

Preface

In 1994, Richard B. Norgaard published *Development Betrayed: The End of Progress and a Coevolutionary Revisioning of the Future*. From an ecological perspective, Norgaard offered an analysis of why development has so frequently failed and the reasons why it is programmed to fail. Dating back to the Western Enlightenment, the modern project has been based on presumptions about universal human values and the idea of progress through control over nature through science, material abundance through technology, and effective government through rational social organization. However, despite resounding achievements, between the promise of modernity and its actual accomplishments, there has been a remarkable gap. Instead of fulfilling its deepest aspirations, Norgaard argues that modernity through science and technology as the main engines of economic growth has led to systematic introductions of risk, environmental degradation, population increase, poverty, social injustice, and cultural destruction on a global scale. The social acceptance of scientific ways of understanding and attempts to act rationally on these understandings has led to the exclusion of other ways of knowing, both scientific and traditional, to the detriment of a coevolutionary path to the future.

In this book, we do not unanimously claim that we share Norgaard's conclusions, but we do share and have been inspired by his co-evolutionary perspective on development and the promise of including other ways of knowing, both scientific, philosophical, and cultural. In particular, the traditional Chinese worldview derived from Confucianism, Taoism, Buddhism, neo-Confucianism, and popular religious practice provides lessons for an ecological worldview based on ideals of harmony, human perfectibility, and systemic fit within natural systems and processes. This remains true even in the presence of the distinctive successes of the Asian Four Tigers (Hong Kong, Singapore, South Korea, and Taiwan) and efforts to draw positive lessons from them by China, India, and others. The traditional Chinese worldview strongly emphasizes the interdependence of all living beings and therefore calls for a delicate balance between human wants and ecological needs. In contrast, the Judeo-Christian worldview contains deeply dualistic and individualistic values that put human beings at the center of the universe. The most extreme version of this anthropocentric paradigm is reflected in the dominant values and beliefs of consumerism. To what

extent distinctive Asian worldviews can alter the Western trajectory remains an open question, one that must be addressed with something other than romantic idealism.

The coevolutionary perspective and the aspiration nevertheless to include other approaches to thought and practice take the form of cross-cultural encounters among American, Chinese, and European scholars who set out to reflect on the cultural contexts and meanings of engineering and development, well aware that development is a complex and nontrivial concept. These cross-cultural encounters can be circumscribed as efforts to grapple with three simply stated but complex questions related to American, Chinese, and European cultural contexts:

- Where do engineers come from?
- What is engineering for?
- What are engineering studies for?

The first question refers to the formation of engineers through educational systems, institutions, degree programs, curricula, courses, disciplines, and more. The latter two questions acknowledge and extend Gary Downey's work on dominant practices and scalable scholarship in *engineering studies*. Here, they more precisely refer to localized meanings and purposes of engineering and cases of critical participation within engineering and sophisticated scholarly reflection on both opportunities and discontents.

What we offer is thus a genuinely cross-cultural, inter-, and meta-disciplinary reflection by engineers, philosophers, humanists, and social scientists. The book is the result of an American-Chinese-European research project launched in Golden, Colorado, at the Colorado School of Mines in May 2010. The original idea for this workshop grew out of previous meetings in 2009 at the Graduate University of the Chinese Academy of Sciences in Beijing and Dalian University of Technology and a previous European-American project titled "Engineering in Context." Regarding the composition of the team, Carl Mitcham was in charge of selecting the American team of scholars, Li Bocong and Carl Mitcham of selecting the Chinese team, and Steen Hyldgaard Christensen of selecting the European team. The structure of the book and the contributions of participants were agreed upon at the 3-day May 2010 workshop in which 21 scholars participated. During the process, Yanming An acted in roles of mediator and translator to bridge potential gaps in understandings between Chinese- and English-speaking participants. Some further coauthors were invited to join the project following the workshop, thus raising the number of contributors to 36.

The working hypothesis and point of departure of the workshop was the shared belief that engineers and engineering are key influences in the new form of the world and experience that we as human beings are creating both locally and globally. Additionally, this creation is most commonly described in terms of development, although the concept of development is usually understood to mean quite different things in American, Chinese, and European cultural contexts. In the extension of this shared belief, some of the questions that we discussed were:

1. What does engineering mean in different contexts?
2. How does international development work challenge the professional identities, practices, designs, and ethics of engineers?

3. How does development at different levels (subnational, national, international, transnational, global) challenge engineers to engage perspectives other than their own (e.g., local communities, engineers from other countries, humanitarians, etc.)?
4. What can we learn from different cultural perspectives?
5. What is the meaning and role of sustainability in relation to engineering and development?
6. In what ways do sustainability support or challenge ideas and practices in engineering?

