

The Future is Smart and Sustainable

In this article, Dr Benoît Jones, Tunnelling and Underground Space MSc Course Manager at the University of Warwick, UK, discusses sustainability.

SUSTAINABILITY HAS BEEN the watch-word of the 21st Century so far. Figure 1 says it all:

However, this article will not be the usual yadda-yadda. At least, I haven't read anything similar before, and if you have thought the same thoughts then we must meet and compare notes. First, I am going to convince you that sustainability is the basis of all good engineering decisions. Then it will obviously follow from this that good engineers have sustainability embedded in their thought-processes and will automatically generate sustainable solutions. To make more good engineers who think sustainably we need to implement a 'sustainability culture' within organisations and within our profession.

After all that ground work, for those hard-headed people out there I'll present the overwhelming business case for sustainability. Finally I'll end with a vision of a smart and sustainable future.

Sustainability is just good engineering

The United Nations Brundtland Commission described sustainable development as "meeting the needs of the present without compromising the ability of future generations to meet their own needs". This doesn't mean, for example, that we have to stop using non-renewable resources right this minute, because that would result in great human suffering, but we need to be moving away from them and investing in a sustainable future. To achieve this we need to take an ethical, long-term, systems-based approach to the planet.

A useful framework for understanding sustainability is to consider three pillars – social, economic and environmental – and balancing these sometimes competing demands will result in sustainable development. I prefer the mnemonic 'people, profit, planet' as it is easier to remember. The three pillars are often represented visually by the Venn diagram in Figure 2:

Now, what does this have to do with us as engineers? First off, we should consider what it means to be a professional engineer. It is not just about providing cost-effective technical solutions. For instance, the code of conduct of the Institution of Civil Engineers states that civil engineers have an overriding responsibility to

the public good and an ethical (and legal) duty to protect the environment. Therefore, the impacts on the local community, the health and safety of the workforce, the durability and longevity of the structure, the need for maintenance, the energy use in operation, the environmental impacts and the carbon

footprint, as well as the cost of construction, are all examples of social, environmental and economic considerations that are part of the decisions we make. These issues are all important and can all be captured under one of the three pillars, so sustainability gives us a framework that assists us in making good engineering decisions.

I hope I have convinced you that sustainability is not only an important and worthwhile thing to do, but it can be used as the basis of all good engineering decisions. It is a framework for identifying issues and measuring the performance of any intervention. It isn't an extra thing we have to do; it is a way of thinking that should be embedded in the way we work. Engineers make dozens of decisions every day, and if we think people and planet as well as profit, we'll make better decisions.

Since I have just used the words 'basis for all engineering decisions', 'a way of thinking' and 'embedded in the way we work', it should be clear that in order to change the way we make decisions, the way we think, and the way we work requires a cultural shift both in organisational culture and professional culture. This 'sustainability culture' is the ideas and beliefs that all members of an organisation

Figure 1: The word "sustainable" is unsustainable (source: www.xkcd.com)

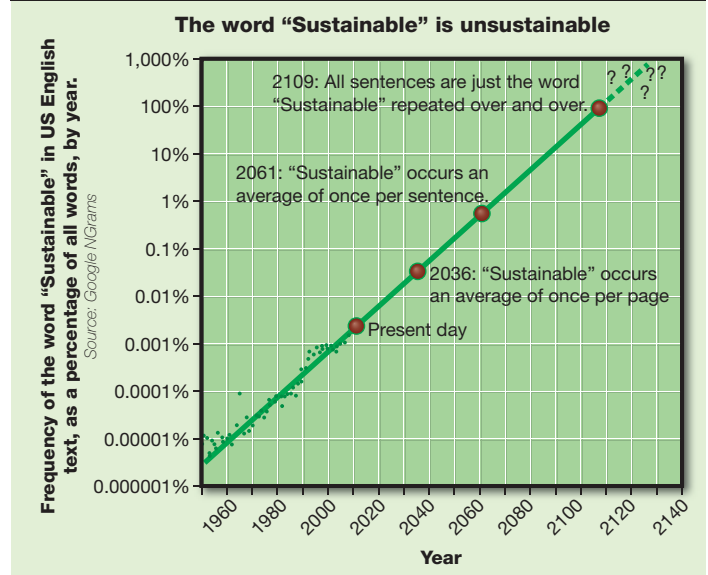
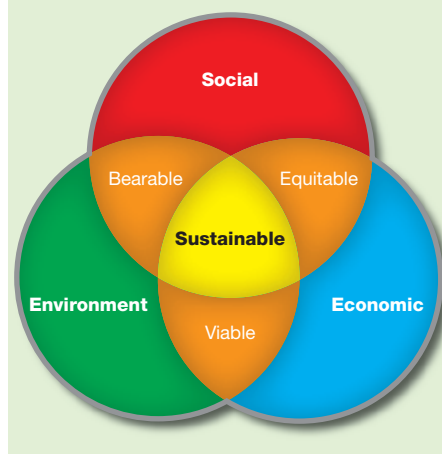


Figure 2: Venn diagram of sustainable development (United Nations General Assembly, 2005).



share about sustainability. The challenge of achieving this could be called 'implementing a sustainability culture'.

