DOWNLOAD PDF ROLE OF ENGINEERS IN SOCIETY

Chapter 1 : The Role of Engineers in the Society - Essay

Engineers have the unique role of solving social problems through the use of machines, devices, systems, materials and processes. Engineering has an inherent impact on society that differentiates it from science.

The quality that we call "humanity" can be achieved only through social living, for man cannot live without societyâ€" the complex network of social relationships, which interconnects human beings with one another. Our society gives content, direction and meaning to our lives, we in turn, in countless ways reshape the society that we leave for the next generation. Social life, however, is not peculiar to humans and can also be found in animals â€" such as ants, bees, geese, elephants etc. However both societies are not just a chaotic collection of randomly interacting constituents. The pattern of relationships among the basic components in a social system is an essential factor of not only the human social living but also of the animals. The components provide the framework for all societies, although the precise, character of the components and the relationships among them vary from one society to another. Important components of a social structure are statuses, roles, groups and institutions. A status is a socially defined position in society. Every member of a society occupies a number of statusesâ€"such as a student, a professor, an engineer, administer, son, father, mother and so on. Broadly, a person can have two types of statuses. One, ascribed status â€" that is attached to people on grounds over which they have no control, for instance being young, old, male female etc. Two, achieved status â€" that depends to some extent on characteristics over which the individual has some control, for example become a spouse, a university graduate, a professional etc. A role is a set of expected behavior patterns, obligations and privileges attached to a particular social status. The distinction between status and role is a simple one: A university professor, for instance, is a social status. Attached to this status is a professional role, defined by social norms prescribing how the occupier of the status should behave. The status of a professor is a fixed position in a society, but a role is more flexible, for different occupants of the status actually play their roles in somewhat different ways. The status of a university professor includes one role as a teacher, one as colleague to other professors, one role as a researcher, and perhaps other roles such as writer of scholarly articles. The roles we play in life thus depend on the statuses we happen to occupy at a given lime, and the two simultaneously determine our behavior. If you are talking to your professor us a student, you will behave differently than you might when years later, you return to visit the campus as a professional. Similarly we respond to people according to the roles they play for us. Roles enable us to structure our own behavior along socially expected lines. We can anticipate the behavior of others in most situations and we can fashion our own actions accordingly. Most social behavior takes place within and among groups, which are constantly being formed and reformed. A group is a number of persons whose statuses and roles are interrelated. The distinctive characteristics of any society depend largely on the nature and activities of the groups that it contains. Groups like statuses can be classified into two main types: A primary group consists of a small number of people, who interact over a relatively long period on a direct, intimate basis. The members know one another personally and interact in a manner thai -is informal and has at least some emotional depth, for instance, family. On the contrary the secondary group consists of a number of people who interact on a relatively temporary, anonymous and impersonal basis. The members either do not know one another personally, or at best know one another only in terns of particular formal roles. Moreover, they are established to serve some specific purpose and people are generally less emotionally committed than they are to their primary groups. Examples of secondary groups are formal organizations such as corporations, political parties, or government bureaucracies etc. Every society must meet certain basic social needs, if it is to survive and provide a satisfying life for its members. For example, children must be raised and cared for important social values must be shared and upheld social order must be maintained, and so on. Each society, in order to meet these basic needs, creates patterns of thought and action that provide an appropriate solution for these recurrent challenges. These patterns of behavior are what we call institutions. Put another way, an institution is a stable cluster of values, norms, statuses, roles, and groups that develops around a basic social need. Thus the family institution provides for the care of children. The educational institution transmits cultural knowledge to

the young. The political institution allocates power and maintains order. Within very broad limits, "human nature" is what we make of it, and what we make of it depends largely on the culture in which we live. Unlike animals, we human beings are not born with rigid, complex, behavior patterns, that enable us to survive in specific habitats, we in fact learn and invent means of adopting physical and social environment. This learned and shared behavior is what we call culture. More explicitly speaking, Culture is the social heritage i. The term Civilization on the other hand refers to the utilitarian order of things. In other words, civilization is the material culture i. While Culture is the realm of values, of styles, of emotional attachment, of intellectual adventures, all things pertaining to non-material phenomena. It is a whole, the round of life in its entire sweep that comprises both the non-material and material objects of human living. We create our culture, but culture in turn creates us. We make our own social environment, inventing, and sharing the rules and patterns of behavior that shape our lives, and we use our learned knowledge to modify the natural environment. Our shared culture is what makes social life possible. Culture frees us from reliance on the slow, random, accidental process of physical evolution, by offering us a flexible and efficient means of adopting to changing conditions. Culture also provides a system of social control â€" a set of means of ensuring that people generally behave in expected and approved ways. It is a social process by which the individual is made group responsive, and by which social organization is built and maintained. Social control comprises two types of patterns of control, i. The informal sources of social control are values and social norms. Values are socially shared ideas about what is good, right and desirable. They are abstract general concepts, which originate in the social structure and culture. People while living in society, experience various facts in life. On the basis of collective living they develop customs, rituals and conventions. This customary behavior provides experiences of good things and ideas to the people. It is these collective experiences of good that we call- values. Social norms on the other hand, are shared rules or guidelines that prescribe the behavior appropriate in a given situation. They define how people ought to behave under particular circumstances in a particular society. Values influence the content of norms, where as norms safeguards values. For instance, if a society values education highly, its norms will make provisions for mass schooling. Values are hard customs of society, a part of the routine behavior and hence the core of culture. However both values and social norms vary from society to society and culture to culture. Speaking of the human society as a whole, human conscious does upheld certain values as uniform and universal â€" such as justice, honesty, truthfulness, compassion etc. Values and social norms ensure that social life proceeds smoothly, as they give us guidelines for our own behavior and reliable expectations for the behavior of others. That is why they are called shared expectations of the group members. Norms are classified into two types, folkways and mores.

