

Towards a sustainable knowledge society



Optimising the contribution of Information Society Technologies to Sustainable Development

TERRA is a response to the pressing need to align the creation of a networked, information and knowledge-based, society (and its accompanying New Economy) with the requirements for achievement of sustainability generally and of sustainable development in general. Specifically it will create (by the use of formal analytical methods) the insights necessary to inform and guide policy-making leading ultimately to the optimisation of ISTs contribution to sustainability.

The IST Proposition

The new technologies of the Information Society (ISTs) seem likely to offer scope to enable economic growth, and to allow a more equitable distribution of wealth, without necessarily increasing consumption, pollution and energy use.

TERRA is a multi-disciplinary, multi-national research project that utilises scenarios and models to achieve insight into the implications (for better or worse) of the technological and scientific developments of the Information Society (more concretely, the Global Networked Knowledge Society) for environmental, social, cultural and economic sustainability. In doing so, it explores the truth of the 'IST proposition' that ISTs can indeed contribute to sustainability through a range of more detailed sub-propositions. Because the first signs of these new characteristics of the gradual maturing of the Information Society are just emerging, hard proofs are not always readily available – but analysis of previous innovation waves suggests that IST-derived innovations will form the primary basis of our answers to sustainability questions for the next quarter century or more.

TERRA not only tests these fundamental 'IST propositions' it also offers guidance on how the vision they embody proposition may be made a reality. Its outputs are firmly

geared to the needs of policy makers and cover, in consequence, not only the specific meanings of underlying concepts and the technicalities of the mechanisms by which ISTs and the associated socio-economic processes of globalisation, networking and 'virtualisation' achieve their impacts, but also the levers, the actions, the actors and the critical uncertainties involved in turning the IST proposition into reality. TERRA is a research project, but one with very specific positive outcomes in mind.

TERRA's Understanding

The relationship between the Information Society Technologies (ISTs) themselves, and their wider societal impact in the shape of the Information Society and/or New Economy is being elaborated by TERRA's linked series of narrative scenarios and numerical models concentrating on identifying and expanding the most crucial aspects of the picture. This Dominant Relationships Modelling preserves scientific integrity (by modelling only that which may reasonably be measured or formalised and



thus modelled). This is combined with a high degree of transparency (since policy recommendations will not normally be accepted, fruitfully debated or usefully acted on if they cannot be confidently understood by those to whom they are directed).

The wider picture is quite complex: ISTs, like all revolutionary technological advances, extend into the real world in ways that, although profoundly influential, can seem at first glance erratic, arbitrary or perverse. By detailed analysis of the environmental and socio-economic effects of ISTs, it is possible to come to a better understanding of such issues as the effects of networks and the spread of innovation, and thus to deduce matching areas of public policy interest and possible intervention points, which will enable enhanced sustainable development.

Key features of this include:

- IST offers vast – but not unique – scope for innovation. Radical changes in scientific and technical understanding (often accompanied by ‘New Economies’) have occurred many times previously and we therefore have good prior examples to guide us.
- Many initial socio-economic effects of such radical technological changes are adverse or evoke adverse responses. These upheavals are sometimes understood as ‘Schumpeterian growth’ or ‘Creative’ Destruction.
- It is only later that the secondary (rebound) effects of innovation follow, revealing potentially large socio-economic benefits. These necessarily lag behind the primary effects (often by years). Such rebounds¹ lead to both benign and malign outcomes – TERRA distinguishes them and provides guidance to maximise the benign and minimise the malign.

¹ As an example of a rebound effect, efficiency increases have reduced CO₂ emissions in OECD countries by 6 billion tons in the last 30 years – but increases related to economic growth, 9 billion tons, have outstripped decreases due to efficiency. Some portion of this 9 billion tons is incited by the lost savings of greater efficiency – this portion is the rebound effect

- Ultimately, however, the benefits of technological advance follow strongly and may extend over very long periods .

It is necessary to see this rather tortuous development progression of IST innovation in its entirety in order to model its effects. In particular, a clear understanding of the operation of the various rebound effects and of the means of harnessing; controlling, and perhaps benefiting from them is vital if the full potential benefits of the Information Age are to be realised. Equally, TERRA recognises that sustainable development is concerned with people as well as with things: questions such as income distribution; globalisation, and the Digital Divide are accorded equal weight with those of environmental sustainability.

