM) with McCormick School of Engineering. Stanford University Graduate School of Business offers joint degrees (MBA and MS) with the Computer Science Department and the School of Earth Science. Columbia Business School has dual

Before assessing to what extent business schools course and program offerings could respond to the need for EC&S education of future engineer-managers, it is important to trace how the questions of EC&S have emerged and developed in the engineering field in general and their expected implications for the contemporary education of engineer-managers in particular.

3 The demand for EC&S education in engineering-management

A review of the main texts[8] and textbooks[9] on engineering ethics and sustainable engineering, as well as of others' reviews and critics[10] allows us to assert that both professionals and academics have adhered to the idea and principles of ethical engineering and social responsibility of engineers - although such a responsibility is still mainly circumscribed within the personal obligation toward the profession; and more recently, to those of sustainability (or engineering & sustainable development) - despite a current over-focus on the techno-environmental dimension.

3.1 EC&S and engineering in general

Debates about engineering ethics could be traced back as early as the end of the 19th century, as governments, professional associations, and academics formally reacted to major safety risks and design defaults related to engineered systems. Later, issues arising in branches and their subfields brought about the development of applied engineering ethics covering particular areas and specialties (for example, genetic engineering, nanoscience, robotics, etc.). Despite intense philosophising about engineer's ethics and social responsibility, following more other incidents during the 20th and 21st centuries (for example, water contamination, bridge and building collapses, chemical leaks, space shuttle disasters, etc.), most of the knowledge and the solutions that have been developing have stressed the engineer's duties to his profession and have remained at the technical level. The generalization of ethical code's adoption by societies and professional associations epitomizes that over-focus on the engineer's «personal obligation» toward the profession. On the educational side, that has translated into preaching (Pfatteicher, 2001). The assumption that individual values and due regard to the professional codes can guarantee ethical behaviour seems to have sparked among engineering ethics' teachers. However, as reminded Basart and Serra (2013), engineer's ethics is just part of a number that must be considered when talking about engineering ethics; and professional codes of ethics do not cover the whole set of actors and systems involved in the world of engineering. A need for a systemic and holistic approach seems to be even relevant now that the sustainable development challenges are calling upon the attention and the interest of the engineering field.

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degrees (MBA and MS) with the School of Engineering and Applied Science (industrial engineering, operation research, earth resources engineering). Oxford University's Said Business School offers dual degrees (MBA and Msc) with the School of Geography and the Environment, Oxford Internet Institute, and the Department of Computer Science.

[7] For example, areas of elective MBA courses at Berkley's Haas Business School include: energy and clean technology, health, and technology. They include technology and operation management at INSEAD in France. INSEAD in Singapore offers elective courses in technology and operation.

[8] For example, Frantz, 1988; Davies, 1995; Clarke and Rhodes, 2002; Geistauts et al., 2008; Fenner and Jeffrey, 2011; DiLoreto, 2012.

[9] For example, Layton, 1971, Gunn and Vesilind, 1986; Florman, 1987; Johnson, 1991; Davis, 1998; Fleddermann, 2004; Martin and Schinzinger, 2005; Harris et al., 2009.

[10] For example, Baum and Flores, 1978; Peterson, 1996; Cavana and Mares, 2004; Adamoski, 2012 Basart and Serra, 2013; Pfatteicher, 2013.

But has the idea of sustainable development, which is much broader than professional ethics[11], brought a systemic and holistic turn (more than the individual responsibility and more than the technical level) into the definition of engineering ethics' domain? On the academics' side, the idea has entered the engineering field mainly in the mid-1990 through research funding and new publications[12], numerous conferences on the subject, as well as new courses and programs. On the practitioners' side, the main actors (public policy makers, industries, and professional associations) have responded essentially in two ways, as noted by Adamowski (2012): 1) policy statements acknowledging the magnitude of the problems in addition to pledging to steer engineering towards a more sustainable future, and 2) technological innovations. Moreover, the need for education has been asserted. Professional associations have firmly stated that engineers have a unique role in society and in sustainable development, and have developed educational programs which embed the principles of sustainability into credentials (DiLoreto, 2012). But to the question whether the current priorities encompass the broader challenges of engineering ethics grounded in the notion of sustainable development, the answer is not necessarily affirmative (Fenner and Jeffrey, 2011; Adamowski, ibid.). The theory, practice, and education related to the emerging field of sustainable engineering have tended to focus more on techno-environmental considerations[13] than human, political, and socio-economics. Fenner and Jeffrey noted, for example, that there is still a need to draw a body of material that would focus on the relationship with the human communities which infrastructures systems serve. According to Adamowski, extending the domain of engineering ethics and adopting a more holistic approach coherent with the notion of sustainable development means that engineers ought to be more actively engaged in political, technical, economic, and social discussions and processes – which seems not to be the case currently. Training them to that task is thus among what is expected from contemporary engineers' educators.

