Sustainability and the Information Society

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Abstract. The aim of this paper is to discuss the notion of sustainability in relationship to the idea of the information society. In the first part the relationship is on ecological aspects of a sustainable information society. In the second and third part of this paper I introduce a broad notion of sustainability that consists of multiple dimensions. The concept of a sustainable information society is developed, it is conceived as a society in which new information- and communication technologies (ICTs) and knowledge are used in order to advance a good-life for all individuals of current and future generations. This idea is conceived in a multidimensional way, identifying ecological, technological, economic, political, and cultural aspects and problems.

Keywords: sustainable information society, sustainability

1 ICTs and Ecological Sustainability

Related to the rising production, use, and diffusion of ICTs there are a lot of hopes, dreams, and myths. This also applies for the ecological subsystem of society where discussions focus on the question if ICTs can advance ecological sustainability, i.e. biological diversity and environmental protection. "Our contention is that, as ICT becomes more sophisticated and more embedded in our organizational structures and everyday life, we are in a better position than ever before to make sustainable development work" [1: p. 5]. I don't think that ICTs automatically advance ecological sustainability, but that ICTs pose both new opportunities and risks for the ecosphere. There is a positive and a negative tendency: ICTs allow the reduction of travelling by doing parts of necessary communications online, it is a medium of ecological communication and the communication and co-operation of the ecological protest movement, but it also contributes to ecological degradation e.g. in the form of computer scrap and the waste and emissions generated in production processes of

ICTs. I will discuss the implications of ICTs for sustainability in the areas of transport, business, ecological activism, and developing countries.

The question is whether private and business Internet communication automatically reduces the need for travelling. This can be the case if people consciously choose to avoid unnecessary travelling and transport by plane and car, but Internet communication also makes it easier to connect people globally and to initiate and maintain social relationships and hence it can also raise the desire or need to meet people face to face more frequently.

Some scientists argue that due to the fact that telework allows knowledge workers to overcome spatio-temporal distances and to work from home the need for transport and hence environmental pollution would be reduced. The same argument can be employed for teleconferencing saying that by substituting personal meetings by teleconferences travelling can be reduced. But teleworkers normally don't work full time at home because they need to stay connected personally and face to face with their social work environment, the number of teleworkers is generally relatively low (in Europe the share of teleworkers in the total labour force ranges from less than 2 per cent to more than 10 per cent, [cf. 9: p. 9])), travelling to work produces only a relatively small share of total carbon dioxide emissions, and working from home doesn't automatically imply less transport because online work can produce new contacts that might generate the need for meeting people personally. Working at home can have negative environmental effects, e.g. people can't go shopping on the way home from work, but might take an extra trip by car from home to shops and supermarkets.

Companies often paint an optimistic picture of the effects of teleworking on the ecosystem, but studies show that although teleworkers frequently reduce their commuting distances "the overall distance travelled for commuting is growing though not very fast. That the last three years represent the highest figures, does not support the thesis which suggests that transport savings have been made because of telework" [9: p. 26]. The European reality seems to be that telework and teleconferencing are simply too unimportant for having positive effects on transport savings and that there are rebound effects from online communication on the increase of travelling. About 5 per cent of the labour force in Europe can be considered as teleworkers, roughly 10 per cent of the working days of the complete European labour force can be considered as home-based telework [9: p. 52]. The result of another study is that "homeworkers are spending more time travelling than conventional workers" [7].

Telework and teleconferences certainly pose an opportunity for reducing travelling, but this opportunity has thus far not been adequately realized. What is needed is a conscious commitment of business and individuals to reduce the amount of travels by car and plane. ICTs alone don't solve the problem. The reality of work and life today is that in a flexible economy and society individuals have to be flexible and have to travel long-distances in order to maintain work-related and private social relationships.

Some scientists argue that the shift from the 'industrial society' to the 'information society' means that the economy becomes less resource-intensive and that hence there is a 'dematerialization' of production that creates a 'weightless economy' that advances ecological sustainability The argument here is that

knowledge-based industries and services are less resource intensive than industrial production, that ICTs can reduce negative environmental impacts of traditional industries by allowing more efficient ways of production and distribution, that certain products and services could be dematerialized/virtualized which would reduce their environmental impact, that such goods are traded and transported over the Internet which would reduce the amount of physical transport, and that ICTs can increase the efficiency of transportation.

