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Ethics and Morality: their Development in Professional Practice

John St. J.S. Buckeridge
Faculty of Science and Engineering, Auckland Institute of Technology, Private Bag 92006, Auckland, New Zealand

A paradigm shift in the manner in which engineers perceive themselves, and are themselves perceived, has occurred in the late twentieth century. This change reflects a move away from a profession that has been constitutionally and functionally introverted, to one that is increasingly accountable, particularly to the *wider public*. This change is seen in the modification of codes of practice, which until mid 1989 had a strong client-profession focus. The new codes incorporate both ethics and a commitment to sustainability. In New Zealand these changes followed the passing of the Resource Management Act, which requires all those who use and develop physical and natural resources to do so in a sustainable way, with adverse environmental effects of any activity being mitigated or avoided. In addition there is emphasis on the need to consider socio-cultural issues during resource development. Penalties for non-compliance are high on local standards, a feature that the cynical suggest is reflected in a revision of professional codes. The concurrent educational environment and the obstacles that have been encountered by the Environment Committee of the Institution of Professional Engineers New Zealand in implementing the new paradigm are discussed.

INTRODUCTION

Images of New Zealand are generally coloured green. This country is perceived as one of the last places in temperate climes that has been ravaged by development. Indeed, a *clean,* green image is one of the most important platforms though which New Zealand products are marketed. In light of this, one could view New Zealand as an ecological refuge, a country where land degradation following industrialisation has touched but lightly. This however, is an illusion, as the current green gazed pasture was, until the arrival of man, a dense forest of extraordinarily high endemism: particularly of plants, invertebrates and birds. This was to change with the arrival of humans, probably some time in the 13th century [1][2]. Whilst it is folly to now dream of closing *Pandora's box*, it is nonetheless important to recognise two perspectives:

- The current infrastructure in New Zealand is responsible for the high standard of living we currently enjoy. In no way can we denigrate the efforts of earlier generations for their actions. They were with few exceptions convinced that survival comprised a battle *against* nature, rather than seeing sustainable practice *within* the natural environment.
- Much of New Zealand's natural environment has been irrevocably lost, (eg 32 % of the endemic land and forest birds, and 18% of endemic seabirds have become extinct since the arrival of humans), further, there are still a number of species classified as *at risk*, eg 58% of vertebrates [3]. There is however, much we can do to preserve what remains.

CURRENT GLOBAL ISSUES

At the dawn of the 21st century, humanity is faced with two global issues of great import: environmental degradation and socio-cultural suppression. The first is a result of unregulated industrialisation, the second derived from a blending of societies in which the special and unique characters of minor cultures is lost. Ironically both issues fall within the broad realm of *engineering*; although it is primarily the first we address as professional engineers, we must also embrace significant elements of the second, which traditionally lies within that oxymoron *social engineering*. An issue of great concern at many engineering conferences I have attended over the last decade has been a need to further humanise the engineering profession, ie to drag engineering away from what is perceived as *the dark recesses of site offices and laboratories*. Mitigation of the widespread public perception that engineers are somewhat focused upon *numerical detail*, (and as such are likely to be unsympathetic to cultural and environmental issues), will almost certainly encourage a wider cross-section of the community to the profession. This has been demonstrated in areas such as environmental engineering, and now must be extended to other, more *left-brained* sectors of the profession [4].

It is important to note, however, that a number of professional engineers in New Zealand have played significant roles in helping to alleviate disease and poverty. Involvement is generally co-ordinated through charitable trusts such as *Red R* (Register of Engineers for Disaster Relief), and *Water for Survival*. These trusts are supported by the Institution of Professional Engineers New Zealand (IPENZ) through mechanisms such as worldwide web page listing, cross-referencing and conference linkage.

In Table 1 a broad overview of the gender balance and *social issues* involvement amongst professional engineers in New Zealand is provided. In many cases actual figures are not obtainable, and where this is so a best guess is provided (eg the number of engineers who are on the database for Water for Survival, and Engineers for Social Responsibility is about 1300, however it is estimated that only about 700 engineers are active contributors). It should be noted, however, that this can in no way adequately address the myriad of community service activities that engineers perform as citizens (which are generally not brought to the notice of the profession).

Although involvement of the profession in social issues (as a percentage) is not particularly high, the outcomes are nonetheless impressive. Over the last decade, Water for Survival, a voluntary organisation primarily focused on the provision of potable water and adequate sanitation, has provided assistance to 270,000 people, effecting total contributions of about NZ$ 2.36 million. Significantly, the overheads for Water for Survival are only about 1.5% of the funds contributed, a testament to the dedication of the professional engineers involved.

