Inside This Issue

The CADMUS Journal

The acronym of the South-East European Division of The World Academy of Art and Science – SEED – prompted us to initiate a journal devoted to seed ideas – to leadership in thought that leads to action. Cadmus (or Kadmos in Greek and Phoenician mythology) was a son of King Agenor and Queen Telephassa of Tyre, and brother of Cilix, Phoenix and Europa. Cadmus is credited with introducing the original alphabet – the Phoenician alphabet, with "the invention" of agriculture, and with founding the city of Thebes. His marriage with Harmonia represents the symbolic coupling of Eastern learning and Western love of beauty. The youngest son of Cadmus and Harmonia is Illyrius. The city of Zagreb, which is the formal seat of SEED, was once a part of Illyria, a region including what is today referred to as the Western Balkans and even more. Cadmus will be a journal for fresh thinking and new perspectives that integrate knowledge from all fields of science, art and humanities to address real-life issues, inform policy and decision-making, and enhance our collective response to the challenges and opportunities facing the world today.

THE WEALTH OF NATIONS REVISITED

CADMUS

NEW PERSPECTIVES ON MAJOR GLOBAL ISSUES

Volume 2, Issue 1

October 2013

CADMUS VISION

The world is in need of guiding ideas, a vision, to more effectively direct our intellectual, moral and scientific capabilities for world peace, global security, human dignity and social justice. Today we face myriad challenges. Unprecedented material and technological achievements co-exist with unconscionable and in some cases increasing poverty, inequality and injustice. Advances in science have unleashed remarkable powers, yet these very powers as presently wielded threaten to undermine the very future of our planet. Rapidly rising expectations have increased frustrations and tensions that threaten the fabric of global society. Prosperity itself has become a source of instability and destruction when wantonly pursued without organizational safeguards for our collective well-being. No longer able to afford the luxury of competition and strife based primarily on national, ethnic or religious interests and prejudices, we need urgently to acquire the knowledge and fashion the institutions required for free, fair and effective global governance.

In recent centuries the world has been propelled by the battle cry of revolutionary ideas — freedom, equality, fraternity, universal education, workers of the world unite. Past revolutions have always brought vast upheaval and destruction in their wake, tumultuous and violent change that has torn societies asunder and precipitated devastating wars. Today the world needs evolutionary ideas that can spur our collective progress without the wake of destructive violence that threatens to undermine the huge but fragile political, social, financial and ecological infrastructures on which we depend and strive to build a better world.

Until recently, history has recorded the acts of creative individual thinkers and dynamic leaders who altered the path of human progress and left a lasting mark on society. Over the past half century, the role of pioneering individuals is increasingly being replaced by that of new and progressive organizations, including the international organizations of the UN system and NGOs such as the Club of Rome, Pugwash and the International Physicians for the Prevention of Nuclear War. These organizations stand out because they are inspired by high values and committed to the achievement of practical, but far-reaching goals. This was, no doubt, the intention of the founders of the World Academy of Art & Science when it established this institution in 1960 as a transnational association to explore the major concerns of humanity in a non-governmental context.

The founders of WAAS were motivated by a deep emotional commitment and sense of responsibility to work for the betterment of all humankind. Their overriding conviction was on the need for a united global effort to control the forces of science and technology and govern the peaceful evolution of human society. Inhibiting conditions limited their ability to translate these powerful motives into action, but they still retain their original power for realization. Today circumstances are more conducive, the international environment is more developed. No single organization can by itself harness the motive force needed to change the world, but a group of like-minded organizations founded with such powerful intentions can become a magnet and focal point to project creative ideas that possess the inherent dynamism for self-fulfillment.

Ivo Šlaus   *Orio Giarini*   *Garry Jacobs*

CADMUS
New Perspectives on Major Global Issues
Volume 2, Issue 1, October 2013

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Education is the premier instrument for conscious social evolution. This issue explores the need and the opportunity for revolutionary advances in higher education. Various aspects of this topic are examined in articles by Ashok Natarajan, Ismail Serageldin, Janani Harish, Orio Giarini and Mircea Malitza, and in the report on the World Academy's Forum on Global Higher Education conducted by WAAS at the University of California at Berkeley on October 2-3, 2013, "Reflections on the Future of Global Higher Education."

This issue of Cadmus also continues the Academy's exploration of a New Paradigm for Human Development. It includes contributions by Jonathan Granoff, Federico Mayor, Alexander Likhotal, F. J. Radermacher, Agni Vlavianos Arvanitis, Michael Marien, Suleika Reiners, Winston Nagan, Marc Finaud and Des Browne relating to democracy, economy, ecology, employment, finance, cooperative security, global governance and rule of law presented and discussed during recent WAAS events at the United Nations in Geneva, Library of Alexandria, Washington DC and Ottawa.

A new paradigm requires a new theoretical framework based on new ways of thinking. Articles in this issue by Raoul Weiler, Jüri Engelbrecht, Roberto Poli and Orio Giarini explore the emerging Sciences of Networking and Complexity as well as new insights into the creative role of uncertainty in social evolution. We hope you enjoy the issue.

Orio Giarini   *Garry Jacobs*   *Ivo Šlaus*

A Revolution and a New Paradigm in Education

Knowledge is the sustenance of civilization and culture. Language is the instrument for mental comprehension and transmission of knowledge. Education is the means by which each generation passes on to the next in a concentrated, systematic manner the cumulative knowledge and wisdom acquired in the past. Of all the technologies developed by humanity, none is as powerful and sophisticated as the means we have fashioned to gather, organize, store, share and transmit knowledge. Education is the instrument of conscious human evolution.

We are on the cusp of a revolution potentially more powerful and important than any technological or political revolution in history. An on-going revolution in Information is generating and transmitting an unprecedented range and depth of data at dazzling speed. A parallel revolution in Knowledge is processing and analyzing that information to forge new fields of study, new perspectives and a greater understanding of the world we live in. Now a revolution in Education is about to transform the way human beings learn and transmit knowledge from one person and one generation to another. After centuries of slow, methodical development, education is evolving today more rapidly than ever before.

"We need an educational system that is far more flexible, adaptive and responsive to the changing needs of society and capable of developing more fully the seemingly unlimited range and depth of our individual and collective human potential."

Advances in communication technology are the immediate occasion and means of liberating education from the university classroom and the printed textbook into the boundless, timeless realm of cyberspace, but the Education Revolution involves far more than adaption of new technology, and the significance of what is happening extends far beyond online courses and e-books. For in the process, the barriers that have long isolated and insulated the university from the world around it are breaking down. The knowledge presently encapsulated in the organized curriculum of higher education represents only a tiny fraction of the cumulative knowledge of humanity. It does not fully reflect the vast knowledge of retired teachers, managers, and public officials that is so often lost when they retire, or the expertise acquired by entrepreneurs and businesses that spend hundreds of billions of dollars every year educating their own employees, or the knowledge acquired by the UN system and other international organizations over six decades of grappling with the challenges of global governance, or the knowledge and experience of thousands of NGOs working on issues related to peace, public policy, economy, ecology and social issues. All these will more easily find their way into the virtual classroom of tomorrow than they have into the physical classroom of the past.

Today education is rightly considered the single most important endowment for success in life. Those with higher education find better work opportunities, earn more, achieve greater security, and live longer, healthier, more satisfying lives. Yet, in spite of rising levels of education globally, unemployment is rising at the same time and it is reaching levels that threaten both human security and social stability in some countries. More education by itself is no longer sufficient. In a world that is changing so rapidly, we need an educational system that is far more flexible, adaptive and responsive to the changing needs of society and capable of developing more fully the seemingly unlimited range and depth of our individual and collective human potential, so essential at a time when we are severely overexploiting the earth's natural capital.

The revolution in education now makes it possible to bridge the gulf that presently divides the knowledge taught in universities from the practical knowledge and skills needed for accomplishment in life. Every student of economics learns the principles of micro-economics that would be operative under conditions of perfect competition, yet such conditions rarely, if ever, exist in the real world of the marketplace. Models and constructs are helpful for advancing our conceptual understanding, but mistaking models for the real world is a recipe for disaster. The awarding of Nobel Prizes in economics for the computerized trading models that have destabilized global financial markets is an instance. Controlled experiments in the laboratory are not adequate preparation for the complexity and spontaneity of life in the world outside. Biological models are insufficient to reflect the evolutionary potential of human consciousness.

In the mid-1990s, the city of Napa, California, asked a group of companies to help redesign high school education to better prepare students for career success. The officials were surprised that the most common criticism made by the companies had nothing to do with the content of the curriculum, but rather it related to the way the content was being taught. Students are taught in school to learn by themselves and they are evaluated solely on the basis of their individual performance in competition with their peers, yet, once they enter the world of work almost every task is a group endeavor requiring the capacity to cooperate with others and complement each other's capabilities. Napa established a new high school and adopted a new method of learning in which groups of students learn together and teach one another. The meteoric rise of Khan Academy and the MOOCs in North America is another visible expression of the new spirit of experimentation, entrepreneurship and innovation that is beginning to permeate the field of education at all levels.

Since the dawn of the Industrial Revolution, massification has infiltrated all aspects of modern life – from tract homes and brand name products to political movements and standardized modular education at all levels. The sheer immensity of the task of raising literacy and educational levels of hundreds of millions of people over the past century has necessitated and justified the mass production approach and that task is not complete. In order to raise the entire world to Western standards of higher education, the capacity of the world's colleges and universities would have to be tripled or quadrupled, an achievement that would

"Providing knowledge and skills is not all there is to education."

require enormous investment and decades to accomplish. Online education offers the possibility of an alternative or a complementary strategy that can not only extend the reach, but also immensely increase the range and variety of knowledge offered through the educational system. This is essential.

> *"Our future lies in evolving an educational system capable of nurturing and bringing out the full latent potentials of each individual."*

In recent decades, the world has made immense progress in extending minimum rights and opportunities to all, but the challenge of human development does not end with meeting minimum needs. Providing knowledge and skills is not all there is to education. It can also impart the understanding and perspective to relate with others and integrate harmoniously with the world around, as well as the universal values which represent the essential wisdom for self-respect, social accomplishment and personal fulfillment. Humanity has a greater potential and a great destiny in store which can only be reached by releasing the creativity and initiative of every individual. Our future lies in evolving an educational system capable of nurturing and bringing out the full latent potentials of each individual. For as the development of the individual depends on the development of the society in which he lives, the fullest development of society depends on the fullest development of its individual members.

Not all changes are necessarily good and not all will welcome even those changes that bring obvious benefits. Much depends on our point of reference and perspective. Comparing online education with the best of the best traditional college education, it is likely to appear a poor and inadequate substitute. But that is hardly a fair standard for comparison. Even in the world's top universities, the difference between the handful of inspirational instructors and the rest is enormous and the distance between the best college and the national or global average is immense. And for hundreds of millions of youth, lack of access to affordable education represents an enormous gulf separating them from a better future. Some aspects of life may have been more civilized and luxurious for the aristocracies of the past, but those benefits accrued to only a tiny elite representing perhaps a tenth of one percent of the population, like the proverbial 10,000 families in aristocratic England. That is still largely true of quality education today. Imagine instead that the most knowledgeable and inspirational thousand or ten-thousand instructors in the world could be made available to students everywhere, at any time and in any language.

> *"Revolutions occur when society resists change and refuses to respond to the compelling call of the future."*

Revolutions are messy affairs and often destroy as much as they create. But throughout history they have been the seeds of new freedom, fresh ideas and creative energies that liberate humanity from the limitations of the past and usher in unprecedented opportuni-

ties for people in general. Revolutions are what we make of them. Revolutions occur when society resists change and refuses to respond to the compelling call of the future. The good news today is that universities are among the leaders in revolutionizing the field of higher education. By this process they may lose some of the prestige and exclusive power that all traditional institutions acquire over time. But reaching out to collaborate actively with other reservoirs of knowledge and expertise in society, what they lose in exclusive status can be more than compensated by what they gain in richer content of knowledge and the capacity to meet social needs. Then a potentially disruptive revolution may be transformed into a rapid, constructive evolutionary movement the world so deeply needs to cope with the emerging challenges of the 21st century. A new paradigm in education may then become the basis for a new paradigm in human development and social evolution.

**Heitor Gurgulino de Souza, Garry Jacobs, Winston Nagan,
Ivo Šlaus and Alberto Zucconi**

Freedom and Unity

America was founded by immigrants from many nations of diverse political ideals, disparate religious beliefs, social backgrounds (French aristocrats, Irish serfs, Chinese coolies), different races (white, black, oriental), and a multitude of linguistic groups. They shared only one thing in common that bound them to one another – a common quest for liberty, a love of freedom.

They discovered that freedom in the New World in a measure never before imagined or realized elsewhere: *political freedom* to speak whatever they chose and elect their own leaders at a time when monarchy still reigned supreme in Europe, the right to vote was confined to three percent of Englishman, and candidates for Parliament came almost exclusively from the upper class; *religious freedom* to believe, speak and worship according to their own dispositions – be they Puritan, Quaker, Anabaptist, Mennonite, Jesuit, Anglican, Lutheran, Huguenot, Catholic, Jewish, Calvinist, Methodist, or a host of others; *economic freedom* where anyone could become anything and rise from rags to riches within a lifetime, where huge chunks of land were given almost free for the asking, where wages rose to ten times the level prevalent in Europe due to the perennial shortage of workers; *social freedom* from class discrimination, where an impoverished boy born in a log-cabin and self-educated could rise to become the President of the country at a time when the European society was still dominated by an aristocracy and landed gentry that occupied all senior positions in government, church, military and universities; and *cultural freedom* from discrimination based on birth and lineage that still marked an English or Frenchman according to his family of origin and his linguistic accent.

"Abraham Lincoln believed in the sanctity of these two apparently contradictory and irreconcilable goals – freedom for all and unity for the nation – and was willing to risk all and sacrifice everything else for the sake of realizing them."

So great was the freedom in America that a visiting French prison administrator, Alexis de Tocqueville, wrote his famous book *Democracy in America* in 1832 marveling at what to Europeans was unimaginable, and a century later his fellow countryman Charles de Gaulle (not known for his excessive love of America) was compelled to proclaim the same while walking the streets of New York. Freedom and freedom alone united these diverse people and molded them into a nation that multiplied rapidly in numbers and expanded rapidly in space until they reached across the continent to the Pacific Ocean.

Yet, it was also the issue of freedom that divided America and Americans from the country's very inception, when slave-owning southern plantation owners refused to join the newly established United States of America without assurances that their black slaves would be regarded under law as personal property, rather than as human beings. Jefferson's famous declaration that 'All men are created equal' was modified in practice to mean all white men – not blacks who were merely property, not even white women, who did not attain the right to vote till 135 years after the Declaration of Independence. Many of those who

had fled to America in quest of liberty were unwilling to extend the same gift to others, if they could benefit from depriving others of the same privileges they enjoyed. The Southern economy rose and prospered for a time on the strength of slave labor, as wealthy monarchs and emperors had ruled elsewhere in the past on the strength of the sacrifices of their people.

The dispute over freedom was a slim crack in the original constitution of the country which gradually widened into a fissure and broadened into a chasm that threatened and nearly succeeded in destroying the confederation of states and splitting it asunder. The American Civil War – the first modern war and bloodiest ever fought until that time – began in 1861 to determine whether that fracture would become a permanent division of the nation into two or more independent countries or whether the original flaw in the union of former colonies would be permanently eliminated. The war was won and political freedom granted to the slaves due to the leadership of a remarkable man and great leader, Abraham Lincoln, who ardently believed in the sanctity of these two apparently contradictory and irreconcilable goals – freedom for all and unity for the nation – and was willing to risk all and sacrifice everything else for the sake of realizing them.

"Freedom remains an empty promise unless it encompasses not only the right to vote, speak and worship, but also assures the right to work, to a steady income and economic security, to social acceptance and mental development."

The outcome of the war ruled for Freedom and Unity. Slavery was abolished from the continental USA, as it had already been abolished throughout Europe. The loosely bound confederation of states was forged into a tightly knit federation with a strong federal government empowered to ensure freedom for all Americans. In the following decades America fulfilled its manifest destiny of incorporating all the territories between the Atlantic and the Pacific. It enjoyed the most rapid economic growth in its history and of any nation up until that time. Before the end of the 19th century, it had become the most prosperous nation in the world.

Yet the quest for real freedom had only been won in principle, not in fact. For freedom remains an empty promise unless it encompasses not only the right to vote, speak and worship, but also assures the right to work, to a steady income and economic security, to social acceptance and mental development. Political freedom is the foundation on which economic, social and psychological freedom are to be attained and assured. The rapid spread of higher education widened economic opportunities for many Americans, but for long the blacks were virtually excluded from access to the best schools and higher institutions of learning. Having attained in principle equality before law, they were still oppressed by social and economic discrimination. It took another 100 years or more to translate the promise of political freedom for the blacks into a modicum of social and economic equality. That struggle is still playing itself out today.

"Political, economic and social freedom have become fertile soil in America for the eventual emergence of psychological freedom – the freedom to be oneself and realize one's unique potential as a human being."

In the 21st century, Americans enjoy greater freedom than the people of any nation in history – freedom to think and speak what they wish, worship whatever they please and be whatever their individual propensities urge them to be. More than its wealth or its power, it is that freedom which makes America so deeply appealing and attractive to people all over the world. As an 18 year old Indian woman exclaimed after working in the USA for a year, "for the first time in my life I am treated as though my ideas and opinions matter, that I have capacities to be developed and aspirations worthy of being fulfilled." Political, economic and social freedom have become fertile soil in America for the eventual emergence of psychological freedom – the freedom to be oneself and realize one's unique potential as a human being.

The combination of Freedom and Unity in America became a source of inspiration for other nations, for the nationalist movements that ended colonialism in 50 countries after the Second World War, for the founding of the UN as a united community of nations, and the birth of the European Union. Had it not been for the Northern victory in the Civil War, history would have been dramatically different. America would not be and would never have become the world's most powerful and prosperous nation, the leader of the free world, the embodiment of the human aspiration for freedom. Far more likely, it would have splintered into a dozen or more independent nations and labored over decades to overcome their differences to reunite as the countries of Europe are laboring today. Yet, Freedom remains an unfulfilled idea in America, a distant goal, perhaps even a fading dream. And the reason is still the same. Those who enjoy the benefits won at such great cost and sacrifice by their forefathers seek to preserve their privileged positions and are reluctant to extend and share what they have gained with others. Freedom to them, like to the slave-owning plantation owners of an earlier period, means freedom for themselves, not assured equality for all.

> *"Speculation is financial slavery."*

Today, the divide that separates people is economic rather than political – the rights of those who possess wealth opposed to the rights of those who aspire for it and are deprived by a plutocratic political system, by an economy dominated by major corporations and money power, and by the right of financiers to speculate, even when it endangers or destroys the real economy which it is intended to support and deprives millions of their capacity to earn and achieve economic security. Speculation is proclaimed as their sacred right while the right to gainful employment is left unrecognized. Speculation is financial slavery. President Franklin Roosevelt understood the divisive power of economic inequality and strove to combat it by launching the New Deal. He understood that economic equality makes real political freedom.

FDR even planned after the war to introduce a second Bill of Rights to protect employment and other economic rights, but died before he could achieve it. The right to employment is the economic equivalent of the right to vote in democracy. Without access to gainful employment opportunities, freedom is a maimed concept.

"The very founding of the World Wide Web was made possible by Gorbachev's radical initiatives, making possible the extension of freedom globally."

The battle won at Gettysburg effectively ended the Civil War, reunited all Americans within a single nation, freed black Africans from slavery and deprivation of their legal rights, and made the USA far stronger than it had been. But the war for Freedom and Unity was not won that day. It continues to be waged on a battlefield that now encompasses the whole globe. Nearly three decades ago another great leader rose inspired by the values of Freedom and Unity. He too risked all to win freedom not only for his own people, but also for the people of many other countries living behind the Iron Curtain and beyond that for humanity as a whole, which was bound and oppressed by the ever-looming threat of total catastrophic war between the superpowers. Mikhail Gorbachev won a huge battle for freedom on behalf of all humanity. Because of his initiatives, a democratic revolution spread throughout Eastern Europe and overflowed to other continents. The world became a far safer, more open, freer place where people could move freely and interact without fear or suspicion. The very founding of the World Wide Web was made possible by Gorbachev's radical initiatives, making possible the extension of freedom globally.

"Every forward step of human progress over the past five centuries has been a step toward greater freedom and greater human unity."

Still, the war is not over. Political battles are still being waged in many countries. Economic inequality is rising. Plutocracy is even more entrenched than ever before. The unequal sharing of resources threatens the stability of the earth's environment. The whole world is held ransom by the manipulations of financial speculators and the political power of vested interests.

The war is not over, but its inevitable future direction and result are assured beyond doubt. Every forward step of human progress over the past five centuries has been a step toward greater freedom and greater human unity. They are the engines that have unleashed the creative energies of humanity and channeled them through social organization into greater material, social and psychological security, welfare and well-being. The signposts for humanity's future evolutionary progress are unmistakable. Our future lies that way. Every small forward step carries us closer to the goal and our common human destiny.

Garry Jacobs

Musings on a New Paradigm

We are the first civilization in which the pursuit of the real and the good has become separated. The current predominant world-view adopts the scientific method as the singular legitimate method of discovering the truth. It relies on prediction, repetition, control, and quantification. Aspects of human experience not amenable to such categories like soul, love, meaning, experience, self, and consciousness are thus marginalized and placed mainly in the realm of aesthetics. It is from the latter categories that purpose, *telos,* is discerned. One could propose that we have a preoccupation with 'how' and are ignorant of 'why'. The outcome is law without justice (a pre-occupation with procedure), medicine without healing (focus on symptoms and neglect of deep systemic healing), financial systems without reference to production of goods and services (the purpose of capital), art without beauty, philosophy without the pursuit of truth (mostly focused on method), weapons without security (nuclear being the best example of improved means to unimproved ends), and religion without love and transcendence (a focus on rites, rituals, and dogmas). The scientific method is a very useful and valuable intellectual tool to investigate, appreciate and, when coupled with technological prowess, can manipulate the natural world. It is not the only dimension of human inquiry or discovery.

> *"The current paradigm conflates economic growth with development globally."*

> *"Development is what happens after sufficient growth to feed, clothe, and house people. It includes culture, spirituality and the quality of being human."*

The current paradigm conflates economic growth with development. Development is what happens after sufficient growth to feed, clothe, and house people. It includes culture, spirituality and the quality of being human.

The current paradigm neglects the necessity to live in harmony with the living systems we wrongly designate as environment but which are actually part of our own being and a wondrous web of which we are a part.

The current paradigm is based on an ideological premise of progress.

There is an absence of the sacred and a recognition of mystery. We come from and return to we know not where. We are sustained and made conscious by a power that remains beyond our intellectual capacity to grasp but which remains real and present and is good beyond our descriptive powers and measurements.

Jonathan Granoff

Creative Consciousness

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Abstract

Consciousness is creative. Creativity expresses in myriad ways – as moments in time in which decades of progress can be achieved overnight, as organizational innovations of immense power for social accomplishment; as creative social values that further influence the evolution of organizations and society; as the creativity of individuality in the leader, genius, artist and inventor; as social creativity that converts raw human experience into civilization; as cultural creativity that transforms human relationships into sources of rich emotional capacity; and as value-based educational creativity that can awaken and nurture young minds to develop and discover their own inherent capacity for knowledge in freedom. Through such moments do society and humanity evolve. Education is society's most advanced institution for conscious social evolution. Values are the essence of society's knowledge for highest accomplishment. Education that imparts values is an evolutionary social organization that can hasten the emergence of that creative consciousness.

Moments are creative. New ideas are conceived, great works inspired, new nations founded, momentous results achieved in creative moments. Sri Aurobindo described moments of creative consciousness as virginally creative moments. At such moments, one feels vividly alive and expansively cheerful, a sure index of success, as evidenced by the lively disposition of the heroine Elizabeth in Jane

> *"Consciousness is self-aware energy."*

Austen's *Pride and Prejudice*. Everyone values the creative disposition, but enjoys it only when it is active. Educating the mind eliminates the uncertainties from one's life. Educating the Spirit lifts it out of the non-creative frame of mind into one of ever-living creative consciousness.

Consciousness is self-aware energy. When it falls into a routine it becomes very efficient. When it breaks new ground, it becomes creative. When a man acts creatively, the public takes note. When a public speaker delivers a creatively inspired speech, he can hold the audience spell-bound or send them into raptures. A moving music performance can raise the audience to great heights of inner appreciation. Even a cook who succeeds in bringing out the subtle rasa (essential taste) of food can inspire deep appreciation. A reader's creative understanding can evoke an inspiring vision that approaches the borders of genius.

1. Organizational Creativity

Organizations also experience creative moments. Organizations are forged by centuries

of social experience. They emerge from creative activities that organize social existence into creative systems. The act is the unit of life, even as thought is the unit of mental life. Act-activities-systems-organization form a progressive chain. When an organization becomes creative, it can transform the social life of a nation, as the Green Revolution rapidly transformed the national life of India by helping the nation attain self-sufficiency in food production. Based on a creative impulse of inspired individuality, it became a movement of national spiritual renaissance. One of its many consequences was to launch a revolution in rural banking that awakened India's rural population to the attractions of urbanization.

> *"To examine history in terms of the development and evolution of organizations will be a rewarding endeavor for sociologists, philosophers and even politicians."*

Harlan Cleveland, a past President of the Academy, was creative with ideas related to organization. He conceived the idea of uncentralized organization. The Visa International credit card system captured his imagination as a dramatic example of the creative power of organization to spread worldwide in the field of consumer finance. The birth of the Internet is a more recent, broad and powerful instance of the same organizational principle which has permeated and transformed all aspects of global society. History has evolved from the history of kings into the history of peoples, nations, cultures, ideas, etc. To examine history in terms of the development and evolution of organizations will be a rewarding endeavor for sociologists, philosophers and even politicians. Cleveland understood the International Standards Organization (ISO) as another striking example of the role of uncentralized organization in the evolution of society. Ideas are a powerful basis for organization. Green Revolution was based on the idea of achieving food self-sufficiency, a seemingly impossible goal at that time, which India actually attained within five years. ISO is based on the idea that establishment of uniform technical standards will improve efficiency and quality of products and work and facilitate trade, which it has certainly done.

2. Values are Creative

Values are an even more powerful basis for organizations. Values are a form of subtle organization that guides understanding and decisions. Novels such as *Pride and Prejudice* and Trollope's *Dr. Thorne* bear witness to the enormous power of values for human accomplishment. The emerging values of individual freedom and social unity, which inspired Lincoln and galvanized America to abolish slavery and found a strong federal government after the Civil War, launched the USA on an evolutionary course that enabled it to emerge as the

> *"Society grows in many ways; commitment to high values is one."*

world's leading nation a century later. The emergence of values in society is a moment of creative organizational evolution. Society grows in many ways; commitment to high values is one. Moments in which society embraces a high value are creative moments.

3. Creativity and Social Evolution

Obstructive anachronisms in the society acquire formidable force of resistance to progress. Only the physical destruction of war is capable of destroying them. Post war periods are known for their infectious social creativity. WWI was hailed as the war to end all wars. But the social psychology of Europe at that time thrilled with the intensity that war offered as an outlet for its pugnacious energies. An Englishman commented that forty years of peace was intolerable to the national psyche. So, the first war half-consciously prepared for the second war. It was assumed that this horrendous war would mark the end of all wars. The end of the second war offered abundant opportunities to end wars forever, but the subconscious urge to prolong the spirit of war was too pronounced. Hence, it was followed by the intense tension of the Cold War for another 45 years.

True to this theory, the great post-war periods of the 20th century were expansive social creativity. World War II was followed by the founding of the UN, the Bretton Woods Institutions and the European Economic Community. The end of the Cold War was followed by the birth of the European Union and the WTO, and most especially the creation of the World Wide Web as the first truly global social organization. The full value of the Internet has not yet become apparent. It is a field of complex organizational growth in cyberspace, without which the advances of the last two decades would have taken centuries. Imagine the creative moment of such a field. The emerging revolution in online education is another creative evolutionary moment waiting to unfold.

Life is entirely creative. All her moments are creative moments. Each man has a different vision. For Steve Jobs, the founding of Apple Computers and launching of the iPod were such moments and their impact spread to reach the whole world. Trade is creative, creative of wealth. Money is the power created by trade. Coins, currency, checks, credit cards are its higher creative accomplishments. It was for trade that the English came to India. But they soon discovered an opportunity to found an empire. At a time of political confrontation in the early 1970s, the monetary benefits of trade motivated Nixon to make a trip to China, with momentous consequences which remain largely invisible, for it effectively eliminated the possibility of war between USA and China.

