AI. Truth, Prejudice, Technological Literacy, Education and TELPhE

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Abstract

Problems believed to be caused by social media such as suicide, and those thought to be, and likely to be caused by ChatboxGPT clearly affect a society's health. Currently these technologies, especially the social media, seem to be more controlling than they are controlled, and a major problem for both the individual and society is how to control them. Such issues are as much philosophical and psychological as they are legal and technical. It is argued that it is a function of TELPhE to provide for a public debate in this area.

In this paper, supported by previously published case studies, Technological Literacy is taken to be an organizing mechanism that enables a person to solve problems caused by technology, and not a not a discipline in the traditional meaning of the term.

A technologically literate person is one who can organise knowledges in order to solve problems created by technology. It is understood that programmes designed to achieve this goal will, in response to the characteristics of the public, have to function at different levels of complexity and as such will require collaboration between the sub-systems of universities, and schools (elementary, middle and high).

Technological literacy is closely related to Frankenfeld's concept of technological citizenship too which Kathryn Neeley drew attention in her 2017 review of the division's development. In that sense it may be regarded as an extension of Neeley's paper, for while beginning with a brief consideration of the role of philosophy in the curriculum, the primary focus of this paper is on learning, because understanding how learning is conditioned is to learn not only how we are controlled but how we control.

Following a very brief discussion of a curriculum model that establishes the need for a technologically literate person to have a liberal education that is grounded in philosophy the paper focuses on learning but in particular cognitive dissonance.

It is argued that if we understand how we learn, we will be better able to control our engagement with the media, to distinguish fact from opinion, and the real (truth) from the false.

Key words AI, Learning, Prejudice, Philosophy, Psychology. Technological literacy/citizenship. Truth.

Introduction

In the two decades or so since the TELPhE division was founded from workshops held by the National Academy of Engineering it seems, I would not wish to be dogmatic about this, to have gone through three phases [1]. The first, was in the provision of engineering courses for non-engineering students, and in particular as 'minors' [2]. This lasted, although excellent papers continue to be submitted in this area of technology, until about 2014 when the Division published a monograph on "*Philosophical Perspectives on Engineering and Technological Literacy*" following the inclusion of 'philosophy' into its activities in 2013 [3]. There was then a flurry of activity in the philosophy of engineering education, and three more volumes were produced. Subsequently, while papers have been given in both the areas of technology and philosophy, there have been a number of papers that have discussed the meaning of technological literacy with a view of obtaining a more comprehensive definition of the subject, the assumption being that it is a subject.

With the exception of a general seminar on engineers and terrorism organised for ASEE at the request of Dr Norman Fortenberry, the division has carried out its activities as a separate entity within ASEE, as of course do all the other divisions. The expectations that it would engage with the K-12 division and cause ASEE to engage with the public on matters of technological literacy have not been met. It may be conjectured that this is because technological literacy is considered to be a technological activity, and not one that engages in conversation about the impact of new (and, indeed 'old') technologies on society. It may be assumed that these can be safely left to the lawyers, government, and by no means least, parents. Questions of child suicide, for example, allegedly caused by social media, and other similar behavioural problems have not been matters for TELPhE or ASEE although they have a powerful impact on the mind. That is, before matters of the ethics of design of such systems are considered. My friends in the Ethics Division will forgive me if I say this is not just a matter for them or TELPhE but ASEE as whole. Last year's developments in AI with the introduction of ChatboxGPT surely make this clear.

The problems caused by social media briefly referred to above, and those being and likely to be caused by ChaboxtGPT clearly affect a society's a health. Moreover, currently these technologies seem to be more controlling than they are controlled, and a major problem for both the individual and society is how to control them. Such issues are as much philosophical and psychological as they are legal and technical. I argue that it is function of TELPhE to provide for a public debate in this area, a view that supports the conception of Technological Literacy as an organizing mechanism that enables a person to solve problems caused by technology, and not a not a discipline in the traditional meaning of the term. It is closely related to Frankenfield's concept of technological literacy too which Kathryn Neeley drew the division's attention in her 2017 review of its development [4].

The idea of such a mechanism is not new and is to be found in Newman's 1852 lectures on "*The Idea of a University*", where it is called a 'science of sciences', and in the representation of technology that I presented at the 2010 meeting of TELPhE shown in exhibit 1. Its intention was to demonstrate that a particular power of mind is required to understand the technological process as a whole. Arriving at that power of mind requires enlargement beyond that which is purely technical. Such a mind is able to look at an activity or object from many different angles, and this requires a particular set of skills in the handling of multi-knowledges.