Engineers for Social Responsibility (ESR) was set up in 1983, essentially as an anti-nuclear group. Members soon took the opportunity to incorporate wider ethical issues into their brief, of which one of the primary objectives was *to disseminate knowledge to all sectors of the profession and the wider community about the positive* and *negative aspects of technology*. ESR were quick to see themselves as an independent, but allied, conscience for the profession, and in this manner had indirect, but useful, input into the development of the IPENZ Code of Ethics.

The Register of Engineers for Disaster Relief was set up to assist relief agencies to contact skilled engineers and technicians at times of disaster. *Red R* operates at both a national and international level, effectively facilitating volunteers to alleviate the crisis following catastrophes. They are affiliated with IPENZ as a *Technical Group*.

THE IPENZ CODE OF ETHICS

Development of a Code

Until 1989 the formal consideration of *issues ethical* within the IPENZ rules was strongly client-practitioner focused, whilst at the same time ensuring that no disrepute fell upon the Institute.

Further, considering the temporal proximity to our current politically correct environment, the language

Table 1: Broad breakdown of New Zealand engineers, showing current gender balance and involvement in areas of social responsibility. ESR/WfS/R represents Water for Survival, Engineers for Social Responsibility and *Red R* respectively. Data as at February, 1999, from Virginia Burton, (IPENZ) and John la Roche (Water for Survival, New Zealand). †Approximate figure, includes significant numbers of production engineers in industry who for various reasons have not joined IPENZ.

Professional engineers in New Zealand		
	Number	Percentage
Total engineers	15,000†	-
IPENZ members (% of total)	7623	50.8
Women in IPENZ (% of IPENZ)	283	3.7
WfS/ESR/R	900	-
WfS/ESR/R (as a % of IPENZ)	-	11.8
WfS/ESR/R (as a % of total)	-	6.0

was surprisingly *male-oriented*, ie:

> *Each member shall so conduct himself as to uphold the dignity, standing and reputation of the Institution and of the profession.*

On an international scale, the period from the mid 1970s to the late 1980s represented one of enormous attitudinal change. This change was fuelled by the sudden realisation that virtually every ecosystem on the planet was degrading. This effected a paradigm shift in how we perceive ourselves within the biosphere, beginning with legislation for environmental protection in the USA, and culminating in the 1987 Report of the World Commission on Environment and Development [5]. These were to influence New Zealand relatively late in the day, as it was not until July 1989 that an *ad hoc* committee, comprising former IPENZ presidents, the CEO of the Consumers Institute and a prominent theologian met in Wellington to review the existing Code of Practice. The outcome was a Code of Ethics, comprising 17 clauses, of which particular reference is here made to clauses 8, 12 and 15 (accentuation mine):

8. However engaged, members shall at all times recognise their responsibilities to their employer or client, others associated with their work, the *public interest* and their profession.
12. A member shall not accept from nor give to any third party anything of substantial value.
15. Members shall strive to relate their work to the *preservation or enhancement of the environment and to make effective use of available resources* of manpower, machines, materials and money.

These clauses demonstrate three key elements of this paradigm shift:

- Clear recognition of the rights of parties beyond client and the profession.
- Reinforcement of the need for engineers to adopt the *high moral ground.*
- Appreciation that the environment needs protection and that resources must not be wasted.

In addition the language was degenderised, although the concept of *sustainable practice* was yet to be formally incorporated.

Nonetheless, even with this approach in New Zealand (and similar from engineering bodies internationally), the global biotic realm showed no real recovery. Indeed, so significant and widely accepted was a recognition of unabated environmental deterioration, that in 1992 UNCED implemented Agenda 21, through which sustainable practice was urgently promoted. The World Federation of Engineering Organisations (WFEO) strongly endorsed this and began to advocate adoption of practical measures, such as cleaner production, environmental management systems, and environmental economics. It was hoped that this would force a still relatively pragmatic profession to embrace a doctrine increasingly perceived as *the New Industrial Revolution* [6]. At this time the WFEO reinforced the need to refocus engineering away from the harnessing of nature, towards resource development that acknowledged a stewardship role toward the environment [7]. An amended WFEO *mission statement* was published by IPENZ in 1993, entreating that:

> *Engineers translate into action the dreams of humanity, traditional knowledge and the concepts of science through the creative application of technology to achieve sustainable management.*

In this document, five fundamental ethical values were recognised [8]:

1. Protection of life and safeguarding people
2. Care for the environment
3. Community well-being
4. Professionalism, integrity and competence
5. Sustaining engineering knowledge

In broad terms there is only *one* real ethic here, the need for all engineers to adopt the ethic of sustainable practice immediately: to the biosphere, to clients, to the wider community and to the profession. So all encompassing is this ethic, that all other points flow from it as subsets - to ignore it is to fail on all counts.