"Thirty years ago, a report submitted to the Club of Rome spoke about the essential role played by the service economy, the unorganized sector, and the non-monetarized sector. The author's thought has not yet received the recognition it deserves. It is a work of a genius."

Montessori, Summerhill and Glenn Doman mark creative moments in early childhood education. They all made education creative. For the child who is memorizing, a moment of original understanding is creative. Similarly, it is a creative moment for the teacher also when he shifts from addressing the memory of the students to addressing their creative minds.

Certain periods in history have been known as creative periods, such as the reign of Queen Elizabeth I in England. People living during such remarkable times will be creative in one way or another. Shakespeare is the most outstanding of many examples. Fashion marks a transient form of creativity at a shallow, superficial level. In many families and institutions there will be a highly creative person whose aura spreads through the whole family and institution. When that person leaves, the creative atmosphere also departs with him. The place loses its luster. When Mahatma Gandhi was assassinated, Nehru went on the radio declaring that the light had been lost over India.

A creative leader or a creative ideal can now give to the world such an inspiring atmosphere. This is a period in which the entire world population can inwardly expand towards higher values of light and felicity. Even the negative indications are indicative of the opportunity. Half-way through Obama's first presidential term, there was a marked change of attitude towards nuclear weapons. After 20 years, the Palestinians revived their efforts for economic planning. The Institute for Cultural Diplomacy was founded in Germany and seeks a solution for the issues that affect the countries of the Levant. The Arab Spring is a negative movement, but a positive symptom of the Spirit of the times.

> *"When we aspire for what is already there, it can be described as ambition. When we aspire for what is as yet unrealized, it is creative aspiration."*

Fields like music and Market are wholly creative, each in its own way. Music has a creative effect when sound turns melodious. The market is creative of profits when it functions creatively. Traffic systems are quite ordinary and routine. But when we compare traffic systems in organized and unorganized countries, the creative role traffic regulation plays in promoting the welfare of a nation becomes apparent. Studying levels of corruption, implementation of human rights, implementation of law and levels of education reveal the complementary impact of each one on the others. Social Development is a creative field of study which is still in its formative stages.

4. Individual Creativity

A foundation named after Croatian physicist Nicola Tesla is trying to identify young people with the potential for genius. The traditional belief is that geniuses are born and not made. Creative consciousness when cultivated can form the bedrock on which genius flowers. Thirty years ago, a report submitted to the Club of Rome spoke about the essential role played by the service economy, the unorganized sector, and the non-monetarized sector. The author's thought has not yet received the recognition it deserves. It is a work of a genius.

"Evolution is not confined to biological species; it occurs in societies as well."

Creativity expresses through enormous energy. To organize that energy into consciousness is further greater work. Energy comes from aspiration. Aspiration for what? When we aspire for what is already there, it can be described as ambition. When we aspire for what is as yet unrealized, it is creative aspiration. Evolution is not confined to biological species; it occurs in societies as well. Evolution is organizing itself under the surface in every sector of society. The shift from memorization to understanding in education is a significant evolution in that field. It can go one step further from conscious understanding to subconscious or subtle understanding, intensifying the evolutionary process. It is not unknown in the world.

> *"The creativity of society accumulated as the achievements of a succession of creative moments over millennia is civilization. The distilled essence of civilization is culture."*

In business and politics astute leaders possess a subtle form of understanding capable of sensing the pulse of the market or the people. Such leaders become very popular. Steve Jobs says he acquired intuitive perception during six months of his stay in India and relied on it for crucial successes in his life, such as invention of the Macintosh computer, Pixar's Toy Story, the iPod, iPhone, iPad and the highly successful Apple Stores. Lincoln possessed the uncanny intuitive sense to know just how much the public would support and tolerate and how far he could push the Northern states to abolish slavery without precipitating an open revolt. Food rationing introduced during the Second World War continued in South India until 1952 out of belief that removing it would lead to hoarding and sky-rocketing prices. The then Chief Minister of Madras Presidency, C. Rajagopalachari, intuitively perceived that rationing could be abolished without any ill-effects. People feared that prices would soar immediately. He was proved right when instead of rising, prices declined slightly. When people wondered how he managed to do it, he said that he did it relying on intuition. If the world's knowledge of intuition is brought into the field of education, it would revolutionize the field and transform teaching into a creative process.

Science has immensely benefitted the world through the discovery of phenomena such as electricity and magnetism, etc. Equally momentous consequences will issue from the discovery of creative consciousness, rather the process that can result in creative consciousness. Even a momentary spark of creativity is highly productive. Sustained creative expression will benefit mankind in unimaginable ways.

5. Social Creativity

Society is creative and is characterized by periodic moments of momentous creativity. The creativity of society accumulated as the achievements of a succession of creative moments over millennia is civilization. That civilization is the essence of history which is itself the essence of social existence. The distilled essence of civilization is culture. Family is the creative social organization that nurtures the biological child to form the psychological citizen. The mother's loyalty enriched by the father's sense of responsibility form the flowerbed on which culture flourishes. The head of a family accepting responsibility for the whole

of the family can be called consciousness responsibility. The constitutional responsibility of a cabinet minister for all the actions of those in his department is the national symbol of it. The unwritten constitution places responsibility for whatever happens in the country in the hands of the Prime Minister.

The process of converting raw energy into creative energy for growth, development and evolution is common to all aspects of life. Our bodies convert the food that is consumed into physical energy for growth and transforms it into energy for healthy living and well-being at the physical level. Society converts raw social energy into organized productive energy and transforms it into cultural values such as honor and hospitality. The most advanced enlightened expression of this process is the conversion into cultural essence of life through education. What families, especially affluent aristocratic families, give to their children through private, personal education by tutors can now be made available to all the children of the world with the same flavor of human solicitude and affectionate responsibility. The World University Consortium can provide it to all who seek it. It can devise new courses that can bring to its process of learning by a process of teaching the higher value of learning for the child's consciousness.

6. Cultural Creativity

The mother is the main source of affection for the child. The wife who enters a man's life later on is a higher version of the same social emotion, whose highest expression is the sacred emotion of Love. Its birth is commonly vitiated by the social institution of marriage in which property is given central importance. If mercenary motives are not present and the child is raised with full affection, the human relationship formed around the child's psychological blossoming becomes the human efflorescence in old age. So great is its power that, according to ancient Tamil literature, it can prevent the graying on man's hair even in advanced age. This is its merest outer expression. Its inner cultural richness expresses as tolerance for the lapses of the younger generation. It is tolerance born out of the soul's inner freedom. That freedom can express as a playful cheerfulness which we find in the heroine of *Pride and Prejudice,* whose creative energies raise her whole family to a higher level of social life. Shakespeare's creativity is rich with subtle truths of life rising to the highest poetic expression, but mostly reflecting darker intensities of life. "Age does not wither" and "Whoever loved that loved not at first sight" are positive expressions of that creativity.

7. Creative Education

Great literature enriches ordinary daily life in many ways possible, but it mainly enriches the subconscious through its subtle faculty. The mind of the child is brilliantly receptive to the accumulated wisdom of the collective. However, formal education often buries this emerging wisdom. Fortunately modern technology can be commissioned to counter these ill-effects, as the iPod has done for music, capturing the world's imagination. When backed by proper technology, such courses can cater to the spirit of aspiring young humanity and awaken their imaginative faculties to develop inwardly and eventually blossom in full creative freedom.

Online courses for college students can be designed more easily than for lower level students. The lower one descends, the more intricate it becomes for various reasons. First, great care is needed not to spoil the innocence of young minds with organized social superstition. Children's minds are fresh and therefore can be easily contaminated. Moreover, no course can match the speed of a child's receptivity. Adult minds cannot appreciate the purity of a child's innocence of truth in goodness. Like a relay runner, the teacher must readily hand over the baton to the child to run further on its own.

> *"Values are the organized capacities of the cultural forces of society imparted to the next generation as an individual possession."*

Society evolves by education. Sri Aurobindo called yoga an organized influence designed to take life to its maximum height by the shortest route. 'All life is yoga' is his mantra. Education is the next best. Values are the organized capacities of the cultural forces of society imparted to the next generation as an individual possession. Education that imparts values is an evolutionary social organization seeking to be born. The World University Consortium can be the vehicle for that accomplishment.

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Tomorrow's Universities and the Seven Pillars of the Knowledge Revolution[*]

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Abstract

The emerging Knowledge Revolution goes beyond the changing technologies and the challenges and opportunities they create to include the structure of knowledge and how it is transmitted inter-generationally and across countries. There are seven major features of that profound transformation, which I call "The Seven Pillars of the New Knowledge Revolution". These are: (i) Parsing, Life & Organization; (ii) Image & Text; (iii) Humans & Machines; (iv) Complexity & Chaos; (v) Computation & Research; (vi) Convergence & Transformation; and (vii) Pluridisciplinarity & Policy. This diagnosis has profound implications on how one should think about the design and management of our institutions of learning, starting not only with universities, but also the school system, as well as our research institutions (whether in universities or in public and private labs), and the supporting institutions of knowledge (like museums, libraries and archives). Radical proposals are advanced for the content, method, participants and organizational setting of education, as well as the role of the University as mediator of transitions, its relationship with society and economy, as well as its physical presence, governance structure and the values it should promote. Core functions and curricula for the future, along with the possibility of a global university consortium, are discussed.

1. Introduction

We all agree that we are moving rapidly towards the knowledge based society and the technology based economy, with the well-known and well-documented aspects of globalization overlaid on this transformation. Here, I am speaking of the structure and presentation of knowledge and how we humans will most likely be interacting with knowledge, whether we are academics or researchers or simply the descendants of those who used to go to public libraries and ask the librarian for assistance with a good book to read or a reference source for the paper they are preparing for college. This knowledge revolution shall have profound implications for the institutions of education from kindergarten through post-doctoral levels, research, whether public or private, and the cultural institutions that support our knowledge structure such as libraries, archives and museums.

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[*] A slightly different version of this material was presented at the meeting of the International Association of Universities (IAU) in Puerto Rico on 28 November 2012.

It is this that I refer to as the "New Knowledge Revolution", a subject I have treated elsewhere at length and in more technical detail.[1] This knowledge revolution can be diagnosed by seven key characteristics, which I would like to call "pillars", and which I shall briefly describe here. These are:

- Parsing, Life & Organization
- Image & Text
- Humans & Machines
- Complexity & Chaos
- Computation & Research
- Convergence & Transformation
- Pluridisciplinarity & Policy

Before proceeding to discuss the manner in which I think this revolution will specifically impact the universities of tomorrow, and making some recommendations as to how that inevitable transformation could be handled to smooth out the change and embrace the future, a brief word about each of these seven pillars is pertinent here.

2. The Seven Pillars of the New Knowledge Revolution

2.1 Parsing, Life & Organization

Since the beginning of time, whether we were writing on scrolls or on codexes, whether the codexes were printed or in the form of manuscripts, the accumulation of knowledge has been based on parsed structures, with units put next to each other like bricks in a wall of an emerging structure.

It was the juxtaposition of these individual parsed works that created the accumulation of knowledge… the rising edifice built piece by piece, brick by brick or stone by stone…

In addition, each piece was "dead". By that I mean that once published it stayed as it was until a second edition would appear. If we both had copies of the same book, we could both open to, say, page 157 and find exactly the same thing in our respective copies. It did not change whether we did it immediately after the book appeared or decades later.

The Internet changed all that…

The web page became the unit of parsing. Instead of the classical sequence of presentation, we now think in terms of a home page and then hypertext links into other related documents. We can expect more fluidity into the merging of image, both still and video, and the transitions from one reference link into another.

Search engines complement the World Wide Web as the online material – unlike the traditionally published material – becomes alive. Today if I look up a web page, and you look it up at the same location a few hours later, it will probably have changed, since the material is constantly being updated.

Furthermore, as we move beyond the current structures of the web towards the semantic web, where we can search for relationships and concepts and not just objects, the structure of organization and presentation of knowledge will become one large interconnected vibrant living tissue of concepts, ideas and facts that is growing exponentially and which will require new modes of thinking to interact with it. It will automatically spawn these new modes of thinking and scholarship will no longer be parsed like bricks in a wall; it will be more like a smooth fluid flowing river.

If we were to try to take into account the emergence of the social linkages phenomena that the internet and the web have now made possible, we can now visualize what some specialists have called the "Meta-Web", which is attributed to high knowledge connectivity and high social connectivity. Does the Meta-Web prefigure the connectivity of intelligence?

2.2 Image & Text

Throughout history, the primary means for the transmission of information has been text. Images were difficult to produce and to reproduce. This has changed. With the digital revolution, everybody can record images and video, and computer generated graphics are becoming affordable for everybody.

The human brain can process visual information with incredible rapidity. Enormous detail can be captured and processed in a fraction of a second. So some new features of the current knowledge revolution appear imminent. One is the far larger reliance on image – in addition to text – in the communication of information and knowledge and the changing forms of the storage and retrieval devices that this will require as we move from text dependent book and journal to digital still and video image presentations as well as three dimensional virtual reality and holographic presentations. Interactivity will also become a feature of this new image-based virtual-reality world. Again what does that mean in terms of the presentation, the search and retrieval functions and the interaction between the researcher and the material in the future?

And what does this mean for the effective description in meta-data, the storage, searchability and retrievability of this enormous and growing world of still and moving images, both fixed and interactive? We will no longer be looking up images through keywords entered into text databases such as meta-data catalogues: Computers will do this for us.

2.3 Humans & Machines

With the exception of pure mathematics and some aspects of philosophy, it will no longer be possible for any human to search for, find and retrieve, and then manipulate knowledge in any field, much less add to it and communicate their own contribution, without the intermediation of machines. Even in literary criticism and the social sciences, the stock of material to search through can no longer be done manually.

This is not good or bad. It just is.

Now, after a special chess playing program called Big Blue of IBM defeated world champion Garry Kasparov in Chess in 1997, can we indeed ask, as some visionaries are doing,

whether "consciousness" and "intelligence" are emanating qualities from very complex systems? According to some, we are going to witness that happening with machines when they will pass certain thresholds of complexity and power, such as when the level of the processing power reaches certain sizes, and software advances within a decade or so after that to certain levels, all of which are likely to happen within the first half of the 21st century.

But whatever the merits of that particular debate and its ramifications, it is clear that changes are already noticeable in the domain of libraries and the internet. One example of that is the new World Digital Library: The system allows one to link video, image text and commentary and maps into one seamless whole and to search by many different approaches (time, geography, theme, cluster, or even by a single word) and browse the material as well as find what one wants from the digitized material on offer from all the countries of the world.

2.4 Complexity & Chaos

The world we live in is remarkably complex. The socio-economic transactions of a globalizing world are exceedingly intricate as, with the click of a mouse and the flight of an electron, billions of dollars move around the planet at the speed of light. The web of interconnected transactions is enormous, and the ripple effects of any single set of actions and its interaction with other effects are difficult to predict.

Our cities have become not only much larger but also much more complex, and ecosystems are not only delicate, they are intrinsically very intricate. So are biological systems.

The reality is complex and chaotic, meaning that complex systems have non-linear feedback loops that result in systems and subsystems that are extremely difficult to predict. Many of our models, based on the simple mathematics and analogies drawn from physics, are proving inadequate.

2.5 Computation & Research

Till now, Computing has been largely seen as the extension of a large calculating machine that can do dumb calculations at incredible speeds. Computer scientists and engineers were implementers who made the life of the creative people and the researchers less tedious. Wonderful tools, no doubt, but just tools all the same. Today, the concepts and the techniques of computing will become a central part of the new research paradigm. Computational Science concepts, tools and theorems will weave into the very fabric of science and scientific practice.

Consider data management. Data when organized becomes information. Information when explained becomes knowledge. That, in turn, when coupled with reflection, insight, and experience may lead to wisdom, but that is another story.

But beyond the scale and magnitude of the collections of data, we are looking for connections between collections of data. These pose particular problems that involve qualitatively different issues. Computer science is where the most work on such classes of problems has been done.

2.6 Convergence & Transformation

Domains are gradually converging. In simplest terms, once upon a time we had chemistry and biology as distinct and separate enterprises, now we have biochemistry. Such moments of convergence, generating new sciences and insights, turn out to be some of the most fecund moments in the evolution of our knowledge and the development of our technologies. Today we are witnessing the convergence of three hitherto separate fields with the birth of BINT: Bio / Info / Nano Technology.

At the same time, we need to develop what the NSF calls "Transformative Research". That is, research capable of changing the paradigm in some fields and domains, such as synthetic biology and femtochemistry. Such research is extremely valuable. We thus witnessed the discovery of the structure and mechanism of DNA engendered fields like genomics, proteomics and metabolomics.

A question before us is whether such developments will remain serendipitous or our research paradigm will systematically force the development of such converging domains and transformative insights. I believe we are poised to do the latter.

2.7 Pluridisciplinarity & Policy

There is real value in crossing disciplines. Both in academic organization and in tackling real-life problems, we note that the old "silos" of disciplines when functioning alone are counterproductive. Much of the most interesting work is being done in between the disciplines, where they intersect or where there are gaps.

We increasingly recognize that our real life problems, such as poverty, gender or the environment, are all multi-dimensional and complex and require a special way of organizing all the various disciplinary inputs. Just as we say that diversity is enriching, so is the sharing of knowledge across disciplines.

The nature of the challenge, its scale and complexity, require that many people have interactional expertise to improve their efficiency working across multiple disciplines as well as within the new interdisciplinary area.

3. Reinventing Education

The structure of the institutions of education and learning, those that channel the preparation of future generations of humans and the trans-generational passing-on of knowledge, will change. They will not only continue to evolve, they will morph into something unrecognizable to those who think of yesterday's schools as a model, or those who yearn for their collegiate university experience. The public and private laboratories and research institutes, those institutions that help in the production, assimilation and codification of current knowledge and the creation of

"[In the future] Continuous learning will be more than a slogan; it will be an economic necessity."

new knowledge, will also change. However, here, I will just say a few words on the more obvious likely impacts of the seven pillars of the new knowledge revolution on schools and universities, barely touching on research facilities.

I think that we need to think even more boldly and dream of reinventing education completely.

The old model of rigid linear advance through 12 years of schooling, followed by four years of university after which one receives a degree that certifies entry into the labor force to practice some profession for forty years and then retire, will become totally obsolete. Continuous learning will be more than a slogan; it will be an economic necessity. The market will demand new skills, and an increasingly competitive world will force enterprises to continuously upgrade the skills of their labor force.

> *"Schools in fact teach children the discipline to endure and master boring and repetitive tasks."*

Furthermore, the existing model of education, under the heading socialization, also tries to enforce certain qualities deemed important by future employers. Schools in fact teach children the discipline to endure and master boring and repetitive tasks. Their natural tendency to communicate with their peers, to run and play is curbed, by being told to "sit still and be quiet". If they do not take easily to that regimen, they are now treated for Attention Deficit Disorder and even given drugs to assist them to comply. They have to stay hours listening to an authority figure, in a setting that is rarely a beautiful architectural space, on a chair and desk that are rarely comfortable furniture. The student learns to be docile and to respect authority and to manage to do repetitive and boring tasks effectively. The implicit model is to train workers for boring repetitive tasks in factories or offices, something the industrial economy of the 20th century clearly demanded, despite its dehumanizing aspects so effectively portrayed by Charles Chaplin in "Modern Times". However, the globalized modern economy is rapidly changing, and robots are more likely to take over the more repetitive aspects of jobs in the future. We already see this clearly on the assembly lines of the automotive industry, which is being followed by industry after industry. Likewise, in offices tasks like data entry and checking are also increasingly being taken over by computers. The future will be for a lot more collaboration between humans and machines, and thus we must question all aspects of the educational enterprise that we have inherited from the last century. No matter how successful they have been, the policies of the past are rarely the best to confront the challenges of the future.

Education is likely to change profoundly in the coming decades, in terms of content, participants, methods, and organizational setting. Let us consider each of these in turn.

3.1 On Content

Curricula and syllabi need to be revised to emphasize basic skills, problem solving and learning to learn. Teachers must be much better trained to become enablers who will encourage children to realize the joy of discovery, and be able to utilize teaching methods that allow each individual to change at their own pace.

The educational system of the future will witness an explosion in content, which is beyond our capacity to imagine today. People will emerge from their basic education, – including university level education – having learned to learn, and having acquired a basic infrastructure of fundamental skills, including interpersonal skills and the ability to function in a society. These fundamental skills will be complemented by a vast array of offerings in every conceivable combination of units and modules covering everything from artistic expression to advanced genomics, from music appreciation to mathematics. The flexibility of these combinations will allow people to learn continuously throughout their lives.

> *"We have barely scratched the surface of the potential that exists in self-learning."*

New fields of learning will come about. The most important discoveries will be at the intersection of the existing disciplines. Totally new fields have come about, such as genomics and proteomics. And beyond the natural sciences we are discovering how important trans-disciplinary work is. We need the wisdom of the humanities in addition to the knowledge of the natural sciences. We need the insights of the social sciences to bear upon the technical options of engineering.

3.2 On the Participants

Participants in our educational enterprise will still involve parents at home and teachers at school. But students will play a bigger role in their own development. And virtual communities on the Internet will create a new form of peer group affecting the mental and emotional growth of the children and young adolescents of the future. I say this, fully cognizant of both its upside and downside. Perhaps we should be more open to what our children will have to tell us… Take the words of Robert Frost, the American Poet Laureate:

> *"Now I am old my teachers are the young.*
> *What can't be molded must be cracked and sprung.*
> *I strain at lessons fit to start a suture.*
> *I go to school to youth to learn the future."*

3.3 On Methods

Methods of teaching in the last fifty years have been almost totally confined to formal instruction in classrooms. Lectures, tutorials and supervised work have been the staples of education from time immemorial. We have barely started to explore guided learning through such instruments as distance learning, the Open University and modular adult education classes. I say that noting that the open university has been around for more than four decades, and that Massive Open Online Courses (MOOCs) are now a reality through the experience of the Khan Academy (which has more than 3.9 million registered students), and the presence of Udacity, Coursera, edX and other offerings. We are just beginning to see the benefits of flipped classroom instruction where the lectures are on video and the students can learn at their convenient time (which also allows students to replay certain parts as many times as they want) and the contact hours will be spent with the teacher working with the students, at

problem solving and clarifications (the functions that were traditionally left to homework to be done by the student on their own time).

We have barely scratched the surface of the potential that exists in self-learning. New "games" or game-like approaches that allow youngsters to gradually master skills by solving ever harder problems will use the same self-encouragement mechanisms and inherent reward mechanisms that current and conventional games do in making the player move from level to level by shooting ever faster and killing more adversaries. The software advances and the private sector's interest to develop such new educational software along with the possibilities of having tablet computers available in India under $40 open up enormous possibilities that will allow us to do much more in guided learning, and to help a thoroughgoing revolution in self-learning.

Although I believe that formal instruction will continue to be important, it will increasingly be supplemented by flipped classroom instruction, MOOCs, games and both guided learning and self-learning will be enhanced through myriad offerings. It will not only benefit the youth in their school and college years. Driven by curiosity and self-interest, the lifelong learners of the future will alternate between broadening themselves or pursuing hobbies on the one hand, and acquiring marketable skills on the other. The offerings for both will be there.

3.4 On the Organizational Setting

Schools and universities will not be replaced by individuals working on computer terminals or on their mobile phones or other technologies, from home or from elsewhere. This is because they serve three functions: a skill and knowledge imparting function; a certification function; and a socialization function. The first and second will change along the lines I have just described. But the socialization function will remain the same.

Children need to be with other children of their age, and so do youth who are just reaching their maturity. They need to learn to interact and socialize with peers. Only schools and universities provide the requisite setting for such socialization, an essential factor for emotional development and the formation of effective citizens.

4. The University - Yesterday and Tomorrow

Universities are an essential institution in any society for many reasons.

4.1 The Mediator of Transition

They are the locus of the transition of adolescents into adults, and the incubator of effective citizens. It is the custodian of the great generational transition. The World Bank has identified five essential transitions that occur between the ages of 12 and 24 in most societies[2] and they make these years particularly important. Since the University helps mediate all these transitions, it is essential that it adapts the fashion in which it plays that role in the lives of our youth. These five transitions are:

Continuing to Learn: Whether to drop out of further structured instruction and university participation or not is the single most important decision in a teenager's life. Its repercussions and the future path of their career will be inevitably affected by it.

Starting to Work: The transition from a dependent student to an independent participant in the labor force occurs in these years, and traditionally with a pre-college or college education. The manner in which the university and by extension other institutions in the higher education system address that transition and facilitate it will have major impact on the economy and on society, not to mention the lives of the young people themselves.

Developing a Healthful Lifestyle: Key decisions on smoking, experimenting with drugs, attitudes towards sex and other choices that confront youth can make all the difference in terms of their adoption of a healthy lifestyle or not.

Beginning a Family: Family formation starts at the older end of the aforementioned age group. Thus, the attitudes that they gain at university and about the higher education system can make all the difference between a society with solid family units and one with broken homes. Household formation is about more than demographic change.

Exercising citizenship: The political awareness of the new generation is usually formed at the university where they join political parties, start to vote and get exposed to a wide spectrum of ideas and debates. Their future attitudes as responsible participating citizens or detached apathetic individuals will make a major difference in the effective democratic evolution of society.[3] The attitudes they develop towards politics and society will also make a difference between the rise of extremism and the success of pluralistic politics.

The World Bank was concerned with government policies that would increase investments directly and cultivate an environment for young people and their families to invest in themselves – what they called "decisions concerning the five phases with the biggest long-term impact on how human capital is kept safe, developed, and deployed". The World Bank then suggests that such policies should have three broad thrusts: expanding opportunities, enhancing capabilities, and providing second chances. Each pathway (opportunities, capabilities, and second chances) is applied to each of the five transitions, generating suggestions for reform.[4]

4.2 The University and the Economy

Two of the traditional functions of the University have a major impact on the economy: Research and certification.

One is, the search for truth in the context of research, and that increasingly involves partnerships with for-profit private sector entities in addition to the government financing of public goods research, with all the advantages and pitfalls that such an expanded partnership offers. The US Academies recently produced a report recommending ten specific actions that should be taken to maintain the pre-eminence of American research universities in the years to come.[5]

The other is the <u>certification</u> function. A university degree was assumed to certify that a graduate has acquired certain skills that an employer will want. Today, the lasting validity of that certification function is being challenged by the revolution in the knowledge society in ways that make it clear that the old model of 12 years of schooling, followed by four years of university and a degree that allows someone to practice a profession for 40 years and then retire is no longer valid. So what changes will be necessary?

First, the silos of disciplinarity in the traditional structure of instruction will have to change. Convergence and transformation are making it clear that although we all need a foundation in one discipline to build on, we also need to learn to interact with others in other disciplines. Universities must adapt to that horizontal broadening.

Second, constant updating of knowledge and skills will be necessary, and a vast program of adult education will become an integral part of the University of the Future. It will allow for flexible career transitions and the modular upgrading of skills in different disciplines. Thus, continuous education will become a necessity if labor productivity is to continue to increase.

4.3 Values

Another traditional and essential function is the university's unique role as the <u>custodian of the past and the inventor of the new,</u> not just in terms of the socialization function and the societally approved behavior of citizenship, but in terms of values and culture. Cultural identity and the meaning and role of our heritage are part of it. History, archeology, cultural studies are all part of learning about our past and maintaining our heritage. But universities are very much the places where the young learn to challenge the existing and the inherited, to seek novel answers and to invent the new. Thus, they become the locus of challenging the status quo, and sow the seeds of innovation, whose products and constructs will become the heritage of the future. This double process of preservation and renewal, of authentication and opening up to the foreign and the new, is one of the unique functions of the university, which will remain and will be expanded in the future.

The University also supports the formation and transmission of the values of science. These values include commitment to truth, to honoring each contributor, to promoting imagination and questioning, to challenging the existing paradigms, to valuing imagination, to remaining open to the contrarian view and to arbitrating disputes by evidence and rational thinking. These are profound societal values, not just necessary behaviors to do effective scientific research. These values are forged by teacher example and student practice.

But perhaps the most important value that a university can promote in its relationship to society is the value of <u>freedom of expression.</u> For that is the fundamental freedom necessary for the practice of other rights. By its practice other socio-political features will evolve. Accountability and pluralism require the contrarian view to be heard and the minority position to be respected. That is what freedom of expression is all about, and universities have been, and will remain, the defenders of these values against the tyranny of the majority and the tide of the conventional taste and opinion.

4.4 The University as a Physical Presence

Despite the enormous impact of the ICT revolution on many aspects of the learning experience, I do not believe that the university as a physical location will simply disappear. I believe that the university is not only going to remain the central part of a changing higher education system, but it is also going to remain a physical presence in our communities and our cities, and that the campus will remain a locus of interaction, not just within the university community, but also between the university and society.