Chapter 2 : The ever-growing importance of engineering in society

Engineers have the further role to put people to work as each working engineer provides employment for 85 other people in allied trades. Engineers are responsible for dams, bridges, roadways, building safety, architecture, and many elements of agriculture.

Nothing is emotional, accidental, playful, by chance, by the way, by the mood. Had the laws of Nature been changing, there would have been no science, no material progress of human being. Nothing in the least is immature, uncalculated, irresponsible, half baked, insecure or unwise. He is the Allah, the Creator, the Shaper out of naught, the fashioner. The then Governor Mr. Nehru gave at home at Rajbhavan to all the participant doctors. Of all the life on this planet, the man is the Supreme Creation of the Lord. He is a vicegerent â€" a Khalifa. The Angels acknowledged this. Man has many qualities which are latent or which he may wish to suppress or conceal, to his own detriment. Again knowledge is already existing, we only explore it to claim to be scholars, scientists, doctors, engineers etc. Thus it is clear that man is just the custodian of Earth. On the contrary whatever is in or around the Earth, it is for the service of man. However the status of man as inheritor of the Earth belongs only to him, who is righteous, the keeper of the law, the self controlled one. The evil-doers cannot in reality over possess the Earth or have power over it. Amongst the vicegerents khalifas i. While Allah creates, fashions things out of nothing. He has to say: Thus he has to prove worthy of the charge of a deputy khalifa bestowed upon him. The Engineer is a professional, trained to create engineered systems for the benefit of mankind. Try to think of it for a while. The list is unending. Thus engineer has a role not only to benefit the society but also in the designing of the society itself. Engineers, by the very nature of their work, have a responsibility to society. I had an opportunity to attend the 20th. Indian Engineering Congress in Kolkata in last December, where besides other things it was stressed in the presidential address by Prof Dr S. The GDP is low. Small scale industries are few. Handicrafts are growing at a low pace. Though tourism is a potential industry, yet income from it is still marginal. Health services are inadequate. Weaker sections of the population are not empowered. To add to all this, the last 16 years have been catastrophic. The state is however well placed on the resources side. Hydropower is still less exploited source. Silk production of quality is below potential limits. Scientific Horticulture is still in infancy. Thus there is unlimited scope for innovation in engineering to help new unique enterprises. Engineers have the capability of making a difference to socio-economic development in a big way. They must help improve productivity, which is very poor at present. Engineers must help people in making more skilled persons. There is no other way. Nietzshe the famous philosopher says: There is more wisdom in the making of an ant than what all the libraries of the world can tell. Alexix Carrol â€" Nobel prize winner in philosophy asserts that: With will to truth it stands or falls.

Chapter 3 : Professional Responsibility: The Role of Engineering in Society

Role of Engineers Engineering in Environmental and Technological Contexts â€¢ Engineers are designers who use scientific principles to optimize their design. â€¢ Engineers can use systematic, objective engineering analysis and design techniques.

The Social Function of Engineering: But what is the nature of that activity? How well does engineering carry out that role? These questions are being asked with increasing urgency by a society that has benefited from great advances in technology, and at the same time, seen dislocations and experienced fears associated with technologyâ€"a society that has become increasingly dependent on technology, but also increasingly ambivalent about it. Often the questions about technology are confused with questions about engineering in the mind of the public despite a growing literature on the relation of technology to the rest of society. Social scientists and philosophers who have studied the technological process have achieved a considerable level of sophistication. However, because of a lack of dialogue with engineers, they too have tended to offer an idealized view of the technological process Bijker et al. Engineering as a Social Enterprise. The National Academies Press. The situation is quite different in the sciences. Scientists have written prolifically and in depth about the social role and impact of their activities. Nothing written by engineers is analogous to J. For instance, could we have anticipated that the automobile would turn out to be a severe source of pollution as well as a powerful instrument of urban change, that radios in every household would catalyze the political emancipation of women, or that television would influence our values and contribute to functional illiteracy? Could we have anticipated that a broader base of affluence brought about by technology in the nations of the West would be accompanied by the rise of anomie and a drug culture among not only the poor and the disenfranchised, but also the more affluent who have in many material ways benefited the most from technology? For example, a gap that exists sometime between the perceptions of the engineers and those of the rest of society can be seen in educational technology. Engineers have tended to focus on the development of new technologies rather than the social setting â€"municipal bureaucracies, school systems, and homesâ€"in which that technology is to become acceptable if it is to be successful NAE, Part of the difficulty engineers encounter in dealing with social issues has to do with too many definitions of engineering and the lack of agreed upon and shared tenets. The kind of definitions that later and to this day seem to have become accepted by many engineers center on the application of science to human welfare. Definitions of this kind fall wide of the mark by remaining too vague about the definition of human welfare and the role of engineering in it. They overlook the essential nature of engineering as a human activity to modify nature a clear distinction between science and engineering. Furthermore, such definitions are not accompanied by a widely shared set of principles that parallel in power and simplicity the verifiable truth of the scientist, although there have been recent efforts to explore key concepts common to all engineering disciplines see, among others, Bugliarello, b. An important point in looking at the social function of engineering is how society makes engineering possible. A complex feedback situation emerges. The artifacts extend the power and reach of society and the individual. Society, in turn, through its organizations and demands, makes possible the development of complex artifacts and stimulates their constant technical evolution and diffusion. Today, to talk about the impact of engineering on society is meaningless without also talking about the impact of society on engineering, and how it shapes the role of engineering. The complexity of the interactions between society and engineering is at the root of unrealistic expectations about engineering, as social entities are often inadequately organized to develop and use engineering effectively. It is also at the root of the frustration of engineers unable to bring their capabilities to bear on the solution of social problems or the effective organization of the engineering enterprise. Most people who study engineering in the United States have higher mathematics skills than verbal and social ones. This limits their involvement in politics and their success in communicating with the rest of society. Society, in turn, often views the engineer as a narrow, conservative, numbers-driven person, insensitive to subtle societal issues. The systematic study of sociotechnical problems is rarely included in the engineering curricula as an important sphere of engineering activity. The curriculum focuses on man-made artifacts to the exclusion,