3.2 EC&S in engineering-management in particular

The need to understand EC&S in a holistic and systemic manner is even more crucial for engineers holding management positions. First, there are two responsibilities to be reconciled though - that of the businessman and that of the engineer[14]. But beyond that consideration at the professional level, the need to highlight other levels of the relationships between engineering and society as well as between business and society, when teaching about EC&S to engineer-managers, is paramount (Davis, 1992; Clarke et al., 2002; Geistauts et al., 2008; Basart and Serra, ibid.; Adamowski, ibid.).

The imperative for ethical, socially-responsible and sustainability-oriented EM has been admitted by many. Following an utilitarian view, it is a question of competency domain. Industries ask more and

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[11] Depleting resources, climate change, and pollution are without discussion problems that the idea and the operationalization of sustainable development are expected to tackle. Nonetheless, and this is what is often forgotten, issues related to social justice, human rights, and quality of life for both the current and the future generations are also among those expected to be addressed.

[12] Including specialized journals such as *International Journal for Sustainable Engineering*, *Journal of Engineering for Sustainable Development: Energy, Environment, and Health*, *Sustainability Science and Engineering*; special issues in EM publications such as the *Journal of Management in Engineering* in January 2012.

[13] Such as « environmental stewardship practices and policies involving energy efficiency, water conservation, climate change, renewable portfolio standards, and other issues » (Qingbin and Dongping, Fang, 2012).

[14] Debates about their dichotomy have flourished after Layton's 1971 landmark book. However, lately, there seems to be an agreement among scholars that despite their differing logics, the duties of engineers and business managers are not incommensurable.

more for leaders trained in broader fields in the current changing global business setting (El-Baz and El-Sayegh, 2010). Thus, engineer-managers must cultivate a wider range of competencies, including environment management, ethics and diversity sensitivity conflict resolution and leadership (Ivanovic and Majstrovic, 2006; El-Baz and El-Sayegh, ibid.). Following a normative view, due to their dual function, the multidimensional nature of their job, the obligations to more stakeholders, and the variety of priorities in different cultural settings, the engineer as a manager has an obligation not only to his profession but to his employees, organization, and the public (Frantz, 1988). Following a critical view, which is more narrowly related to the systemic and holistic approach mentioned above, when engineers are also managers, they are exposed to more dilemmas, tensions, and paradoxes. Their practices and decisions take place within technical and organizational systems, which are themselves embedded in complex social, political, cultural, and economic frames. Geistauts et al. (2008) assert, for example, that their individual value set, even when coupled with those expressed in their codes of professional conduct, is insufficient to guarantee that they would display a socially acceptable behaviour in every setting. When we look at the industries that hire engineer-managers, many issues (for example, drug pricing in developing countries, risks of corruption in the construction industry, risks associated with genetically-modified organisms and nanotechnology, privacy protection in the IT sector, product safety in the FMCG sector, transfer pricing in the digital industry, planned obsolescence, etc.) are so problematic at the system level, that the mere competency (utilitarian) and ethical business conduct (normative) of the engineer-managers are not enough to address them. It is not exaggerated to say that the agenda to educate engineer-managers about ethics and social responsibility, and most of all about sustainable development, will remain unfulfilled without a reflective inquiry. Getting engineer-managers to be reflective practitioners entails that they ought to be educated about the interactions between engineered and non-engineered systems, the relations between the organizations they work for and the society, as well as the values and views of the different actors in such interactions, the social structuration of their practice (for example, the spread of some engineering-management models throughout the world and its impacts on different communities), the conditions under which solutions to EC&S issues (for examples, norms and standards) are negotiated and agreed on, etc. (Russell, 2001; Adamowski, ibid.).