Evidence for that abounds. MIT put all its courses online, but that did not result in the disappearance of applicants to obtain the MIT learning experience physically. MIT remains a major center of research and learning not just in the USA but in the world. The Bibliotheca Alexandrina and the University of Pittsburgh present the SuperCourse, with over 170,000 PowerPoint lectures, but that does not replace the need for a proper institutional set-up for learning and socialization. The role of the University as a physical presence should not be underestimated.

4.5 University Governance

The juridical status of the university is not the decisive issue in ensuring its excellence. Examples are many: e.g. UC Berkeley and Harvard show how a public and a private establishment can both be outstanding institutions. But in all cases a certain set of features mark their governance, including the degree of autonomy they enjoy in their decisions, the clarity of their sense of mission, and the standards they aspire to achieve.

Today, along with the general ideological drift in many parts of the world, there is a conception of idolizing the private sector, which suggests to some that higher education needs to develop a "business model" to curtail the increase in costs and promote efficiency. Some even go as far as suggesting copying the manufacturing Business Model with: Future employers as customers; Students' skills as products; Teachers as workers; and the Administration as managers. Nothing could be more destructive of the educational enterprise than thinking along those lines.

While the educational enterprise can certainly benefit from a radical overhaul in how it undertakes its duties, it is in the context of greater sharing with the students, greater involvement with parents and society, greater common exploration of the boundaries of the new, greater involvement of the social actors in this central societal enterprise that we must seek the business model for the 21st century. A decision-making structure in the university should include all the social actors as partners in this enterprise: Students, Faculty, Administration, Community, Parents, Government, Financiers, and Industry.

This would not only ensure a greater transparency, responsibility and accountability, it would also help resolve the old town-gown debate, as well as structure the involvement of the social actors in such a way that the essential autonomy of the institution is protected by embedding it in the context of this broadened partnership.

So, let me now try to summarize and bring together these various threads into ten recommendations that I would make for the University of Tomorrow.

5. Ten Aspects of Higher Education in the 21ˢᵗ Century

5.1 Part of a Renewed Education System: Reinventing Education

The ICT revolution and the transformation of knowledge manifested in the seven pillars are changing the concept and practice of education at this very moment, whether the authorities recognize it or not. Instruction is increasingly supplemented by guided learning and self-learning. The internet is opening undreamed of vistas of possibilities. Online education is a reality, and is growing fast.

On-line education can also leverage the "flipped classroom" technique used by a few innovative educators. The idea is to record the lectures separately, allow the students to see them at their own time, and maintain the classroom "face time" for the teachers and the students to work together on problem solving and other tasks. This "flips" the conventional approach where the classroom face time is used for lectures and the students do the exercises and problem solving on their own.

These and other innovations are still in the experimental stage, in the sense that we do not know if they will bring improvements in learning and retention or acquisition of problem solving skills and imagination by the students better than other more conventional teaching techniques. In the 1960s in the US there seemed to be a concept that different meant innovation which was by definition better than the existing conception. Experience has shown that not all innovations are improvements and not all old-fashioned techniques need to be discarded. This will be equally true of the new and dramatic change that the ICT revolution is bringing to education.

5.2 A Changed Higher Education Landscape

The ICT revolution is already offering many more options than anyone would have thought possible. Khan Academy (http://www.khanacademy.org/) offers all sorts of courses in all subjects with online tutorials and other toolkits and support systems for both teachers and learners. The University of the People (http://www.uopeople.org) is a tuition-free on-line university intended to democratize higher education. The Library of Alexandria, in collaboration with the University of Pittsburgh, offers the Science Supercourse (http://ssc.bibalex.org/), a collection of over 170,000 PowerPoint lectures that can be used as is, or from which individual slides can be taken to compose your own lecture, and there are many other examples, with more being created every day. Another initiative by The Jack Parker Corp. and Big Think, called "The Floating University", aims to offer online Ivy League courses a la carte for a relatively cheap cost… and there are many other examples.

Indeed the challenges to the classical model multiply every day. When Stanford University professor Sebastian Thrun first offered a free online version of his "Introduction to Artificial Intelligence" class, 160,000 students from around the world signed up. Impressed by that and inspired by the Khan Academy, he created a startup, called Udacity, to pursue that model.[6]

He is not alone. Others have moved into the area of Massive On-Line Open Courses (MOOCs). Two other Stanford professors have started a new startup called Coursera that is being used by a number of major research universities, with the purpose of offering MOOCs.

It is not clear whether all these will impact on the for-profit online universities and training programs and/or will impact the enrolments at the universities at which these professors learned and are or were teaching until recently. It is clear however, that the overall landscape of higher education is changing dramatically, even if the university, albeit a much transformed university, will remain a central player in the system in all societies.

Thus, we can say that the landscape for higher education institutions is rapidly changing and is going to change even more dramatically. Pluralism of approaches and institutions is the new norm. The old effort to fit universities into models and to straitjacket the models with equivalences is likely to be further eroded by these new creations with every passing day. I say that fully realizing that various universities will want to consider equivalences for learning done elsewhere or not under their purview if they are to acknowledge these in some sort of credit to some sort of degree or certification. But too many of these will exist for each to be recognized, and many of these options will survive whatever the old-line existing universities think of them.

Yet, none of these will actually replace the university as a physical institution, where things important to society are undertaken. They will be seen as complements to the transformed university, which will have many manifestations.

5.3 The University and Society

The University will be the locus of change in society. It is where the young learn to be adults, and where dependents become independent and active citizens. But it will play a greater role than this. With continuing education becoming a must, I expect that the University of Tomorrow will have a large presence of ongoing adult learning programs. This will mean that the traditional concept of the community of scholars will be supplemented by returning adults. This will help intergenerational communications as much as lateral communications. That and a major expansion of community outreach will be part of the University of Tomorrow, diminishing if not abolishing the old town-gown dichotomy.

5.4 The University and the Economy

We all know the dual role of the university: from preparing young people for the rapidly changing job market to driving research and innovation in a society. Both of these functions shall remain. But with the much greater blurring of the boundaries that I expect in the years ahead, it will be necessary for the University of Tomorrow not to lose sight of its fundamental functions and get attracted to the profit-making mode which is the rightful preserve of the private sector. Having cautioned against the wrong choice of business model, I also caution universities against turning away from their broader socio-cultural mission towards the profitable and the excessive service of economic interests.

5.5 The Core Functions of the University

Many of the traditional functions of the university, such as the search for truth through research and dissemination and discussion, the defense of values, the mediation of transitions in young people's lives and the certification of having achieved a certain level of marketable skills, will remain. But the last, the certification function, will change dramatically in its content and in its manner of application as continuing education, and upgrading of these skills will become mandatory de-facto if not de-jure. Thus, the university will not be just a stage in everyone's life, but a lasting presence in our community, our society.

As we learn to learn, and use a wide array of self-learning and guided learning in addition to more traditional instruction, and as traditional instruction itself changes, we must be aware of the possible risks associated with such a transformation. Our pursuit of personal choices could lead to dilettantism, and the pursuit of Pluridisciplinarity may produce a generation of generalists who lack the proper disciplinary foundations to keep driving the boundaries of knowledge and the machinery of the Science, Technology and Innovation (STI) triangle, so necessary for socio-economic well-being.

This balancing act will be the biggest challenge before the universities of tomorrow. Those who succeed will be able to retain or achieve that aura of excellence that is difficult to define precisely, but that which great institutions of learning have always had.

5.6 Curricula for Tomorrow

There will be multiple offerings online, not just at large but involving participants on campus as well. Such MOOCs and more specialized versions of them will also allow for "flipped classroom" instruction.

The content of the regular curriculum will probably be a three-tiered structure, with emphasis on streamlined but bedrock core programs, and with lots of variation. The three tiers would cover:

- The foundation (a broad liberal arts and scientific exposure);
- The specialization in a discipline; and
- The transdisciplinary exposure.

The teaching curriculum will teach above all "learning to learn" and an approach to knowledge and research, as specific content is likely to evolve rapidly. A firm and broad foundation in these attitudinal skills, learning skills, inter-personal skills, and socialized behavior, as well as good grounding in one discipline and a broad exposure to the values of the university, will lead to graduation and the job market, followed by continuing life-long education, through formal instruction either online or in person, or a combination of both.

5.7 University Governance in the 21ˢᵗ Century

The University needs to involve as partners in its decision making the broad gamut of social actors with whom it must interact, and who are affected by and can affect, the institution's decisions.

Opening up the University to a broader set of partners will not demean it or diminish its commitment to excellence and the core values it stands for. Stephen Jay Gould observed:

> *"It is important that we, as working scientists, combat these myths of our profession as something superior and apart. ... science can only be harmed in the long run by its self-proclaimed separation as a priesthood guarding the sacred rite called **the** scientific method.(emphasis in original) Science is accessible to all thinking people because it applies universal tools of intellect to its distinctive material."*[7]

5.8 What Business Model for the Future?

The attempt to copy the manufacturing business model into the university should be avoided. The business model it should adopt, however, is one where it can have a clear set of functions, and broad consensus by the social actors through its open governance structure, and seek to involve those whose decisions on funding will make the execution of these functions possible. That means the involvement of what are traditionally seen as external parties, must become part of the University's business partners: The private sector, government and the civil society. The nature of the partnership is to have clear expectations and transparency in the use of the funds that each party has allocated to the university.

The fine-tuning of this business model will raise the question of the right balance between research and teaching, the role of the university as advisor to the government and the undertaking of programs simply because they are popular with the civil society. It will also raise questions about changing the profiles of the faculty. But that is where the governance structure comes in as a corrective to ensure that the university does not drift towards a profit-making business model at the expense of its educational and cultural mission.

5.9 Values and Modernization

The University requires free enquiry for the practice of research and the pursuit of knowledge. That requires the adoption of certain values that I have referred to elsewhere as the "Values of Science".[8] We all know that effective pursuit of science requires the protection of independence. Without independence of inquiry, there can be no true scientific research. The safeguards which independence requires are obvious: free inquiry, free thought, free speech, tolerance, and the willingness to arbitrate disputes on the basis of evidence. These are societal values worth defending, not just to promote the pursuit of science, but to have a better and more humane society. A society that is capable of adapting to change and embracing the new. A tolerant society.[9]

Tolerance based on the adoption of the values of science is different from the tolerance begotten by indifference to the behavior of others, dismissing them without engaging them. Tolerance among scientists must be based on respect. Respect as a personal value implies, in any society, the public acknowledgment of justice and due honor. ... "If these values did not exist the society of scientists would have had to invent them to make the practice of science possible. In societies where these values did not exist, science has had to create them."[10]

All of these values are the core values of the university. They are values honed by teacher example and student practice. But broader still are the functions that allow us to teach our

children that words such as truth, goodness, beauty, equality, liberty and justice are not empty words, but ideas that civilized humans live by.[11] The university is the place where citizenship is first exercised, and it is where youth – and the returning older former students joining the adult education programs – can be exposed to the notions of civil discourse, dialogue and orderly debate of complex ideas in the framework of pluralism and mutual respect. That is a core function of the University of Tomorrow, especially in these times of rapid change and globalization.

5.10 Building in Change

Whatever we do, and however much we reflect and plan, reality will overtake us with more change than we can anticipate. Thus, it will be essential to build in change into whatever plans we strive for. The mechanisms of constant and ongoing monitoring and evaluation of university performance and the changing socio-economic context in which they operate should be a feedback model to the decision making machinery in the governance model of the university. The ability to introduce change rapidly will be important. This will happen anyway in a pluralistic higher education sector as some of the institutions disappear and other new and innovative institutions appear.

6. A Global University?

While the internet has opened many avenues, and social media has become a part of everyone's life, it remains true that recent research finds that people who rely on Facebook for their socialization are less happy than those who actually have real world social interaction.[12]

It behooves us therefore to also raise the question about whether a global consortium of universities could offer at least some students a global university program that would allow real experiential learning about real people and real social contexts. Here are some thoughts, defined in mid-2013, suggesting what such a program could look like.

6.1 A Global Consortium and a Global Program

The nature of the global society towards which we are moving at frightening speed opens up new avenues for us to reflect on the possibilities that were barely feasible in the past. Already in Europe an acceptance of common standards and a systematic agreement between countries allow young people in the Erasmus Mundi program to take different semesters in different establishments in different countries as they work towards their degrees. This allows these young people to mix with youth of their age in different countries as they study with teachers of different nationalities and get exposed to the societies and cultures of various European countries. This undoubtedly broadens their perspectives, widens their network of acquaintances and expands their horizons, regardless of the content of the courses they are formally studying.

We have long advocated as part of the Euro-Med schemes an expansion of this Erasmus program to encourage youths from both sides of the Mediterranean to have the benefit of this multiple exposure to different cultures and different peoples. Today, thinking boldly, there is no reason why the idea of such a program should not be adapted at a global scale. It could

be built upon a foundation of MOOCs where membership in a class is no longer confined to those who are physically located near the professor and his or her base of teaching; it could be refined in the sense of having a consortium of participating universities that will agree to have such a program among their offerings, and make that option available to their students who participate in that program at the university, and a number of these students could then be the ones that physically go in different locations at different universities, and continue their studies in an expanded international framework. It takes the American "semester abroad" concept and the European Erasmus program to a new scale and would open avenues for the brightest among the students of the developing countries to explore new avenues and become the first students who are truly trained and socialized as citizens of the world.

7. Conclusions

Have we even begun to plumb the depth of the challenge and its implications? Can we even claim to have properly sketched out the full range of implications that the seven pillars of the new knowledge revolution will force upon us? Do we know what the technologies of the future will do to our ability to summon the spirit of the past and conjure inspiring images to help us create a new future? Who can tell?

> *"In this modern age, we are "Questers" who understand that knowledge and cultural expression are a journey and not a destination, and who recognize that there is more importance in the fecundity of the questions than in the finality of the answers."*

I hope that the recommendations that I have sketched out will help lay the foundations for a proper response to a rapidly changing world, not by trying to define that world accurately and prescribe actions precisely, but by proposing approaches that will involve the key actors and allow for maximum flexibility as we allow the institutions to evolve and the processes to adapt and the boundaries to move as we respond to that ever changing landscape, as we increasingly move into a world whose wonders we can only dimly perceive. It would be hubris to imagine that we – who could never have imagined the impact of the internet 20 years ago, or the reach of Facebook and Twitter ten years ago – would be able to lay down a precise path to the future for the next 20 years or so. We can only raise questions and express hopes…

No, there are no complete or even fully satisfying answers to many questions implicit in the discussions above. But in this modern age, we are "Questers", to use the expression of Boorstin,[13] who understand that knowledge and cultural expression are a journey and not a destination, and who recognize that there is more importance in the fecundity of the questions than in the finality of the answers.

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Notes

1. Ismail Serageldin, *The Seven Pillars of the Knowledge Revolution* (Alexandria: Bibliotheca Alexandrina, 2010). That material was based on a distinguished lecture delivered by the author at the NSF in Washington in 2010.

2. The World Bank, *Development and the Next Generation WDR 2007* (New York: The World Bank, 2007)

3. Robert Putnam et al., *Making Democracy Work* (Princeton: Princeton University Press, 1993).

4. The World Bank, *WDR 2007*. The World Bank advocates that "To mobilize the economic and political resources to stimulate such reforms, countries must resolve three issues: better coordination and integration with national policy, stronger voice, and more evaluation". Furthermore, the *WDR 2007* also examines two other themes: youth migration, and the increasing use of new technologies. The former is not part of this essay; the latter is at the heart of it.

5. The National Research Council, *Research Universities and the Future of America* (Washington DC: The National Academies, 2012).

6. Jeremy Hsu, "Professor leaving Stanford for online education startup," *Innovation News Daily* http://www.msnbc.msn.com/id/46138856/ns/technology_and_science-innovation/t/professor-leaving-stanford-online-education-startup/

7. S.J.Gould, *Time's Arrow, Time's Cycle : Myth and Metaphor in the Discovery of Geological Time* (Cambridge: Harvard University Press, 1987), 7

8. Ismail Serageldin, *Science: The Culture of Living Change,* Second edition (Alexandria: Bibliotheca Alexandrina, 2007).

9. Robert P. Wolff, Barrington Moore Jr. and Herbert Marcuse, "Tolerance and the scientific Outlook" in *A critique of Pure Tolerance* (Boston: Beacon Paperbacks, 1969), 53-79. Regretfully, in the concluding paragraph, this excellent essay uses some unfortunate references to Muslims and the Koran, attributing to them the willingness to see.. "other books...may be cast on the flames." This typically ignorant comment is the usage of a Western stereotype that is unworthy of the rest of the essay, which deals with Science and tolerance and reason in the Western context.

10. J. Bronowski, *Science and Human Values* (New York: Harper and Row, 1972), 63

11. Mortimer Adler, *Six Great Ideas* (New York: Macmillan, 1981)

12. Ethan Kross et al., "Facebook Use Predicts Declines in Subjective Well-Being in Young Adults," *PLOS One* http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0069841;jsessionid=7B9DB8A5009547B7A59D5D4B353A09E4

13. Daniel J. Boorstin, *Cleopatra's nose: Essays on the Unexpected* (New York: Vintage Books, 1994), 17

Online Education:
A Revolution in the Making

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Abstract

Internet and Communication Technologies are transforming education, taking it out of the traditional classroom and making it open, affordable and dynamic. Universities, publishers, corporates and individual lecturers are creating online courses. A course consists of video lectures, electronic study notes, online tests and assignments. Anyone who wishes to learn may enroll in these courses, take the lessons, complete the tests and assignments, and receive a certificate upon successful completion of the course. These Massive Open Online Courses (MOOCs) are making world class higher education available to all those who wish to learn, regardless of age, location or educational background. Education faces a number of challenges worldwide. Over 366 million youth are unenrolled in colleges. College education is growing more expensive. Many institutions face shortage of qualified faculty members, funding and infrastructure. Education over the internet can address many of these issues. Online classes are scaleable – a class of 50 can be expanded to teach 50,000. Teaching and learning over the internet can be done at a fraction of the cost of traditional classroom teaching. Flexibility, mobility, use of multimedia technologies, constant syllabus revision, collaboration and interactive discussions give online education an advantage. This is still an evolving field. New partnerships, innovations and technological advances are revolutionizing teaching and learning, and clearly, online education is an integral part of the future of education.

1. Introduction

A much quoted and requoted quip about education is that it has not changed much since the middle ages. If a physician from the 12th century were to enter an operation theatre in a hospital today, he would faint. Whereas a teacher from the same period could enter a classroom and feel quite at home. But this joke is becoming more and more obsolete every day. The past two years have seen such a phenomenal transformation in the nature of education that even a teacher from an earlier decade would feel the change.

Technology that has penetrated every aspect of our life has altered teaching and learning. Internet and Communication Technology (ICT) has rewritten the rules. The university is no longer the sole repository of scholarship. The class is not enclosed within the walls of the classroom anymore. Knowledge is not contained in a textbook. Imparting it is not the domain of the teacher. The degree is not the sole proof of learning. Education, as we have known it,

is on the cusp of a profound change. Gutenberg's printing press made books easier to print, and what had been handwritten, rare, precious and so tied to library shelves was freed of the chains. The computer and internet gave us the 'soft copy' that freed information from all physical media. ICT is virtually opening up education to the whole world.

> *"Education is an insurance against poverty."*

2. Value of Education

Education is directly or indirectly connected to every global challenge we face. Statistics from every continent show that the higher the level of education, the lower the rate of unemployment. Even in countries where unemployment levels are high, the unemployment rate of those with a degree is less than unemployment rate of those without a college education. Higher educational attainment also correlates with higher earnings. Perhaps with the exception of Bill Gates, Steve Jobs, Mark Zuckerberg and a few others, college education is essential for a rewarding career.

That makes education an insurance against poverty. Illiteracy, unemployment and poverty form the hotbed of extremism, and education that tackles each of these issues is a safeguard against violence at all levels, domestic to international. Better educated people are better equipped to overcome the frictions of globalization and cultural differences. Historically, education and democracy have been inextricably linked. No country with very low levels of education has been democratic over the long term, and almost every country with a high level of education has remained a stable democracy.

Life expectancy is found to be strongly associated with education. Data shows that among 15 OECD countries, a man with tertiary education lives 8 years longer than one without a degree or diploma. According to a 2012 UNESCO report, each extra year of a girl's schooling reduces her fertility rate by 10%. At the same time, the probability of infant mortality reduces by 5% to 10%. The children of more educated people are better immunized and twice as likely to survive beyond age 5. Education also turns out to be the first vaccine against disease.

Those with higher levels of education are more likely to report stronger civic engagement. They take action to address ecological and social issues. Education plays a key role in our attempt to evolve a new global paradigm to meet today's challenges.

3. Gaps in Education Today

People arrive packed with food, sleeping bags and torches, ready to spend the night outside. They are not campers holidaying in the woods. Nor are they eager customers impatient to buy the latest model of the iPad or iPhone at an Apple store in New York or Beijing. They are parents of three year olds queuing up in front of the school gates in many Indian cities, to secure an application form for kindergarten. Application forms are limited in number, and obtaining a form is the first of many steps in obtaining school admission for their wards. So, the night before the forms are distributed, parents queue up on the road outside the school, to ensure that they get the form in the morning. If this is strange, college admission

can be worse. The acceptance rate in some Indian colleges is less than 2%, and the admission process is a pressure cooker like situation.

"If all those of college going age in India need to be enrolled in tertiary education, then the country will need 132,000 more colleges, and 4.1 million lecturers will have to be recruited to teach these new students."

The Indian national college enrollment rate is under 20%. If all those of college going age in the country need to be enrolled in tertiary education, then India will need to send 95 million new students to college. That means 132,000 more colleges will need to be built, and 4.1 million lecturers will have to be recruited to teach these new students. If in 65 years of independence, the nation has reached a position where it has 35,000 colleges and .8 million lecturers, what will be the time, cost, resources and effort required to multiply the educative capacity of the country 4 times in the next few years!

The Indian college education scenario is indicative of the same level of functioning in many other countries as well. The world over, more than 366 million youngsters are left out of tertiary education. If all of them are to be admitted to college, how can they be accommodated, or can they ever be accommodated? Such a large gap between demand and supply as it exists in India does not exist everywhere, but every country has its own set of issues.

According to *American Dream 2.0,* the Gates Foundation report, just over half the students who enroll in an institution of higher learning in the US graduate within 6 years. One of the primary reasons students drop out is finance. In the past three

"In the past three decades, average family income has risen by 16%, while fees at public univer-sities have gone up by 250%."

decades, average family income has risen by 16%, while fees at public universities have gone up by 250%. Some of the enrolled students are forced to drop out of college and take up a job because debts are piling up. The student loan debt of over $1.1 trillion in the US is composed of 38 million borrowers. The higher the fees, the greater the borrowing, and higher the default rate, dropout rate and the unemployment rate.

Where finance is not a problem, quality of education can be. Much as it may defy the imagination, there are schools and colleges that teach the technology of magnetic tapes and punched card readers to their students of computer science. Syllabus updation takes place once in a few years, while advancement in technology is announced every few weeks, if not days. There are classrooms without roofs, without walls, without even teachers. More than half the college faculty positions in India are currently vacant. Low college enrollment rates result in fewer eligible teachers and lack of good teachers affects college education in return.

Many other factors trouble education today. It is one of the first victims of conflict and violence. In societies where women are repressed, half the population is consequently left out of education. Those with special needs and challenges often face insurmountable obstacles

on their path to school and college. In the US, 57% of youth with visual impairments attend post secondary schools compared to 68% of the general population. In many developing countries, not even 10% of such youngsters receive any kind of education. With low levels of education, poverty follows.

4. The Online Revolution

The challenges facing education are numerous and varied. There have been attempts, some successful, made to address them in the past. But what makes this period momentous is that technology makes it possible to break into another space and time, taking education to a whole new plane.

When we order a book online from Amazon or one of the many similar online stores, we hardly wonder at the act. But when Jeff Bezos started Amazon.com 18 years ago, Barnes and Noble, the Borders Group and other large bookstore chains dominated the market, and the idea of a website competing with the giants was a new, even irrational one. But the startup not only overtook everyone else in the domestic market, but soon began selling to the whole world. The user friendliness of the site, the wide range of products, discounts, user reviews, wish lists, targeted advertising and the convenience of shopping from home made the whole idea a perfect success, and setting up an online store seems the most obvious thing to have done then.

The idea of online education is similar. Just as Amazon took the experience of shopping out of the brick and mortar store and made it available on the internet, enhanced the process and continues to do so in a hundred ways, it is possible to do the same with education. Both traditional universities and a range of startups are experimenting with new models that challenge centuries of convention. In another 18 years from now, online education will seem to be the most obvious thing to have done at this time. Today when one mentions major booksellers, the name of Amazon comes first to mind. In education, it is Harvard, Cambridge, MIT and the like. What will it be 18 years from now?

What is online education? The terms virtual education, e-learning, web-based training, computer-aided instruction and digital education are all references to the use of electronic media and ICT in education. In other words, it is what we have been doing since the 1960s. In 1960, the University of Illinois linked computer terminals in a classroom to allow students to access informational resources on a particular course while listening to recorded lectures. Today, when we read an online book or newspaper, a newsletter or even a mail message, we are engaged in online education. Participating in a discussion, reading a blog, visiting a website, watching a video, referring to an online dictionary or encyclopedia, even social networking are learning experiences, and come under the same definition.

If online education has been around for over half a century, why is everyone suddenly talking about it so much now? Since 2004, enrollment in online learning has recorded a growth of 2% per year. Almost 25% of all students in post-secondary education in the US were taking online courses in 2008. In 2009, it had risen to 44%. This figure is projected to rise to 81% by 2014. From being a marginal, experimental idea, online education is gaining

mainstream acceptance. From renowned universities to educational startups, from publishing houses to software companies, everyone has realized the potential of online education to democratize and revolutionize global education.

5. MOOCs

MOOCs, or Massive Open Online Courses, have become phenomenally popular. A MOOC refers to a web-based class that can support a large number of students. Anyone from anywhere in the world who wishes to learn can enroll in a course. Each course typically consists of short video lessons, with a lecturer or subject expert teaching the subject with the help of models, images, animation and video. Each lesson is followed by multiple choice tests that the students take online and assignments that they complete and submit. Multiple choice tests are automatically corrected, essays are peer reviewed or graded by teaching assistants. Students can email or chat with lecturers, participate in forum discussions, raise questions, form study circles and in some cases, even meet co-students offline. After all the video lectures have been watched and tests successfully taken, the student is awarded an electronic certificate of completion by the MOOC provider. These providers can be colleges, private educational companies, even individuals.

With advances in multimedia and technology, new and innovative methods of teaching and learning have evolved. Video conferencing software makes it possible to recreate a classroom in virtual reality. Social networking sites can be used for real time research. Cloud computing technology assists in online collaboration. Learning Management Systems allow anyone with little technical knowledge to create a course and present their expertise online. 3D gaming teaches as much as it entertains, and can improve the impact of education tremendously. Crowd sourcing harnesses the knowledge already discovered. E-book readers, notebook computers, tablets, phablets and the like that will be developed between the time of writing this article and its publication make dissemination of knowledge easier, more effective and affordable.

In a trendsetting move, MIT put all of its educational materials online in 2002, allowing free access to all. In ten years, many colleges have followed suit. According to the Babson Survey Research Group report, in 2012, 2.6% of the colleges in the US provided MOOCs, and an additional 9.4% were in the planning stages of creating MOOCs. Some colleges collaborate to provide their courses under a single platform. One example of a collaboration of many institutions is edX. It began as a combined initiative of Harvard University and MIT, and as of August 2013, University of California at Berkeley and 25 other international institutions were involved. Coursera and Udacity are two of the largest private MOOC providers. They are funded and managed by educational entrepreneurs and provide a platform for a college or lecturer to teach a free course online. Most MOOCs are not for credit, and do not award degrees that are officially recognized by universities. But some are experimenting with charging a fee, arranging a proctored examination at the end of the course, and providing a degree. Some colleges collaborate with private MOOC providers and allow their students to take some courses online. Online education is an evolving industry, and every day sees the birth of innovative ideas.

6. Advantages of Online Education

Best quality education can be made available to the whole world. Remember that one brilliant lecturer you had, whose classes were inspiring, who awakened in you an interest for the subject, whose lessons you still remember. Imagine if every student could learn from that lecturer. And if every subject could be taught by lecturers like that. The best lecturers in every field could be identified, and their courses made available on the internet. Faculty shortage will become a thing of the past. Every student regardless of country, background and academic proficiency could learn from the best talent in the world.

An online course need not be restricted to watching a recorded lecture. Animation, virtual reality, audio, video, virtual lab, video conferencing, chat, discussion forums and social networking sites make learning a richer experience. Imagine learning Shakespeare by watching his play enacted, geography through virtual visits to the places studied, history through documentaries and dramatic presentations of historical events, or science through films of actual experiments and conversation with famous scientists. It is no surprise that the Babson Survey Research Group report shows that 77% of academic leaders rate the learning outcomes in online education as the same or superior to those in face-to-face classes. Neil Armstrong called the first step he took on the moon as a giant leap for mankind. We are currently making that giant leap in education.