except for specialized cases, of biological systems and organisms. This narrow focus has kept engineering away from not only a rich source of inspiration for specific technical feats and lessons offered by systems of great subtlety and complexity, but also a deeper understanding of environmental change. Most high school students today do not view an engineering education as a path to success and prestige worthy of the sacrifices of a rigorous curriculum. Page 76 Share Cite Suggested Citation: Even bright young engineering students, upon graduation, switch to careers in business management, law, and medicine. On the other hand, engineering continues to be a powerful instrument for social mobility and advancement for immigrants and the poor. This situation accentuates the perceived social gap between engineers and other professions in society. It is further reinforced by massive layoffs in defense industries and practices in the construction business that treat engineers more as commodities than as professionals Jacobs, In different societies engineering provides most of the same artifacts: There are societies where engineers carry out broader functions by virtue of the position they hold. In several European and developing countries, they head state organizations and major industry conglomerates, participate in government, and enjoy high social prestige. By contrast, engineers in the United States are absent from major positions of societal leadership, and only a handful serve in Congress, as governors, or at the cabinet level. In the United States the number of engineers per capita is roughly half that of Japan. The situation needs to be addressed not only in terms of supply and demand of engineers, but also in terms of the basic structure and direction of the country. In so doing, we must be mindful of historical precedents of declineâ€"like Rome of the third and fourth centuries or the Ottoman Empire of the seventeenth centuryâ€"which some historians believe started with a decline of interest in technology de Camp, ; Kinross, Some of these factors are now receiving attention in the literature out of a concern about engineering ethics Layton, ; Unger, Social Responsibility The burning question for engineering in extending the outreach of society is: What is responsible outreach? The answer is perhaps best given in evolutionary terms. Man-made artifacts, albeit extensions of our body, have not evolved through the gradual process that has shaped man and other biological species. Thus, we constantly face the question of whether the technology we develop enhances the long-range survival of our species. Because assessing how well engineering carries out its social function lacks the ultimate test of the crucible Page 77 Share Cite Suggested Citation: In the following paragraphs, I offer five guiding principles, some of which are already deeply embedded in the conscience of engineers. Uphold the dignity of man. The dignity of man is an imponderable in terms of a clear evolutionary meaning. However, it is a fundamental value of our society that never should be violated by an engineering design. This happens when the design or operation of a technological product a building, a machine, a procedure fails to recognize the importance of individuality, privacy, diversity, and aesthetics and is based on a stereotyped view of a human being. Avoid dangerous or uncontrolled side effects and by-products. The challenge to engineering is how to fulfill its social purpose in ways that either control side effects and by-products or make them more easily foreseeable. This demands a rigorous preliminary examination of how to solve a problem and achieve a given social purpose. The problem is complicated beyond measure by the multitude of pressures leading to the development of a design or a technology â€"be they political, economic, popular, or intrinsically technological. These pressures can lead to unwise outcomes beyond the ability of engineering to solve, for example, the deferral of municipal maintenance due to constrained budgets or the abandonment of nuclear power plants in some Western countries. Make provisions for consequence when technology fails. The importance of making provisions for the consequences of failure is self-evident, especially in those systems that are complex, pervasive, and place us at great risk if they fail. A simple example is the failure of an air-conditioning system in a closed ventilation system, as occurred tragically in at Mecca, with the loss of over a thousand lives Newsweek, A more complex example is the space shuttle. Because it is the sole vehicle for a multitude of space tasks, any of its failures sets back our position in space. Avoid buttressing social systems that perform poorly and should be replaced. This runs much against the grain of most engineers. Thanks to a multitude of technological and engineering fixes Weinberg, , our society often avoids rethinking fundamental social issues and organization. However, short-run technological fixes can put us at much greater risk in the long term. In the case of energy, for instance, technological or commercial fixes cannot mask the need to rethink globally the impact of consumerism and the interrelationship of energy,

environment, and economic development. At present the engineering profession is poorly equipped to do so both in this country and elsewhere. Few engineers, for instance, have been involved in developing a philosophy of technologyâ€”as distinct from that of scienceâ€”and in teaching the subject in engineering schools. This separation of engineering and philosophy affects our entire society. Engineers, in shaping our future, need to be guided by a clearer Page 78 Share Cite Suggested Citation: The great social challenges we face require a rethinking of the human-artifact-society interrelationship and the options it offers us to carry out a growing number of social functions using quasi-intelligent artifacts to instruct, manufacture, inspect, control, and so on. Social Purpose How well does engineering fulfill it social purpose? This apparently simple question presents several problems. Which social group are engineers trying to satisfy? Is it a family, a tribe, a company, a municipality, a nation, or a supernational global entity? It is clear that different groups have different technological needs and expectations, and that if engineering satisfies some groups, it may not satisfy others. What about the needs of the engineers themselves as a social group? A technology that does not respond to the interests of other social groups but serves exclusively its own purposes evinces concerns about autonomous or runaway technology Winner, The term satisfaction lacks a rigorous definition necessary to describe an engineering response to a particular social need. The dimensions of a social group are a particularly important factor. In the case of small social groups resources are generally too limited to develop anything but the simplest technologies. Even the wealthiest of families today could not, even if they wished it, mount a manned exploration of space. With this comes the associated danger of alienation from technology or of resentment spurred by limited participation and ignorance. At a national and global scale, there is a similar lack of powerful supranational organizations to mobilize and control technological resources. Hence, the danger of global environmental damage continues. Today, intermediate-size organizationsâ€”corporations and governmental bodiesâ€”are most effective in mobilizing technology in response to their needs. An important determinant of how well engineering satisfies its social Page 79 Share Cite Suggested Citation: Engineering today continues overwhelmingly to focus on inanimate artifacts or machines, just as engineering school curricula worldwide continue to bypass sociotechnological integrations like the biomachineâ€”the ever-growing interaction and interpenetration of biological and machine systems. The factory environment so single-mindedly rationalized by the engineer F. Taylor overlooked the effective integration of the workerâ€”the biological unitâ€”and the machine in the production process. This is so almost everywhere in the world, with the notable exception of Japan, where a different social ethos has produced a more effective integration.