Several drafts of a new IPENZ Code of Ethics were prepared and circulated, with a revised Code incorporating the five clauses (immediately above) being formally adopted in 1995. The order of these five clauses was the subject of some heated discussion over the following year, such that a further revision was released in August 1996. The new order (and inferred priority) became:

1. Members have a duty of care to protect life and to safeguard people.
2. Members shall undertake their duties with professionalism and integrity and shall work within the levels of their competence.
3. Members shall actively contribute to the well-being of society and, when involved in any engineering project or application of technology, shall, where appropriate, recognise the need to identify, inform

and consult affected parties.

4. Members shall be committed to the need for sustainable management of the planet's resources and seek to minimise adverse environmental impacts of their engineering works or applications of technology for both present and future generations.
5. *Members shall continue the development of their own and the profession's knowledge, skill and expertise in the art and science of engineering and technology and shall share and exchange advances for the benefit of society.*

In view of the significant recent changes in the way society perceives professionals and the rapidity with which the IPENZ Code of Practice has developed over the last decade, it is interesting to read that the 1996 Code of Ethics was published as the *final version*. With little imagination, one can at the least see *Clause 4* being expanded to include sustainable practice beyond our planet.

A SUSTAINABLE MANAGEMENT ACTION PLAN

At the 1994 annual conference, IPENZ members agreed that an Action Plan be prepared to ensure that *sustainable management* became an explicit part of all facets of IPENZ activities and culture. Later that year, the IPENZ Environment Standing Committee produced a Sustainable Management Action Plan which identified activities that should be taken at five institutional levels to promote sustainable management. These levels were the IPENZ Board, Board Committees, Technical Groups, Branches and Individual Members. The Action Plan was published as an A4 (folded A3) form, tabulating the 43 specific actions required of all the parties involved to effect sustainable management. These actions fell into five categories:

- Institution Affairs (primarily deals with the conduct of institution affairs and promotion of the sustainable management of natural and physical resources).
- Ethics (essentially a request for a new code that reflected sustainable management).
- Engineer's Education (to increase member's competency in sustainable management).
- Research and Technology (promoting development of sustainable technologies).
- Community Interaction (engineering outreach, with the aim of promoting sustainability to the wider community).

As discussed earlier, the new Code of Ethics was developed and endorsed by the profession within two years. Progress on the other activities has been less than dramatic however: a national workshop scheduled for 1998, at which an update and review of progress in the implementation of the Action Plan was to be given, was cancelled due to insufficient interest. This may be interpreted in two ways: either engineers are now confident that they are acting in a sustainable manner, or they have other more engaging priorities. What is apparent is that some of the profession, (especially civil engineering contractors), feel strong antipathy toward what they see as an inappropriate greening of engineering, resulting in impedance or prevention of future resource development.

NEW ZEALAND'S CURRENT INDUSTRIAL CLIMATE

Over the last decade, New Zealand industry has undergone significant restructuring, with most components of central and local government engineering (eg Ministry of Works) being *privatised*. The result has been a significantly more focused, *lean and hungry* industry with, in a majority of cases, a short to medium term outlook. Under these conditions, unless sustainable practice can be demonstrated to be of early economic advantage, it will not be pursued. In this environment altruism becomes a rare commodity, with a concurrent decline in ethical standards.

The challenge, for both the profession and the educators, is to promote the economic advantages of practices such as cleaner production. IPENZ has gone some way in addressing this by setting up a Centre for Sustainable Management. Inaugurated at the University of Auckland in 1996, this Centre aims to proactively inculcate sustainable practice into all aspects of engineering. It is intended that the Centre act both on a national and regional level, and through networking build up and provide a comprehensive database of economically viable, culturally acceptable and sustainable engineering case studies.

ON THE NATURE OF ETHICS

A code of ethics is derived from a set of values that are adopted by a particular society at any one time, ie they reflect contemporary morality. Moral codes in this context, however, are relative and evolve with the changing need of societies. Interestingly there are few (moral) values that are *universally* accepted by humans, including the sanctity of human life.

A source of much vexation is a notion, held by many, that ethics cannot be taught, primarily because by the time students arrive at university, their system of *val-*

ues is fixed. What we, as educators, must attempt is to provide a learning environment that will permit intelligent adults to see beyond their current intellectual boundaries. I have found the use of *systems thinking*, where the focus is on outcomes (= consequences), to be one of the most effective ways in which to approach this [9].