A decade or so later without reference to this earlier work, using a case study Michael Lyons and I showed how in the case of the Grenfell Fire that for the victims of the fire to become fully engaged in the official enquiries they would need a range of ‘knowledges’ in order to be able to both establish the questions that they ought to ask and understand their answers [5]. While this would require some technical knowledge it would also require an understanding of human behaviour. They would have to be technologically literate.

Similarly in a later case study of the Boeing 737Max air disasters I showed that while some descriptive technological knowledge of how an aircraft flies was necessary the causes of the accidents could not be understood without some knowledge of organisational behaviour, and the culture of the organisation (Boeing’s) [6]. Again, the criticisms of the UK’s civil service handling of the vaccine supply programme made by Dame Katie Bingham might have been better understood if its organisational culture had been examined, a point that can be made about more recent criticism of the activities of civil servants [7].

Taken together these reinforced my view that technological literacy is not a discipline as such but an organising mechanism that enables a person to solve problems caused by technology. It involves the concept of the “technologically literate person”. It is a developmental concept, since not everyone will be able, or want to be technologically competent at the highest level. Its concern is with minimum competency, and n particular with the starting point of its development, ‘learning how to learn’

Playing catch up

Whereas the concept of technological literacy has been discussed in scientific and technological circles in the United States it has not been the subject of much public discussion: it has been the subject of absolutely no discussion either in expert and political circles or with the public. The same is true of Ireland. The creation of such discussion is completely overshadowed by governments trying to play catch up with their role in controlling recent developments, and battles with parents who want more controls than governments are prepared to give, raising questions about the role of parents in controlling the technologies used by their children. For example, one columnist would stop the sale of smart phones to under sixteen-year-olds [8]. Will the large technology companies prove capable of regulating themselves, or will governments have to intervene, more or often than not, after the event? Either way, the problems are boxed and dealt with as single issues as and when pressures cause them to be taken out of the box. They are not seen as different constructs of a society that is becoming or has become technological, thus the problems of living in such society are not considered, and the idea that the principal goal of education should be the preparation of individuals to live and work in a technological society is ignored. It is with an educational approach such as that which has been suggested that the skills required for controlling technologies in personal circumstances, and more generally for the common good, are likely to be developed.

This places an obligation on those who believe that radical change is necessary to promote their ideas in such a way that the system develops in small steps to ensure the permanence of such change. I shall argue that this is a role for TELPhE.

A Role for TELPhE

If it is accepted that TELPhE has a role in the promotion of engineering and technology to non-engineers then it is argued here that it also has a role in the development of a curriculum that prepares individuals to live in a technologically dominated society which they control rather than being controlled. Such a curriculum will require the ability to acquire understanding in all aspects of the model shown in exhibit 1 as they relate to the person society, and work. A technologically literate person is, therefore, one who is able to embrace and control the technologies with which he/she is confronted.

An education that creates the environment in which a person can gain the skills required to live in a technologically created environment will be intensely personal for technology is inherently related to the person. It is not something that is apart from the person or the community (systems) that a person inhabits. It impacts on relationships, and therefore on growth for "*we come to be who we are as personal individuals only in personal relationship(s)*". That is, we can only develop as persons in relation to other persons. It follows that "*Every individual agent is therefore responsible to all other agents for his/her actions* […] "*the intention of any agent, is however, relative to his knowledge of the Other*" (but his/her) "*responsibility cannot extend beyond his knowledge*" [9], and that is why a technologically literate person will have received a liberal education, in order that he can understand 'man' (person, the human) in all its aspects. That is why those who advocate an emphasis on STEM subjects at the expense of the arts/humanities are misconceived [10]. Every subject, be it anatomy, chemistry, engineering, history or literature tells us about the 'person' in ways that the other cannot, and that applies as much to psychology and sociology as it does to any other subject.

Exhibit 1 displays a spectrum of knowledge(s) that or may not be required to solve technological problems both at the level of process (engineering) and its product (technology), but it is questionable as to whether it displays the dynamic of 'intention' indicated previously, for 'intention' clearly belongs to the base. The base should, therefore, be modified to include 'intention(s)'. The determination of values and intentions is an intensely philosophical activity, mostly not understood by the person as such, and almost certainly casually developed, or as Bill Grimson suggests of engineers "*just plainly taken for granted*" [11].