The reality of dematerialization seems to be that fully virtualized products and the ICT sector constitute only a small portion of the economy, that the total resource use of the economy is constantly rising, and that hence thus far there has not been a massive 'greening' of production and consumption induced by knowledge products and ICT [6, 15]. It is not true that "economic value is dematerialising" [3: p.1]. Postindustrial capitalism as a dematerialized ecologically sustainable economy is a myth. Alain Touraine has argued in this context that the information society is a 'hyperindustrial society' [11]. It is not a new society that is characterized by immaterial goods, but a new phase of development of capitalism that is both continuity and discontinuity of industrial capitalism and has emergent qualities such as the central importance of cognitive, communicative, and co-operative labour.

The knowledge economy is not an economy of invisible and intangible goods, there indeed are many physical information commodities that are transported and sold. Another argument is that certain products and services can be entirely virtualized and transported in digital format over the Internet and that hence material and energy savings can be made. If music, books, newspapers, and journals are distributed in digital format online resource savings in production and distribution can be made. Also new flexible production technologies that are based on just-in-time-production (e.g. books on demand) allow resource savings. But almost no one wants to read a book or a whole newspaper online because it is not very comfortable to read on screen, therefore many people print out articles or whole books which results in a high consumption of paper, toner, and ink. There are certain alternatives such as e-paper that can be reused, but companies thus far have not widely supported reusable or eco-friendly equipment (such as e-paper, the 'green PC', or refillable ink cartridges for printers) because reusable computer equipment is not only less resource-intensive, but might in the long-term also be less profitable. Thus far companies have not much supported the development of ecologically sustainable ICT equipment. The use of recyclable and reusable equipment could indeed reduce the environmental impact of ICTs, but for doing so the logic of capital accumulation needs to be subordinated under ecological and social awareness. The relationship of ICTs and sustainability is not only a question of ethical consumerism, but also one of corporate social and ecological responsibility. In capitalism not those technologies that most benefit society and ecology are promoted, but those that enable capital accumulation. Hence it is e.g. not solar or wind energy or the reusable computer that are promoted, but nuclear energy, fossil fuels, the automobile, and non-renewable computer equipment. As long as a company is profitable, it might be open-minded for ecological and social goals, but capitalism is based on competition and economic crisis is an inherent feature of the system, hence in the end in many cases the logic of profit will outstrip social and ecological awareness.

For ecological sustainability we don't necessarily have to slow down technological progress, but the way hardware is manufactured and diffused surely have to change because millions of people continuing to buy a whole new computer each two or three years is detrimental to reaching ecological goals. One should also add that ICTs are industrial products, their production and disposal generates waste and emissions. Environmental performance assessments of computer technologies show that the latter doesn't heavily reduce material outputs, the production of one PC requires 16-19 tonnes of material resources and more than 5000 kWh energy, the emission of the production of one piece include 60 kg waste, 1850 kg carbon dioxide, 2 kg sulfur dioxide, and 1 kg nitrogen oxide [5]. The knowledge society is not an immaterial society, but a new phase in the material reality of capitalism. It requires a large material infrastructures made up by computers, periphery, servers, routers, switches, network cables, etc. The hardware industry makes profit by selling computers and periphery. If computers were used for a longer time or if it were increasingly possible to renew only certain parts in order to come up to date with technological progress and not having to buy a whole new computer, environmental improvements could indeed be made. But his would require a step away from the logic of profitability towards the logic of ecological sustainability. Hence it would mean to accept lower profits in order to protect the environment. Such moves are possible, but they contradict the dominant economic logic. If corporate social responsibility shall not only be ideology, corporations must be ready to go beyond and to question to a certain extent capitalist logic.

There are technological possibilities to reduce the energy consumption of television sets and monitors (by using LCD monitors and television sets and selling such machines at reasonable prices) as well as computers (by including components that automatically detach computers from energy supply if they are not used for a certain time, Switched Mode Power Supply). But the interests of the energy industry might be detrimental to establishing 'green ICTs' because high amounts of energy use mean high profits, what is needed are political pressure and unified laws that define minimum standards of energy efficiency of ICTs and require producers to include energy consumption labels on ICTs. This might have negative consequences on profitability, but if sustainability shall be achieved the domination of society by economic logic must be challenged.