Expansion is possible on a scale larger than ever conceived of before. Imagine doubling the size of a traditional college class. If a class of 50 were to be expanded to accommodate 100 students, it might be managed with some ingenuity. If another 100 were to be enrolled in the same class, it might be difficult. But if a 1000 students need to be taught, it would require setting up new classrooms or a college itself, hiring lecturers, providing the infrastructure and investing a lot of time and money. Whereas in the case of an online class, a class of 50 can accommodate 50,000, 5 million, or even 50 million. The digital classroom does not have the constraints that its physical version has. Scalability is critical in education systems of the future. Tertiary education participation rate in 2010 was 80% in OECD countries. It is 26% for China, 18% for India, 41% for Latin America and 7% for Sub-Saharan Africa. Like the proverbial Bata salesman who saw people barefoot in Africa and found in it a huge opportunity, the poor enrollment rates in countries in Asia and Africa can be seen as an indication of an exponential rise in the demand for education there. The enrollment rate has tripled in China between 2000 and 2010. In the same period, India and Latin America have seen doubling of rates. An education system that aims to provide education to all needs the potential to incorporate students in large numbers, read millions.

Flexible hours and self-paced learning suit those who are trying to juggle work, family and studies. After finance, the next greatest challenge to retaining students is class timing. All those who drop out of college because they need a job or cannot leave the house for family reasons can be retained if they are allowed to take classes when and where they can. Online education can be paced to adapt to the speed and capacity of each individual student, so above average learners can proceed quickly and others can take more time. Space and time become irrelevant. Students can take a class at home, at work, during travel, or just about

anywhere. The class is not limited by time either. Once a lecture is recorded, it is available forever. Students can watch it any number of times till they master the subject. We can have talented and inspiring lecturers teach us even after they are gone. Imagine having Einstein tutor you at home on a one-to-one basis. It is just one of the possibilities of online education.

Text and audio content can be made available in multiple languages. With the help of translation software, educational resources in one language can be made available to everyone in every language spoken on earth. This automatically expands the student base from North America and parts of Europe to include the whole world. Some countries and colleges have resources for those with physical challenges. If these could be made available to all such people in countries where such facilities are not even conceived of yet, or have never been attempted for want of resources, hope for a better life will replace despair.

Online education lends itself most naturally to collaboration between colleges, government organizations, companies and communities. This opens up infinite opportunities for students. It also lends itself to be customized and specialized to meet the varied interests and needs of students, far more than is possible in the bulk educational delivery system now prevalent for higher education. Syllabus revision can be done on an ongoing basis, without a lengthy procedure, administerial bureaucracy and the cost of reprinting thousands of books. This way, students stay updated with rapid social and technological advances. A wider range of subjects is available for students to choose from. This especially benefits students in rural areas and small towns where colleges offer limited program options. Students benefit from exposure to many cultures and viewpoints. Learning from a lecturer from another country, and discussing with peers spread all over the globe, students gain a global perspective that would otherwise have been beyond their reach, and which will qualify them to become global citizens.

In a world where the cost of education is rising rapidly beyond the reach of many students even in Western countries, online learning represents a way to deliver education at a fraction of the cost of traditional classroom education. Apart from tuition, costs of transportation and accommodation can also be saved.

7. Questions about Online Education

We may talk about online education saving everyone time, money and a lot of trouble, but there are also many who vehemently call for saving education from this online frenzy. When The New York Times declared 2012 the year of the MOOC, there were others who termed it the year of hyperbole. Selling books, headphones or used cars may very well be done online, but education is not a commodity to be sold. It is a process to be experienced. Nothing ever can replace the physical presence of a teacher. Teachers do not just teach their subject. In a hundred ways, they pass on their passion for learning, their values and principles to us. Their presence inside and outside the classroom, their handwritten notes on the answer sheets, their jokes and reprimands, their scholarship have all influenced us deeply. How can an image on a computer screen fill that place? Attending class with a group of friends, scribbling messages to one another, discussing, arguing, studying together – aren't all these as integral a part of college as acquiring a degree? The time spent at the college canteen, dorm, lab,

campus grounds, baseball matches, class outings are all learning experiences that teach us lessons that last a lifetime. Can all this be stimulated in virtual reality? Lifelong relationships often begin in school and college. How can the internet give all these? In a world where people are already getting addicted to gadgets and becoming more isolated, what will the youngsters of the next generation be like if they are left in front of the computer all day or night? What will the physiological, social, psychological consequences be? Doesn't the virtual world come with its share of problems – problems of security, hacking, identity theft? How can one make sure that the youngster sitting at the computer is watching a video lecture and not indulging in some recreational activity that does not serve any purpose? What if a forum discussion strays from the subject to personal affairs? Evaluating a multiple choice question can be automated, but how can a software program evaluate an essay on the subtle humor in the works of William Makepeace Thackeray? It is not easy to stay focused and self-motivated when one is given freedom. Why is the dropout rate in MOOCs so high? How can an employer be certain that the applicant actually took the online course and tests, and not a proxy? These are some of the questions being raised.

> *"When Gutenberg started printing Bibles, the capacity to read and write was taken as a sign of genius and many protested that the Word was meant to be read only by priests."*

New developments are always received with some degree of skepticism or opposition. When Gutenberg started printing Bibles, the capacity to read and write was taken as a sign of genius and many protested that the Word was meant to be read only by priests.When electric street lights were introduced in Germany, some declared it as evil. God had meant the day to be bright and the night dark, man should not interfere with the divine will. When Apollo 11 was launched, there were some who criticized spending millions of dollars on a fool's errand. Until the dawn of the PC, working with computers was regarded as the sole province of engineers and scientists. The ATM, cell phone, satellite TV, social networking, e-commerce, internet banking, wearable computers – which one of these was welcomed without cynicism, only to be accepted as a matter of fact in due course?

8. Interactivity

An internet-based education need not exclude the traditional classroom. A blended or hybrid version can combine the best of both formats and elevate education to as yet unknown standards. When a lecturer uses a recorded lecture, there is more time for direct interaction with students. Any student can directly email the lecturer, have a live chat discussion, or participate in a video conference. Skype, Webex, Google Hangouts are some of the video conferencing platforms that enable the creation of global classrooms. More versatile and user-friendly group discussion software and feature-rich social networking sites allow students to relate to their classmates.

Online education need not isolate the student; it can enable him/her to connect in ways never done before to students across continents, cultures and age groups. Some forums allow

voice messages in addition to text. Live chat makes discussion as close to a classroom discussion as possible. Questions posted in forums in Coursera courses are answered, on an average, in 22 minutes. Students who are active in the forums, who answer questions, or even raise them are noted, and their participation is positively reflected in their grades. Posts can be voted for, and students whose posts receive the most votes are similarly appreciated on the completion of the course. Forums keep track of the most popular topics and questions raised, and the MOOC instructor personally responds to them, or takes them up during subsequent live conferences.

Following instructors or peers on Facebook, Twitter and other social networking sites makes learning fun, and more effective. A lecturer teaching science fiction asked his students to watch a film as a course requirement. Students could watch the movie anywhere they found convenient, but were required to 'live tweet' their viewings. This created a collective experience out of the disparate viewings. Then he used Storify, a tool to collect updates from social networks and created an interactive, dynamic and social story, and put his students' posts together. The tweets and the story form as much an education as his course that follows. Moreover, they make students connect with each other in dynamic ways. Using video conferencing facility, another lecturer taught a global classroom, followed by a live discussion between students in the US, Brazil, India and China. Inkling, a company that creates interactive digital textbooks, allows the reader to not only take notes, but also create study groups online, and lets one see others' notes and highlights in real time, creating running discussions on the go. Kno Inc., an education software company, lets you get even your professor's notes right in your e-reader.

Many educators are using Pinterest, the pinboard-style photo-sharing website, to aggregate images, create visual scrapbooks, publish students' work, and engage a group. The networking power of Facebook is already legendary. A study of Facebook usage among educators and students concluded that the participation of a mentor and mentee on a Facebook group page is seen to positively affect their relationship both online and offline. Students and mentors that interacted regularly, posting questions and receiving feedback through the page, were observed as having a stronger relationship than other mentor-mentee pairs.

Peer review which is part of some online courses can be an education in itself. Online forums make it possible for students to raise questions and to teach one another as well. Some MOOCs allow students to identify classmates from the same vicinity, and enable physical meetings, much as home schooling students have their study groups and joint activities on a regular basis. Coursera meet ups allow Courserans living in the same locality to meet, discuss the course or any other subject. At a meet up in Menlo Park in 2012, the organizers expected a turnout of 100 students, but more than 600 attendees arrived, raising the question whether meet ups are the new classrooms. Interaction, meetings and socializing are possible even in online education.

9. Education 3.0

Education as we used to know it, and which is now termed Education 1.0, was imparted by teachers in the classroom using textbooks and notes. Education 2.0 saw the cautious

acceptance of technology. Computers and the internet were used to supplement teaching and learning. Today what we are witnessing is Education 3.0. Education takes place everywhere, in the classroom, at home, on the road, in the workplace, anywhere. It comes from teachers, classmates, friends, strangers. Technology has permeated everything, and education has become lifelong.

New learning methods have always evolved. An advertisement for shorthand courses through weekly mailed lessons was seen in the Boston Gazette in 1728. The University of London first offered distance learning degrees in 1858. In the 1930s, schools and colleges in the US were using radio to teach students. UK's Open University established in 1969 initially relied on radio and television broadcasts for delivering its courses. In 1976, Coastline Community College in the US combined computer assisted instruction with telecourses to successfully establish online distance learning. The limitations of the classroom were overcome long before the advent of internet. Distance and Open learning have provided education to students who either could not, or did not attend regular classes. According to the 2011 report of the US Department of Education, 20% of all students enrolled in college took at least one distance education class, and 4% enrolled in an entire program through distance education. In India, 24% of all students study through the correspondence method. IGNOU, an Indian open university, teaches 3.5 million students each year. Turkey's Anadolu University and Allama Iqbal Open University in Pakistan educate nearly 2 million students each. Since its launch, UK's Open University has taught almost 1.8 million people worldwide. Online education is one step in a long continuum.

Online education is to distance education what the E-book reader is to the book. It is not a glorified version of the older one. It brings much greater capabilities than ever imagined to improve the quality and effectiveness of this huge field. True, there is only so much that can be transmitted through wires, or wirelessly. Online education is the solution to a number of problems, and at the same time poses a different set of challenges.

10. Innovations Unlimited

Startups and established companies alike come up with products, services and ideas that seek to improve online education and meet the challenges it presents. The range of subjects offered by MOOCs and providers of online education leaves the students spoilt for choice. There are search engines such as Moocse that search the MOOCs for the required course. Class Central, MOOC List and moocs.co are online course aggregators or directories that list all available courses. Some even allow students to rate the courses they have taken and lecturers they have had, to guide others. Learning Management Systems (LMS) such as Blackboard, Moodle and Desire2Learn allow the creation and management of online courses. Presentation, audio, video and graphics software allow a subject expert to create all the components that make up the course. One need not be a college lecturer or a PhD holder to create a course, companies like Udemy and Educreations allow anyone to host courses online and share knowledge with the world. Khan Academy, Codementor, Colingo, Magoosh and many others focus on one or a few subjects exclusively. TED Talks educate in an unconventional, inspiring way. Major players such as Apple, Samsung, Nokia and Sony

create devices that cater to the educational needs of students. Others like Datawind come up with low cost devices that aim to make digital education affordable to all. Publishing houses like Pearson and tech companies like Inkling and Kno create interactive, digital textbooks that allow the reader to organize notes and take tests on the internet, so that the plethora of information does not overwhelm the student. Organizing software such as Zotero allow one to categorize data, ebooks, websites, videos, notes, and synchronize all these online with other users. Kno Inc. provides a personal study dashboard that helps students track their learning engagement for each ebook they use. Wordle, a tool for generating customized "word clouds" from text, can be used to make text more visually appealing, and put to uses that are limited only by one's imagination. Biometric devices for identity verification aim to minimize fraud. Hardware, software and strategies that seek to prevent malpractice during the course and evaluation, and different revenue models that will make open courses sustainable are mooted. Google and edX are collaborating on a new online learning platform, MOOC.org, which they aim to make the YouTube for MOOCs. Udacity, along with other online education providers and tech companies in Silicon Valley, has launched The Open Education Alliance, which is an experiment in open education. Collaborations are the rule of the day, with tech giants and startups, government and voluntary organizations, universities and publishing houses coming together to educate. Tools are available for every conceivable aspect of learning – for event scheduling, translation, flashcard creation, mind mapping, document sharing, digital storytelling, screen casting, note taking, blogging etc.

11. Assessment & Certification

There are course providers that adopt the freemium model, where the basic course is provided for free, and students are charged to take a proctored exam, and receive credit for the course. Coursera launched Signature Track, which gives students the opportunity to earn Verified Certificates in recognition of their work and completion of a course, and within 9 months of the launch, 25,000 had signed up. These certificates are building a reputation as an accessible credential for adults to demonstrate their proficiency in a range of skills and disciplines. Signature Track links one's online coursework to one's real identity. It provides financial aid for students who are unable to pay for the certificate. Its participants are substantially more likely than the average Coursera student to complete a course. These Verified Certificates are beginning to be included in resumes, cover letters and LinkedIn profiles. Certification ties in with employment opportunities.

12. Employment

Many online educators provide training for students through tie-ups with companies. Some allow companies to recruit from among their students. The Cisco Learning Network is a social networking site that lets users seek knowledge, training, and support to enhance their careers through various certifications offered online. The portal also has a mentorship programme where peers anywhere in the world can mentor others that are preparing for certification exams via discussion forums, blogs, video interviews and wikis. Udacity allows students to share their resume with recruiters and provides employment assistance by matching students with prospective employers. Knight Center for Journalism in the Americas' program

on journalism offers students the chance to interact and learn directly from data journalism experts working for leading U.S. publications. The advantage of education providers partnering with companies is that students can be trained in a way that ensures they will be hired, almost guaranteeing employment. There are now enterprises like Accredible that translate all online learning into a five star rating to assist recruiters take a decision about the applicant. Online accreditation and certification are going to assume a lot of significance given the projected shortage of graduates worldwide. Manpower Group's 2013 Talent Shortage Survey finds that currently, 35% of employers worldwide report having difficulty filling jobs

> *"The Academy has envisioned an idea half a century ahead of its time, and is perfectly poised to assume leadership by creating a World University Consortium."*

due to a lack of available talent. A 2013 study by the Lumina Foundation finds that by 2020, 65% of the workforce will require some form of post-secondary education. At the current trajectory, the US will be at 48.1%. A study by the McKinsey Global Institute says that by 2020, there will be about 38-40 million too few college and university graduates to satisfy the demands of the global labor market.

13. World University Consortium

> *"The future of education is online."*

Education is breaking out of monastic retreat and coming into much closer contact with the real world. Online education blurs the line between the university and society-at-large enabling other players to become major knowledge providers and enabling academia to experiment with new types of courses that do not fit within the confines of conventional academic disciplines. The completion rates of MOOCs may be low, but given that the strength of many MOOCs runs into tens of thousands of students, even a completion rate of 10 or 20% means a class larger than most college classrooms. The course "Functional Programming Principles in Scala," from Switzerland's École Polytechnique Fédérale de Lausanne attracted 50,000 students. 83,000 enrolled in "A History of the World since 1300" at Princeton University. University of Edinburgh's course "Introduction to Philosophy" drew almost 100,000 participants. With such numbers, even a miniscule completion rate translates into a very large class.

The founders of the World Academy of Art and Science were inspired in 1960 by the idea of establishing a "world university". The Academy has envisioned an idea half a century ahead of its time, and is perfectly poised to assume leadership in this initiative by creating a World University Consortium.

14. The Future is Online

The future of education is online. The claim is backed by all available data. The Babson Survey Research Group, supported by The Sloan Consortium, Pearson and the College Board, has been studying online education since 2002. Its January 2013 report, *Changing Course: Ten Years of Tracking Online Education in the United States*, is the tenth annual report in

this series. According to it, 71.7% of higher education institutions were offering some form of online learning in 2002. In 2012, it had risen to 86.5%. 34.5% of these institutions offered complete online programs rather than individual courses in 2002. Now the number is 62.4%.

In 2003, 57% of academic leaders rated the learning outcomes in online education as the same or superior to those in traditional classroom learning. In 2012, the number had risen to 77%. However, faculty resistance to online teaching is considerable. 27.6% had accepted the value and legitimacy of online education in 2002, and that rate has inched up to 30.2% in a decade. Academic leaders and faculty members at institutions with online offerings have a more favorable opinion of the outcome of online courses than those at institutions with no online offerings.

69% of chief academic leaders say that online learning is critical to an institution's long term strategy. The number of American students taking at least one online course is 6.7 million. The proportion of all students taking at least one online course is 32%, up from 9.6% ten years earlier. Mark Twain is supposed to have humorously said that he never let his schooling interfere with his education. His words are literally coming true for many.

The cold numbers above all represent heartwarming human stories. A self-learner left a note in one of the popular MOOCs. He had been working as a shelf stacker for 6 years, applying for 4 jobs every week but with no avail. Programming had long fascinated him, but there had been no opportunity to learn. The advent of online courses had provided the opening, and the shelf stacker took a programming course, applied for a software job, and found one that paid more than twice his earlier salary. When he went to a dentist and filled out a form, under occupation, he put 'software engineer' instead of 'shelf stacker'. There can be no number affixed to the sense of satisfaction, pride and joy in that.

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Bibliography

1. Justin Bokor, *University of the Future* (London: Ernst & Young, 2012)

2. "Key Messages and Data on Girls' and Women's Education and Literacy," *UNESCO* http://www.unesco.org/new/fileadmin/MULTIMEDIA/HQ/ED/pdf/globalpartners-key-messages.pdf

3. "OECD 2013, Education Indicators in Focus," *OECD* http://www.oecd.org/edu/skills-beyond-school/EDIF%202013--N%C2%B010%20(eng)--v9%20FINAL%20bis.pdf

4. "The American Dream 2.0," *HCM Strategists* http://www.hcmstrategists.com/americandream2-0/report/HCM_Gates_Report_1_17_web.pdf

5. "Changing Course: Ten Years of Tracking Online Education in the United States," *Babson Survey Research Group* http://www.onlinelearningsurvey.com/reports/changingcourse.pdf

6. Pamela Pollara and Jie Zhu, "Social Networking and Education: Using Facebook as an Edusocial Space," *Proceedings of Society for Information Technology & Teacher Education International Conference 2011* http://www.academia.edu/394232/Social_Networking_and_Education_Using_Facebook_as_an_Edusocial_Space

7. "The World at Work: Jobs, Pay, and Skills for 35 Billion People," *McKinsey Global Institute* http://goo.gl/xwXkSA

8. "The Great Talent Shortage Awakening: Actions to take for a Sustainable Workforce," *Manpower Group* http://www.manpowergroup.com/wps/wcm/connect/3335c8e9-8b90-4496-adcc-af1e6ca28d6d/2013_Talent_Shortage_WP_FNL_US_hi.pdf?MOD=AJPERES

9. "A Stronger Nation through Higher Education," *Lumina Foundation for Education* http://www.luminafoundation.org/publications/A_stronger_nation_through_higher_education-2013.pdf

The Double Helix of Learning and Work[*]

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Editors' Note

The Double Helix of Learning and Work by Orio Giarini and Mircea Malitza is a report to the Club of Rome first published by UNESCO in 2003. It advances fundamental paradigm-changing ideas in the field of education. Drawing inspiration from the double helix structure of DNA, the authors seek to strengthen the relationship between education and employment in order to bring 'The Knowledge Society' within reach. This article contains the first chapter of the report. Successive chapters will be carried in subsequent issues of *Cadmus*.

Chapter 1
"I Learn, therefore I Change"

1.1. LIFELONG LEARNING: A BLOCKED PROJECT

A new concept of *lifelong education* emerged by the end of the second half of the Twentieth Century. Over that period, human societies had tended to place education among their top priorities. The idea that good schooling was the underlying prerequisite of modern life, welfare, and normal social integration had never seemed more obvious. The widespread interest in education was exploited by political parties, which busily produced doctrines, solutions, and reform plans. In the developed countries, education benefited from extensive support and generous facilities, while the developing countries inaugurated campaigns against illiteracy and for the establishment of structured education systems.

Nevertheless, dissatisfaction about the performance of educational institutions has persisted from one generation to the next. Since Philip H. Coombs published *The World Educational Crisis* (1968), the catchword has been: all countries face a severe crisis in their education systems, and all countries have solemnly launched comprehensive reforms. Few people understood that the very idea of intermittent reform was wrong and that a good school

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[*] All content being used from the book *The Double Helix of Learning and Work* – a Report to the Club of Rome – by Orio Giarini and Mircea Malitza, published in 2003, is copyrighted to UNESCO. The full book is available online for download at http://unesdoc.unesco.org/images/0013/001307/130713eb.pdf

needed to undergo continuous reform, adjusting itself to the needs of society and to the new promises of technology after having introduced proper mechanisms for change into its institutional setup.

"Education does not conclude with graduation or a doctoral paper, but it remains open-ended."

It is difficult to expect that, all by itself, one of the most conservative structures of civil society should be able to develop a vocation for perpetual change. For centuries, people have perceived education as a fixed system through which "innocent" young people are processed in order to be returned to society after a decade or two, well-equipped with knowledge and skills that are necessary for a productive life. No matter how many efforts are made to humanize this process by imparting to it affective, moral, or aesthetic dimensions, deep down it has never changed.

Education is viewed as a system with an input and an output, and its effectiveness is measured by means of statistics, costs, infrastructure, and personnel. At its core lies a centuries-old set of subjects or disciplines in a *curriculum* that has a flow similar to that of etymology, like a river that gradually deepens and branches out. Ever since the days of ancient Greece, mathematics has been mathematics, music has been music, astronomy has been astronomy, and medicine has been medicine. Until recently, despite the dynamic evolution of the content, *i.e.,* the syllabus, one thing has been clear: the river flows into the sea, and the school is a closed chapter for those who have left it.

Hence, the revolutionary importance of the newly emerging concept. Under several different names, such as *permanent education, continuous education, recurrent education,* it states the same thing. Education does not conclude with graduation or a doctoral paper, but it remains open-ended. The graduates of classical cycles return to take up new subjects. Since the 1990s, this idea has been embodied in the principle of lifelong education or lifelong learning. It points to what was suggested several decades ago, namely learning from "the cradle to the grave".

Let us assume that adult thirst for knowledge has not been discouraged by the closed doors of the official educational or school system, which is considered to be *formal* because it is regulated by laws, ordered by professional *fora,* and recognized by means of official documents, *i.e.,* diplomas. Adults, therefore, have had to resort to *non-formal* organizations that have come in a Variety of forms: so-called peoples' universities, evening courses, and university-level special courses on arts, sports, religion, and foreign languages that entitled graduates to recognition through certificates or other such documents, however, at a lower level than that conferred by "official" diplomas. Such certificates have only acknowledged the fact that a given person has taken a certain course, without providing an additionally recognized right.

At the same time, the explosive development of the mass media, despite their pre-eminently commercial character and focus on entertainment, has been offering new sources of information and knowledge regarding such topics as history, economics, social science, and culture. That kind of acquired knowledge is not entitled even to the less authoritative rec-

ognition provided by a certificate of non-formal education. Everything that an individual can pick up from his or her family or kin group, from readings, or from watching television falls under the no less important category of *informal education.*

Lifelong education is a new and powerful concept that illustrates the changing relationship between the state and its citizens. It is not limited to individuals in a certain age group who have to go to school. Rather the entire population claims the same right, in regard to education, that it has acquired in regard to health care: lifetime access.

The term, *lifelong,* applies to education as well as to learning. The word, *learning,* was introduced over the past few decades, rather than *education,* to emphasize the primacy of the learning process, whereby the individual is supposed to play the leading role, while the notion of an educational system carries the connotation of external intervention. In such a vision, the teacher does not administer knowledge, values, and skills, but returns to *maieutics* – the Socratic method – as a means to facilitate the acquisition of knowledge by those who are interested in doing so.

The ministries of education still retain their names, there being no "ministries of learning". The whole system that is being organized, financed, and maintained by the state is education-rather than learning-based, even though the latter should, in fact, be its basis of operation. Lifelong learning does exist, even if it is an individual responsibility. Each individual resorts to whatever methods may be available to maintain the continuous functioning of learning mechanisms.

The concept of lifelong learning, however, is no longer embraced by the societies of today, simply in the sense of informal and non-formal resources. It is permeating a new vision of education as a guiding and organizing principle. Its merit is to induce a unitary/unifying vision of all education or learning phases, from kindergarten to the doctorate, and on, for a sixty-year life span.

Lifelong learning has come into the limelight for the following simple reasons. The last few decades of the past century coincided with a spectacular explosion of human knowledge. (Here, knowledge is understood as any statement subject to universal verification and validation, a scientific theorem, or a technological recipe, blueprint, or know-how.) Science and technology provide the most accurate definition of knowledge. In a broader sense, knowledge is also acquaintance gained by experience and work, even if it is not theorized or formalized. A huge amount of practical knowledge has been transmitted from generation to generation and has been incorporated into skills to be applied.

Science and technology are the pillars of civilization, followed by universal practices such as trade and other economic activities. Cultures belong to a different sphere, that of beliefs, values, and particularities of language and history which account for their splendid variety.

It has been noted that a piece of knowledge is a perishable product. It is subject to a law similar to that applying to radioactive substance physics:the half-life principle. The school enclosure functions under a similar hypothesis: it equips persons with knowledge that is

supposed to be relevant for the rest of their lives. But the existing system appears to be shaky once school leavers discover that everything they have acquired or learned is no longer valid after a lapse of ten years. A specialist in technology would normally consider that the "shelf life of a degree in engineering is about three years". The halving time of some radioactive substances is hundreds of years, but in the case of knowledge, halving may take less than a decade. Either the inherent frailty of knowledge must be acknowledged, or a radical recycling procedure must be introduced. This last solution points to continuous or lifetime learning.

The second root of the concept is demographic. Life expectancy has increased in the developed countries beyond the age of 70. Young contingents are smaller. The whole of society is aging. The closed educational system was designed and developed for large cohorts of young people and for short active lives. As we write these lines, an 81-year-old Japanese minister is replacing a 71-year old one. The third age has started to look for ways of keeping busy, and it is demonstrating remarkable participatory impulses. Elderly people would like to keep abreast of the times, but the bastion of formal education stays closed.

The social dimension cannot be overlooked. Civil society, today, is vocal. There are numbers upon numbers of non-governmental organizations, movements for the protection of individual rights, for the emancipation of women, and for the inclusion of minorities. Not only do engineers find themselves disoriented when confronted with new technologies, but also those adults, who, when requested to give an opinion, discover that their schooling has not taught them how to communicate, to co-operate, to initiate a new project, or to found a business. Should the doors of the system to active life be thrown open, a greater concordance between theory and the actual throb of life and nature would be achieved as well as the promise of a more harmonious and less schizoid or stressful life. In fact, this last social argument supports and explains the wide attraction that lifelong education now enjoys.

> The high-tech information society is, by its very nature, a changing society that is continuously requiring the mastering of new information and new techniques usable in occupational pursuits. We have, since the early 1960s, been talking about "life-long", "permanent", or "continuing" education which means that no matter how much formal education a person has been able to acquire at the beginning of his or her life, relearning and new learning has to take place continuously throughout the rest of this person's life. Today, in some countries, the costs incurred by enterprises for the upgrading of the competencies of their personnel are of the same order of size as for the entire public system of education (Torsten Husén, "Education by the Year 2025", 1999-2000).

The key question is the following: why does this universally recognized, embraced, and proclaimed concept not work? The question is not about the effectiveness of the vast rhetorical exercise in its favour. What is being evoked is the fact that one rarely encounters a 40-, 50, or 60-year old person who returns to a university saying, "I want to go on", and who finds a welcoming open door. The system is not prepared for such an eventuality. Should this person be sent to the same college from which he or she graduated? But this person has different interests now which do not fit into the educational sphere of that college. Should the

university authorities recommend new textbooks, select bibliographies, extensive courses so that the person might keep in touch with contemporary knowledge? But he or she only needs clarifications, specific applications of that vast amount of knowledge in his or her field of interest, with a meaningful impact on his or her social roles. All this person can receive is a short summer course, designed with the best of intentions by some well-meaning professors, sometimes in collaboration with industry.