Chapter 4 : Role Of Engineers In Society Essays

THE ROLE OF ENGINEERS IN THE SOCIETY By OHANENYE JOSHUA NDUBUISI MOBILE: + EMAIL: joshuzzles06@www.nxgvision.com NIGERIAN SOCIETY OF ENGINEERS, Mandatory Continuing Education Workshop (13th - 15th March) An Engineer is defined as a person whose job involves thinking out a problem and providing solution in advance.

By investing in their infrastructure, these countries provide a lasting incentive for their economies, and maintain a solid basis for future sustainable growth. There are, however, a number of critical obstacles that are standing in the way, the most important being the global lack of skill within varying fields of engineering. It is certainly not a new message, but it is one of growing importance: Their knowledge and skill are in demand across virtually every sector , from forestry to finance and everything in between. The demands of modern society require us to continually interact with our surrounding environment; to harvest and exact what we need to sustain life and develop human empires. It is, however, the role of the Engineer to minimise the effects of damage to our ecosystems, and design necessary infrastructures that are efficient as well as safe. They may fall into a technical role, which immerses them in the realm of mathematics, physics and science, or a more managerial role that could lead them to focus on communications, report writing, finance, negotiations and the development of people. But whichever way you look at it, all these occupations are motivated by human need and sustainability. Their only contact with something that they think is Engineering is when they have someone repair their domestic equipment, and the media adds to this ignorance by talking about Engineers clearing trees from railway lines. Until people are helped to understand that professional Engineers are responsible for everything that is made and I realise this can be good or bad , we will lose our best young people to other subjects and callings. What would modern life be without devices, computer software, complex mathematics, heavy-duty vehicles and scientific programmes? How could we ever fully appreciate aesthetics without the stunning architectural designs that grace cities all over the world; the Taj Mahal, Ferdinand Cheval Palace and even the Great Pyramids- Engineered by our Egyptian ancestors millennia ago. Imagine a society without any buildings at all, let alone the beautiful ones. These are all highly specialised fields that simply distil basic concepts, but they have gone on to serve as the fuel of civilisation itself. Imagine no cities, no roads, no airports or any other kind of transportation network. What if there were no environmental laws, no operations to clean-up hazardous waste and no measures in place to avoid environmental issues- these are all crucial disciplines in the field of Engineering, and yet, they only scratch the surface. If Engineering did not exist, and the world was not blessed with highly skilful Engineers, infrastructure would be an alien concept as there would be no roads, and also no vehicles to travel on them. It would be impossible to build any structure more complex than a hut. Any device, machine or even process you can think of that makes our lives even a little easier would be gone, along with civilisation, as we have come to know it. Carleton University A world without the skilled people that fill these job roles is one that has broken down. To remove Engineering would degenerate humanity back to the most basic innovation; we would never have discovered the wheel, been able to hunt or forge the Seven Wonders of the World. A world without Engineering would be a world without humanity , as it is our ability to design and to create that sets us apart from the rest of the natural world. It is our duty to ensure that there are enough skilled people to meet the future demand. If you are interested in a career in engineering, the best way to give yourself a helping hand into the industry is through a high quality education. Read on for more information on some of the leading institutions offering world-standard engineering programs: The University is particularly known for its excellence in research and teaching, for innovation, and for its strong links with business and industry. The breadth of engineering topics offered, the active research culture, established links with business and industry, and access to the latest technologies ensure that graduates are equipped to meet the challenges they will face in modern industry or in further studies. The University puts students at the heart of everything it does, giving them the best possible opportunity for success in the future. The institute is rated as world-standard for research, employability of its students, teaching, facilities, innovation and inclusiveness, representing a

fantastic choice for students throughout the world. Students are prepared for success within their professional fields and are given the skills and knowledge to be able to contribute meaningfully to improving society within Korea and the wider world. At undergraduate level first degree , you can specialise in Aerospace, Communications, Electronic, Mechanical, Software or General Engineering. With each type of course, you are given the opportunity of working for a year in industry or studying abroad between the second and third years of study. A The Florida Institute of Technology provides high-quality education to a culturally diverse student body seeking higher education opportunities. The university encourages students to serve within their local community and prepares them for entrance into the global workforce. It is globally renowned for its outstanding academic programmes, excellent faculty and its alumni success. La Trobe has recently launched a new Bachelor of Engineering course that includes the option of a six-month industry placement. By working with industry, La Trobe has developed a degree that addresses the growing complexity of the engineering profession. As new industries and technologies emerge, engineers are expected to be able to work internationally and across traditional engineering disciplines. The new multidisciplinary Bachelor of Engineering Honours at La Trobe prepares students to design sustainable and creative solutions to these complex, technical problems. Read the full profileâ€¦ Read Full Article.

Chapter 5 : Engineering in Society | The National Academies Press

The Role of Engineering in Society: Engineering Design Some will say that I'm an academic and that I'm supposed to be a scientist, but I have this craving to be an engineer. Waldron (12).