2 Towards a Sustainable Information Society?

An anticipation of the idea of sustainable development can be found in Marx's writings. He argues that in communism the globe must be improved by human beings and passed on to succeeding generations in such a condition. "From the standpoint of a higher economic form of society, private ownership of the globe by single individuals will appear quite as absurd as private ownership of one man by another. Even a whole society, a nation, or even all simultaneously existing societies taken together, are not the owners of the globe. They are only its possessors, its usufructuaries, and, like *boni patres familias,* they must hand it down to succeeding

generations in an improved condition" [8: p. 784]. If one compares this passage to the most common definition of sustainable development by the Brundtland Commission – "Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs" [14: p. 43] – one finds a striking concurrence.

In 1992 the UN Conference on Environment and Development ('Earth Summit') took place in Rio de Janeiro, Brazil, where for the first time heads of state from all over the world gathered to discuss problems of sustainability. At the Earth Summit all participating countries agreed to the Rio Declaration on Environment and Development that put forward 27 principles for the future that can help in achieving sustainable development. The discourse on sustainable development shows a shift from the view of nature as an enemy that must be controlled to a view that considers nature as an important pre-condition of human existence that must be treated carefully. In 2002 the World Summit on Sustainable Development (WSSD) conference was held in Johannesburg with the intention of having a review ten years after the 1992 Rio Earth Summit. The outcomes include a Plan of Implementation and the Johannesburg Declaration on Sustainable Development [16]. Whereas the Earth Summit focused on the environmental issues of sustainability, the WSSD conference more effectively integrated economic and equity issues into the discussion.

In the discourse on sustainability there has been a shift from a focus on ecological issues towards the inclusion of broader societal issues. The 'triangle of sustainability' introduced by the World Bank has been very important in shifting discussion on sustainability from purely ecological aspects towards more integrative concepts. Ismail Serageldin, then vice-president of the World Bank, identified an economic, a social, and an ecological dimension of sustainability. "It is not surprising that these concerns reflect the three sides of what I have called the 'triangle of sustainability' - its economic, social, and ecological dimensions" [10: p. 17]. It has now become very common to identify an ecological, an economic, a social, and an institutional dimension of sustainability (as e.g. the EU and the UN do). "At the time of Rio, sustainable development was mainly about protecting nature, but now, in the wake of Johannesburg, it is first and foremost about protecting people" [16: p. 22].

In the relationship of nature and society human beings and groups act as subjects that appropriate and change nature in different ways. Although nature is active itself (it produces itself permanently in autopoietic cycles), it is an objective structure in society that is changed by man and enables the latter's activity. Hence one can conceive human individuals and groups as subjects and natural resources as objects in the nature-society-relationship. One can distinguish four types of sustainability concepts based on where in the nature-society-relationship they locate sustainability. Ecological reductionistic approaches define sustainability primarily in ecological terms, social projectionism considers sustainability as a quality of social systems, dualistic approaches speak of both a sustainable ecology and a sustainable society, but they consider both realms to be independent. Ecological reductionism ignores social aspects of sustainability such as wealth, participation, and wisdom, social projectionism is ignorant of the relative autonomy of nature, dualistic approaches ignore the interconnectedness and interdependence of nature and society. Dialectical

approaches on sustainability try to solve the problems of these concepts by arguing that societal sustainability requires ecological sustainability and ecological sustainability societal sustainability, the two systems mutually enhance each other.

Table 1. A Typology of Approaches on Sustainability

Approach	Nature (Object)	Society (Subject)
Ecological Reductionism	Sustainability of Nature	
Social Projectionism		Sustainability of Society
Dualism	Sustainability of Nature	Sustainability of Society
Dialectic Thinking	Interconnected Sustainability of Nature and Society	

Both nature and society are self-organizing systems in the sense that they permanently produce themselves, i.e. their elements and unity, they are self-maintaining, self-reproducing, and (in the case of society) self-reflecting. Nature is made up of eco-systems that permanently reproduce themselves, they are living, autopoietic systems that permanently reproduce their elements and their unity. If man negatively influences nature by depleting and polluting natural resources, ecosystems are no longer able to autopoietically reproduce themselves and break down. Hence their processes of reproduction and differentiation come to a halt. Ecological sustainability means that humans appropriate nature in a way that allows ecological diversity, i.e. the autopoiesis of nature can develop in such a way that nature flourishes, reproduces its subsystems, differentiates itself and produces new qualities, i.e. new ecological life forms and subsystems.