No curriculum can avoid considerations of philosophy since as Grimson points out using the Oxford Dictionary's definition *"it is a set of opinions or ideas held by an individual or group; a theory or attitude which acts as a guiding principle for behaviour; an outlook or world view"* [12]. A first step in developing a philosophy is to understand ourselves and this we do throughout life and that is why education for technological literacy is a life-long activity, and of necessity embraces the whole curriculum from cradle to grave, a point that has been demonstrated for the middle (primary and post primary) curriculum by the young child and philosophy movement [13].

The remainder of the Paper is devoted to discussion of some first steps that might be taken to understand ourselves and others in support of the general thesis that the basis of a curriculum designed to produce persons who are adjusted to living in technologically dominated society are philosophy and learning. Or, understanding human behaviour through understanding ourselves.

Learning

One of the best kept secrets in education is ‘learning’. It is omitted, although inherent in Exhibit 1 when questions are asked of the system it describes.

Academic institutions, for the most part, assume that everyone knows how to learn, or if they do not, there is something wrong with them. This view is in no small measure due to a widespread view of knowledge that dates back to the ancient Greek philosophers; that knowledge is divided into disciplines, and that each discipline has within it the structures for its learning and teaching. There is, therefore, no case for a separate psychology of learning. Teachers act as transmitters, mediators and translators of knowledge and pursue their goals through, didactic teaching, supervised practice, and Socratic discussion.

Irrespective of this view psychology continued its investigations and in 1959 L. Festinger had published *“A Theory of Cognitive Dissonance”* in the United States [14]. And in the UK in 1960 M. L. Johnson Abercrombie published “*The Anatomy of Judgement”* with the sub-title *“An Investigation into the Processes of Perception and Reasoning”* [15]. These theories and their associated investigations continue to resonate, and support the view that understanding learning is necessary if a person is to be technologically literate. Two examples from these studies follow.

Cognitive dissonance

An important characteristic of memory and perception is that we tend to remember our successes and forget our failures [16]. At the same time, we tend also to be very consistent in our attitudes and opinions [17]. Apart from the fact that this makes it more difficult to adapt, by accommodating new perceptions that possess values also contained within our own value maps. We tend to use sets that have served us well in the past, The same is true of problem solving: we tend to use the same heuristic whatever the problem [18]. Jerome Bruner has called this persistence forecasting and it can in a new situation prevent us from using more efficient strategies. We tend to believe in the advantages of what we already possess. Dissonance or down shifting arises when we have to accommodate a new value system with which we have no empathy. This can happen to university students when faced with new concepts in subjects such as philosophy and sociology particularly if they have an empathy with matters metaphysical [19]. It will be readily agreed that entering into dissonance may impact negatively in understanding what is true.

Challenges to values may be perceived as threatening. More generally in situations perceived to be threatening we narrow our perceptual field and return to our original view [20]. Such behaviour in which we revert to tried and trusted ways can affect the higher order cognitive functions and thus the ability to solve new problems. Interestingly it has been suggested that down shifting of this kind might the reason why students fail to apply higher levels of the Bloom *Taxonomy of Educational Objectives* [21].

We have to learn to be able recognize our biases and prejudices in order to adapt and that may be achieved through reflection [22].

The most pertinent example of dissonance at the present time are the press statements of the spokesman of the Israeli and Hamas in the Gaza War. The same differences in presentation are apparent in media reports of what members of the Israeli and Palestinian public think.

Deception and control

It is likely that we will readily concede that propaganda is a form of deception. It is less likely that we will concede that we are regularly deceived and through such deceptions open to control. Our understanding is that we are free and the controller of our freedom. The advent of social media brought with it the view that this was not the case. The best-known example is that the media induced suicide among teenagers, currently the subject of much discussion. The question is therefore – to what extent are we controlled by the media (or more generally outside events), and what can we do about it? It is argued here is that, if we understand how we learn, we will be better able to control our engagement with the media, to distinguish fact from opinion, and the real (truth) from the false.