Professional engineers must lead and drive strategic innovation and change at the societal level across many domains: But for this to happen we must transform the role of the engineer in society and our expectations of their role. First define innovation Innovation happens at many levels: Not all innovation is good for society; there is destructive innovation â€" this is why engineers need a deep ethical and reflective dimension. Innovation and technological change are a combination of technology, social and cultural dimensions â€" they are inseparable. Technology development and implementation is a social activity Engineering work is clearly a social and political activity, although this has been ignored in engineering education. There is never just one possible design: A goal may be reached by adapting many different paths, some of which are better than others but none of which is in all respects the best way. Engineers must learn to deal with this ambiguity and the vested interests at the societal level. The public image of engineers and engineering is poor in some countries and very high in others â€" how about combining the best governance models from each. As a result of the past emphasis on technical skills and the consequent neglect by engineers of the social and environmental dimensions of their work, the image and status of the engineering profession is declining as the public identifies engineers with controversial and environmentally damaging technologies. Selection and recruitment of engineers tied to poor image Whatever the reasons, the poor image of engineering has consequences that go beyond the egos of engineers. The historical reasons for a technical focus are driven by status â€" but it has a big downside. Engineers have long been unhappy with their status in society â€" especially severe in the UK â€" at least for the past 50 years. There has been no significant improvement, with endless government petitions that go nowhere. They feel that they do not receive the social respect and financial rewards that people in other professions do, for example law, medicine, accounting, and management consulting. Practising engineers and professional engineering institutions and societies have traditionally been seen as emphasising science and mathematics as a means of gaining status. But this focus on science and even gaining a MBA still leaves a big gap in humanities and in strategic thinking. Engineers for the most part are poor communicators â€" poor at rhetoric and debate at the societal level when complex vested interests are part of the equationâ€" an MBA is not enough. It has been designed and built to serve for the most part a capitalist model. Granted, courses have been developed in sustainability and so on in recent years. Conclusion We need a new kind of engineer â€" rebranded with new societal expectations. Engineers are now keen to throw off the image of having a narrow technical focus and disinterest in how society works. Increasingly raising the status of engineering and the employability of engineers is seen to be dependent on fostering a broadened outlook. The role of the engineer: Way forward Engineering is an evolving profession that must adapt to suit its context and the needs of the community but the current context and expectation is far too narrow. This requires the top tier professional engineers to move beyond the current functional disciplines to a new holistic governance model, a broader more integrative education model, and a redefinition of the symbiotic relationship between the engineer, the enterprise and the greater society. And law must underpin this new model. Without law it lacks traction. Professional engineers must lead and drive strategic innovation and change at the societal

Chapter 6 : Enabling innovation â€“ the role of the engineer in society - The Engineers Journal

The natural role of engineers consists in solving the real-world problems of society. To resolve the basic needs by attempting to produce practical tools to enhance the life in the world, through the use of laid down scientific theories and laws.

Introduction A call was made by Prince Charles in his sustainability lecture NCE, to revisit the definition of civil engineering especially as he saw the profession playing a crucial role in tackling future challenges such as climate change. It is now timely for professional civil engineers to not be afraid to say what they really think to government, clients and employers. The Profession firstly serves mankind and everything we do needs to take a global perspective. However, personal fears may be inhibiting an ethical stance for many. In this the individual needs to subscribe to the corporate ethic, i. All professionals should regularly consider the ethics of their position and the work they are involved in Fan, Professional challenges, disagreements, dichotomies and dilemmas are inevitable and taking an ethical view can help inform decision-making and be the source of technological development rather than a constraint van den Hoven et al, Nowadays the two most important of these boundaries are: In the working context, the professional, however engaged, has a duty to comply with the ethical and conduct standards set by the Institution ICE, ; and have regard for the wider standards expected notably by the Engineering Council. There is a third boundary, that related to the information made available to the client and how it may be constrained or presented in a particular way and to whom. In an open system the information about the scheme, both locally and in a wider context would be made available to the paying client and to society as a whole. This can lead to decision making that is sometimes misguided where the form and amounts of information provided have not been the most appropriate. This is illustrated by the use of sewer flow and quality models to decide upon large investments in cleaning up polluting discharges into the environment. In England, consultants, regulators and sewerage undertakers rarely if ever acknowledge these uncertainties, which with a changing climate can only become greater in the future Schellart et al, There is a general need to reframe how such uncertainties are handled and presented professionally if they are to be coped with appropriately in terms of the big challenges ahead Brugnach et al, At times this may mean that the needs of the employer, where the professional is employed by a private or public organization, have to be subordinated in the best interests of the client. A professional in such a position has to try to ensure that the immediate client their employer and the project client are both served well by their work as a professional. Ideally this should also serve the needs of society. Especially as many historical civil engineering projects had been deleterious to the environment, using up precious non-renewable resources, and creating climate changing wastes: The Engineering Council, in their inter-institutional guidance on sustainability Bogle, re-emphasise the ethical dimension to engineering endeavours and state six principles engineers should: For example, b includes requirements for the engineer to: Unfortunately, for many civil engineering employees especially in large organisations, their ability to apply these principles is defined by their employer, who may also be a public body, rather than the wider world or their own understanding of professional ethics. The art of corporate social responsibility may or may not serve the same principles as the professional civil engineer, as employer organisations in themselves serve many masters, not least shareholders Barry, There can be major tensions as a result of the need to balance professional activities between the various boundaries constraining, yet at the same time opening up, the range of activities within which civil engineering endeavours are carried out â€” e. Yet, it seems that civil engineers are mostly able to balance their activities successfully avoiding transgressions of the codes of ethics and professional conduct, especially where the professional is working for a large organisation. McGowan reported that the majority of those found guilty of professional misconduct by the Professional Conduct Panel of ICE were either individual practitioners or part of a small consultancy and that the misdemeanours concerned inadequate client communication or not keeping up to date as regards practice. The ethical challenge Engineers have long been proud that they do what anyone can, but they do it better, more efficiently and more cost-effectively. Self-evidently the works done by our forebears almost always benefitted mankind,