Social systems and society are self-organizing in the sense that there is a permanent mutual production of social structures and practices of human actors. These processes are goal-oriented, i.e. humans have the ability to identify and anticipate different paths of development, to judge which ones they consider as desirable and to act according to these wishes, values, and desires. Societal sustainability is based on the desire of all human beings to live in a fair, just, and beautiful society. Sustainability in general means a good life for all. Society is made up of different, interconnected subsystems: ecology, technology, economy, polity, and culture. Sustainability is a desirable aspect that humans strive for in all of these subsystems. A sustainable society encompasses ecological diversity, technological usability, economic wealth, political participation, and cultural wisdom. Usability means that technologies are designed in a user-friendly way and support humans in achieving their goals more easily. Economic wealth means that basic needs and social security should be provided for all human beings. Political participation requires a distribution of power that enables humans to adequately influence those decisions that affect them. A culturally wise society is one that is critical, self-reflective, allows a plurality of life-styles, meanings, ways of life, and values that complement each other (unity in diversity) and finds ways to solve and manage its problems in a way that brings advantages for all. Culture is made up by various subsystems such as the mass media, science, art, education, ethics/belief systems, medicine, sports, and the system of social relationships. In these systems cultural sustainability, i.e. wisdom, has different meanings such as wise knowledge and media (mass media), truth (science), beauty and imagination (art), literacy and good

skills (education), openness and unity in diversity of values and rights (ethics), health (medicine), fitness (sports), love and understanding (social relationships).

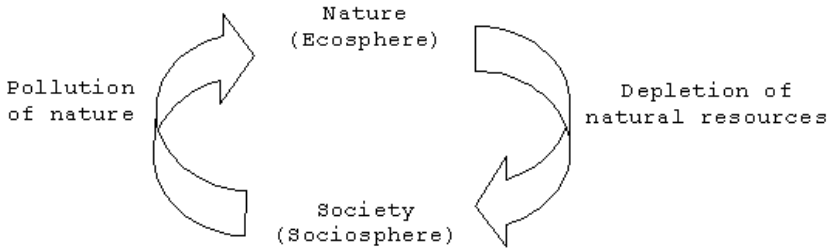
In a dialectical approach on sustainability ecological sustainability is based on social sustainability and vice versa, i.e. biological diversity is best advanced by a society where we finds technological usability, economic wealth for all (i.e. a rather symmetrical distribution of wealth), political participation for all, and cultural wisdom and a biological rich and diverse ecosystem is a life-support system that is a good foundation for a socially sustainable society where one finds social systems that are usable, wealthy, participatory, and wise. An unsustainable ecosystem advances an unsustainable society and vice versa: If man pollutes nature and depletes non-renewable natural resources problems, i.e. if he creates an unhealthy environment, problems such as poverty, war, totalitarianism, extremism, violence, crime, etc. are more likely to occur. The other way round a society that is shaken by poverty, war, a lack of democracy and plurality, etc. is more likely to pollute and deplete nature. This can result in a vicious cycle where nature and society are connected in negative feedback loops that have destructive effects for both systems. If nature and society are connected in sustainable ways there can be positive feedback loops that enable both systems to flourish and to develop in sustainable ways. Sustainable development of the ecosystem means that it increases its diversity and reproduces itself, sustainable development of the socio-sphere means that it increases wealth for all, fosters technological progress that benefits all, and enhances participation and wisdom for all. In a sustainable society social structures such as technology, property/use values, power, and knowledge/meaning are produced and enhanced in ways that benefit all human beings, the self-organization cycles of a sustainable society develop in such a way that a good life for all is possible, the self-organization of the ecosystem and the self-organization of the socio-sphere positively influence each other.