Inevitably, such questions relate to ongoing discussions among engineering educators regarding engineering epistemology and the proper relationship between theory and practice and interactions between “the technical” and “the social” in an engineering education deemed suitable for engineering practice in an increasingly globalized professional context.

In an extension of Andrew Jamison’s historiographical work on engineering and technology and Anders Buch’s analysis of dominant discourses in the literature on engineering challenges, the workshop identified three different strategies to the integration of what has been called “social,” “contextual,” or “nontechnical” knowledge into engineering education. Each of these strategies is characterized by a distinct set of inherent normativities. Concurrently, these strategies reflect different perspectives on development related to commercial, societal, and cultural contexts, respectively. The three strategies are:

1. A business strategy

Aimed at optimizing local and national competitiveness and profit and securing economic welfare through a focus on the market system, companies’ demand for competencies, employability, management, and technical innovation. Epistemologically speaking, here nontechnical knowledge predominantly takes the form of integrating business knowledge and business disciplines into engineering curricula.

2. A professional strategy

Aimed at improving living conditions and securing social welfare through technological solutions that focus on macro-ethical responsibilities in relation to humankind and nature. Here, the emphasis rests on engineering virtues, professionalism, solutions that work, and “doing service” to humanity by enriching technological solutions. Nontechnical knowledge integration quite often takes the form of an endeavor to restructure undergraduate engineering as an academic discipline, similar to other liberal arts disciplines in the sciences, arts, and humanities. Strong emphasis is put on professional and disciplinary mastery with the goal of preparing students for lifelong learning rather than employment as an engineer immediately after graduation at the bachelor level.

3. A hybrid strategy

The point of departure for this strategy is the disintegration and proliferation of technological knowledge and the emergence of techno-science. The aim is to produce new knowledge and engage with the community. Nontechnical knowledge takes the form of (a) increased context sensitivity and a concern to increase the breadth of problem scoping in engineering and (b) integration of contextual

knowledge and understanding into engineering curricula with an emphasis on social responsibility.

These three strategies and their inherent normativities will either explicitly or implicitly, individually or in combination, make themselves heard as the backdrop of the individual chapters in this book.

We would also like to emphasize the collective character of the volume. This is reflected on two levels. First, in spite of our aim to write a scholarly book allowing participants a certain degree of freedom to pursue their research priorities, it has been a central concern for all of us that the work should present itself as a coherent and integrated whole. Second, the collective character of the book is reflected in the fact that a considerable number of the 23 chapters are coauthored, a few of them even across cultural divides.

Because the book aims to further the dialogue between engineering and philosophy by exploring ways the humanities can contribute to self-development in engineering education through the appreciation of the multiple contexts within which engineers increasingly work, academics are our primary audience. However, the book also addresses a wider audience and may actually function as a means to achieve greater self-understanding for both teachers in engineering disciplines and for practitioners. Additionally, educational policy makers, on both political and institutional levels, may find valuable material for reflection and inspiration here, insofar as different chapters provide insights into what development policy makers should know about engineering. We believe that, not least, the process of globalization compels engineering educators to rethink and to recontextualize engineering education in order to educate a better and more hybrid type of engineer. Finally, we hope the book may inspire students of engineering as well as students of the humanities and social sciences who are interested in the challenges and complexities that a rapidly changing and globalized world pose for higher education in general and for engineering education and practice in particular.

The Structure of the Book

The structure of the book reflects an effort to present the individual chapters in a logical and coherent manner. At the beginning, there is an introduction which serves to frame the contents but can also be read separately. The separate chapters are grouped into three main parts, each presented and framed by its own short introduction. An abstract and a number of keywords at the beginning of each chapter support a reading overview.

In the first part, engineering and development and dialectics of good intentions are reconsidered or questioned from both philosophical and engineering perspectives. The second is focused on engineering education. This part is devoted to a comparative analysis of American, Chinese, and European perspectives on engineering education viewed from both a synchronic and a diachronic perspectives. The third

part consists of a combination of comparative case studies of specific technologies, engineering leadership, and engineering ethics studies starting with a study of Engineers Without Borders, followed by a comparative study of socio-technical integration in research policies, scaling up to a general perspective on the relationship between engineering, nature, and society in the final two contributions.

The diversity of images and identities of the engineer, and the diversity of environments within which they work, is also reflected in the diversity of contributors. Historians, sociologists, and philosophers meet with “hard-core” electrical and mechanical engineers. Backgrounds in literature meet backgrounds in business administration and chemistry. The reader may feel the original backgrounds in the angle and style of the different chapters. The American, Chinese, and European origin of the authors may also be perceptible in the differences in the use of the English language. For the editors and other contributors, this variety of inputs was an enriching experience. It was also one of the starting premises of the project. We hope readers will feel and appreciate something of the experience we had when working together.

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