Three specific issues are used in TERRA as an organising device by which the project focuses and manages its work on the meeting of policy challenges. There are, of course, far more issues involved in the subject – but these three span the field well and allow links to many of the other key issues.

1. Human capital in the information age “Knowledge and information is being produced today like cars and steel were produced earlier. But just as the importance of land in production changed dramatically as the economy moved from agriculture to industry, so too does the movement to a knowledge economy necessitate a rethinking of economic fundamentals. In the Information Age intellectual rights, rather than physical products are being transacted. The cost of development of new products far exceeds the cost of production. Skilled, talented, innovative and fulfilled people constitute human capital, which fuels economic growth. All people everywhere have the potential to contribute. One of the major policy dilemmas already facing decision makers is how to secure the supply of human capital with the declining and aging population.

Economic sustainability propositions

ISTs can catalyse human capital expansion and thus promote sustainable economic growth

The expansion of the GNKS can result in sustained increases in productivity and market efficiency growth and their diffusion throughout the globalised economic system.

2. Equity and growth –“Social capital is the glue that holds a society together.” Inequality undermines social capital, fuelling illegal acts, crimes, terrorism, etc. ISTs put a premium on highly educated labour as a source of economic growth, while globalisation supported by information technology has a tendency towards the “winner takes all” phenomenon. A major dilemma for the 21st century will be how to balance the economic growth needed to reduce unemployment with the reduction of inequality needed to secure social capital.

Social sustainability propositions

While the initial deployment of ISTs and ‘New Economy’ dynamics have tended exacerbate welfare, digital and/or income ‘divides,’ the unfolding of a GNKS based on open and universal access can harness the same technological, market and social forces to promote greater equality of opportunity compared either to recent experience or the pre-GNKS era.

The GNKS encourages and influences the processes of globalisation, and can help to develop collective awareness of collective problems, mobilise local action to address them and promote the emergence of new governance institutions to balance local and global problems, incentives and powers to act.

While the mere fact of globalisation – or the connection of each to all – does not of itself imply either integration or convergence, ISTs can facilitate mutual awareness and respect.

The GNKS can encourage peace and minimise conflict by substituting a complex interlocking maze of global allegiances for previously narrow tribal and racial allegiances.

3. Information Age sustainability – ISTs profoundly affect the environmental, economic, societal and cultural dimensions of sustainability. In particular, environmental impacts may have positive or negative effects on ‘sources’ (life support systems and resources) and ‘sinks’ (human domination of nature from biodiversity to climate change). On the one hand, ISTs bring a burgeoning middle class (increasing consumption loads) and, on the other, ISTs allow more efficient extraction (accelerating exhaustion and delaying development of substitutes). Rebounds and secondary and tertiary effects are already well understood in some circumstances – but by no means all. Policy issues can include informational approaches to enhancing efficiency of resource use, corrective taxation, support for development of alternatives, etc.

Environmental sustainability propositions

Emergent technologies based on information (from ICTs to bioengineering) can help to dematerialise production and distribution of goods and services by reducing associated material inputs and waste outputs.