When asked about their involvement in lifelong education, universities will briefly mention such *ad hoc* courses that entitle one not to a diploma, but to a mere certificate. They do not offer an orderly learning system; they do not include the applicant into a coherent programme; and they show no interest in what he has formally learned. Why is that? Because higher education curricula stop short of any extension, they do not have open valences to future possible programmes. Programmes are invariably terminal.

This reality draws attention to an element without which the concept remains inapplicable: the curriculum has to be open at the end, while now it is fatally closed. It has to continue into the fourth stage (the other three being clearly defined: basic, secondary, and tertiary). That is, the stage of active life, when life's actor has full and mature possession of his or her capacity to learn alone (goal choice, course choice, choice of the best time frame), assisted by tutors, and enjoying the educational facilities of the school (libraries, laboratories, and other logistical paraphernalia).

As for official recognition, the concept of lifelong education has broken all records. The European Union countries introduced it into the Treaty of Amsterdam. The year, 1996, was declared the "European Year of Lifelong Education". The entire education and training programme of the Communication Commission (Towards a Europe of Knowledge) for 2000-2006 is centered on the subject of lifelong learning. Following the major series of reports that introduced the concept, the recent UNESCO Delors Report (1998) ranks it first among the principles that are most likely to guide the future of education.

Despite significant conceptual progress, the situation in the field remains confused and unsatisfactory. According to the EURYDICE Survey of March 2000 (European Commission, 2000) "as in the case of other desirable social goals, there is a difference between the ideal and the reality, theory and practice, and promises and results".

Is the current situation a result of the difficulty in formulating a precise definition of lifelong education, a fact that has been pointed out by many analysts? All major concepts that influence political activity – *i.e.,* democracy, liberty, welfare – are fuzzy. There is no clear boundary, no precise beginning and end. But this fuzziness does not impede either the broad use of such concepts or their incorporation into legislation and common law.

The present state of the implementation of the concept is that of a huge basket of experiences, in which all attempts, otherwise praiseworthy, to embrace all new forms of learning pertaining to each and every social category and age are thrown in.

It is to be noted, however, that the assembled experiences have been conceived either outside the classical system or in addition to it. If they stay outside, there will be plenty

of goodwill and understanding. Jonasson's (1988) report is quite clear. Four categories of learners (some young students, some aged students, graduates, and those seeking employment diversification in new fields) make up *heterogeneous* groups that require a different, more clear-cut system. The objections of the advocates of the existing educational system, with its traditional and acknowledged discipline, rigour, and academic ethos, arise when a single lifelong education system is brought into question. Pressing the matter to the root of that resistance, one finds an element that has been badly neglected so far: the pressing need for a single methodology, for one homogeneous system, based on a new perspective on knowledge, which still appears to be dominated by the archaic schema of disciplines and their curricula. How can continuous lifelong education be introduced when the traditional curricula are designed for a discontinuous and closed education?

"Interdisciplinarity has been another cardinal idea of the past few decades. It has been the same guiding light for scientific research as lifelong learning has been for education. As in the case of education, what has blocked its coming to fruition has come from the same source: the watertight separation of disciplines or fields of knowledge."

It is only by breaking that deadlock and overcoming the contemporary impasse and confusion that it will become possible to give free rein to one of the most interesting ideas of our time.

1.2. INTERDISCIPLINARITY: AN AILING IDEA

Interdisciplinarity has been another cardinal idea of the past few decades. It has been the same guiding light for scientific research as lifelong learning has been for education. As in the case of education, what has blocked its coming to fruition has come from the same source: the watertight separation of disciplines or fields of knowledge.

Disciplines in the education system more or less coincide with the divisions in the classical schema of sciences. A given science has been conventionally defined according to its object, methods, and theories (also including its language and concepts). Astronomy, mathematics, logic, and mechanics have been recognized as such since antiquity, and their spheres are sharply delineated by the above-mentioned definition. But the progress of knowledge has created new fields of science. Thus, the social and human sciences were slowly emancipated from the embrace of philosophy. The difficulty has lain not so much in defining the objects of the new fields, but, rather, in the elaboration of their particular methodologies, basic theories, and concepts that should be comparable in rigour to those of the older sciences.

The common front of all sciences has always been the complexity of reality. Advancement has depended directly on the progress of technology or on the symbolic apparatus that has led research into areas previously inaccessible to direct observation or non-abstract repre-

sentation. The atomic era, the cosmic era, and the era of genetics that mankind has entered almost concomitantly these days are the most visible headlines of the new fields of science. In all these fields, our imagination is incapable of producing representations. The atom, the cell, or outer space require not only technical tools of access but also abstract tools, *i.e.,* mathematical models playing the part of a mental technology. The complexity of these three levels of reality has reached unprecedented levels.

The sciences need to rely on one another in their endeavour to move forward. Piaget enumerates them according to the criterion of growing complexity and decreasing generality: mathematics, mechanics, physics, chemistry, biology, and physiological psychology. Each field is connected to a less complex field: mechanics is subordinated to mathematics; physics creates a new branch (*i.e.,* mathematical physics); physical chemistry becomes a branch of chemistry; biology becomes so indebted to chemistry that it accepts a biochemical merger; and physiological psychology introduces mathematical methods and biochemical mechanisms in its effort to account for human behaviour.

Taking a cue from the historical solidarity of research branches that went so far as to create mixed fields in the natural sciences, the second half of the Twentieth Century acknowledged the primordial need for *interdisciplinarity* with renewed intensity. The concept has evolved from isolated cases to gain the status of a general organizing principle of knowledge. The disciplines are tending to break away from the stage of stark separatist defense and to accept the imperative of interdisciplinarity.

The *multidisciplinary* approach, defined as a partnership of distinct disciplines, follows logically. The same holds true in the case of a *pluridisciplinary* team made up of specialists in mathematics, physics, chemistry, astronomy, and various technologies who plan and manage a cosmic flight. *Pluridisciplinarity* adds a new touch to *multidisciplinarity,* in attempting to describe the joint efforts of two or more related disciplines to solve a common problem. *Cross-disciplinarity* means pushing back the boundaries of a classical disciplinary turf and making a daring foray into the methods of another, as in the case of "mathematical music". There is also *transdisciplinarity* in the attempt to transcend the boundaries of a discipline by moving into an area of principles or of general methods. The term has also been used when exploring visions or outlooks accessible to the general public without requiring specialist training.

The most widely used and accurate term is *interdisciplinarity,* which contains both the simple joint action or exchange of methods among disciplines and their merger. It announces the prevalence of the problem to be solved over the disciplines that might claim it for their own spheres of concern. It sets out from the existence of "academic disciplines", which it does not demolish, but rather combines into a scientific production co-operative.

The division between natural and social sciences, which became the subject of a major debate in the Nineteenth Century, is based, not so much on the specificity of the object of study – living and inanimate nature or man and society, respectively, but rather on the different methods they use. Within the experiment incorporated by the social sciences, towards

the end of their speculative age, the observer was no longer exterior to the experiment but became part of it. Objectivity received a different meaning in the approaches of the social and the natural sciences. Unlike the latter, psychology started to make use of introspection. Despite the tensions between them (see the dispute between psychology and sociology), the social sciences and the humanities, nowadays, have caught the interdisciplinary fever in an effort to define their own identities.

History has an older record of spawning connected sciences: archaeology, epigraphy, documentaristics, numismatics, museography, ethnology, ethnography, and others – all distinct disciplines.

Economics made a pact with mathematics the moment it became, prevailingly, a science of the measurable. In its quest for improved methods, it began to make use of the mathematical models employed in physics (mechanics, gas theory, thermodynamics), thus encroaching upon their privileged field of application. No sooner had the game theory been elaborated for the distinctive purposes of mathematics than it spread widely both into the social sciences (*e.g.,* the theory of conflicts) and into the natural sciences (*e.g.,* ecology).

The major cross disciplinary impact that mathematical models have had deserves special mention. The era of quantification was heralded when all the sciences, striving for rigour, resorted to measuring and quantifiable procedures. As a science of structures (and not of quantity), mathematics is actually related to structuralism, a trend with many echoes in the social and human sciences. Levi-Strauss (1949) would soon use mathematical instruments in ethnography just as Piaget (1967) did for the study of the evolution of thinking. It was linguistics that eventually confirmed the mathematical model in the humanities, the first to create a new discipline: mathematical linguistics. Then natural and artificial languages and grammars inspired the search for idioms to express nature, society, and life. The language of genes was next to be explored, and algebraic grammars attempted to decipher the underlying principle of the phenomenon of life.

Several trends influenced all disciplines more or less successfully during periods of considerable enthusiasm. We may thus mention cybernetics (the science of common mechanisms in technology and society), systems theory, semiotics, the theory of catastrophes, the theory of chaos, and later, computer science. They may be viewed as the off-spring of mathematics, the cardinal science of symbols and of abstract objects.

We should now ask ourselves whether or not this interdisciplinary impulse, born of the research function of disciplines and of the purposes assumed by science, has been followed by a similar process insofar as the pedagogical side of disciplines as subjects to be taught in schools is concerned. The answer is negative. Pedagogical disciplines have retired into a form of isolation that appears to be far tighter than academic disciplines with their penchant for symbioses and synergies.

Moreover, when schools have attempted to "update" themselves, they have only received "purist" acquisitions.

Such was the case of the Bourbaki School[*] and its search for fundamental structures, which inspired the idea of introducing the set as a basic concept instead of the number. The result was a broadly unsuccessful pedagogical experience (see, Kline, 1973). The prevalence of academic purists caused probability calculus to lose the weak position it once held, not to mention the disappearance of trigonometry and determinants. Had the school been inspired by mathematical models, it would have introduced finite mathematics resulting in a larger number of easily assimilated applications.

We should have expected the Humboldtian model of university, which provided universities with a research function, to better synchronize the pace of research with that of formal education. Despite the advent of that seminal idea, the gap between science and school-taught disciplines deepened. Departments and faculties became more specialized; chairs were established for increasingly narrow disciplines. One of the pioneers of spatial navigation, Hermann Oberth – whose book (*The Rocket towards Interplanetary Spaces,* 1923) was described by his student, Wernher von Braun, as "the scientific fundament of special navigation development technology" – was a high school teacher in a small town in Transylvania when he wrote it. When asked how he could possibly have acquired the information required for such an insight, he simply replied: "I graduated from Cluj University, Faculty of Sciences, where I took courses in mathematics, physics, and chemistry". Here we have an interesting example of a complex, eminently interdisciplinary, object of research based on multidisciplinary university education *avant la lettre.*

Medicine has probably benefited most from the multidisciplinary approach and acquired an impressive advantage in the process. This success is due mainly to the fact that it is a confederation of sciences or disciplines (anatomy, physiology, hematology, etc.) and that it remains open to new disciplines (such as infra-microbiology). When a physician needs to examine a patient, all disciplines compete and converge in his or her analysis and diagnosis. Another range of disciplines concerns fact-finding and treatment (radiology, balneology, chemotherapy, etc.). Today, medicine is, of course, the expression of its own evolution, but it is also the result of massive and decisive contributions from the external apparatus of cell biology, chemistry, and high technology (lasers, magnetoscopy, computers, etc.).

A less often cited scientific revolution, in the same order of magnitude as that occurring in medicine, is the *revolution of materials.* A new class of materials, with new properties, is invading the artificial human environment from house and furniture to goods of mass consumption, automobiles, etc., gradually substituting for "traditional" materials. The paternity of such materials is so interdisciplinary that their source becomes uncertain: metallurgy, inorganic chemistry, physics, industrial procedures, and others all coalesce to produce them.

These two examples also point to the difficulties and dilemmas of interdisciplinarity. Let us assume that the object of study is an unknown disease or a new composite material. An interdisciplinary team is formed. Which is the most economical, that is, the cheapest and

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[*]"'Bourbaki' is the collective pseudonym for the authorship of thirty-six volumes of comprehensive texts, started in 1939, by an élite group of French mathematicians, designed to present mathematics in a contemporary and original way, and to illustrate its axiomatic structure" (see: http://education.guardian.co.uk/Print/0,3858,4545977,00.html)

the most efficient way to assemble the team: with persons each representing a single discipline or with persons who, by virtue of their education, possess the necessary knowledge from all these disciplines? Is it the team that has to be interdisciplinary as a group, or should interdisciplinarity apply to its individual members? In the first case, more people are called upon; therefore, the costs rise. Time is required for them to become accustomed to one another, and so the costs rise even higher.

> *"Almost all problems are now interdisciplinary, and they claim an adequate preparation."*

The cost issue has long been a part of decision-making in the management of research and education, sometimes emerging as a decisive argument. There were people who regarded costs as irrelevant when it came to the progress of knowledge or to the shaping of personality, but their number has tended to decrease considerably. The other component of that reasoning, *efficiency,* is even more persistent. In pursuit of a goal, teamwork is crucial. Efficiency is based on communication, which, in its turn, is based on common language. It is thus better for fellow members of a team to have related interdisciplinary training.

The optimal research solution eventually depends on how learning is organized. The more interdisciplinary the latter, the better the chance for the former. The pressure on research with respect to interdisciplinarity has been passed on to education that has been in no hurry to react. The disciplines are even more obstinate and rigid in education than they are in research.

The stubbornness of the disciplines in higher education is forcing graduates to start anew at other faculties in order to be able to cope with the demands of their jobs. A young man from Germany says he is a physician, but he is now studying computer science because he has come to realize that he needs the latter as much as he needs medical information. Engineers who study economics, philologists who study management, and computer scientists who undergo training in finance represent frequent cases of costly and unnecessary duplication. What can be more inefficient than achieving interdisciplinarity by enrolling in two faculties instead of in one? The answer given by formal education to this phenomenon is very unsatisfactory. In the best cases, graduates are directed to non-formal education, parallel to but outside the system.

He that will enquire out the best books in every science, and inform himself of the most material authors of the several sects of philosophy and religion, will not find it an infinite work to acquaint himself with the sentiments of mankind concerning the most weighty and comprehensive subjects. Let him exercise the freedom of his reason and understanding in such a latitude as this, and his mind will be strengthened, his capacity enlarged, his faculties improved; and the light, which the remote and scattered parts of truth will give to one another will so assist his judgment, that he will seldom be widely out, or miss giving proof of a clear head and a comprehensive knowledge. At least, this is the only way I know to give the understanding its due improvement to the full extent of his capacity, and to distinguish the two most different things I know in this world, a logical chicaner from a man of reason (John Locke, *Of the Conduct of Understanding,* 1706).

Seven conclusions can be drawn from the above considerations:

i.   The two contemporary strong trends, interdisciplinarity and continuous education, are interconnected, and they both rely on constituted, quasi-rigid bodies of knowledge, *i.e.,* the disciplines.

ii. Disciplines have begun to lose their function, much as is happening to the State in politics. They are eroded, but not abolished. Their roles change. A new criterion for the evaluation of disciplines refers to the measurement of their open valences and their readiness to combine with other disciplines rather than to their endurance in splendid isolation. It is all about achieving interdisciplinary partnerships.

iii. The transition that is now taking place is one from the pre-eminence of the disciplines to that of the problems to be solved. Almost all problems are now interdisciplinary, and they claim an adequate preparation.

iv.   In order to become lifelong, education has to provide for an ability to use information in future professions that are defined according to the type of tasks, subjects, and problems to be solved.

v.   Research is likely to be more open, more flexible, and more receptive to interdisciplinarity than is the more conservative educational system.

vi. Because they are joined in a common knowledge-acquisition process, the schools of research and of education rely on knowledge classification in disciplines. Both of them are obstructed by the rigidity of institutionalized disciplines and by their respective spokespersons.

vii. The liberation of the two concepts from persistent schemas for the purposes of true development demands a flexible schema of knowledge classification to replace the stiff academic or educational disciplines by smaller, easily combined units. These should be the building blocks for interdisciplinary edifices that are able to accommodate all the directions indicated by the nature and demands of the problems to be solved.

1.3. WHAT PEOPLE FOR WHAT SOCIETY?

For centuries, education has been organized and learning has been oriented according to the prevailing models or theories about what an educated person should be.

Quite influential for a long period, Plato's schema favoured the generation of an élite capable of leading a hierarchic society, while other groups, also belonging to the societal structure, such as warriors and workers, were to be trained separately. Hence the special attention that was paid to abstract and philosophical learning, in ancient Greece, and the neglect of practical or manual work. The dichotomy between liberal and vocational studies persisted. The Thomist scholastic model should also be mentioned with reference to the pre-eminence of faith and theology over reason and philosophy.

The philosophy of the Enlightenment primarily praised science, reason, and experience. John Locke, in *Some Thoughts Concerning Education* (1693), named virtue, wisdom, breed-

ing, and learning as goals of education. The focus was on individual freedom, and the role of institutions was looked upon with suspicion.

The reaction to the Enlightenment created the naturalistic school. Rousseau emphasized emotion and intuition. Marx was preoccupied with healing the alienation brought about by class division and proposed the ideal of the *communal man,* free only within his socially acknowledged needs and responsibilities.

In education, the pragmatism of Peirce, James, and Dewey led to the design of a reflexive, critical man, whose sources of knowledge were activity and experience. The behaviourists substituted control for liberty and, based on the role of the reward and punishment schema, suggested performance achievement by means of exterior conditioning that left little room for personal initiative. Programmed education is linked to this school, but it should not be entirely discarded along with its reductionist premises.

Many postwar philosophical trends influenced education by introducing new concepts, as in the case of existentialism: choice and decision in an existential situation. Hence, the growing role of responsibility and authenticity, the ideal being "to be" instead of "to seem" or "to have". The number of versions proposed as educational ideals is quite large, and the lack of agreement points to their historical character, that is, to their random emergence and dependence on the dominant vision or philosophy at a certain historical moment. This reality is an incentive or at least a justification for our generation to try and to free itself from the pressures of tradition or of common law and to formulate its own guiding principles for education.

Two major debates took place in an effort to formulate educational goals and the means to achieve them:

i.   Does education serve the needs of society or those of the individual?
ii.   Does education focus on the knowledge object or on its subject?

The first dichotomy points to the pre-eminence of society over the individual or the other way round. If society comes first, then education is shaped according to its needs; but as these are perceived differently by classes and groups, the debate will continue at the social and political level. As a reaction to totalitarianism that imposed the goals of society, regardless of individual destinies, the focus shifted to the rights and aspirations of individuals. Still, whenever society feels an acute need, *e.g.,* for development, education will be oriented towards the macro-social objective. In the developed countries, the emergence of an unwanted phenomenon such as unemployment introduces that general concern into the educational discourse, somewhat diminishing the attention paid to individual choices. Moreover, a certain parallelism with the content of political discourse can also be established. The more conservative part of the political spectrum with a fondness for economic liberalism will support free initiative and will focus on the individual. Social democrats will put a premium on solving social problems, thus taking their cue from the perceived interest of society.

The second dichotomy arises from the notion of how education should function. The main concern could be about the object of education, *i.e.,* the substance of the knowledge to be taught. At the opposite pole, the critical point could be the assimilation and processing

of knowledge by individual subjects. In the former category, we have the hetero-structuring processes, the actions whereby the student becomes an exterior agent, while the object of knowledge to be transmitted is seen as preeminent. Such is the case of traditional schools in which the arrow goes from knowledge to the students, the same as in behaviourism and cybernetics. In the latter category, it is the action of the individual student that matters in the first place. The fact of using the notion of *learning* more than that of *education* stands for the priority that is currently given to the subject (the individual).

In this respect, the parallelism with political discourse is no longer perfect. Despite the preference given to the individual and to personal initiative, the conservatives favour stronger control and discipline. While the social democrats emphasize the primacy of society and the role of its educational institutions, they tend to justify more lenient, loose, or permissive control systems and to show more confidence in the individual. When it comes to conveying their values, the conservatives appear to be more skeptical about the preferences of individuals or their ability to make free (and good) choices.

There are other paradoxes as well. The existentialist trend vehemently upheld the necessity of a strong relationship between learning and life. If one takes a closer look, one cannot help noting that, with its focus on the present tense, that school of thought was quite deficient in its contemplation of the future. It never provided a long-term educational solution.

In the absence of strong and clear orientations that are capable of gaining broad consensus, it becomes possible and, indeed, necessary to seek solutions outside the prevailing political, philosophical, or ideological discourse. Most of the trends in education are not mistaken when they signal the importance of either the individual or the social factor, but start sinning when they dismiss or neglect the importance of other factors, such as institutionalized education.

Intuition suggests the idea that modern societal and economic development depend not so much on achieving perfect, deterministic, and sure objectives, but rather on developing creative activities, in a world where uncertainty, probability, and risk are a given condition, providing a circumstance of real opportunities and choice.

This would not be a step backwards towards irrationality. Quite the contrary, more intelligence, more rationality, more initiative are required to cope with situations of uncertainty, which after all are the daily experience of every living being. The simplistic vision of mechanized pre-programmed robots belongs much more to a deterministic world: the attempt to achieve abstract "certainty" and "perfect information" can only lead to a dogmatic, pseudo-religious system on the one hand, or, on the other, to the annihilation of all intelligence, to the destruction of all hope for development and creativity. Hence, the prevailing atmosphere of pessimism in the world. The marrying-up of contemporary scientific thinking with social sciences, and in particular with economics, in an increasingly complex world which is interactive even beyond the limits of planet Earth, is providing a rich source of moral and intellectual stimulus for reconstructing an Image of the Future. Learning to face uncertainties and to manage risk beneath these new horizons might in turn lead to a quantum leap in the human condition (Orio Giarini and Walter R. Stahel, *The Limits to Certainty: The Facing Risks in the New Service Economy,* 1993).

A realistic approach should start, in our view, from the old and simple idea according to which education has to prepare the individual for life in society. The system has to be designed with an aim to help the individual find and play a rewarding role, in both moral and material terms, while offering him or her maximum freedom of choice. Let us start by identifying the ideas that are likely to meet general consensus.

i.   *Increased societal rate of change*: Change is occurring in society at a speed unknown to previous generations that could accept the prospect of a constant or linear trajectory in the course of their lives. According to the principle that "the rate of learning should be higher than the rate of change", the primary task of education is to train people so that they can master change and not suffer from it.

   –*Corollary: Flexible frames of mind.*

ii.   *Anticipation, no more adaptation:* The ability to adapt, once considered as the privilege of an intelligent person, has become an insufficient outcome in the case of education today. Adapting oneself to a given situation means staying behind the events at all times, because at the moment of adaptation, things have moved again. Adaptation has acquired a new meaning: it is running behind the events, always trying to catch up with them. Cultivating an anticipatory attitude in conditions of uncertainty and risk in young people means equipping them with the kind of knowledge that enables them never to be taken by surprise.

   –*Corollary: Introducing foresight courses and techniques: probability calculus - a new Weltanschauung since the age of algebra, living with incessant change and uncertainty.*

iii. *Continual renewal of knowledge:* The perishable nature of information along with the rapid pace of change lays the foundation for continuous education.

   –*Corollary: Adequate teaching of knowledge, including the "map of ignorance" and open problems, science museums, real and virtual experiences.*

iv.   *Lifelong education:* Subject's approval of continuing learning, perpetual incorporation of learning into a learning process with open perspectives.

   –*Corollary: Continuous curricula as possible roads into maps of knowledge.*

v.   *Interdisciplinarity:* De-emphasizing disciplines in favour of problem solving.

   –*Corollary: Introducing global problems (i.e., food, water, population, health, education, environment, habitat, etc.) requiring highly interdisciplinary approaches in growing proportions.*

vi.   *Distinction between identity and role*: Identities are the product of cultures (involving beliefs, values, and tradition). They have to be encouraged through a type of education that trains people in a multiple-culture society. Roles are assigned by civilization.

Civilization requires specific roles to be performed by teams made up of people with different identities. The job is a particular instance of the role.

   – Corollary: Education becomes flexible in relation to cultures building upon today's multiculturalism. The resulting variety is compensated by the improvement and transmission of universal knowledge values, the common treasure of a single civilization.

vii. *Mobility of the individual*: This is one of the features of the society of tomorrow, one that is already noticeable in the current major trends.

   – Corollary: Education is meant to prepare people for a new kind of life, with more roles to play; this kind of life requires higher mobility, not only movement but also transfer from one role to another.

viii. Competitiveness, an increasingly salient feature of societies based on a market economy.

   – Corollary: Education can decisively enhance the competitive edge (as it has already done so far: formal and non-formal contests, examinations, challenges, recognition of qualifications, especially by means of credits, etc.), while paying attention to equal opportunities and equitable rewards.

ix. *Free initiative*: A cardinal requirement in today's society; it calls for educating for creativity and the encouragement of innovation.

   – Corollary: If the emphasis on innovative spirit and the exaltation of creativity have not led to nameable results, such a situation results from the fact that new methodologies have been placed outside school or learning. The capacity to create and to innovate presupposes general orientations in education, freedom and courage to take the initiative, and a highly associative and combinatorial system of knowledge.

x.   *The network* is the horizontal structure of the society of the future leading to a reduction of vertical hierarchy.

   – Corollary: Development of the ability to work in a team, to choose partners, and to maintain partnerships. The networks give a global (or at least a regional) dimension to human activities. The training of people is thus performed within a regional and global horizon.

xi. *Communication* is already at the center of attention. It solves the dilemma of the individual versus society and is consequently elevated to the rank of a philosophical concept (Habermas, 1973).

   – Corollary: Introducing interactive communication in the current learning process in combination with the acquisition of techniques for conveying articulate and correct messages in several international languages.

xii. *Technologies* (ICT) facilitate learning activities by providing the basic tools and tangible support for the knowledge acquisition process.

> *– Corollary: The subject of learning is an individual using a computer and a modem, seen above all as intellectual tools. He or she should know how to handle those tools for communication, knowledge management, reasoning, and experimentation.*

The debate on the goals of education and the principles to be recommended by the philosophy of education gradually lead one to the discovery of the possible features of the future society in which the individual strives to find a place for him- or herself and to interact with it. Whether one starts with the individual or with society is irrelevant. Nor is it relevant to speak either of the flow of knowledge from society towards the individual as an object of study or of the flow from the individual, as a knowing agent, towards society as a repository of knowledge.

An analysis of the present trends from a prospective angle tends to put at rest the disputes and dilemmas of education by introducing other vital problems into the discussion. If knowing a subject becomes inseparable from computer technology, what will counterbalance one's physical solitude and what kind of face-to-face inter-human activities will have to be maintained and encouraged? If communication presupposes the mastery of widely spoken languages, what becomes of the relationship between one's mother tongue and other languages, given the fact that generalized automatic translation is not yet in the cards? If mobility is a must, how can excessive versatility be avoided? If competition is the law, what are the personal virtues or traits of character that will have to be cultivated in order to keep human interaction within peaceful and non-violent limits?

At any rate, knowledge – a fundamental concept for lifelong education and a basic concept for interdisciplinary research – also remains *the* concept when the goals of education are considered. The definition of knowledge as the *knowledge industry* is thus confirmed. An examination of the area of goals leads to the conclusion that the low efficiency of education as related to its aims is due to the use of inadequate methods for presenting, processing, assimilating, and storing knowledge in individual or social memory.

1.4. LEARNING AND WORK IN THE KNOWLEDGE ERA

The description of the new economy at the stage of globalization as the "knowledge economy" imparts a new status to education and changes the structure of labour and employment.

Education, viewed as the industry of knowledge, is assigned a central place in society. It witnesses an acknowledgement of its numerous claims for resources and attention. The classical formula defining the economic factors (*i.e.,* capital, natural resources, and labour) is modified once information has been identified as another basic economic factor. Nevertheless, a neutral piece of information is just a supporting element for a piece of knowledge.

Nowadays, knowledge is the main resource that is added to the classical triad. Still, it can only add value to natural resources and capital through the agency of the people who make up the labour force. In the past, the degree of personal qualification altered the supplementary

demand for manpower, but it pointed to the proportion of "skills" rather than to the quantity of knowledge it saved from manual work. The advent of the knowledge economy indicates a superior phase, one that accounts for the portion of universal knowledge that people bring to the process of problem solving (production, services, organization).

What is this knowledge? It is a continuous process that produces precise statements in a univocal language that is universally valid, or justifiable by means of a reproducible process, regarding the various relations that develop in the real world. These pieces of knowledge are grouped into large branches, such as physics and its disciplines that multiply through increasing specialization into a family comprising several dozens of disciplines. The treatises assembling those pieces of specialized knowledge as well as hundreds of learned magazines register their incessant progress.

From a mathematical point a view, each branch is a graph called a tree. Metaphorically speaking, the classical schema of science classification is a collection of trees, a sort of "orchard".

The schema gets complicated the moment interdisciplinarity comes into play. Arches meet and the graph becomes a lattice. In the tree of physics, there are disciplines that link to other branches and further on to the trees of other disciplines.

Rather than being a catalogue of isolated "trees", science is represented in a huge single table. It should be noted that the advance is marked by a diminishing generality of the object and by increasing complexity.