in the widest sense as well as benefiting the immediate client the one who paid. Maximising the benefits and solving problems seem to be good definitions of what civil engineers actually do. Nowadays, perhaps more than in the recent past, the multiplicity of professions involved in infrastructure and the built environment requires a new way of collaborating and even a new type of engineer. The current problems and opportunities that go with this require a move away from the traditional engineering reductionism of complex phenomena into simple constituent elements in order for society to apply traditional engineering skills to find practical solutions to problems in nature such as climate change. Recognising the importance of the interface between nature and society has never been more important than it is now and recent ideas and guidance about ecosystem services are helping with this e. The new, or perhaps restated, boundaries to engineering need to help professionals move away from the traditional engineering technocratic perspective in order to include a wider range of knowledge, especially concerning societal values and interests Naustdalislid, Now, minimisation of the use of resources is essential as is reduction of emissions of any sort. Such moves also require the embracement of the wider principles of engineering ethics to ensure societal and environmental needs are fully met. Is it for example, enough to devise solutions to problems that do not ensure that as wide as possible benefits and opportunities for society and the environment are embraced, if that is what the client wants? The presence of compelling legislation or regulations should not constrain the professional engineer from doing things differently, c in the introduction although concerns about innovations and their efficacy can rightly inhibit recklessness f in the introduction. The perceived sustainability of organisations themselves can constrain innovation and the use of wider boundaries in engineering. When moving from one regime to the next in terms of innovations in practice, it is not sufficient just to challenge the technological paradigms; the institutions and the governance arrangements that deliver the supplanted practices are also likely to need to be changed as well Brown et al, Recent examples of potential complaints about unprofessional practices include concerns about over-engineering of the completed A46 Newark to Widmerpool improvement Greenwood, and the proposed New Wear Bridge in Sunderland Wynne, and the viability and advisability of the proposed HS2 rail link The Economist, For every concerned correspondent there are invariably a number of supporters of these schemes. While there will always be professional disagreements about the best option to fulfil a particular societal need, it is the ethical duty of all professionals to provide advice and information that is impartial, well-balanced and using the best available knowledge. With the advent of the new National Planning Policy Framework in England, the streamlining of the planning process is likely to result in fewer challenges to big schemes an intention of DCLG , seemingly contrary to the promotion of localism through the Localism Act Should professional engineers then simply press on with designing the best scheme for a client where there are clear flaws in the original definition of the needs and requirements? Taking a societal stance, perhaps the original definitions need to be reconsidered and an alternative approach developed to fulfil the original need. Elsewhere in the world, a green infrastructure approach is being taken wherever possible e. Achieving this was not easy for the professionals concerned CDM Smith consultants who had to fight many battles over more than 5 years to make the regulators and fellow professionals understand the potential value of taking a green infrastructure approach through retrofitting across the city. This required significant resourcing and commitment at the highest level in the City of Philadelphia Maimone, In the London Plan GLA, , the Mayor wants to make the city one of the greenest in the world, yet has failed to make the connection between continuing to drain the city as it has always been drained by building the new sewer tunnels to take the runoff, and the need for stormwater to be used on the surface to irrigate the new green city especially at a time of water stress Gard, Greening is not the only opportunity in London provided by surface water. Blue-green cities where water is evident help to cope with climate change and provide a wealth of water-related multiple benefits including place making and quality of life Digman et al, They do when addressing a single problem, but at what costs? We also know about the need to maximise value to society in everything a civil engineer does â€" surface water can provide significant added value and schemes that address only single problems as the London sewer tunnels do are no longer affordable. Any competent professional should be aware of this. In many ways the proposals are an example of the classical approach to civil engineering challenges seen as a problem. There is a single problem, the solution to which is to construct

new tunnels, mainly beneath the river bed, to store excess overflow spills, which will then be pumped back up for treatment. Since the great public health revolution in the mid s, where the key building blocks of public health engineering were laid down, much knowledge about urban drainage has been developed and the use of computers has facilitated more detailed analysis than ever before of the performance of systems e. At the same time as confidence has risen regarding the ability to estimate rainfall, the way in which urban hydrology functions and the potential polluting impacts on receiving waters of urban runoff, emerging ideas have come to regard all forms of water as potentially beneficial, especially where climate or weather variability is threatening supply security e. The growing knowledge about climate change is clear that whilst there may have been a period in history where predictions of the performance of urban drainage systems could be made with some certainty, this no longer pertains and past records are scant indications of how rainfall and runoff will behave in the future Milly et al, Therefore professionals are faced with chronic and significant uncertainties about the future and the way in which any new infrastructure will perform, just at a time when computer models appear to provide some certainty. There has never been a more significant period in history where the uncertainty of analysis and the building in of adaptive flexibility into infrastructure has been more important Gersonius et al, The difference today is that there is very little time and opportunity to act to avert the coming impacts from climate change as stated by Prince Charles and yet engineers and other professionals are failing to change the practices fast enough that are known to exacerbate climate change and which fail to provide the resilience required to reduce future vulnerabilities in society Naustdalslid, ; Gersonius et al, Despite this, no carbon footprint or carbon impact assessment for either the operation of the tunnels nor for the construction has been undertaken or even required by the client or by the overseeing department, Defra. This raises the question for London: For the tunnel, it is too much stormwater overflowing from the sewerage system; whereas for the desalination plant it is not enough water? Why not utilise the stormwater near source to solve both problems as advocated around the world Centre for Water Sensitive Cities, ? Ironically the new tunnel will have no benefit for the increasing flood risk within London and this will require additional measures; proposed by Thames Water TW as yet more large sewers, despite the recognition by others that new sewers are no longer the answer to this problem Pitt, ; Ofwat, It is not only engineers who are faced with potentially conflicting loyalties and interests, environmentalists in particular have held significant sway over the constraints within which engineers have had to operate for many years. Recently the anthropogenic benefits accruing from environmental goods and services known as ecosystem services have been acknowledged and, via a monetisation approach are being used in benefit-cost evaluations Everard, Nonetheless, environmental scientists are also implicated in failing to take due account of the trade-offs between one environmental improvement and another consequent impact e. Often the activities of the former in addressing single issue environmental protection policies lead to impacts in terms of adding to the climate change problem. The Tideway sewer tunnel is an example of this. The Environment Agency set the standards and targets for compliance with the Urban Wastewater Treatment Directive for the proposed sewer tunnels in London. Questioning of the EA and Thames Water regarding the wider energy use and carbon impacts of the tunnel solution went unanswered. At no time were the marginal benefits of collecting spills from many of the overflows compared with the high consequent increase in overall scheme costs. Nor were the considerable modeling uncertainties made clear and linked to the benefit-costs of the scheme. In fact the EA used an internal verification process to confirm the way in which the final decisions as to which CSOs needed to be connected into the tunnels, rather than an independent and publically verifiable process. Therefore, marginal aquatic environmental benefits obtained by connecting certain overflows are now being implemented at great expense and have been decided based on imprecise computational models, with no attempt to illustrate to decision makers the uncertainties and marginality of the value of doing this. As a result, high energy and carbon in use and embodied in the construction are adding to the drivers of climate change. Being a professional implies responsibility for conduct that extends beyond purely self-interest and beyond the interests of the employer when necessary and beyond the requirements of legislation or regulation Fan, In New Orleans, post-Katrina, the US Army Corps of Engineers are rebuilding the defences much as before the disaster as there are limited options available within the regulatory system Jonkman et al, Such an approach is