4 The potential role of business schools in educating future engineer-managers about EC&S

Since more engineers are attending business schools, since the latter are offering specialized courses and programs for students having a background in science and engineering, and since these future engineer-managers are in need of EC&S education, it can be assumed that management educators are expected to have a role to play in such an endeavour. Texts about the teaching of EC&S specifically to EM students in business schools are scarce. However, from an assessment of EC&S education in business schools in general, and relying on our own teaching experience, we will discuss to what extent these schools can be a potential arena for the development of an alternative approach to EC&S teaching, which goes beyond the technical and the professional levels and adheres to reflective inquiry.

4.1 The offerings of EC&S education in business schools: an assessment[15]

While the notions of business ethics, corporate social responsibility, and sustainability now enjoys wide currency among management schools, how business students have been educated about them has nonetheless been the subject of intense criticisms. Some have disparaged EC&S teaching, especially in North-American and European schools, for its lack of materiality (proven strategic advantage) for businesses. Some others have attacked it for its inability to change behaviour (ethical conduct) towards moral righteousness. Hence, what has been understood as the main challenge is either the demonstration of the positive link between more ethically-educated managers and more profits or the positive link between more ethically-educated managers and more legitimacy (better reputation or less corporate scandals). Responding to those criticisms, business schools have tended to offer courses which are over-focused on instrumental (recipe for success) or normative (deontology) ethics. To our interrogation whether EC&S teaching in business schools can respond to the challenge of extending the domain of EC&S taught to engineer-managers and of motivating them to be reflective practitioners, the portrait that we have just drawn may conduct us to offer a negative answer.

Nonetheless, despite that seemingly utilitarian and normative emphases found in the mainstream business ethics' teaching, a recent call for the renewal of EC&S education has found interest among some business educators (for example, Springett and Kearins, 2001; Bradbury, 2003; Ghoshal, 2005; Lapointe and Gendron, 2005; Springett, 2005; Giacalone and Thompson, 2006; Evans et al., 2006; Hartman and Werhane, 2009). The latter argue that rather than stimulating a reflexive thinking, the mainstream approach to EC&S teaching in business schools is largely designed to serve the new «market for virtue» (Vogel, 2005). Training in management may provide a tacit stamp of approval for the current corporate and institutional framework, to the extent that it does not question it. This is however basically the same framework in which severe social disparities, natural resource depletion, and economic crises have occurred. «Themes in (…) business ethics largely indicate an acceptance of the status quo business context and preparation to adjust to and operate within that status quo. There is limited critical analysis or morally imaginative constructive posing of alternative macro and moral standards. » (Petrick et al., 2011:58). Although educators holding that view represent only a minority, their propositions and experiences signal that it is possible to innovate in EC&S teaching by adopting a critical instructional and pedagogical approach (Kearins and Springett, 2003; Welsh and Murray, 2003; Brown and Macy, 2004; Wheeler et al., 2005). Those are the ones that allow to embrace the system level (beyond the professional one), to think holistically (beyond the technical aspects and the direct stakeholders), and most importantly, to reflect on the relations between business and society.

4.2 Our experience at the Management School of the University of Québec in Montréal

Taking our experience as illustrative of an adhesion to that critical turn, we are providing below a brief account of how we defined the aim and scope of the EC&S course we are teaching at the MBA level and of how we chose the type of pedagogical methods we are using.

Our stand-alone graduate course, untitled « Economic and socio-political context of businesses » is a mandatory part of the specialized MBA in Science and Engineering[16] at the school of management of

[15] This assessment draws from our review of the literature on EC&S teaching in business schools as well as others' reviews on the same themes (Crane and Matten, 2004; Wright and Bennett, 2011; Petrick et al., 2011; Moon and Orlitzki, 2001).