Table 2. Dimensions of Sustainability

Dimension	**Quality**
Ecological Sustainability	Biological Diversity
Technological Sustainability	Usability
Economic Sustainability	Wealth for All
Political Sustainability	Participation of All
Cultural Sustainability	Wisdom
Sustainability of:	
Mass Media	Wise Knowledge and Media
Science	Truth
Art	Beauty and Imagination
Education	Literacy and Good Skills
Ethics	Openness, Unity in Diversity of Values and Rights
Medicine	Health
Sports	Fitness
Social Relationships	Love and Understanding

Modern industrialism is unsustainable in two ways: 1. Accumulation processes result in the depletion of non-renewable natural resources, limits to extraction and accumulation are herewith created. 2. Economic production and consumption result in residues of goods that are shoved into nature by society in the form of waste. Hence ecological degradation includes both depletion and pollution. Based on figure 3 one can describe ecological degradation as a double process of the depletion of nature (in the direction where nature is appropriated by society) and the pollution of nature by society (in the direction where society transforms nature) (cf. fig. 3). Unsustainable ecological development is a process where depletion and pollution of nature by society cause the breakdown of more and more material (living and non-living) cycles of self-organization in nature and create threats to the survival of the whole eco-system that forms the material foundation of society. Hence the destruction of nature also threatens the survival of society and humankind.

Fig. 1. Unsustainable ecological development



3 Measuring the Sustainability of the Information Society

The shift towards the knowledge-based society has resulted in an increasing orientation of empirical sociological research and statistical analysis towards developing statistical indicators of the knowledge-based character of the economy and society. In order to benchmark the success of the member states in achieving the goals defined in the eEurope action plans the European Council has defined main indicators plus supplementary indicators in the areas of 1. Citizens' access to and use of the Internet, 2. Enterprises' access to and use of ICTs, 3. Internet access costs, 4. eGovernment, 5. eLearning, 6. eHealth, 7.Buying and selling on-line, 8. eBusiness readiness, 9. Internet users' experiences and usage regarding ICT-security, 10. Broadband penetration [2]. There are 16 policy indicators and 25 supplementary indicators. For benchmarking eEurope 2002 there were 23 indicators. There was a World Summit of the Information Society (WSIS) thematic meeting on 'Measuring the Information Society' from February 7-9, 2005 in Geneva in which possibilities for an international unification of information society indicators were discussed. The

final conclusions suggest 42 indicators in 3 areas: 1. Infrastructure and access, 2. Access and use of ICTs by households and individuals, 3. Access and use of ICTS by businesses [17].

Sustainability indicators such as the Ecological Footprint, the Pilot Environmental Sustainability Index, the Living Planet Index, the early OECD core set of environmental indicators, Eurostat Environmental Pressure Indicators, and Material Flow Analyses focus on the ecological dimension of sustainability. Many of these indicators are based on the OECD's Pressure-State-Response (PSR) model that assumes that human activities exert pressures on the environment that change the latter's state which results in responses of society in the form of policy measures.

The discourse on sustainability has shifted from an early ecological focus towards the inclusion of economic, political, cultural, and social issues. Hence there are not only ecological indicators, but also ones that try to cover the whole bandwidth of societal issues concerning sustainability. Such broad indicators of sustainability covering a wide range of topics and societal areas are e.g. the United Nations Commission of Sustainable Development's (UNCSD) set of indicators of sustainable development, Eurostat sustainability indicators, the World Development Indicators that are based on the Millennium Declaration, the sustainability indicators suggested by the Wuppertal Institute, the Genuine Progress Indicator, and the Barometer of Sustainability.

In 1996 the United Nations Commission on Sustainable Development (UNCSD) developed a list of 134 indicators of sustainability [12]. Later the UNCSD chose to classify indicators according to thematic areas. A working list of 134 indicators was selected and 22 countries volunteered to test their applicability. The goal for 2001 was the development of a standardized set of indicators available as a tool to measure progress towards sustainable development. As such a standardization the United Nations Division for Sustainable Development [13] suggests a total of 57 indicators in four key areas: social, economic, environmental, institutional. Based on the UN indicators Eurostat [4] developed 64 indicators of sustainability in the same four main areas as UNDSD..