Our intention is to illustrate this by examining the process of information gathering from the total amount of information available to us by sight. Abercrombie makes the important point that because the total information available to us from a stimulus pattern combined with that which we already possess, requires us to make a judgement in the twinkling of an eye. Moreover, in that twinkle many factors of which we are unconscious contribute to the judgement. Abercrombie identified as many as 37, related to prior experience (e.g. and recent and frequent events), organizational factors (conflicts of interest), personality characteristics (e.g. needs, attitudes, values), and other person characteristics (e.g ability, age).

One outcome of this process of perception is that we do not necessarily see the same stimulus pattern as others. This means that in our learning we are continuously having to reconcile our views to arrive at agreement, which optimistically, we might consider to be the 'truth'. From a teaching perspective, irrespective of level, teachers have to face the fact that not every student will perceive what they are saying in the way they want it to be perceived. More significantly that mis-perception may be the cause of poor performance. That is why attention to the research that has been done on the learning of concepts is so important [23].

It is easy enough to verify that a stimulus might cause a variety of responses. Ask each member of a small group of people to turn on a water tap so that it drips about once a second into a bowl. Ask them to watch the water coming out of the tap and joining the water in the bowl, and then to write a description of what they saw. The descriptions are likely to range from the artistic to the scientific [24].

My final example relates to modern warfare and to the intelligent control of weapon systems and therefore the morality of their use. John P. Sullins writes "*the operators of telerobots*" (we think of drones) "*necessarily see the world a little differently when they look at it through the sensors and cameras mounted on the machine and this may impact the ability to make ethical decisions or at least influence the kind of ethical decisions they choose while operating the machine. When one is experiencing the world through the sensors on a robot one is experiencing the world telepistemologically, meaning that the operators are building beliefs about the situation that the robot is in even though the operator may be many (thousand) miles away from the tele robot. This adds a new wrinkle to traditional epistemological questions. In short how does looking at the world color one's beliefs about the world*?" [25] More significantly how does it color one's decision making when one has to distinguish between innocent people and the enemy? And this, as Sullins says, is "*a monumental problem*". He argued, that while telepistemological distancing has been one of the reasons that it is difficult to exercise intelligent control over machines they have had the ability to reduce casualties. When he wrote his article, he was not able to say whether the ethically positive outweighed the

negative. He pointed out that if telerobotic warfare fostered hatred and caused the moral agency of an enemy to be disregarded then ethical conditions for a just war would not be reached [26].

That article was published in 2013. Its relevance to the wars in the Middle East and the Ukraine will be apparent.

Not only do these weapon systems illustrate the importance of perceptually driven behaviour but they also show that epistemology is not a trivial subject that technologically literate person can avoid. The problem for TELPhE is to develop appropriate curricula for different levels of capability that entertain these understandings. It cannot avoid epistemology which is intimately related to notions of perception, memory, proof, evidence, belief and certainty.

Notes and references.

1. The view that follows is a personal impression. For a detailed history of the development of the idea of technological and engineering literacy see Krupczak (jr), J and J. W. Blake (2014) Distinguishing Engineering and technological literacy in Heywood, J and A Cheville (eds) *Philosophical Perspectives on Engineering and Technological Literacy.* A Publication of the TELPhE division of the American Society for Engineering Education. Washington DC pp 3 – 25.

For a recent definitive review of the development of TELPhE see Hilgarth, C. O and J. Heywood (2023). Moving technological and engineering literacy into mainstream conversation. The 2021 Whitepaper "Future Directions for Technological and Engineering Literacy and the Philosophy of Engineering" Revisited. *Annual Conference Proceedings of the American Society for Engineering Education (ASEE).* Washington DC. ASEE.

2. Krupczack, J (2018). Creating Engineering Classes open to non-engineers. Bibliography and reference information. Workshop U249 at 2018 ASEE annul conference, The bibliography can be downloaded from Technological and Engineering Literacy Publications -Selected Bibliography https://drive googler.com/file/d/IrCyppb:FLSKewphPvH_FBCXw!UDEmoNe/view

3. *loc.cit* note 1, Hilgarth and Heywood.

4. Neeley, K (2017). From Technological Literacy to the Philosophy of Technology and Technological Citizenship. Proceedings Annual Conference of the American Society for Engineering Education paper 20040.