For centuries, education has copied the disciplines of science, confining itself to the main branches and several subdivisions. No subject, except for the topics of doctoral dissertations, has pushed specialization to the outer limits. Today it is physically impossible for an individual to keep pace with the latest developments. Making out what is essential and what is not from the viewpoint of knowledge and skill transmission and assimilation is a Herculean task. The current approach amounts to selection and simplification, with an occasional, *ad hoc,* chance to gain deeper insights through optional courses in various areas of the immense knowledge map.

Let us briefly examine the persisting dilemmas of education, starting from that of *generality versus specialty*. A preference for generality appeared at the time when the educational goals were set for ensuring the development of the intellect (France and Germany), of character (England), or of the citizen (USA). It still has undeniable applications in the way primary education is designed, possibly also secondary education and other compulsory courses. But for higher education, the goal of training specialists prevails.

The answer that the school keeps giving to the question, "What is a specialist?" refers to the disciplines. One may be a specialist in mathematics, chemistry, biology, or in a subdivision of those disciplines; the narrower it is, the more meaningful the specialization. Still, in the field of actual work and practical activities, the answer to that question is different. The specialist is defined according to what he or she can do, the type of problems he or she

can solve, or the roles he or she can play. The disciplines are no longer defining elements: they are parts of each specialization. A large number of specializations strives to acquire the ability to develop practical approaches to real problems or tasks. The more graduates there are, the more difficult it becomes for them to find employment. Speciality defined by activity gains in importance. Specialty is treasured, but not disciplinary specialities; rather, hands-on activity and work are treasured.

The successive paradigms that embrace all knowledge are transgressing the boundaries between disciplines. They lead to alternative knowledge segmentation based on new criteria that challenge the established fields:

> according to the type of crisis that emerges; according to the type and degree of complexity of the process; according to the way temporality is involved and to the relationship with chronological time; according to the type of symmetry or asymmetry; according to the way some metaphorical processes are employed; according to the type of logic, particularly to the degree of employing non-classical logic; according to the nature of cognitive models; according to the nature of the systems involved (the modern theory of systems); according to the nature of language structures; according to the nature of semiotic processes (Marcus, 1999).

Related to this dilemma of education is that of *theory versus applications*. It is obvious that the disciplines will encourage the theoretical trend, since theory is their real vocation. To applied education, the vocational option is provided. The preference for theory in the established disciplines turns vocational education into a secondary choice. Moreover, having opted for vocational education (producing workers, technicians, accountants, schoolteachers, etc.), an individual has fewer chances to rejoin the theoretical direction that ensures access to higher-valued and better-paid jobs. The prejudice that favours theory over practice has run so deep that the vocational option is considered worthy only of "drop-outs". "If you don't learn, you'll become an apprentice!" The most important differentiation among students would occur at the end of compulsory education (around the age of 16).

A major error was made in the confrontation of approaches: apprenticeship was left out of the inventory of methods. There was no room left for private learning in a single, unique model (the master), once the teacher of a discipline had talked to an entire class within a school. The tutorial system in the British colleges was an exception to the rule. Another exception was the German system of vocational learning. Other systems did not even include apprenticeship in Vocational education. In the arts or sports schools, apprenticeship has also been maintained as the best solution for performance learning (*i.e.,* musical instruments, skating, skiing, swimming, etc.). The tutor or the master is obviously an expression of interdisciplinarity. A new schema of education needs to reintegrate the tutorial system.

The sociology of education opened an interesting subject when, embarking upon an analysis of the *mechanism of manipulation by means of schooling,* it attempted to elaborate a theory of cultural transmissions (see Bernstein, 1972). It started from the definition of the curriculum that "entails a principle... whereby of all the possible contents of time, some con-

tents are given a special status and enter into an open or closed relation with each other". It is to be noted that this definition actually represents a constellation emerging from a system of choices (of the designers of the system). The social nature of this exercise has to be emphasized.

There are two distinct types of curriculum: *collected and integrated.* Two aiding concepts (*classification and framework*) assist in the design of a typology of educational codes. "Any organization of educational knowledge which involves strong classification gives rise to... a collection code. Any organization of educational knowledge which involves a marked attempt to reduce the strength of classification is here called an integrated code". On the other hand, the *frame* "refers to the form of the context in which knowledge is transmitted and received" to "the specific pedagogical relationship of teacher and taught" and, what is important, "to the strength of the boundary between what may be transmitted and what may not be transmitted". Based on this schema, the author considers that "the European non-specialized, subject-based form of collection involves strong classification but exceptionally strong framing"; the English version "involves strong classification, but relatively weaker framing than the European type. It is specialized, with very strong insulation between "pure" and "applied" knowledge; the course-based non-specialized USA form of the collection... has the weakest classification and framing of the collection code".

The implications of this analysis reveal that the way of designing the curriculum as well as the code and the frame are the mechanisms through which society gains control and reaches the desired goals. In case society aims at building an open structure (*i.e.,* one which accepts a variety of opinions and a diversity of categories, obtaining the solidarity of the citizens through integration processes around common projects), we shall have to consider designing the curriculum in such a way as to accommodate that democratic requirement. The new schema will be mirrored in the increasing degree of individual choice within the connection between the fields of knowledge and the ability to move from one to another, in other words embracing an integrated code with the least constraining frame.

> God alone is worthy of supreme consciousness, but man is made God's plaything, and that is the best part of him. Therefore, every man and woman should live accordingly, and play the noblest games and be of another mind from what they are at present.... For they deem war a serious thing, though in war there is neither play nor culture worthy the name..., which are the things we deem most serious. Hence all must live in peace as well as they possibly can. What, then, is the right way of living? Life must be lived as play, playing certain games, making sacrifices, singing and dancing, and then a man will be able to propitiate the gods, and defend himself against his enemies and win the contest (Plato, *Laws, vii,* 796).

The computer science revolution has brought an unexpected element into the discussion of *motivation,* which is essential to the learning process: *the play.* The passion with which children use the computer is by all means remarkable. The hours they spend punching the keyboard, the amount of concentration they put into it, unequaled by study or reading, have

been simply explained by the fact that a miraculous new game object had entered their lives. The ancient Romans, who used the same word to designate both school and play (*ludus*), inferred the main source of interest of the very young.

Through games, young people learn computer programming and virtues. The computer becomes their guide on the Internet, in their visits to museums, libraries, and sources of knowledge. It stimulates experiments: children drive cars and pilot aircraft in the virtual world at a time when simulation games become accredited learning methods for managers, financiers, investment strategists, etc.

The books by Johan Huizinga (1955) and Caillois (2001) revealed the deep meaning of games in human society, where fundamental activities (politics, economy, and culture) are reducible to ludic interpretations. Far from being an evasion of serious study ("Are you learning or playing?"), the game knocks at the door of the educational system, bringing an important amount of motivation and autonomous behaviour. It also fulfills another requirement of education, namely the development of curiosity and of the ability to ask questions and to formulate hypotheses: the mark of creativity. The child experiences invalidation or confirmation of an assumption in the same way as he or she wins or loses a game. Once introduced into the learning process, the ludic element breaks the century-old spell of the constraint (the long school years) and permanently shifts the focus onto the subject of learning.

The classical system based on the theoretical teaching of disciplines has been criticized for its neglect of *skill or aptitude* development. Here is the young subject of learning handling a machine: the computer. He or she simultaneously uses his or her hands and his or her head. From the very beginning, he or she depends on communication skills and develops them continuously: he or she types; he or she produces texts; he or she reads and answers messages and commands; he or she conceives various programmes or complies with their requirements; or he or she applies the rules for the operation and maintenance of a device that is at the same time a television screen and a telephone. All that is valued in a specific skill (*i.e.,* meticulousness, patience, continuity of effort, concentration, accepting a fixed workplace, undergoing a self-improvement process, and closely observing a sequence of commands) implicitly becomes part of the training of a young person who uses a computer. This instrument, which is nothing but a node in a network, also encourages teamwork.

Should we have to indicate the most important quality for the learning process, we would emphasize the *ability to concentrate*. It is well known that this ability is not well developed in early childhood (a maximum of twenty minutes at a time for children in kindergarten and primary school). Later on, the capacity to concentrate has to be maintained through various procedures known to educators (e.g., interrupting the discourse to engage in dialogue, standard time distribution, etc.). In contemporary society, noise, multiple simultaneous signals, and dozens of visual, written, or auditory sources that assault young individuals conspire against their ability to concentrate.

Educators have confirmed a deterioration in the ability of school children to concentrate when they are confronted with the onslaught of the multi-source information society. It is

therefore difficult to estimate the important part that the computer plays in the development of that valuable capacity. The passion with which the subject gets involved in a programme or a simulation game has caused concern about the "loneliness" awaiting him or her as a result of the curtailment of social contact and dialogue. The same suspicion was voiced in the case of distance learning as compared to the advantages of the classical "face-to-face" system. Of course, education is entitled to design compensatory methods to develop sociability and direct contact with other people.

Two decisive advantages come to mind with respect to the classical system. Knowledge is not merely streamlined through a passage of written text or an oral communication. All senses are open to capture information. First and foremost, the images are visual ones. *Multi -media,* is the type of presentation in which the text is accompanied by images (including movie sequences), graphs that modify and move, spatial representations, the voice of the presenter and, possibly, music. Can a speech and a few notes on the blackboard compete with a multi-media history lesson that includes visits to museums or the sites of past events, even with a feature movie evoking them?

Secondly, the computer has become *interactive.* Three decades ago, the early use of audiovisual teaching aids in schools caused considerable enthusiasm. It was soon proved that their main deficiency was that they encouraged passivity. The image on the screen or the voice coming from the headphones could not be questioned. The progress of artificial intelligence enables the computer to introduce reasoning and the possibility of dialogue. When the computer does not understand the question posed by the subject, it asks for additional information and produces an answer that has not existed in its inventory of possible answers. This answer could be compared to that of a competent teacher.

We shall now turn to anthropology in order to establish the advantages of a new education. Humans are weak creatures, with pulses of Renaissance force. They place themselves at the core of things to consolidate their precarious condition. Compared to the animal realm (particularly to a similar medium-sized animal), human physical abilities and instincts are puny: muscular strength, ability to run, sharp teeth, etc. It is through symbols and tools that humans make up for this deficiency. They use both to create universes that otherwise do not exist in nature.

The symbols and tools belong to two spheres in which humans nest: the *noosphere* and the *technosphere.* They are both products of human *imagination.* Knowledge is based on symbols. Humankind departs from reality to return to it armed with symbolic models. Culture is a product of symbols, and tools (that need symbols) are the basis of civilization. Both presuppose continuous effort, hard toil, and obstinate determination. According to Goethe, even if man fails, he who continues and strives shall be redeemed.

The anthropological insight prompts us to place *technology* on the same footing with symbolic activity. In doing so, we differ from the ancient Greeks who did not accept the nobility of tools. The second remark points to the development of imagination that owes more to fairy tales and science fiction than to formal school education. Finally, there is the *ethic of work* at the ludic level, introduced and developed within the learning process so that

it will then operate to the end of human life. From this point of view, leisure is nothing but a contemporary commercial myth.

> The conclusions of the Lisbon European Council confirm that the move towards lifelong learning must accompany a successful transition to a knowledge-based economy and society. Europe's education and training systems are at the heart of the coming changes. They too, must adapt.... The Commission and the Member States have defined lifelong learning, within the European Employment Strategy, as all purposeful learning activity, undertaken on an ongoing basis with the aim of improving knowledge, skills, and competence.... Lifelong learning is no longer just one aspect of education and training; it must become the guiding principle for provision and participation across the full continuum of learning contexts. The coming decade must witness the implementation of this vision. All those living in Europe, without exception, should have equal opportunities to adjust [to] the demands of social and economic change and to participate actively in the shaping of Europe's future. (European Commission. *A Memorandum on Lifelong Learning,* Staff Working Paper, Brussels, 30 October, 2000).

The conclusions of the approach outlined in this chapter are the following:

i.   Education, in the era of knowledge, returns to its real vocation as a *knowledge institution.* The *Knowledge Economy* has the merit of discussing education, research, and work in the same framework. The organization of education and its effectiveness rely on the way knowledge is transmitted and assimilated. The revolution does not start from the substance that comes by itself, but from the methods.

ii.   Knowledge is archaically classified in large disciplinary blocks that education assumes as teaching subjects. The first step is to reclassify knowledge into units or building blocks, modules that may be handled easily and combined within an integrated system having permeable internal boundaries. To put it in sociological terms, an integrated code and weak curricular frames are needed.

iii. The free combination of modules facilitates the coupling of natural sciences not only with the technical sciences but also with the social sciences, the humanities, and the arts, thus achieving a balance among the factors that make up individual personality.

iv.   The combination of modules into a personal itinerary presupposes the autonomy of the subject, and meeting its demands means "learning to learn".

v.   The dilemma, "theory versus activity", disappears the moment learning modules are able to combine with activity modules, and lifelong learning is paralleled by lifelong working.

vi.   Gradual specialization for the final target of activity is achieved with the general contribution of all disciplines.

vii. Constraints are lessened through the introduction of the ludic element, essential to both learning and work.

viii. Skill acquisition is not an isolated chapter; it is integrated into the process of knowing comprising both the "what" and the "how".

ix. Imagination and concentration are some of the important faculties for this system to break fresh ground.

x. Education will be role-oriented, this concept comprising professions, work, social and political functions, and any aspiration towards creative activity.

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Reflections on the Future of Global Higher Education
WAAS Conference Report

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Abstract

Education is the most important catalyst of social evolution. Today higher education is in the early stages of a revolutionary transition that will have immense impact on the future of global society. This article presents an overview of perspectives explored at the World Academy's Forum on Global Higher Education conducted at the University of California at Berkeley on October 2-3, 2013. It examines issues resulting from rapid changes in educational technology and organization that impact on accessibility, affordability, quality, relevance, employability and content of higher education. It envisions establishment of a World University Consortium as a network and umbrella group to facilitate educational partnerships and linkages with other interested stakeholders at the international level, to provide a centralized source of information about latest innovative ideas and developments in this field, and to explore creative solutions to enhance the reach, quality and relevance of higher education globally.

There are defining moments when the long, slow crawl of history leaps into the future. The Reformation, French Revolution, and birth of the Internet are instances. Such a moment has come for higher education. No one can predict with confidence what the future of higher education will bring, but it is certain to be very different from what we have known in recent centuries. Education is in the early stages of breaking the boundaries imposed by the physical classroom, the monastic insulation of the college campus, the arbitrary rigidities of degrees, courses and one hour lecture segments, the social barriers of class divisions and the economic barriers of affordability. Misinformation, misconceptions and myths abound, but beneath all the hype, there are real forces at work and real changes in the offing.

The World Academy's Forum on Global Higher Education was conducted to examine recent developments at the epicenter of educational innovation in Silicon Valley and to explore their potential implications for the world-at-large. The conference brought together leading educators from six continents to interact with faculty from UC Berkeley, Davis, Irvine, UCLA, Stanford, San Jose State, Carnegie Mellon, Duke, Phoenix, Florida, UNLV, San Diego State, Humboldt State, Brandman, Meridian, Berkeley City College, Mt. San

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Jacinto College, Ohlone College and Sofia University. They met with representatives from the Western Association of Schools and Colleges, International Association of University Presidents, Creative Commons, Policy Sciences Center, Tony Bates Associates, Center for Partnership Studies, Spire Education, InterEnvironment Institute, Center for Digital Education and Net Impact, diplomats from Colombia, India, Mongolia and Venezuela, and companies pioneering new technologies and services in the field of education, such as Google, Pearson, Fujitsu, 2U.com, uncollege.org, Knewton, StudyRoom, Talent2 Education and Accredible.

The Academy's emphasis on global higher education is a natural and inevitable product of its endeavor to frame a new human-centered paradigm for global development. Efforts to address the pressing global challenges related to the financial crisis, rising levels of unemployment, poverty, ecological imbalances, international security, democratization, global governance and rule of law all depend on raising the level of education and understanding of people around the world. Without enhancing the quality of human understanding, knowledge and skills, these problems will continue to defy solution.

1. Global Needs Assessment

There was a consensus among conference participants that significant changes are needed in the global system of higher education in order to meet the diverse needs of humanity. In his inaugural remarks, UC Berkeley Executive Vice Chancellor George Breslauer described the growing pressures on his institution to cope with stresses resulting from the very rapid pace of technological change, rising costs and globalization. While local conditions naturally vary, there was a broad agreement on seven priority objectives: expanding accessibility to make quality higher education available to a much larger proportion of the population in both economically advanced and developing countries; raising completion rates of students who enroll in college; bringing down the cost of education, which is an increasing burden to students everywhere; improving relevance to eliminate the mismatch between the knowledge imparted and the skills required by the labor force to achieve full employment; enhancing quality of education; applying innovative technologies for delivering content, interaction with students, evaluation, assessment and accreditation; and reformulating the content of courses and curriculum to more effectively address social needs.

"A Chinese farmer would have to work for 13.6 years in order to fund tuition at a Chinese university, while those who live in wealthier urban areas pay the equivalent of 4.2 years of an individual's annual income on average."

Globally, levels of education are rising about 2% faster than GDP growth. The rapid expansion of the international Middle Class is generating increasing pressure for expansion of capacity in higher education. Figure 1 shows the percentage of the population in the age groups of 25-34 and 55-64 that has completed a college degree course in different countries.

Korea leads the world with 65% of 25-34 year olds obtaining a bachelor's degree or higher qualification compared with about the 40% average in OECD countries. Comparison of this age group with the 55-64 year old group reflects the rapid growth of higher education in recent decades.

An increasingly educated workforce is essential for responding to the growing complexity and sophistication of modern society and work. Globally, those with a college degree achieve higher rates of employment and earn significantly more than those with lower levels of qualification. According to a study by the Hamilton Project, an economic policy initiative at the Brookings Institution, those who graduate from a four-year college in the USA, on average, earn $20,000 more a year than those with only a high school diploma, as a result of the degree.[1] In spite of the clear economic advantage of higher education, the percentage of adults with at least a bachelor's degree ranges from a high of 45% in Norway to a low of less than 10% in many poorer developing countries as shown in Figure 1. In its report *A New Dynamic: Private Higher Education,* UNESCO estimates that the global system for higher education will need to expand its capacity to accommodate over 262 million students by 2025, up from 97 million in 2000.[2]

Figure 1: Percentage of the Population with Tertiary Education in Select Countries, 2010[3]
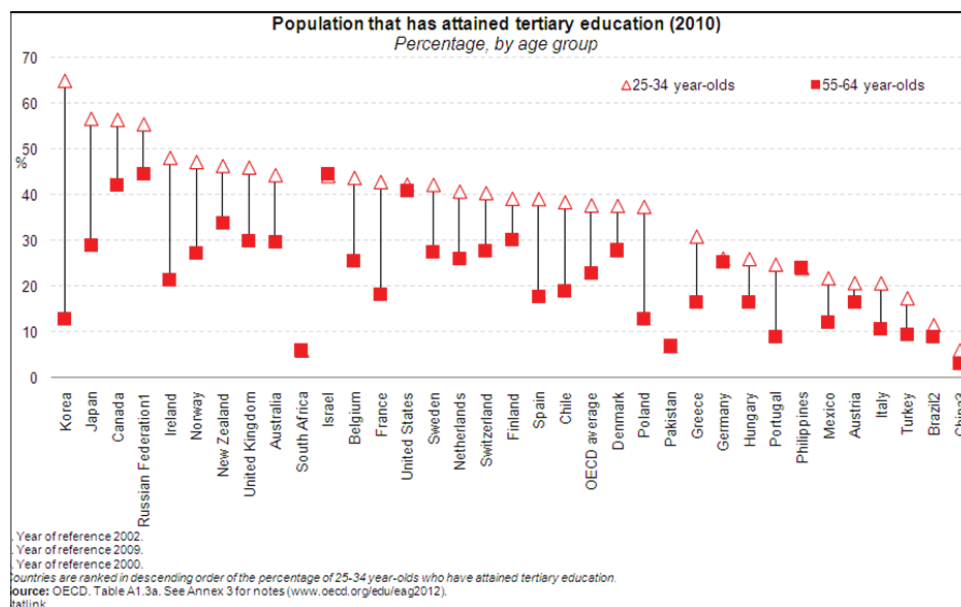
Affordability is closely related to accessibility, for the wealthy are never denied educational opportunity. Even in education-rich America, John Mitchell, Vice Provost of OLI at Stanford, pointed out that large numbers of qualified, economically disadvantaged students are being denied education due to the limited capacity of public systems. In Brazil an esti-

mated 4.5 million aspiring students will be denied higher education this year. Increasing accessibility is essential in all countries. A combination of rising costs, lower levels of economic growth and higher government budget deficits is forcing many universities in the USA to raise tuitions and reduce financial aid to the needy. Since 2000, the average tuitions and fees at public four-year institutions in the USA have risen by 72%, while the average earnings of full time workers aged 25-34 who only have a bachelor's degree has declined by 14.7%. Student debt has topped $1 trillion and is now the single largest category of private American household debt. The situation in developing countries such as India is even more precarious, as most of the expansion in higher education has been in private, for-profit institutions charging exorbitant admission fees beyond the reach of even Middle Class applicants. A survey conducted by the Associated Chambers of Commerce and Industry of India, ASSOCHAM, revealed that Indian parents invest an average 75% of their income in their children's education.[4] According to a Xinhua News report, a Chinese farmer would have to work for 13.6 years in order to fund tuition at a Chinese university, while those who live in wealthier urban areas pay the equivalent of 4.2 years of an individual's annual income on average.[5] Each year of higher education costs 6 to 15 months' labor for a rural parent in China.[6]

Table 1: Education Cost Affordability Rankings in Select Countries, 2010[7]

Country	Education Cost	Median Income	%	Rank
Australia	$7,692	$23,017	33.42%	12
Canada	$5,974	$26,623	22.44%	10
Denmark	$530	$22,929	2.31%	2
England & Wales	$1,243	$24,652	21.45%	9
Finland	$5,288	$21,010	5.92%	6
France	$585	$20,660	2.83%	3
Germany	$933	$22,020	4.24%	5
Japan	$11,865	$22,790	52.06%	14
Latvia	$3,299	$13,646	24.17%	11
Mexico	$5,077	$4,615	110.01%	15
Netherlands	$3,125	$28,032	11.15%	7
Norway	$596	$26,623	2.24%	1
New Zealand	$3,118	$19,265	16.18%	8
Sweden	$600	$20,716	2.89%	4
USA	$13,856	$26,990	51.34%	13

Table 1 compares the total cost of completing a four-year degree, including tuition fees, textbooks and study materials, in various countries with median national income. It shows the average cost of education which ranges from a low of 2.2% of median income in Norway to a high of 110% in Mexico.

Rising levels of unemployment severely aggravate the education challenge. Youth unemployment levels are double the national unemployment average in most countries, ranging from 35% in Italy and 38% in Portugal to more than 50% in Greece, Macedonia, Serbia, Spain and South Africa.[8, 9] While college graduates continue to earn significantly more than those who lack a degree, fewer graduates are finding a college degree an assured passport for remunerative employment.

The correlation between level of education and level of income is clearly evident. More education clearly pays. In 2009 college graduates in USA recorded employment rates 18% higher and income levels 22% higher on average than high school graduates.[10] Figure 2 shows the earnings by level of educational attainment in USA.[11] The average annual earnings for a high school graduate in the US is $30,000, whereas for a degree holder, it is over $60,000, and for a professional degree holder, over $120,000. In OECD countries, on average, the relative earnings of those with a tertiary education is over 1.5 times that of those with lower levels of education. In Brazil, Chile and Hungary, it is more than twice the earnings of adults with lower levels of education.[12]

Figure 2: Earnings by Highest Level of Educational Attainment in USA (2008-12)[13]
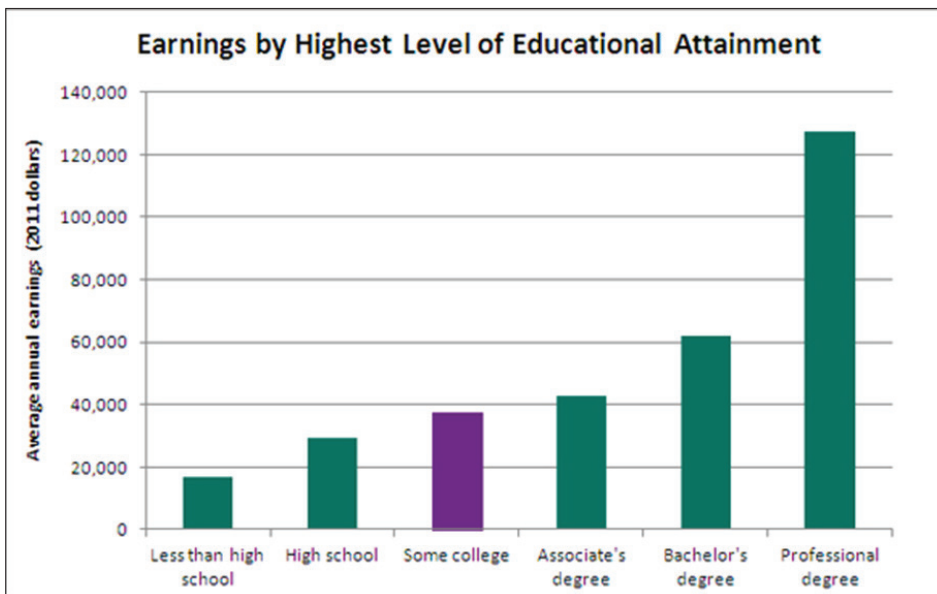
At the same time, employers are increasingly critical of the failure of conventional degree programs to impart the knowledge and skills students require for successful careers. A new US survey of American entrepreneurs cited by *The Economist* reconfirms the complaint that companies cannot hire the right people because universities are failing to keep pace with a fast-changing job market.[14] Among the many noted deficiencies is the failure of higher education to equip students with the skills needed for working in teams, thinking for themselves, understanding other people and being creative.

Figure 3: Relative Earnings of Workers by Educational Attainment in Select Countries, 2011[15]
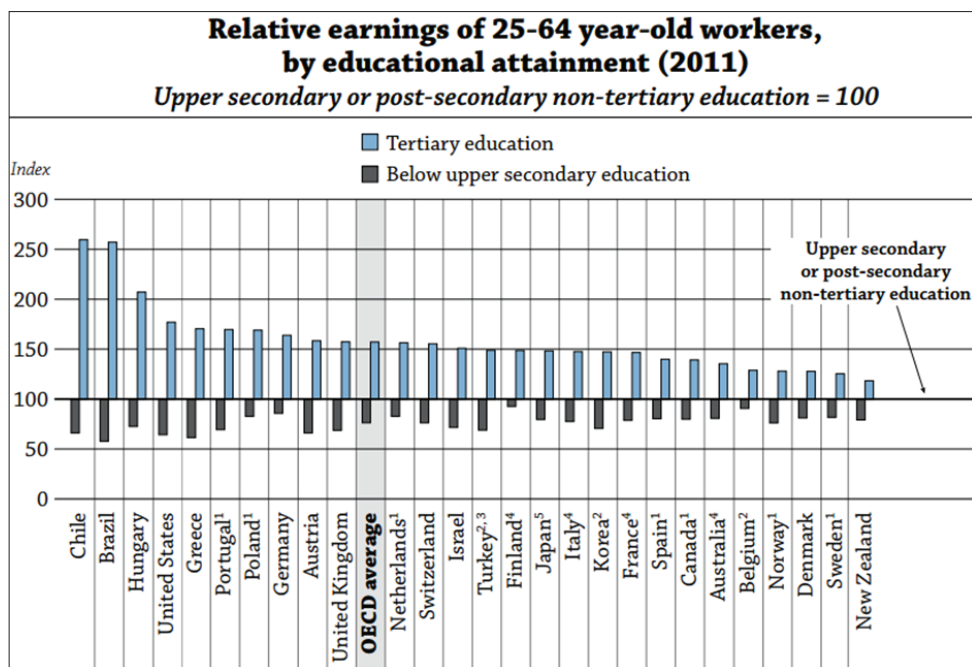
Quality education is still a luxury enjoyed by a few. In evaluating the quality of new educational delivery systems, there is a tendency to exaggerate the quality of traditional institutions of higher education, ignoring the fact that even in the finest institutions, the quality of instruction varies widely. Between the best and average differences in quality can be enormous, and even greater between the average and the lowest level of institutions. In developing countries, many institutions are very poorly equipped, faculties are under-qualified, student-teacher ratios are far too high, and many teaching positions remain vacant. In India the vacancy rate among public institutions is about 40%. One need only try to recall the number of truly inspiring instructors encountered during four years to realize how rare top quality education truly is. But the importance of quality is not diminished by its scarcity. Enhancing quality is as important and as great a challenge as expanding the system quantitatively.