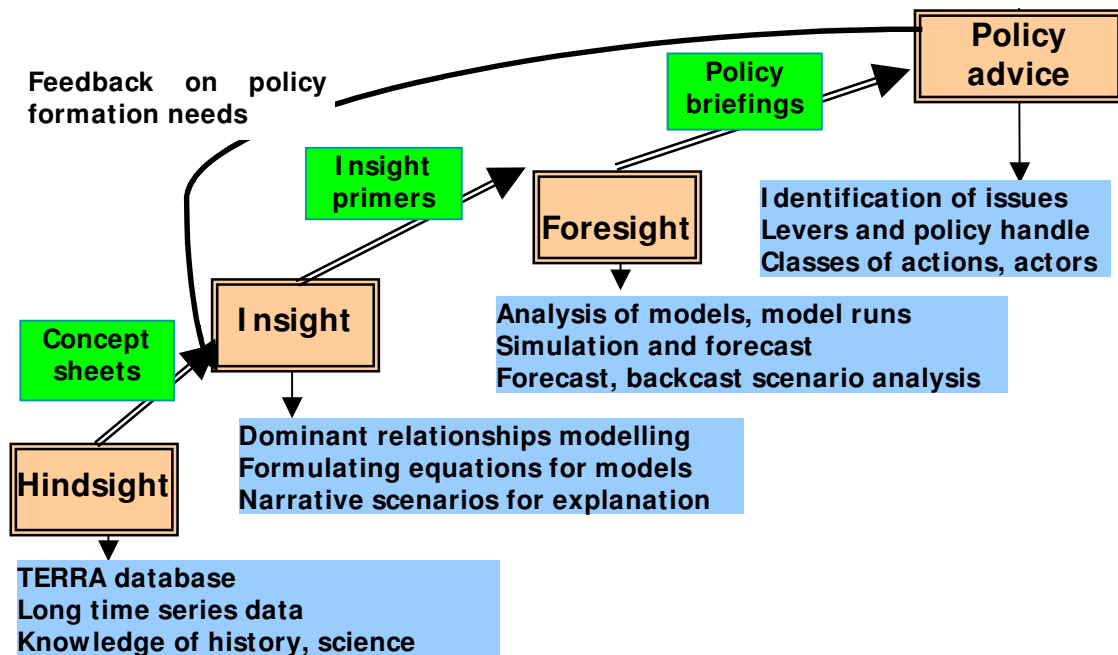
The new technologies and the new forms of human interaction they support can lead to a substitution of immaterial goods and services for material production and consumption.

Both dematerialisation and immaterialisation reduce the opportunity cost (price) of material inputs and environmental sinks and increase the welfare content (and even the levels) of income and wealth. The change in relative prices can induce substitution of material for immaterial inputs. The increase in purchasing power can stimulate consumption of both material and immaterial goods and services. These substitution and income effects can outweigh the benefits of the original changes.

These are not the only issues under examination – but they do allow TERRA to focus, and to bring some clarity to the complex issues concerned. Having unpacked these themes, it is then necessary to bring the themes, and the generality of work in TERRA, back into a common framework of

integration and this re-integration in itself is a major area of activity in TERRA.

scenario formulation. The TERRA backbone is of progression from established data and knowledge, through the creation of insight,



Several concept sheets (CS) have been developed in which the main issues are further discussed. TERRA's view on Sustainable Development is discussed in CS1; the relationship of the Information Age to sustainability is discussed in CS2; issues concerning policy formation in CS3. CS4 is focused on Dominant Relation Modelling, and "Rebound effects" are further explained in CS5. TERRA's treatment of integration and interconnection is discussed in CS6. The focus topics Human Capital; Equity; and Information Age sustainability are discussed in 7, 8, and 9.

From Insight to Policy

Underlying the TERRA work of expanding and testing the 'IST Proposition' and of optimising ISTs contribution to sustainability is a progression of the development of understanding that allows the movement from the development of insight to the creation of policy.

The TERRA backbone

TERRA is much concerned with modelling and with the use of scenarios, but is not tied to any single paradigm of modelling or of

via whichever established formal model/scenario techniques is most suited to the enabling of foresight. It is from foresight, mediated by insight that policy advice derives. Insight thus lies at the heart of TERRA.

The models in TERRA are made in a transparent way – they are not intended to be 'black boxes' whose workings may only be understood by the initiated, producing definitive forecasts and prescriptions, but consist rather of visible structures of explained linkages whose workings can be examined and discussed as a means of coming to greater understanding.

It is through the visibility and quality of the reasoning that policy advice in TERRA is given substance and made trustworthy: ultimately, the purpose of TERRA is that its advice should be accepted and acted on.

For more information please contact the Terra 2000 Project Secretariat:

**RAND Europe
Newtonweg 1, 2333 CP Leiden
The Netherlands**

**Telephone: + 31.71.5245034
Fax: + 31.71.5245191
[http:// www.terra-2000.org](http://www.terra-2000.org)**