5. Heywood, J and M P. Lyons (2018). Technological literacy, Engineers, Public Officials and the Public. *2018 Annual Conference Proceeding of the American Society for Engineering Education (ASEE)*. Washington DC. ASEE

6. Heywood, J (2021) The concept of technological literacy examined through the lens of a case study concerning the Boeing 737 Max accidents. *2021 Annual Conference Proceeding of the American Society for Engineering Education (ASEE)*. Washington DC. ASEE

7. Heywood, J (2023). Lessons for engineering, engineering and technological literacy from the experience of Britain's Vaccine Task Force (VTF). *2023 Annual Conference Proceedings of the American Society for Engineering Education (ASEE*). Washington DC. ASEE

8. Thomson, A (2024) Why I would ban smartphones for under – 16s. *The Times* February 7th.

9. This paragraph is based firstly on the work of John Macmurray but the first paragraph is from his biography (i). The second quotations are from Macmurray, J (1961). *Persons in Relations*. London. Faber and Faber p 119. Secondly, on Newman, J. H (1852) (1917 impression). *The Idea of a University*. London. Longmans Green.

(i) Costello, J. E (2002). *John Macmurray. A Biography*. Edinburgh. Floris Books p 326.

(ii) For a concise study of the work of Macmurray in relation to engineering see Cheville, A (2022). Becoming a Human Engineer. A Philosophical Inquiry into Engineering Education as Means or Ends.UK. Ethics International Press. eBook ISBN 978-1-871891-76-8. See chapter 5 on How actions affect others, Cheville links actions to belief systems thus: "*As agents we can choose either to believe that our actions are mostly isolated and do not affect others unless we wish them to, or that we are continually and irrevocably connected to the larger whole. The belief system we adopt affects our intention and modes of reflection and thus affects the actions we take and how we develop as persons. If we believe in connection then we must accept that the beliefs of other persons, our community, and society at large will affect our actions and beliefs as our actions will affect them*" (p 50).

10. Duncan, Emma (2023). We should cheer the decline of humanities degrees. *The Times* 18th April.

In The Idea of a University Newman writes: "*Literature stands related to Man as Science stands to Nature; it is history. Man is composed of body and soul; he thinks and he acts; he has appetite, passions, affections, motives, designs; He has within him the lifelong struggle of duty with inclination; he has an intellect fertile and capacious; he is formed for society, and society multiplies and diversifies to endless combinations his personal characteristics, moral and intellectual. All this constitutes his life, of all this Literature is the expression, so that Literature is to man in some sort what autobiography is to the individual; it his Life and Remains"* p 201 of the 1947 edition – edited by C. F. Harrold (Longmans Green). For a commentary see McGrath, F (1961). *The Consecration of Learning*, Dublin. Gill. See chapter 5.

11. Grimson, W (2014). Engineering and philosophy in Heywood, J and A. Cheville (eds). *Philosophical Perspectives on Engineering and Technological Literacy.* A Publication of the TELPhE division of the American Society for Engineering Education. Washington DC p 35

12. *ibid*.

13. Philosophy and the Young child curriculum promoted at Montpelier College. First major publication on this topic seems to have been Matthews, G. B (1980). *Philosophy and the Young Child*. Cambridge MA. Harvard University Press.

14. Festinger, L (1959*). A Theory of Cognitive Dissonance*. Stanford. Stanford University Press.

15. Johnson Abercrombie, M. L (1960) "*The Anatomy of Judgement". "An Investigation into the Processes of Perception and Reasoning.* [1989 edition], Free Association Books, London.

16. Bruner, J., Goodnow, J., and G. A. Austin (1956). *A Study of Thinking*. New York. Wiley.

17. *loc.cit* reference 13.

18. Luchens, A. S (1942). Mechanisation in problem solving, the effect of einstellung. *Psychological Monographs* No 248.

19. Clifford Longley wrote "the ability of people not to hear pronouncements that they are not expecting to hear, or to dismiss the importance of the information presented to them because it does not fit into their prevailing mind-set appears to have blocked Derek Worlock's ears to the message of the Pope's address". Longley uses Worlock's diaries to show how this was a function of Worlock's beliefs reinforced by prior experience. Worlock was a significant member of the RC Hierarchy in England and Wales. Longley, C (2000). *The Worlock Archive.* London. Geoffrey Chapman.

20. Combs, A. W. and G. Snygg (1949*). Individual Behaviour, A Perceptual Approach to Behaviour.* New York. Harper and Row.