A global needs assessment must also highlight the need for revolutionary changes in the content of what is being taught. In a world of increasing complexity and speed of change, the knowledge imparted by overly-specialized courses of study is grossly inadequate to equip students to understand the world they live in, adjust and adapt to change, earn a decent livelihood and contribute meaningfully to the development of society. The declining emphasis on the liberal arts is aggravating the problem. Interdisciplinarity, multidisciplinarity, transdisciplinarity are vital for providing students with intersectorial, integrated perspectives. There is ample and mounting scientific evidence that our relationship with ourselves, others and the planet we live in is the main variable influencing all the aspects of our lives. We need to see, think and act systemically. Economy is inextricably interlinked with technology, politics, law, society, management, psychology and the environment. Medical practice today requires an increasing knowledge of technology, sociology, psychology and ecology. Law is an artificial abstraction when divorced from an understanding of political and social processes. Vocational skills are inadequate unless accompanied by an understanding of other people, the capacity to work in groups, a knowledge of technology and its impact on human health. In an increasingly globalized world, citizenship necessitates an understanding of other nations, languages, cultures and historical periods.

> *"Interdisciplinarity, multidisciplinarity, transdisciplinarity are vital for providing students with intersectorial, integrated perspectives."*

2. Is there Life beyond the MOOCs?

Can Online Education (OLE) successfully address the need to expand global capacity in higher education? Distance learning in one form or another has been around since the 1950s. Bob Horn was part of the first institute for educational technology established at Colombia University in the 1960s working on the first authoring system for computer-based instruction in collaboration with IBM. There is nothing especially new about online courses except the wildfire speed with which MOOCs or Massive Open Online Courses are spreading. UC Irvine launched open courseware in 2000 and now offers 90 courses online, including the entire undergraduate chemistry curriculum. Carnegie Mellon created its first web-based, free courseware offering in 2002. MIT uploaded their undergraduate courseware to the web a decade ago. UC Berkeley introduced its first online course with physical exams in 2007. Between 2004 and 2012, Oakland University in Michigan launched 20 online degree programs in the humanities and health sciences.

The past 18 months have witnessed an explosion of open, online courseware in American higher education, prompting the *New York Times* to proclaim 2012 the "year of the MOOC". Founded by Harvard and MIT in December 2011, edX now includes more than 20 partner universities offering 77 courses and more than a million students. Founded by Stanford professor Sebastian Thrun three months later, Udacity is already offering 25 courses to more than 400,000 students. And even more impressive, the youngest of the three, Coursera, now includes instructors from 73 universities, more than 440 courses and 4.7 million stu-

dents in 196 countries.[16] Universities such as UC Berkeley are experimenting with multiple approaches including public MOOCs, online for credit and certificate courses, and self-financing professional Master's Degree programs in fields such as public health and computer science. San Jose State, the oldest public university in California, already has more than 7000 students enrolled in about 100 online courses.

Figure 4: Major players in the MOOC Universe[17]
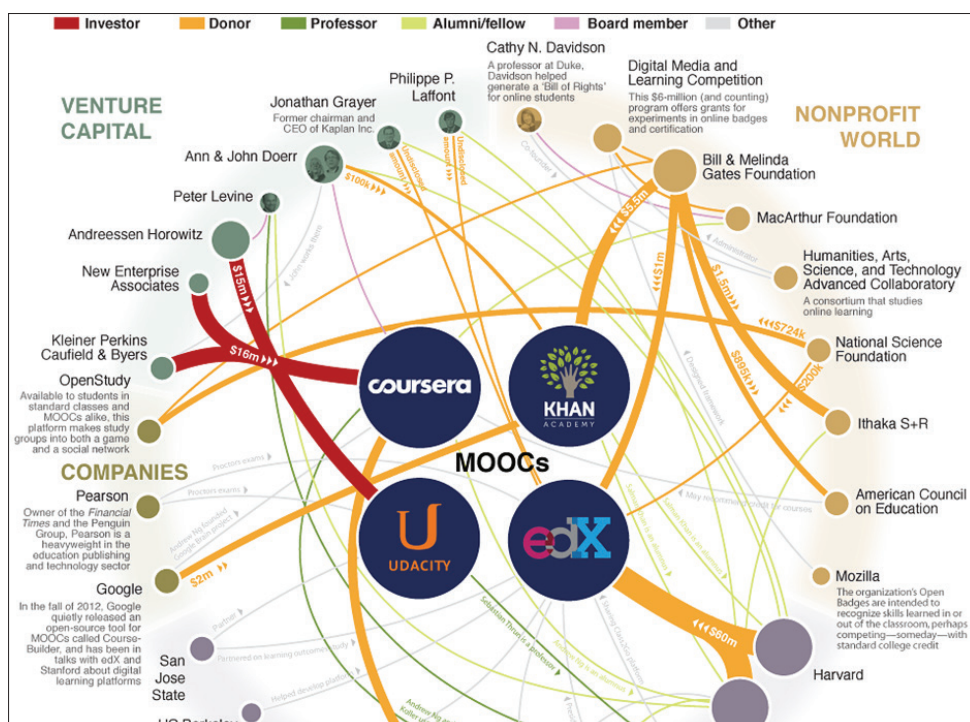
One result of the explosion of MOOCs has been to break down the traditional boundaries separating institutions of higher learning. Today many institutions are sharing their technologies, course content, students and even faculty with other institutions in the same country as well as with students and institutions in other countries. Education is going global.

There has been a vigorous debate as to whether the high dropout rate experienced by MOOCs is the result of a design failure or a failure to filter out underqualified, uncommitted students. Gary Matkins, Dean, Continuing Education and Distance Learning at UC Irvine, thinks that MOOCs are being critized for what they are not rather than being judged for what they actually are. The preoccupation with course completion rates has obscured more important qualitative issues – such as learning and retention rates among serious learners.

The sudden rise of the MOOCs has raised fundamental questions about the essential ingredients for effective education. Jorge Klor de Alva, former President of the University of

Phoenix, identified essential elements for a global educational model, including scalability, centralized aggregation of curriculum, structured scheduling, quality assurance, accreditation, financial viability and regulatory challenges posed by local and national authorities. It remains unclear how and to what extent MOOCs will be able to successfully address these and related issues.

Can online video lectures really equal or replace live contact with instructors in the classroom? The consensus of conference participants is that it cannot, but that MOOCs can play an important role as a complementary or supplementary tool for content delivery. UC Berkeley, Irvine, Stanford and many others are now experimenting with hybrid, flipped classroom models in which a significant portion of content delivery takes place online outside the classroom, leaving faculty more time to interact directly with students. MOOCs have proven an excellent medium for beta-testing new learning content and techniques. Philip Stark, head of Statistics at Berkeley, found that automated online testing freed up graduate student instructors to spend time working with students on problem solving and solution design. Armando Fox, Faculty Director, Berkeley Resource Center for Online Education, utilizes a hybrid system he calls SPOC (Small Private, Open Courseware), making it possible to expand class size from 40 to 100 students, while achieving better outcomes than through traditional classroom teaching. Candace Thille reported results from hybrid courses at Carnegie Mellon in which learning time was abridged from 16 weeks to 8 weeks and four classes to two classes a week, with better learning outcomes.

Khosrow Ghadiri at San Jose State utilized an online circuits and electronics course on edX, as part of a hybrid model. At home, students watched the online lecture, then filled out a survey designed to gauge which parts they understood and which gave them trouble. Ghadiri spent the first part of each class reviewing the most problematic topics. Then he broke students into small groups to work on solving problems together, and quizzed them individually on each day's material. At the end of the semester, 91% passed the course—a huge improvement over the 65% average pass rate over the past seven years. Georgetown University found it was able to expand its Master's Degree program in Public Health 20-fold and achieve better outcomes by taking it online, and its online nursing program was so successful that it cancelled the off-line program.

The evidence suggests that while MOOCs by themselves may not equal the quality of learning experience provided by classroom training in many universities, they can make the best quality course content accessible globally, including in places where a shortage of qualified teachers and textbooks deprives many students of access to reliable knowledge. What could be the impact on quality of higher education, if the world's most informed, inspiring and skilled communicators could be made available to students everywhere, anytime and in any language?

MOOCs in some form and combination with personalized interaction offer considerable promise as a solution for expanding accessibility and overcoming the critical shortage and high cost of faculty. Catheryn Cheal, San Jose State University Academic Technology Associate Vice-President, reports online instruction combined with online proctoring of exams enables a single instructor to serve 700 students for statistics courses, 14 times the 50 stu-

dents manageable by traditional classroom methods. For psychology, the comparable figure is 400 students. In future groups of campuses could be pooling their courses to widen the range available to students everywhere.

Fabian Banga of Berkeley City College calls for a much broader conception of open educational resources that incorporates the full power of network connections between faculty and students and peer to peer among students. He is experimenting with innovative learning platforms and other enormously powerful technologies for interconnectedness, including Google hangout, YouTube, and Twitter.

The California Community College System, which covers 2.4 million students enrolled in 112 campuses, is the largest system of higher education in America. Mike Orkin, Vice Chancellor of Educational Services at Peralta Community College District, described how the State of California plans to link all these institutions together so that students enrolled in any campus can have access to thousands of online courses offered by other colleges in the system. This is only one example of a trend that could eventually lead to development of a world university network.

3. From Teaching to Learning

Regardless of the ultimate fate of the MOOCs, their dramatic arrival is likely to have a lasting impact on higher education. A profound shift is occurring in ideas about what higher education is all about. The ability of a teacher to deliver classroom lecture content to hundreds, thousands or even hundreds of thousands of students simultaneously raises more fundamental questions about the true nature of education and the true role of faculty in delivering it. In an age of ubiquitous information and YouTube-like streaming video systems, is content delivery the sole or primary role of instructors? Or is there something more to teaching? The transmission of specific knowledge content is no longer viewed as the sole or predominant goal. The emphasis is shifting from knowledge content to pedagogy, from teaching to learning. According to Mark Fink, Vice Provost at UNLV, the role of faculty is shifting to facilitating learning, which is what it should have been all along.

Exposed since birth to the intensities of a digital, interconnected, interactive world, the younger generation wants a more active type of learning experience. Mohammad Qayoumi, President of San Jose State University, calls for the creation of a new eco learning system that utilizes technology as a weapon for mass instruction. Situated in the heart of Silicon Valley, he insists that rapid innovation is as important for educational institutions as it is for business success.

The advent of Open Learning Initiative (OLI) systems has revived age-old debates regarding teaching and learning and spurred studies to try to understand more about how different types of students learn different types of subjects. Few, if any, of the conference participants believe that OLI can completely replace human interaction between students and instructors. But most would agree that OLI is shifting the emphasis from content delivery to how best to promote active learning by students, marking a change in emphasis from Learning Management Systems to Adaptive Learning Systems.

4. Changing Roles of Faculty and Students

Recent developments in OLI have raised many questions regarding the role of the instructor in higher education. No longer is the instructor adequately described as one who has already acquired knowledge. Instruction implies also the capacity to transmit it effectively to others. This in turn requires a knowledge of the learning process and how to facilitate it. Furthermore, the conversion of live lectures into OLI requires several sets of skills that few faculty members now possess.

The rapid growth of the MOOCs has only been made possible because they have broken up the task of course development into numerous roles, each performed by a specialist. Faculty provide the content. Learning architects trained in structural design create workflow process models to improve learning speed and retention rates. Content developers reorganize the content into smaller segments of knowledge, typically 10-15 minutes in length, combined with short quizzes and interactive exercises. Trained actors are often utilized to film lecture segments. Udacity is experimenting with the use of mentors available 24 hours to monitor student learning activity, help them acquire skills in self-learning, motivate them to work on their own and promote interaction with other students.

One of the challenges is to devise the right mix of incentives to overcome the indifference, fear or reluctance of faculty to embrace new methods. Developing and running online courses also require a considerable investment of time by the faculty who design and administer them. Philip Stark estimates that he invests roughly four times more time supporting his online courses than traditional classroom courses, although he is able to cover 2.5 times more students in the process. By one estimate it requires up to 400 hours to convert a traditional lecture course into a fully interactive online learning experience. Once the course is developed, the time invested per student taught may come down dramatically and eventually prove far less than that of classroom training, but the high barriers to initial entry represent a real obstacle to rapid adoption of OLI courses by large numbers of faculty. John Mitchell estimates that about 100 members of the Stanford faculty will engage in OLI in 2013, representing about 5% of total faculty. If this is the case in the innovative birthplace of Coursera and Udacity, rates of adoption must be far lower in most other universities. At SJSU, another pioneer, thus far about 0.5% of faculty are presently engaged in OLI. These low participation rates reflect the fact that we are still in the very earliest stages of the OLI revolution and it is difficult to envision how far and what form these new learning platforms develop. OLI requires new types of infrastructure to support data capture and analysis to access the effectiveness of different tools and methods. In order to facilitate the radical transition of universities to cope with the challenges of an online environment, organizations such as 2U.com are partnering with academic institutions to bring their content online.

The development of OLI is also making it possible to harness the enormous knowledge and teaching capacity of retired faculty to fill the growing gap between the demand and availability of qualified instructors and to utilize their capabilities to teach people anywhere in the world.

The conception of the student is also rapidly changing. Today only 17% of college students in America are full-time. The traditional conception that employment follows higher education is no-longer valid. More and more people are going back to college to augment their learning either as a support for career development or a means to enrich their years in retirement. The average student in the USA works 19-20 hours per week, which means he or she is both student and employee. More than 40% of adults participate in formal and/or non-formal education in a given year across OECD countries. The average age of online learners is now 34, up from 27 in 2002. MOOCs may form a critical element in future educational systems designed to promote life-long learning. The relationship between education and employment must necessarily undergo a significant change in future in order to equip workers of all ages with the ever increasing range and levels of skills required to maintain competency in an increasingly sophisticated labor marketplace. Orio Giarini and Mircea Malitza called for transforming this relationship into a "double helix of learning and work".[18]

MOOCs have also accelerated the globalization of education. Dan Clancy, Director of Education at Google, believes that the biggest shift in global education will be the rising importance of the non-Western world. Presently 60% of Coursera students are overseas and 80% already possess a college degree.[19] The six countries with the highest online enrollment in Coursera courses (after the U.S.) are Brazil (5.9%), India (5.2%), China (4.1%), Canada (4.1%), the United Kingdom (4%) and Russia (2.4%).[20] Among edX's students, 9% come from Africa and 12% from India.[21] SJSU is training Pakistani instructors how to teach online. UC Irvine's chemistry courses are being utilized by faculty in Africa.

5. Education as Dialogue

No longer is education a one-to-many process. The emerging learning model is the network. In an age of mechanization and massification, it is easy to lose sight of the fact that education is essentially an organic process of transmission that takes place from one human being to another. The capacity to acquire, accumulate, codify and transmit knowledge from one person to another and from one generation to another is the most striking characteristic distinguishing human beings from other species on earth. No matter how powerful the technologies we develop for storage and delivery of information, education is a dialogue between living beings – an exchange of ideas and perspectives between conscious minds. Human interaction has always played and always will play an essential role in effective education. As Aftab Omer, President of the Meridian University, put it: "The challenge is to integrate high tech with high touch."

Clancy likens recent developments in education to what has occurred in the television industry over the last few decades. Broadcast TV was the primary delivery mechanism until cable, satellite, VCR, digital video, the Internet and YouTube gradually made inroads into its territory. Today broadcast TV accounts for only 11% of total video viewing. Something similar is likely to happen in higher education, where until very recently brick and mortar universities accounted for the vast majority of knowledge dissemination. Clancy expects peer to peer instruction, including small group learning and team assessment, to play a much

greater role in the education of the future. As he put it, "The crux of education is social inter-action."

There was a time when reading and writing were rare endowments and the majority relied on a very few to perform these essential functions. Advances in education enable most people on earth to now perform these functions themselves, but we still rely on other minds to develop ideas and present knowledge in forms we can readily understand and absorb. Technological advances facilitate the delivery of knowledge from one mind to many others, but they have not and cannot entirely eliminate the essential role of thoughtful human interactions.

OLI cannot eliminate the need for human interaction in the learning experience. But it may radically alter the sources of that interaction. Ken Goldberg, a UC Berkeley professor, estimates that human beings currently spend about 10 billion minutes a day on Facebook and generate 400 million tweets. He and Yuko Okubo of Fujitsu have been collaborating to develop a social innovation tool called Opinion Space, a collaborative discovery engine that allows large groups to brainstorm.

In future some aspects of the role of the teacher may increasingly be performed by students themselves. Recent studies testify to an obvious truth which every instructor knows from personal experience, i.e. we learn best when we teach others. The absence of live contact with teachers has led the MOOCs to focus on ways to promote more interaction between students through online chat rooms, Q&A systems and physical meetings of their own. Coursera encourages both online and offline interaction. Online, the response time to questions posted on Coursera forums is 22 minutes. Offline, there are Coursera communities spread over 2,787 cities worldwide that enable students to connect with each other. Courserans in the same geographic location can form communities and plan meetings. Any member can suggest a date and venue to initiate a meeting to form study groups, share ideas, and socialize too. Online social learning platforms such as StudyRoom and Grockit facilitate meeting classmates outside the classroom. Students can join a study group for any subject of their choice, and share, collaborate, learn and teach. Educators can form their own virtual classes, and connect to their own and other students online. The service tracks student engagement and participation, and helps identify active and contributing students. StudyRoom monitors the level of interaction between students, incentivizing students who teach other students and making it possible for more advanced students with proven competence to earn money by offering assistance to students in courses they have already completed. 2U.com is also experimenting with ways to incentivize more advanced students to work with those who need assistance, so that mentoring forms an integral component of the learning process.

6. Evolution of the Textbook

The classroom and the instructor are not the only things that are changing. The shift from print to electronic media is transforming the textbook from a passive medium for knowledge storage into an active, interactive, dynamic learning platform combining text, images, audio, video, animation, data analysis, self-paced learning and continuous performance assessment into an integrated learning system.

Pearson, the world's largest textbook publisher, is in the process of reorganizing itself around emerging technology and global needs. Data analysis of individual learning patterns now makes it possible to develop products that deliver personalized learning experiences to each student. Pearson is also experimenting how to promote virtual peering between students for both motivation and knowledge transfer. Pearson's ebooks have, in addition to the entire textbook, interactive quizzes, weblinks, audio, video, animation and search features. Highlighting and making notes are possible. They also allow the creation of study groups to share notes with friends. McGraw Hill's LearnSmart software serves as a personal tutor. It can predict what the student is most likely to forget, and when. It analyzes how students perform in embedded quizzes and which concepts stump them. It can then create a personalized reading experience by highlighting the most important concepts a student needs to learn at that moment. As the student progresses, it adapts and adjusts the content based on his or her individual strengths, weaknesses and confidence, ensuring that the time spent studying is efficient and productive.

The boundaries between information and edutainment are thinning. Digitization is also broadening the concept of 'textbook' to encompass the rich and varied reservoirs of quality content offered by sources such as National Geographic, Scientific American, Psychology Today and Discovery Channel.

Knowledge grows by free exchange. Globalization of access to information goes hand in hand with globalization of education. Creative Commons is a not-for-profit presently working with governments, educational institutions and foundations in 72 countries to establish global standards for open licensing of content that facilitates free sharing, while protecting the legitimate rights of authors. Google has already invested $180 million to digitize about 30 million books, but without much revenue or needed legal agreements. Making access to the world's digital libraries universal will certainly be of great benefit to students worldwide. WAAS Fellow Lloyd Etheredge is working on a legal framework for an economically-sustainable digital Global Public Library, made accessible free of charge to individuals, including a usage-based, global payment system.

7. Accreditation

Gone are the days when the university was the sole repository or delivery point for in-depth formal knowledge delivery. Universal access to information and knowledge codified as courses is leading to what Ralph Wolff, former President of the Western Association of Schools and Colleges (USA), terms the 'deinstitutionalization of learning'. He estimates that only about 17% of formal learning in the USA takes place in traditional programs. The rise of the MOOCs is leading to a coursification of learning, in which knowledge is delivered course-wise rather than degree-wise. There is an increasing emphasis on competency-based programs without credit hours, in which students study on their own and then are evaluated in terms of the extent of knowledge acquisition.

Accreditation is one of the greatest challenges faced by the plethora of emerging MOOC platforms. Hundreds of thousands of students are flocking to the MOOCs for free access to world-class course content, but the creation of professional quality courses is a costly,

time-consuming process requiring sophisticated technology and expertise and costing as much as $100,000 per course. Moreover most students enroll in courses in order to obtain a valid proof of competency which will aid them in seeking a job or advancing their careers. Thus, accreditation is essential for the rapid adoption of online forms of education and the power of accreditation presently resides where it always has in traditional brick and mortar institutions.

Early adapters are experimenting with various ways to make OLI financially viable. For-profit startup, Coursera, is addressing this problem by offering certificates of completion to students who pay an additional fee. Some universities are offering credit for OLI courses provided students pay tuition fees and appear for physical exams. The University of Maryland University College has announced that starting from Summer 2013, it will award transfer credit to those who have taken and can prove what they have learned from certain MOOCs. To get credit, students will have to prove that they know the material, either by taking a paid version of the course, which includes proctored exams, or by going through a rigorous "prior learning assessment" process at UMUC, which measures competency on a topic.

The American Council on Education, which advises college presidents on policy, has evaluated MOOCs—five from Coursera and four from Udacity—and recommended to its members that students who pass those courses should be awarded transfer credits.[22, 23] San Jose State University, Georgia Institute of Technology, Colorado State University, the American Public University system, Central Michigan University, Kaplan University, Regis University, the State University of New York's Empire State College and Western Carolina University award transfer credit to students who have studied through MOOCs.[24, 25]

A variety of new online institutions are also being formed to test alternative designs. University of the People is a free, online academic institution approved by the California Bureau for Private Postsecondary Education to award degrees and has applied for accreditation status. World Education University, which opened in February 2013, offers 100% free college level education to anyone, anywhere, anytime, supported by an innovative advertisement-based revenue model. Their academic catalog consists of 341 courses, and they offer 43 different degree and certificate programs. As of September 2013, WEU had students in 179 countries enrolled in their online courses. WEU is also in the process of applying for accreditation. Minerva Project aims to be an online Ivy League university, providing students with a four-year American university education, starting in Fall 2014. It hopes to receive accreditation through a partnership with the Keck Graduate Institute, a part of the Claremont University Consortium.

According to the old management maxim, you get what you measure. Therefore, new credentialing systems are based on the premise that learning involves much more than merely the acquisition of specific course content and that measures need to be refined to access acquisition of a much wider range of competencies than merely text and lecture based knowledge. Will degrees remain the primary credential for certifying learning? Possession of a university degree conveys relatively little specific information about the competencies a student

has acquired. New models such as Degree.com and Accredible.com are facilitating the shift from degree-based to skill-based learning models. The founders of Accredible, Alan Heppenstall and Danny King, envision a decoupling of the educational and certification processes. They are trying to shift the focus from certification of courses taken by students to validation of the actual competencies a person has acquired and can document, regardless of whether they were obtained through traditional classroom instruction, online learning, on the job learning or other forms of life experience. Accredible is a comprehensive and inclusive form of credentialing that makes it possible for individuals to develop their own personalized, customized knowledge profiles validated by a variety of means, including formal certification, the testimony of experts, and other forms of evidence. Alternative means of certification such as the one being developed by Accredible can play an important role in making MOOCs credible.

"A new paradigm in education must be based on new thinking."

Another approach is being developed by Joanna Normoyle, Experiential & Digital Media Learning Coordinator at UC Davis, who is experimenting with new types of curriculum designing and new recognition systems to help students develop important skills necessary to address sustainability issues in the real world related to problem solving, thinking, communicating, design, visioning, marketing, management and social interaction. A system of badges is being used to incentivize new types of experiential learning, competence, knowledge and values.[26]

Globalization poses another challenge to traditional forms of accreditation. Education is going global. American universities are now educating about 800,000 foreign students every year.

American universities led by NYU are establishing campuses and affiliated degree courses overseas. As the size of their college-age populations levels or declines, European countries are also striving to attract more foreign students. At the same time, the promise of high quality education is attracting more students from developing countries to the world's premier institutions of learning. Standardization and internationalization of credentialing would significantly facilitate global educational exchange.

Globalization is giving rise to new models. Founded in 1999, Laureate International Universities network has grown to include 72 institutions in 30 countries throughout North America, South America, Europe and Asia. Institutions within the network operate both campus-based and online programs with a total enrollment of more than 780,000 students.

8. New Foundations for Higher Education

A new paradigm in education must be based on new thinking. As one of the Academy's founding fathers, Albert Einstein, said *"We cannot solve our problems* with the same *thinking* we used when we *created* them." Side by side with the need to educate more people better is the need to reconsider the intellectual foundations on which current knowledge is based. While technology has been a powerful driver for expanding access to affordable

education, a parallel movement is needed to re-examine prevailing notions regarding the fundamental purpose of education, the division of faculties into separate disciplines, and the essential nature of the knowledge needed for accomplishment in the 21st century. As Emil Constantinescu, former President of Romania and Rector of the University of Bucharest, observed, "Modern knowledge cannot and should not be reduced to a technical compilation and use of information. Knowledge has to be co-extensive with the depth and breadth of human wisdom, accumulated over millennia. Bare information opens a royal way to massification, whereas knowledge stimulates the harmonious development of responsible individualities." While concern with foundations of knowledge and education is not new, the tumult of change stirring higher education today has created the need and opened the way for greater exploration of these profound issues.

Figure 5: The Learning Framework for the Future
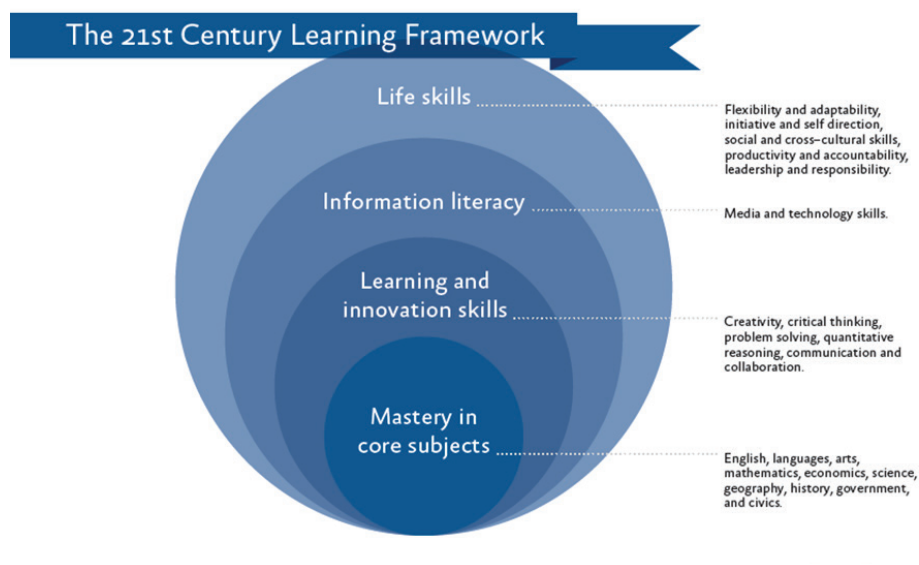
We have already noted the emerging shift from subject to person, from teaching to learning, from concentration of content to concentration on the learning process. The essential goal of all education is to enhance the capacity of the student to acquire and utilize knowledge in a living social context, which includes the ability to seek, gather, process, assess and absorb ideas, information and experience; to modify existing understanding based on new facts and perspectives; to utilize what is known to solve problems involving aspects that are uncertain or unknown; to interact effectively with other people both for the exchange and enhancement of knowledge; and to apply all these capacities to enhance all aspects of human security, social welfare and psychological well-being. Most of these objectives are at best incidental or even contrary to the design and actual delivery of most higher education models today. We need to foster at every level of society an awareness of the social construction of

reality, of our powers and responsibilities for the present and future of humankind and the whole planet. We need more effective intellectual perspectives to correctly diagnose the problems and formulate effective, sustainable solutions.

Mohammad Qayoumi supports the call of the US-based Partnership for 21st Century Skills for a wider conception that embraces core subjects, learning and innovation skills, information literacy and life and career skills as depicted in Figure 5.[27, 28]

> *"Social reality is not divided into courses and disciplines – it is an indivisible whole."*

The felt need for new learning paradigms is a reason for the success of unconventional alternative learning models such as UnCollege.org, which was founded by college drop-out Dale Stevens in 2011. Stevens refers to his model as unschooling to contrast it with traditional forms of homeschooling. UnCollege offers students an opportunity to learn how to learn in non-traditional environments while taking a year off from college. It offers The Gap Year, a one year program that consists of a residential program with other UnCollege Fellows, a stint abroad, an internship, and ends in the completion of a real project. This one year helps students to develop meta learning skills. They participate in workshops and roundtables, meet entrepreneurs, work or volunteer in a foreign country, and gain real world work experience. The internship may be at a giant tech company, a small startup, or a charity distributing aid in Africa. The project could be organizing an exhibition of photographs, publishing a book, or creating a functioning company. UnCollege introduces the Fellows to a network of mentors, and offers them assistance in becoming financially independent at the end of the program. Stevens' ultimate objective is more revolutionary. It is to offer a complete alternative to formal higher education that will more effectively equip youth with the initiative, confidence, problem-solving capacities and social skills needed for success in any field of endeavor.