Systems thinking encourages a move away from the reductionist doctrine that has pervaded many aspects of engineering over the last millennium: ie it is by reducing the components of a structure to its basic elements that we previously attempted to comprehend it, explain it and then probably redesign it. The *systems thinking imperative* is the child of necessity, being nurtured by the deleterious changes to our environment. It is only by adopting a holistic approach to resource management, where we are required to assess effects of actions critically, that we will halt an increase in global entropy.

A cautionary note: today's economic climate, particularly following the 1998 Asian Crisis, has made New Zealand industry more conservative - with budgeting tight, risk taking very measured, and fewer *public good* activities. Under these conditions young engineers with commitments will find it increasingly difficult to adhere to codes of conduct, where, on the basis of technical adequacy, conscience dictates that they should withhold approval of plans that fail to meet accepted professional standards.

Closing the gender gap

Table 1 also provides an indication of the inroads that women are making in the engineering profession. Although many women enter *engineering* through non-traditional disciplines such as food technology and environmental engineering, they are severely under-represented in IPENZ, ensuring that female input and perspective into policy formulation is weak. The reasons why women have found traditional engineering unattractive has been broadly debated, the most likely answers being lack of opportunity, lack of role models and the lower appeal of what may be defined as *left-brained pragmatism*. The knowledge that women are currently embracing environmental engineering programmes may reflect:

- an opportunity to exercise (inherent?) feminine nurturing abilities to alleviate an ailing biosphere;
- a degree of egalitarianism: environmental engineering is a new discipline within engineering and has few role models, advancement is more likely to be on the basis of ability rather than gender.

A further reason why environmental engineering has such a high popularity with women is that it involves significant elements of biology and, more recently, *philosophy*. The need to integrate both of these components into the curriculum as compulsory is a direct response to legislation such as New Zealand's Resource Management Act [10] and Conservation Act [11]. Both these are of interest to ethicists in that they require practitioners to make both value and moral judgements, eg The Conservation Act uses the term *intrinsic value* in defining *conservation*, yet *intrinsic value* itself is not defined. Elsewhere in literature, *intrinsic* is often taken to mean *essential* and *belonging naturally*, these terms are however relative, and when applied to self introduced species (eg in New Zealand recent arrivals include the Welcome Swallow and Royal Spoonbill) require *value judgement* and as such become unworkable. The Resource Management Act goes further in requesting the exercise of *duty* (as opposed to making a legal edict) in the avoidance of deleterious activities. A concept of *duty* may be perceived as a moral obligation, in which case value judgements are required in the exercising of it. This is inferred (but not entirely clarified) in a subsequent *explanation* in the Act, where it states (Part III (17):2):

> *The duty referred to is not of itself enforceable against any person, and no person is liable to any other person for a breach of that duty.*

CONCLUSIONS

Our current educational environment has not effectively met its greatest challenge: that of designing an undergraduate engineering curriculum that produces graduates capable of reversing the inexorable degradation of the biosphere. We need to include sufficient *liberal arts* components in the new curriculum to enable engineers to make value judgements about the wider implications of engineering proposals. We urgently need to embark upon an international programme to ensure that *all* engineers are aware of the current environmental crisis, and, through networking and the establishment of comprehensive case studies, to provide appropriate global options for local problems [7][12]. In doing so, we must ensure that technology is increasingly viewed as a tool, rather than as a solution to technical problems [13].

An already *overfull* curriculum is perceived by many as being unable to accommodate new course(s) on issues such as ethics. Even if there was space however, any approach with a new stand-alone ethics course would be quite inappropriate as it would fail to place issues such as social responsibility within an engineering context. By ring-fencing *ethics* we would ensure failure in any attempt to humanise the undergraduate curriculum. Teachers will ultimately incorporate appropriate ethical elements within all their courses, but this will take time. In the short term it will be necessary to offer short courses through the Continuing Professional Development programmes now adopted by most professional institutions.

What is certain is that future scientists, technologists and engineers will face even greater moral dilemmas. Shadows of this are currently darkening the field of genetic engineering, where the following questions are being asked: What is the value of a human life? Does life have intrinsic value, or just utility [14]?

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BIOGRAPHY

John Buckeridge is Professor, Associate Dean, and Head of the School of Engineering in the Faculty of Science and Engineering at the Auckland Institute of Technology.

He has professional interests in environmental engineering, professional ethics, engineering education and resource management. He is a member of the Institution of Professional Engineers New Zealand Standing Committee on Engineering and Environment, and the Association for Engineering Education in South East Asia and the Pacific. His current involvement with the UNESCO International Centre for Engineering Education includes membership of both the 1999 (Auckland) and 2000 (Hobart) conference committees.

John has authored more than 100 publications and technical reports in his fields of interest. His most recent publications demonstrate a growing focus on sustainable practice and social responsibility within the engineering profession.