Implementing a sustainability culture

An example of a cultural shift that has been implemented in the past is the way in which safety culture has become the norm. Nowadays, most engineers automatically consider health and safety in every decision they make, and this has been the result of a cultural shift. The Confederation of British Industry wrote a seminal report in 1990 titled 'Developing a Safety Culture' (CBI, 1990). The recommendations of the CBI report could easily be adapted to the implementation of sustainability culture. This is how I would summarise the main points:

- crucial importance of the leadership and commitment of the Chief Executive – leaders need to walk the talk and put the full energy of the board behind it
- depends on the role of line management, the involvement of all employees and on openness of communication – this will ensure sustainable practices are implemented and new ideas are generated
- the importance of demonstrating care and concern for all those affected by the business – sustainable businesses have better and more profitable relationships with employees, stakeholders, customers and suppliers (Eccles et al., 2011)
- a long-term strategy that has to be continually reinforced
- it must counter the belief that sustainability is an add-on, optional extra, or a fad

Concentrating on sustainability culture will not be at the expense of safety culture, since health and safety are part and parcel of sustainability. The key motivating factor used in behavioural-based safety to inspire people to behave in a safe manner is caring for the health and safety of those around us and wanting everyone we work with to be able to go home unharmed. The key motivating factor in sustainability culture could be caring for the planet we live on, its ecosystems and its inhabitants, and wanting to leave it in a better state than when we arrived. Another motivating factor is wanting to do a good job, and for us engineers this means building sustainable infrastructure.

Business case for sustainability

The most basic business case for sustainability is, as Yvon Chouinard, the founder of Patagonia, said, "there is no business to be done on a dead planet". This is a long-term view, and one might wonder whether the markets are set up to think so far ahead (although it is becoming a less long-term view as the need to combat climate change becomes ever more urgent). For instance, oil companies are valued based on reserves that if exploited fully will result in devastating climate change. To have a 50% chance of keeping climate change below 2 °C of warming will

require us to leave about two thirds of it in the ground, resulting in a huge reduction in demand for oil, a collapse in prices and a collapse in the valuation of reserves (HSBC Global Research, 2013). According to HSBC, the market capitalisation of oil companies is overvalued by 40-60%. So clearly people who are buying shares either assume these climate change targets will not be met, or are taking a short-term view of investment on the scale of months or years rather than decades. Companies, however, and particularly construction companies, are beginning to take a long-term view. This is not unselfish, as there is also a strong business case for sustainability.

Nowadays, tenders are increasingly being scored with a higher weighting on sustainability than cost. So companies with a track record of sustainability are becoming more competitive. Competitiveness in non-price factors such as health and safety or sustainability is a no-brainer, particularly as it doesn't cost much to implement and there are other benefits as well.

A reputation as a responsible corporate citizen will benefit any company, both in terms of share price, in relationships with stakeholders, and in attracting and retaining staff. At the BASE Birmingham event in April 2013, Ian Renhard, head of UK Construction at Interserve said that even in a recession, having a strong sustainability strategy makes them more resilient. Companies want to work with other companies with similar commitments, and both Interserve and Jaguar Land Rover have found that their commitment to the local community and to training has strengthened their supply chain, improved planning for future skills, made them a more attractive employer, and improved their corporate reputation, making their companies stronger as a result.

The Stern Review (and Birmingham's mini-Stern Review) demonstrated that almost all of climate change carbon reduction is wealth-generating and improves the quality of people's lives (Gouldson et al., 2013). For example, an investment of £3.6bn in reducing Birmingham's carbon footprint would pay for itself in only 3.8 years and create 1,650 jobs. It would also reduce vulnerability to future energy price increases, protect competitiveness, improve public health and slash the carbon footprint. In fact, given the benefits, even someone who won't accept the overwhelming evidence that anthropogenic climate change is happening would have to agree that carbon reduction is a good investment.

The business case for sustainable development is now not just compelling, but indisputable.

Smart and sustainable

It is difficult to separate 'smart' and 'sustainable'. Cities are a system of systems, and making cities sustainable will involve the integration of systems and the use of smart

technologies to collect data and create synergies, for example to reduce energy use, pollution or traffic jams.

The way we work has been changing rapidly with technology such as the internet, email, social media and smartphones. Work/life balance is now difficult to achieve due to a phenomenon called 'work/life merge' – we can now work from home and on the move, and this allows more flexible working and better productivity, but it also makes it difficult to separate work time from personal time. This move to communication in the virtual world implies that geography is less important, but this doesn't appear to be the case. According to Rick Robinson, a Smart Cities Architect for IBM, the geography of a city is still vital for creativity and collaboration. This means that there will still be work for us tunnellers for the next few decades at least, but our solutions will need to be smart and sustainable.

Conclusions

Sustainability is not a fad and it is here to stay. It is a powerful idea and a useful decision-making framework, but to gain the greatest benefits we need a cultural shift from thinking of sustainability as an add-on extra to implementing a sustainability culture within our organisations and within our profession.

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