hardly an ethical or professional one and it is arguable that any professional in such a role is no longer a professional, but rather functioning as a technician Schon, It is the duty of a professional to push the boundaries; to attempt what has not been tried before unless there is an unacceptable risk in a particular course of action. Even Ofwat is calling for greater innovation by the water and sewerage companies in England and Wales Ofwat, , although whether such innovation is envisaged as going beyond competition exhortations is doubtful. These established frames taken for granted common-sense are often difficult to reflect on and they define what is normal, reasonable, feasible and justifiable in practice. Hence this makes it difficult for individuals to make sense of complex cases and the action required in the novel ways required to deliver sustainability or at least resilience. Of course the use of SuDS, the associated costs and uncertainties, the disruption and finally the staged benefits of gradual implementation are all difficult to quantify Ashley et al, But evidence from many other parts of the world shows that it does work and can bring major enhancements to the urban environment Thurston, Simple comparators of costs for the mono-problem solution, showing that conventional sewer storage is cheaper than the limited SuDS options investigated Thames Water, fail to take into account the full range of additional benefits from the latter approach. These benefits will mainly accrue to society as a whole and will take at least years to come about. A period during which the gradual introduction of SuDS can be tested and techniques improved. The latest expectation for completion of the tunnels follows a similar timescale and delivers no benefits during the period, only the disbenefits of construction disruption. Following such a course also commits society to using the tunnels in some 20 years time and beyond, when it may be prohibitively expensive or climate impacting to require such high energy use. At a time of economic stringency it is inevitable that a number of professional engineers will find themselves working as technicians, unable to practice to the breadth and scope of their calling, and carrying out duties that lead to solutions to problems that are not as sustainable as they might be. In a second paper, addressing the future of the ICE Foulkes, describes the Institution as highly traditional and that radically new thinking is demanded to keep up with the demands of the competitive world; necessitating changes that many members will not be comfortable with. In an increasingly demanding society, members and the Institution itself will need to be confident in their ethical and moral positions if they are to truly help society into a sustainable future. Land use and retrofit options. Review of Current Knowledge. Sept Issue ES3 paper

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Engineering needs to be understood in the context of its role in society, and your role as an engineer has to be understood in the context of your work within a company, and ultimately within society.

Marketing; and Health sectors. These are used to automate agricultural processes, such as harvesting, fruit picking, ploughing, soil maintenance, weeding, planting, irrigation, etc. Source Agricultural Sector Agriculture simply put is the cultivation of crops and rearing of animals. This definition is as related to agricultural science. Due to the advancement in the agricultural practice, agriculture has developed a strong link with the field of engineering. It is because of the magnitude of this link that leads to the creation of agricultural engineering, which is among the branches of engineering. This engineering branch takes care of agricultural related affairs. This importance added by engineering has really promoted the practice of agriculture all over the world. There are specific kinds of fertilizers for specific kinds of crops. These fertilizers in most cases are products of chemical engineers. They look into the chemical constituents of the manure and used the result generated from the scientists to know which will have good effects on crops and go into their productions. In the dry season, there is no rainfall, yet agricultural products are being supplied to markets where they are being sold to the consumers. Drilling engineers are among the people that make those products available as through the work they do generate water from beneath the ground. It is the water that is used to keep the crops growing through the irrigation system. Banking Sector Sometimes people argue on why engineers should be found in any bank. They do say that none of them suppose to be there because there is a big difference between the two disciplines. The fact remains that engineering is a course of men who can withstand pressure and a great test. Because of this, bank sometimes chooses graduates from this discipline to work with. That is why some engineers are found in the marketing department of various banks today. Banks are interested in who will give them what they want and not just who studied their related course in the tertiary institution. Engineering plays fundamental roles in banking institutions of various societies. In a bank, there are many engineers that engineer the affairs of the banking activities. Without these engineers, the banks will not function effectively. Banks are advancing on a yearly basis and they have been demanding the services of the engineers especially Software and Networking Engineers to make the advancement unique. Engineering in banks has added a lot to the quality of services that banks render to their customers. Let us start with the one every bank customer is aware of before going deep in the other area of the banking activities. Gone are days when bank cashiers count money with the manual process using their fingers. Today, the money is being counted within few seconds by money counting machines. Who manufactured those counting machines used in the banks for counting of money? The answer is nobody else than the engineers. That is to say that the money counting machine would not have been in existence if not because of the engineers. What of the computers used by bank staff during their banking activities? Are these computers thrown from heaven for the banks to start marking use of them? No, at all because they are physically made through computer engineering and then supplied to the banks that make use of them. Modern day banks cannot function without the use of durable bulletproof doors, to be protected from the hands of the armed robbers. The features of these kinds of doors are usually made of glass and some others steel. Metallurgical and materials engineers that deal on glass and steel are the people that test and confirm the strength of the materials used in the production of such doors so that they can resist the effects of bullets bullet proof doors. Importance of engineering in automobile sector. The car used is an automobile. Source Automobile People like to have mobile houses of their own if they have the money to make a purchase. Automobiles have helped in a great way to ease the stress being faced by the man from moving from place to place. These automobiles are into existence because the engineers came up with the idea and they succeeded in making it accessible to people all over the world. It is engineering that is being studied that gave birth to many designs of cars that are all over the world. Starting from the making of the cars from the scratch, mechanical engineering makes it possible. This is the category of the engineering field that first designs the shape of the car in question before the final production. When it comes to the making of the engines of the automobiles, metallurgical engineers play their own roles as well. This is