There are both indicators for measuring the information society and sustainability. But there is a lack of attempts trying to measure the progress towards a sustainable information society. If we assume that important societal changes are taking place and affecting all realms of society that are due to the increasing importance of information, ICTs, networks, and globalization, it is not sufficing to measure the degree to which society is an information society, but one also should develop indicators that show to which degree we live in a sustainable information society that provides human well-being and ecological diversity. The task of a theory of the information society is on the one hand to discuss and advance essence, principles, and dynamics of the new societal formation, and on the other hand to identify aspects and indicators of sustainability that allows stakeholders to develop guidelines for advancing the sustainable character of the information society. The information society indicators that are currently used and discussed focus on quantifying the production, diffusion, and use of ICTs in society, but they frequently lack an explicit inclusion of sustainability issues. Approaches on measuring sustainability discuss broad societal issues, but they frequently lack taking adequately into account issues of information and ICTs. Some of them simply ignore

such topics, others only include measurements of computer and Internet diffusion in society. The task at hand is to identify principles, tendencies, opportunities, risks, dimensions, and indicators of a sustainable information society, to assess and develop ideas of how to use information and ICTs in such a way that ecological, economic, social, and institutional sustainability can be advanced, and to work out indicators for measuring the degrees of sustainability of the various dimensions of the information society.

During the last decade there has been a shift from considering sustainability as a purely ecological concept to defining it in broader societal terms. Hence the discourse on ICT, knowledge, and sustainability shouldn't halt at ecological issues. I have argued that there are ecological, technological, economic, political, and cultural aspects of sustainability and that goals of sustainability are biological diversity, technological usability, economic wealth for all, political participation and justice for all, and cultural wisdom and unity in diversity management. Information and ICTs pose both new opportunities and risks in all of these subsystems of society, it is antagonistic and produces in parallel various tendencies that run counter to and contradict each other. Table 3 identifies opportunities and risks of the various dimensions of the information society. A sustainable information society is one that advances such opportunities and minimizes risks.

Depending on how ICTs are socially designed and applied they can have positive and/or negative effects on society. There are enabling and constraining tendencies of ICTs and information in society and ecology today, it is a political task to advance and realize opportunities and to avoid risks that are related to ICTs.

Table 3. Dimensions of the Sustainability of the Information Society

Dimension	**Quality**	**ICT- and Information-related Opportunities and Risks**
Ecological Sustainability	Biological Diversity	Ecologically sustainable vs. ecologically destructive ICTs
Technological Sustainability	Usability	User-oriented, user-friendly, enabling vs. Unusable, constraining ICTs
Economic Sustainability	Wealth for All	Free knowledge and ICTs vs. Knowledge and ICTs as commodity and private property
Political Sustainability	Participation of All	Participation vs. Control enabled by ICTs
Cultural Sustainability	Wisdom	Wisdom vs. False Consciousness advanced by ICTs
Sustainability of:		
Mass Media	Wise Knowledge and Media	Participatory, wise Online-Journalism vs. Manipulative, one-dimensional Online-Journalism
Science	Truth	Speed vs. Quality of E-Science
Art	Beauty and Imagination	Aura Gain and participatory art vs. Aura and authenticity loss of

		works of art in cyberspace
Education	Literacy and Good Skills	Co-operative vs. Individualized E-Learning
Ethics	Openness, Unity in Diversity of Values and Rights	Open VS. Fundamental values communicated in cyberspace and by cyberethics
Medicine	Health	Positive vs. Negative effects of ICTs on health
Sports	Fitness	Advancement/socialization vs. limitation/individualization of physical activity and games
Social Relationships	Love and Understanding	Cyberlove vs. Cyberhate

4 Conclusion

The modern mode of production that is based on the logic of accumulation has produced unsustainable patterns of development that continue to shape the information society. The emergence of the information society has put forward both new opportunities and risks for sustainable development. A theory of the information society should help analyzing and identifying risks, opportunities, and choices. For doing so a multidimensional concept of sustainability and the sustainable information society as well as concepts for indicators that measure the degree to which a sustainable information society has been achieved are necessary and foundations of such an approach and research-program have been suggested in this paper.

A sustainable information society is a society in which knowledge and the usage of new, computer-based, networked information and communication technologies (ICTs) advance a good life for all individuals belonging to current and future generations. This notion is multidimensional and suggests that ICTs and knowledge should help humans and society in achieving biological diversity (ecological sustainability), usability of technologies (technological sustainability), wealth for all, (economic sustainability), participation of all (political sustainability), and wisdom (cultural sustainability). In the cultural realm there are several sub goals of sustainability, wisdom contains wise media, truth, beauty and imagination, literacy and good skills, unity in diversity, health, fitness, love and understanding that should be supported by knowledge and ICTs.

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