[16] The program was first opened in the Fall of 2008 and has so far graduated 106 students.

the University of Québec in Montreal[17]. Students enrolled in the program have undergraduate degrees in mechanical engineering, chemical engineering, computer science, biology, health science, and fundamental sciences. In the chronology of the MBA curriculum (generally five terms), our course is at a late stage (during the fourth term). The preceding terms, students had to attend courses in human resources, marketing & finance, and production. Hence, we could afford not to emphasize on the development of problem-solving skills, which we assume were already acquired during earlier training. Instead, we chose to target their competency in concept application (including how businesses for which they work are situated in their institutional frameworks), in situation assessment (including the actors involved and their respective interest), and in critical evaluation of decisions at various levels (encompassing the organizational and the institutional ones). It is explicitly stated in the syllabus that the course is for students whose objective is to advance their understanding of EC&S by examining the institutional frames and features of businesses' policies and practices, instead of searching for these concepts' normative and universal definitions or for 'the one best way' to implement them in organizations or for the best substantive and procedural parameters of social and environmental performances in the science and engineering sectors. Beyond presenting the concepts of ethics, corporate social responsibility, and sustainable development, the early part of the course is devoted to laying out a comprehensive, detailed conceptual framework using insights from various social sciences (including Strategic Management, Political Economy, Economic Sociology, and Sociology of organizations). Though not without difficulties, the theoretical readings used in that stage encourage future engineer-managers to make sense of the interactions between their work (or project) setting and the broader socio-economic system beyond a mere utilitarian and normative understanding.

We are aware of the fact that such a deconstruction of EC&S issues is not an effective "hook" for MBA students whose perception of a course's relevance may still be entrenched in the mainstream rationale of materiality to business [18]. The pedagogical methods that we have developed to overcome that challenge include: case studies, group-deliberation, presentation of an issue-analysis (issue that students feel are most relevant to their industry). These small group activities and cooperative student projects all give the opportunity to actively participate in the learning process by talking, reading, writing and reflecting. Earlier researches in education have demonstrated that such an active participation in the education process increases learning and retention (Asbaugh and Kasten, 1995; Ates, 2012). Case studies, which are widely used in business schools, have also been proven to be an effective learning method for students in science an engineering (Kvam, 2000; Ates, 2013).

[17] The management school of the University of Québec in Montreal where we are faculty members is ranked 7th in the latest Corporate Knights' TOP MBA. That ranking uses similar methodology as the Aspen Institute's Beyond Grey Pinstripes ranking, which «had established criteria rewarding schools for emphasizing social responsibility, environmental sustainability and community engagement through institutional support, student initiatives an coursework» (www.corporateknights.com). It is worth noting that our school is ranked first among Canadian French-speaking schools. Serving annually more than 13000 students, it is also part of the 15 best business schools in Canada, according to SMBG-Eduniversal, and offers one of the 10 most innovative MBA in the world, according to the magazine *L'Expansion*. The concepts of social responsibility and sustainable development are entrenched in its mission. Members of its faculty are notorious researchers and authors in the field of corporate social responsibility and sustainable development, especially in the French-speaking management scholarship in North-America and in Europe.

[18] Materiality by demonstrating «why should companies do this?» and how it will improve «efficiency, productivity, and processes», according to Porter, a guru in strategic management, interviewed by Morsing (2003).

5 Conclusion

The main objective of our paper was to discuss whether and how business schools can respond to the challenge of educating future engineer-managers about ethics, corporate social responsibility, and sustainable development. Observations of the trajectory of the demand for both engineering ethics education and business ethics' education as well as reviews of earlier works on these themes allowed us to assert that a critical turn is imperative in order to fulfil the agenda of EC&S education. That turn has not gained yet the interest of many educators though. Literature on the critical instructional and pedagogical approaches in EC&S teaching to future engineer-managers is scarce. Relying on others, propositions and our own teaching experience, we demonstrated that however challenging, such a quest for including reflective inquiry into EC&S education is feasible. Overall, the goal is to apply a diversity of teaching strategies to enhance the feelings of relevancy and engage students with overarching critical concepts.

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