21. Caine, R. G and G. Caine (1991). *Teaching and the Human Brain*. Alexandria, VA. Association for Supervision and Curriculum Development.

22. For an extended discussion of Perception see Ch 2 of Heywood, J (2009). *Managing Schools as Learning organizations. Adaptability and Change*. Dublin, Original Writing/Natonal Association of Principals and Deputies

23. Heywood, J (2018). *Empowering Professional Teaching in Engineering. Sustaining the Scholarship of Teaching.* Morgan Claypool, (Synthesis Lectures on Engineering series- since 2023 published by Springer). See Chapters 10 and 11.

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24. For a study of engineering students and their tutors who undertook this exercise see Heywood, J (2017). *The Human Side of Engineering*. Morgan Claypool, (Synthesis Lectures on Engineering series- since 2023 published by Springer). P 9 and Journey 2.

DOI 10,2200/S00748ED1V01Y20162ENG028

25. Sullins, J. P (2013). Roboethics and telerobotic weapons systems in Michelfelder, D. P., McCarthy, N., and D. Doldberg (eds). *Philosophy and Engineering: Reflections on Practice, Principles and Process.* Dordrecht. Springer.

26. W. Richard Bowen, a distinguished engineer points out that from earliest times there have been attempts define a 'just' war. Following Jones (1998) he lists five conditions for dealing with the decision to begin a war. These are as *follows "1. There must be a just cause (such as to repel an aggressor). 2. There must be just content (such as to restore peace and justice). 3. War must be a last resort, every possibility of peaceful settlement having been*

exhausted. 4. The declaration of war must be by a legitimate authority. 5. There must be a good prospect of success".

Bowen, W. R (2009). *Engineering Ethics. An Aspirational Approach*. London. Springer.

Jones, R. G (1998). Peace, violence and war in House, B (ed) *Christian Ethics*. London. Continuum.

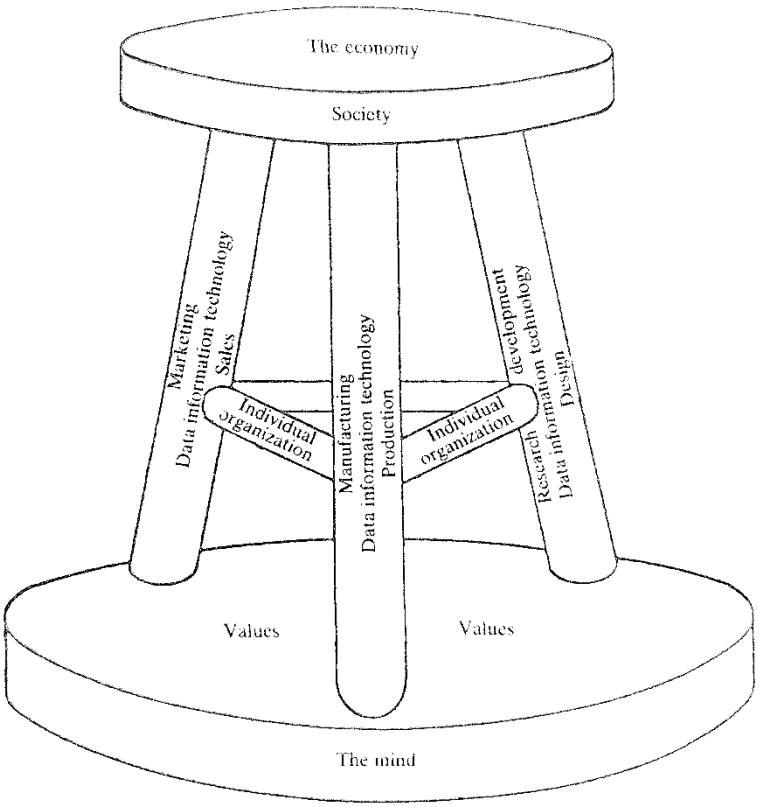

Exhibit 1. A model of the design, manufacturing process that leads to a technology. The base represents the power of human beings as represented by their minds. It is the mind which is the source of ideas and decisions. Information is passed from and to the mind along the legs and for convenience this flow is shown at the centre of each leg. The legs contain the technologies of action which support the economy and embrace society. The horizontal support which is attracted to the technologies of action represents the binding forces brought about by the interaction between individuals and their organizations,