evidence on the importance of engineering in the beautiful world of the automobile. Metallurgical engineers make proper effort to find out the proper quality of alloys to be used in the production of the engine blocks before finally casting the engine of the vehicle. The casting of the engines of vehicles can be carried out using any convenient casting processes, especially investment casting process. The author of this article who is a graduate of Metallurgical and Materials Engineering is currently developing a book which discusses the applications and importance of Materials Engineering in the society. This is a sound book that will serve as an eye-opener to people who want to know more about the engineering field. The piston and the gears of cars are products of casting carried out by metallurgical engineers during car production. When investment casting is used to make these parts, high accuracy is obtained. But other casting processes can be used for the production. The importance of engineering in our society made it possible for car owners to drive so many designs of cars each year. Someone may be driving Honda model and all of a sudden hear that the latest Honda of which has more advanced level has been produced by the company. What he does on hearing this is to sell his old modeled Honda and go for the new design, all centering on the importance of engineering in the society. Educational Sector Education is very important in the life of every intelligent individual, and it has been spiced up with the contributions of engineering. It will be boring without the presence of engineering in it. The works of the engineers are seen in all levels of education; primary, secondary and in the tertiary level. People on many occasions have got involved in debates based on the positive contributions of engineering in the education department. Starting from the clothes that teachers and the lecturers wear to classes where they teach the students on the knowledge they need to acquire, the clothes would not have been made if engineering is ignored. That you as are a reader of this piece of write-up wear cloth on your body right now is a product of textile engineering field. In various institutions of learning, it has been made compulsory that every school will have computers integrated as part of their academic study or curriculum. These computers being talked about are made possible because of the efforts being put by the computer engineers. Some higher institutions have air-conditioners installed in their lecture halls to make the students feel comfortable learning in a good environment. This machine that maintains a certain level of temperature in lecture halls and offices in educational institutions are all products of engineering. Marketing What business does engineering have with marketing? Has engineering in any way contributed to the level of marketing activities in our society? The answer to the questions is yes. Engineering in totality has greatly impacted much in the marketing sector. Marketing is the action or the business of promoting and selling products or services. The promotions of services and products have been made possible as engineering continues to advance on the daily basis. The internet has helped many businessmen in the marketing of products and selling some useful services to their customers. People sit with their computers and advanced mobile phones and promote their businesses through this channel. Presently, there are many websites created where people go and render services to get paid in turn for the work well done. An example of such website is the one called Fiverr. This is a website that has been a source of daily bread to people from different parts of the world. There are dozens of services being offered by sellers in that website including web and graphics designs, promotion of books and other tangible goods, application designs, sound cloud works, writing businesses, and so many others. Because of the importance of engineering in the field of marketing, people can use their mobile phones, which are the products of engineering, to order for goods from other countries which get supplied to them within few days. Also, some business owners have hosted many websites on the web where they tell people all over the world of products and services they sell without the buyers visiting the location of the business company. Health Sector Health and engineering; any similarity? Do you think the two have something in common or does engineering have an influence on it? Beyond any reasonable doubt, the health department of every country firmly depends on engineering to achieve any of their goals in the health status of the patients being admitted to the hospitals. It is true that engineering does not have any business with the drugs being used in hospitals as that is the business of pharmacists, but, what about the other equipment used in the hospitals? Let us start with the instruments which the doctors used whenever they are carrying out surgery. Do you think the materials of that nature are being produced by the doctors? No, because starting from the pattern making to the final finishing stages of such equipment are being carried out by the engineers. Examples of such instruments are

the scalpel, surgical lamps, stethoscope, and so many others. All these instruments are made available to the surgeons with the help of engineering. There are situations where the patients are not manually diagnosed by the doctors to find out the cause of a particular illness. In such complicated cases, the doctors use computers to find out the cause of such illness. These computers are being produced by the engineers who apply engineering principles to automatically detect problems in the human system. Conclusion Engineering as a profession is a major player in the twenty-first century. Engineering is a unique profession and it has been changing the face of the earth to good. The world is upgrading and seeing clearly because of the importance of engineering profession in our society. In this piece of write-up or essay, the author detailed out the importance of engineering as it relates to agricultural, banking, automobile, educational, marketing, and health sectors.

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Finally, Engineers contribute considerably to the quality of life in society and it is important that they articulate their role clearly and firmly. We hope that a definition of these principles will enhance this contribution, Without Engineers we cant even think about getting so modernized world, where almost every person depends on Technology.

Chapter 9 : Role of Engineers in Society & Institutions - Ethics

Role of Engineers in Transforming the Society Topic: Role of Engineers in Transforming the Society Objectives: Ã˜ to open an issue exploring the roles of engineers in transforming our society Ã˜ to gather data regarding the past and present roles and significant contributions engineers have played and made in and to Philippine society Ã˜.