The World Academy is focusing on the future of education precisely because education is such a powerful determinant of our collective capacity to address the pressing issues confronting humanity today. Although interdisciplinary and multidisciplinary courses have been around for decades, they still occupy a marginal place in higher education, often perched precariously between two or more stools of conventional disciplines. But social reality is not divided into courses and disciplines – it is an indivisible whole. Economic and financial issues are inextricably interlinked with and based upon issues of law, governance, human rights, social process, individual psychology, culture, geography, ecology and historical development. This is the rationale for the Academy's quest for a New Paradigm for Human Development that recognizes the common theoretical foundations and practical implications of the world's most pressing challenges.

Throughout history, education has gradually and incrementally evolved in response to changing social needs, more commonly to conserve past achievements than to pioneer the future. As Roberto Peccei, former Vice Chancellor of UCLA, put it, "Universities are better suited as repositories of knowledge than as agents of change." In future we need institutions that will not only transmit the rich heritage of past knowledge to younger generations, but also pioneer the ideas needed to build a better world.

Robert Fuller, former President of Oberlin College, describes education as the single best weapon of counter-terrorism to meet global threats. As American colleges in the 1970s became the active instrument for racial integration in response to rising levels of social unrest, effectively creating a black middle class, Fuller says that today the world faces a similar challenge at the global level, the challenge of rapidly developing the potential of more than one billion people in developing countries to create a global middle class. WAAS can be a leader in that movement.

At a still deeper level, education is founded on and inseparable from human values. Values represent the quintessence of wisdom acquired over centuries as to the fundamental principles governing human accomplishment, individual and social. They are not merely inspiring ideals. They also have profound practical importance. Formal education supported by family, culture and religion are the principal means for the transmission of values from one generation to the next. The multiple crises confronting humanity today are indicative of a need to consciously inculcate higher values through the educational system.

The achievements of Western society have been made possible by recognizing the value of the individual human being and providing the widest latitude of freedom for individual development. Its problems arise from the absence of a corresponding emphasis on individual social responsibility to the collective that has contributed so much to enhance the life of its members. Technology and organization have been powerful drivers of social progress, yet in the process they have almost come to supplant and suppress the value of the human beings who have developed them and whose welfare they intended to serve. Modern science and technology are a superb testament to human creativity, but become monstrous when applied without reference to their impact on people. Modern organization is godlike in its effectiveness, but it becomes inhuman when a system or procedure is divorced from human welfare and well-being. No longer can we abide by the notion of education as purely objective, neutral and value-free. If it does not consciously impart values of freedom, equality and dignity for all, then by that very omission it sanctions their very opposites.

As education goes global, great care must be taken to counter a subtle form of cultural imperialism that will almost inevitably impose Western values on populations whose cultural heritage is very different from our own. Conscious efforts should be taken to promote MOOC courses by scholars and experts from all cultures, so that the university of the future truly becomes a global learning ground where all cultures can gain and all can give. Conscious emphasis must be placed on those values which are truly universal and on respect for cultural differences, whether they result from geographic distinctions between people or from societies in different stages of social development.

9. The Ultimate Question

The Millennium Development Goals focus on primary education. In contrast, the Berkeley discussion gave voice to the conviction that higher education can and should be made available to all and it called for recognition of access to higher education as a fundamental civil right.

Much of the experimentation witnessed so far is an effort to use familiar methods to meet the needs of a new context, when what is really required is to evolve a new approach at a higher level. The rapid expansion of global needs and capabilities calls for the formulation of an entirely new paradigm for global education.

> *"Today a World University is an idea whose time has come."*

It is far too early to predict the most likely form that global higher education will take in the coming decades, but the forces driving that change are sufficiently powerful to ensure it will be very different than the form that has endured with only minor variations over the past two centuries. Reflection on recent developments helps us formulate the questions that need to be asked. But, as Ralph Wolff, put it, "If you think you know the answers, you just aren't asking the right questions."

The World Academy's Forum at UC Berkeley sought to pose the ultimate question to participants which no one seems yet to be asking: "If you were asked to design a world-class system of higher education accessible to all human beings, how would you do it?"

The question has already evoked some inspiring answers. Lloyd Etheredge envisions a Global University Movement whose mission is to provide "An education equal to the best in the world, available to everyone." Going beyond MOOCs, it would include many educational and technical options, honoring the dignity of each individual, a world that warmly welcomes each young person and is committed to providing resources for them to develop their potential and have a life that they love, lighting fire under national and local government officials to make supportive investments for rapid progress, generating solutions to translation challenges, volunteering enrollment for tutoring and coaching, creating opportunities for private sector startups in each country, and developing a Global Public Library of at least 30 million volumes available to the global public free of charge.

10. World University Consortium

The World Academy was founded in 1960 by distinguished individuals concerned by the impact of the explosive growth of knowledge to address global issues related to the social consequences and policy implications of knowledge. Their aim was to create a forum where problems can be discussed objectively, scientifically, globally and free from vested interests or regional attachments, to arrive at solutions that affirm universal human rights and serve the interests of all humanity. WAAS was founded on faith in the power of original and creative ideas – Real-Ideas with effective power to change the world and its motto is "Leadership in thought that leads to action".

The Academy's founders intended that WAAS should function as *"an informal World University at the highest scientific and ethical level, in which deep human understanding and fullest sense of responsibility will meet."*[29] Although some modest beginnings were made in its early years to establish regional centers of excellence, political conditions at the height of the Cold War, as well as limitations in transport and global communication, posed insurmountable obstacles to realize this vision at that time. Today a World University is an idea whose time has come.

A major objective of the Berkeley conference was to assess the need and potential for the establishment of new types of educational institutions dedicated to realizing this vision. The World Academy's Forum on Global Higher Education provided an excellent opportunity to examine recent advances, brainstorm on new models and creative solutions for establishing a world-class system of higher education available to all humanity and to forge an international alliance of stakeholders committed to making it happen.

At the forum, the leadership of WAAS announced the founding of the World University Consortium, a network and umbrella group to facilitate educational partnerships and linkages with other interested stakeholders at the international level, to provide a centralized source of information about latest innovative ideas and developments in this field, and to explore creative solutions to enhance the reach, quality and relevance of higher education globally. A radical change in conception is imperative. A truly global education cannot be limited to the perspectives of one or a few nations or cultures.

The mission of the Consortium will be to evolve and promote development of accessible, affordable, quality higher education worldwide based on a human-centered approach that shifts the emphasis from specialized expertise to contextualized knowledge within a trans-disciplinary conceptual framework reflecting the complexity and integration of the real world. It will strive to shift the emphasis of higher education from teaching specialized content to learning that enhances the capacity of students to think and discover knowledge for themselves, from theoretical mastery to acquisition of knowledge, skills and values relevant to each individual's personal development and career – an educational system better suited to develop the full potentials of social personality and individuality for productive engagement, social welfare and psychological well-being.

The consortium will pursue several closely interrelated objectives. It will strive to identify best practices globally and promote effective models to improve accessibility, quality, affordability, employability, innovation and social relevance in higher education. It will explore innovative open learning systems and online and hybrid delivery systems. It will encourage experimental research and application of advanced methods to improve the learning process. It will promote person-centered approaches that emphasize self-guided learning, critical and original thinking, inspirational forms of instruction, learning to learn, cross-cultural and trans-cultural, multi and trans-disciplinary contextualized perspectives and experiential learning.

From its inception, the greatest resource of the World Academy has been the network of its talented, committed members and the many other individuals and institutions with which our members are closely bound by work and values. WAAS is an embodiment of the ultimate value of the human resource and the unlimited creative potential of human beings. The Consortium will seek to create a worldwide forum where all the stakeholders can meet, interact and create new networks, partnerships and projects.

Many excellent ideas have already been proposed regarding the range of activities the Consortium may undertake in pursuit of its mission and objectives. In the coming year

WAAS will be reaching out to its Fellows and partnering institutions to formulate strategies, establish priorities and frame a plan of action. We invite all those within and outside the Academy to join us in this collective endeavor.

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Notes

1. Michael Greenstone and Adam Looney, "Regardless of the Cost, College Still Matters," *The Hamilton Project* http://www.hamiltonproject.org/files/downloads_and_links/September_2012_Jobs_Report_FINAL.pdf

2. "A New Dynamic: Private Higher Education," *UNESCO* http://unesdoc.unesco.org/images/0018/001831/183174e.pdf

3. "Education at a Glance 2012," *OECD* http://www.oecd-ilibrary.org/education/education-at-a-glance-2012_eag-2012-en

4. "Steep Rise in Education Fees," *The Associated Chamber of Commerce and Industry of India* http://www.assocham.org/prels/shownews-archive.php?id=3914

5. Michelle FlorCruz, "China's Steep University Tuition Costs The Average Farmer 13 Years Of Income," *International Business Times* http://www.ibtimes.com/chinas-steep-university-tuition-costs-average-farmer-13-years-income-1101434

6. Keith Bradsher, "In China, Families Bet It All on College for Their Children," *The New York Times* http://www.nytimes.com/2013/02/17/business/in-china-families-bet-it-all-on-a-child-in-college.html?pagewanted=all&_r=2&

7. Alex Usher and Jon Medow, "Global Higher Education Rankings 2010," *Higher Education Strategy Associates* http://www.ireg-observatory.org/pdf/HESA_Global_Higher_EducationRankings2010.pdf

8. "Employment and Labour Markets: Key Tables from OECD," *OECD* http://www.oecd-ilibrary.org/employment/youth-unemployment-rate_20752342-table2

9. "Global Employment Trends for Youth 2013," *ILO* http://www.ilo.org/global/research/global-reports/global-employment-trends/youth/2013/lang--en/index.htm

10. Greenstone and Looney, "Regardless of the Cost, College Still Matters," *The Hamilton Project*

11. Michael Greenstone and Adam Looney, "Is Starting College and Not Finishing Really That Bad?," *The Hamilton Project* http://www.brookings.edu/blogs/jobs/posts/2013/06/07-return-to-some-college-greenstone-looney

12. "OECD (2013), Education at a Glance 2013: OECD Indicators," *OECD Publishing* http://dx.doi.org/10.1787/eag-2013-en

13. Graphic reprinted with permission from Greenstone and Looney, "Is Starting College and Not Finishing Really That Bad?," *The Hamilton Project*

14. "Not Open for Business," *The Economist* http://www.economist.com/news/business/21587778-americas-engines-growth-are-misfiring-badly-not-open-business?fsrc=nlw|hig|10-10-2013|6772701|37726496|

15. Graphic retrieved from "OECD (2013), Education at a Glance 2013: OECD Indicators," *OECD Publishing*

16. *Coursera* https://www.coursera.org/about/community

17. "Major Players in the MOOC Universe," *The Chronicle of Higher Education* http://chronicle.com/article/Major-Players-in-the-MOOC/138817/ Copyright 2013 The Chronicle of Higher Education. Reprinted with permission.

18. Orio Giarini and Mircea Malitza, "The Double Helix of Learning and Work," *Bucharest* http://unesdoc.unesco.org/images/0013/001307/130713eb.pdf

19. Carmelo Cipolla, "2013 e-learning trends," *KnowledgeOne* http://www.knowledgeone.ca/blog/post/2013-e-learning-trends.aspx

20. *Coursera Blog* http://blog.coursera.org/post/29062736760/coursera-hits-1-million-students-across-196-countries

21. Geoffrey A. Flower, "An Early Report Card on Massive Open Online Courses," *The Wall Street Journal* http://online.wsj.com/article/SB10001424052702303759604579093400834738972.html?KEYWORDS=MOOC

22. "ACE to Assess Potential of MOOCs, Evaluate Courses for Credit-Worthiness," *American Council on Education* http://www.acenet.edu/news-room/Pages/ACE-to-Assess-Potential-of-MOOCs-Evaluate-Courses-for-Credit-Worthiness.aspx

23. "ACE to Forge New Ground in MOOC Evaluation and Research Effort," *American Council on Education* http://www.acenet.edu/news-room/Pages/ACE-to-Forge-New-Ground-in-MOOC-Evaluation-and-Research-Effort.aspx

24. Steve Kolowich, "American Council on Education Recommends 5 MOOCs for Credit," *The Chronicle of Higher Education* http://chronicle.com/article/American-Council-on-Education/137155/

25. Steve Kolowich, "A University's Offer of Credit for a MOOC Gets No Takers," *The Chronicle of Higher Education* http://chronicle.com/article/A-Universitys-Offer-of-Credit/140131/

26. Joanna Normoyle, "UC Davis Badges," *Presentation at World Academy Forum on Global Higher Education* http://www.worldacademy.org/files/UCB/UCD_Badges_J.Normoyle.pdf

27. *Partnership for 21ˢᵗ Century Skills* http://www.p21.org/overview

28. Data adapted from Mohammad Qayoumi and Kim Polese, "Reinventing Public Higher Education: A Call to Action," *San Jose State University* http://www.sjsu.edu/president/docs/reinventinghighered_full.pdf

29. "WAAS Manifesto," *World Academy of Art and Science* http://www.worldacademy.org/content/history

The Future of Water:
Strategies to Meet the Challenge

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Abstract

Despite the UN's adoption of a new economic and social right in 2010 − the Right to safe drinking water and sanitation − the deficit of fresh water is becoming increasingly severe and large-scale.

The mounting water crisis and its geography make it clear that without resolute counter-action, many societies' adaptive capacities within the coming decades will be overstretched.

The scale and the global nature of the water crisis demand a new level of statesmanship, of vision and of international action. To master successfully the threats of water crisis, not only its effects, but essentially its underlying causes must be addressed by implementing structural changes in our water policies and economies. This requires a coherent strategy in which the economic, social, water and environmental aspects of policy must be properly coordinated.

The world needs a standalone comprehensive "water goal" in the post-2015 development agenda, based on principles of equity, solidarity, recognition of the limits of our planet and rights approach, and linking development and environment in analyses and in governance policies. Such a goal would address the three interdependent dimensions of water: Water, Sanitation and Hygiene, Water Resources Management and Wastewater Management and Water Quality.

Scientific understanding of water risks and worldwide evidence clearly define the challenges to be addressed and provide a sound basis for policy; the resources required could be made available if the water agenda is given sufficient priority; and the benefits and opportunities of early action are undeniable. In fact, the moral, scientific and practical imperatives for action are established.

The United Nations' General Assembly recognized a new economic and social right in 2010 − the Right to safe drinking water and sanitation.

Despite the UN's adoption of this vital principle, the deficit of fresh water is becoming increasingly severe and large-scale – whereas, unlike other resources, there is no substitute for water.

While the drinking water target has officially been met according to the UN's criteria (based on the number of pipelines) and statistics, in reality the existence of a pipe does not

necessarily mean there is clean water reliably flowing out of it; and even if there is, it may be very far away, or priced at a rate which some people cannot afford. More worrying still, recent reports show that drinking water availability in Africa is declining, and the UN Habitat warns that by 2030 more than half the population of huge urban centers will be slum dwellers with no access to safe water or sanitation.

"The UN Habitat warns that by 2030 more than half the population of huge urban centers will be slum dwellers with no access to safe water or sanitation."

The mounting water crisis and its geography make it clear that without resolute counteraction, many societies' adaptive capacities will be overstretched within the coming decades. This could result in massive migration, destabilization and violence, jeopardizing national and international security to a new degree. As John F. Kennedy rightly observed in the early 1960s: "Anyone who can solve the problems of water will be worthy of two Nobel Prizes − one for peace and one for science." The observation made 50 years ago has become more appropriate today.

The figures are staggering. The UN Food and Agriculture Organisation estimates that by 2025 1.8 billion people will be living in regions stricken with absolute water scarcity, while two-thirds of the world population could be living under stress conditions. The United Nations Environment Programme (UNEP) assesses that, by 2025, water withdrawals will increase by 50 percent in developing countries, and 18 percent in developed countries. According to UNEP and UN Habitat, about 80 percent of wastewater from human settlements and industrial sources is discharged to the environment without treatment. Last but not the least, the IPCC report suggests that by 2050 annual average runoff will have increased by 10%-40% at high latitudes and decreased by 10%-30% over some dry regions at mid-latitudes and semi-arid regions at low latitudes.

As always, the cost of no action will be much higher than that of action. The return on investment for providing basic services need not be demonstrated anymore. For safe drinking water and sanitation, the World Heath Organization estimated returns of $3-$34 for each $1 invested depending on the region and technology. Worldwide, more than 7,000 major disasters have been recorded since 1970, causing at least $2 trillion in damage and killing at least 2.5 million people. The Stern Review on Climate Change published in 2006 concluded that by 2050 extreme weather could reduce global GDP by 1% and that climate change could cost the world at least 5% in GDP each year if left unabated. If even more dramatic predictions come to pass, the cost could rise to more than 20% of GDP.

1. Where We Stand Today

There will be 220,000 people at the dinner table tonight who were not there last night—many of them hungry, thirsty and desperate. Population growth is one of the major drivers of the multiple changes taking place around the world, including in terms of economic activity and availability of natural resources like water.

Humanity currently uses half of the accessible 12,400 km^3 of freshwater per year. The bad news is that the water use is growing even faster than the population: water consumption in the 20th century grew twice as fast as the world population. As a result, a third of the world's population lives in water-stressed countries now. By 2025, this is expected to rise to two-thirds.

> *"Since 70 percent of world water use is for agriculture, water shortages inevitably translate into food shortages. By 2050, after we add another 3 billion to the population, we will need an 80 percent increase in water supplies just to feed ourselves."*

The problem of overcoming the water crisis comprises many complex and controversial questions. But thinking about ways of countering the global water crisis, we must first of all recognize its direct causes.

They include:

1.1 The growth of the world's population and of agricultural, industrial and energy production, which are the main consumers of water;

The global population tripled in the 20th century but water consumption went up sevenfold. Half the world's people already live in countries where water tables are falling as aquifers are being depleted. Since 70 percent of world water use is for agriculture, water shortages inevitably translate into food shortages. By 2050, after we add another 3 billion to the population, we will need an 80 percent increase in water supplies just to feed ourselves.

Already, around one billion people are chronically hungry, and by 2050 agriculture will have to cope with these threats while feeding a growing population with changing dietary demands. This will require doubling food production, especially if we are to build up reserves for climatic extremes.

To do this requires sustainable intensification − getting more from less − on a durable basis.

1.2 The environmental consequences of economic activities and the destruction of natural ecosystems;

Current estimates of global GDP are around US$ 60 trillion and even at modest per capita growth rates in the emerging economies of the world we could easily see a world (as we conventionally measure it today) with a GDP closer to US$ 200 trillion that would meet poverty targets − three worlds sitting on our present one world but stretched to the limits with regard to consumption and production patterns.

We are polluting our lakes, rivers and streams to death. Every day, 2 million tons of sewage, industrial and agricultural waste are discharged into the world's water, the equiva-

lent of the weight of the entire human population of 6.8 billion people. 80% of the world's rivers are now in peril, affecting 5 billion people on the planet. We are also mining our groundwater far faster than nature can replenish it, sucking it up to grow water-guzzling, chemical-fed crops in deserts or to water thirsty cities that dump an astounding 750 million m³ of land-based water as waste in the oceans every year. The global mining industry sucks up another 750 m³, which it leaves behind as poison. Fully one third of global water withdrawals are now used to produce biofuels − enough water to feed the world. A recent global survey of groundwater found that the rate of depletion more than doubled in the last half century.

> *"The amount of wastewater produced annually is about six times more than the water present in all the rivers of the world."*

1.3 Wasteful use of water and other natural resources in an economy driven by hyper profits and excessive consumption;

The amount of wastewater produced annually is about six times more than the water present in all the rivers of the world.

In many places of the world, a staggering 30 to 40 percent of water or more goes unaccounted for due to water leakages in pipes and canals and illegal tapping.

In the US some of the 852 billion litres wasted each year through over-watering can be saved by installing smart systems which deliver just the right amount of moisture.

City landscaping or "urban irrigation" makes up 58 percent of urban water use, besides the water wasted which generates over 544,000 tons of greenhouse gases annually.

U.S. water-related energy use is at least 521 million megawatt hours a year − equivalent to 13 percent of the nation's electricity consumption.

The carbon associated with moving, treating and heating water in the U.S. is at least 290 million tons a year.

1.4 Mass poverty and backwardness in countries where authorities are not able, and often have no desire to organize effective water management;

Almost two in three people lacking access to safe drinking water survive on less than 2 dollars a day and one in three on less than 1 dollar a day.

World Bank estimates that 53 million more people were trapped in poverty last year, subsisting on less than $1.25 a day, because of the crisis. This comes after the soaring food and fuel prices of recent years, which pushed 130 to 155 million people into extreme poverty, many of whom have still not recovered.

Dirty water is the biggest killer of children; every day more children die of waterborne disease than HIV/AIDS, malaria and war together. In the global South, dirty water kills a child every three and a half seconds. And it is getting worse. By 2030, global demand for water will exceed supply by 40%—an astounding figure foretelling terrible suffering.

It is not surprising that virtually all of the top 20 countries considered to be "failing states" are depleting exponentially their natural assets—forests, grasslands, soils, and aquifers—locked in a vicious circle to sustain their rapidly growing populations.

1.5 The arms race and the senseless waste of enormous amounts of wealth and resources in wars and conflicts;

Roughly ten years ago, James Wolfensohn said he was not able to comprehend why the world spends only 50 billion dollars on development aid annually while it squanders a whopping 950 billion dollars on its armed forces. "If the world's rich nations spend the 950 billion dollars to really fight poverty and disease," he argues, "they would not need to spend even 50 billion dollars fighting wars."

"US$105 billion was spent on nuclear weapons in 2011, up from US$91 billion in 2010. Shifting spending (and this is mere 7% of the world military budget!) away from weapons to sustainable development would have profound impacts on the lives of over 3 billion people and would promote security and stability around the world."

Today, the world spends twice as much on war. Two decades since the end of the Cold War, over 20,000 nuclear weapons still exist, with many on high alert and each weapon much deadlier than those that devastated Hiroshima and Nagasaki in 1945. US$105 billion was spent on nuclear weapons in 2011, up from US$91 billion in 2010. Shifting spending (and this is a mere 7% of the world military budget!) away from weapons to sustainable development would have profound impacts on the lives of over 3 billion people and would promote security and stability around the world. Spending US$105 billion annually over five years towards sustainable development could:

- Lift 1 billion people out of poverty.
- Allow 60 million more children to live past their 5th birthday.
- Supply 700 million people with clean drinking water.
- Give 1.3 billion people access to basic sanitation.
- Provide 280 million children with proper nutrition.

In light of these various negative impacts, a question must be posed to political and economic leaders: For them to respond to the water and related environmental crises, and ensure the better management of these resources, how severe must the resource and ecological risks on a nation's economy become before they act, and how do these factors affect a nation's ability to pay its debts?

There are many economic justifications for action. A 10% drop in the productive capacity of soils and freshwater areas alone could lead to a reduction in trade balance equivalent of more than 4% of GDP.

And we should start thinking not exclusively in terms of associated expenses, but also in terms of the cost of not providing access to water. People without access to basic water supplies and sanitation, especially in Asia, Africa and Latin America, work fewer days because of illnesses and diseases. WHO estimates that meeting the MDG goal for water and sanitation by 2015 will result in productivity gains above US$700 million per year solely from there being fewer cases of diarrhea for health systems to manage.

2. The Water-Energy Nexus

The water crisis cannot be decoupled from its energy dimension.

Europe's power sector accounts for 44% of all water withdrawals, and 8% of consumption – mainly evaporation in cooling towers. China already faces a water shortage of 40 billion m^3 per year, yet coal-fired generation is expected to increase 43% by 2020. It already accounts for around 60% of total industrial water demand. Peter Evans, Director for global strategy and planning at General Electric Co., told during a Tokyo conference that Asian utilities are "assuming the water is there. They actually will not be able to build as many coal plants as the projections suggest."

Coal, gas and nuclear power generation all use large amounts of water. Of these, nuclear is the thirstiest. A combined-cycle gas turbine plant of around 450 megawatts could consume 74 million m^3 of water during its lifetime, and a coal-fired power station of 1.3 gigawatts no less than 1.4 billion m^3. The latter figure is seven times the annual water consumption of Paris.

By contrast, wind and PV generation use very little water. The renewable technologies that consume water are solar thermal electricity generation, biomass and waste-to-energy, geothermal, and in a more direct sense, hydro-electric.

Policy-makers are showing signs that they are increasingly prepared to ensure the energy sector pays an appropriate cost for the water it uses. The European Union has reviewed its water policy goals as part of its Blueprint to Safeguard Europe's Waters.

But in the US, the energy sector's use of water looks like it is set to soar despite the deployment of renewable energy. This is because of non-conventional gas. While shale gas has become a live political issue in that country, coverage has almost purely focused on the issues of fugitive emissions, ground-water contamination, and whether the process should be regulated at a Federal or State level.

What has not been debated is the actual consumption of water.

Chesapeake Energy Corp. reports that drilling a deep shale gas well requires up to 2,000 cubic metres of water, but the "fracking" process requires, on average, an additional 20,000 cubic meters to be injected per well at high pressure to break up the rock. Multiply this by the hundreds of thousands of fracked wells needed to meet the increasing gas demand in the coming decades, and that's a lot of water. Some may be reusable, as long as the salinity is not too high, while some may require a significant amount of wastewater treatment and energy. The costs of this post-processing must be accounted in the price of shale gas energy.

Fracking supporters like to compare its water use with that of corn ethanol – not exactly a champion for the rational, fact-driven deployment of clean energy. The real comparison should be between gas-fired generation based on fracking, and wind or PV. On that count, the water factor comes down strongly in favour of renewable energy.

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"To meet the threats of water crisis successfully, we must address not only its effects but also essentially its underlying causes, by implementing structural changes in our water policies and economies. This requires a coherent strategy in which the economic, social, water and environmental aspects of policy must be properly coordinated."

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3. What Next?

The scale and the global nature of the water crisis demand a new level of statesmanship, of vision and of international action. To meet the threats of water crisis successfully, we must address not only its effects but also essentially its underlying causes, by implementing structural changes in our water policies and economies. This requires a coherent strategy in which the economic, social, water and environmental aspects of policy must be properly coordinated.

Major issues, whose scale and importance were not reflected in the MDGs, are those of our decreasing per capita water supplies, of the overuse and sometimes irremediable pollution of our watersheds, of the predicted conflicts over water usage and of the looming impact of climate change on the water cycle. The process that led to the adoption of the MDGs had only retained the humanitarian aspect of these well-established trends.

Today the world needs a standalone comprehensive "water goal" in the post-2015 development agenda linking development and environment in analyses and governance policies. Such a goal would address the three interdependent dimensions of water: Water, Sanitation and Hygiene, Water Resources and Wastewater Management and Water Quality. Setting the goal will not be an instant "silver bullet" solution. But it would reflect the needed awareness and mobilization of those who have the power to make things change.

The goal must be based on principles of equity, solidarity, recognition of the limits of planet and rights approach, coupled with effective means to check and demand the accountability of all stakeholders. It should help distinguish between the different aspects of water use and the related rights and obligations of different participants in this process at the local, national and international levels.

It should advance water innovation, smart water solutions and recycling that need to be introduced in the next 5-10 years.

Water justice must become a recognized and operational element of new water strategy. The UN's resolution declaring water as a human right urges States and international organi-

zations to provide finance, capacity-building, and technology transfer through international assistance and cooperation, especially to developing countries.

In rich countries, the state has invested in water infrastructure over the centuries and progressively asked consumers to cover the cost of water services. Many developing countries are so deeply in debt that the state is unable to invest in infrastructure without the support of the international community. We cannot expect poor people to pay for water infrastructure; most people could possibly pay a reasonable, affordable charge for their water services.

Therefore, the new financial mechanisms urgently need to be put in place. Decentralised financing and cooperation must be enhanced, including targeted development loans guaranteed by local authorities from the North.

In conclusion, a scientific understanding of water risks and worldwide evidence clearly define the challenges to be addressed and provide a sound basis for policy; the necessary lines of action have been identified; the resources required could be made available if the water agenda is given sufficient priority; and the benefits and opportunities of early action have been demonstrated. In fact, the moral, scientific and practical imperatives for action are established.

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ADDENDUM

The Actual Volume of Water on Earth[*]
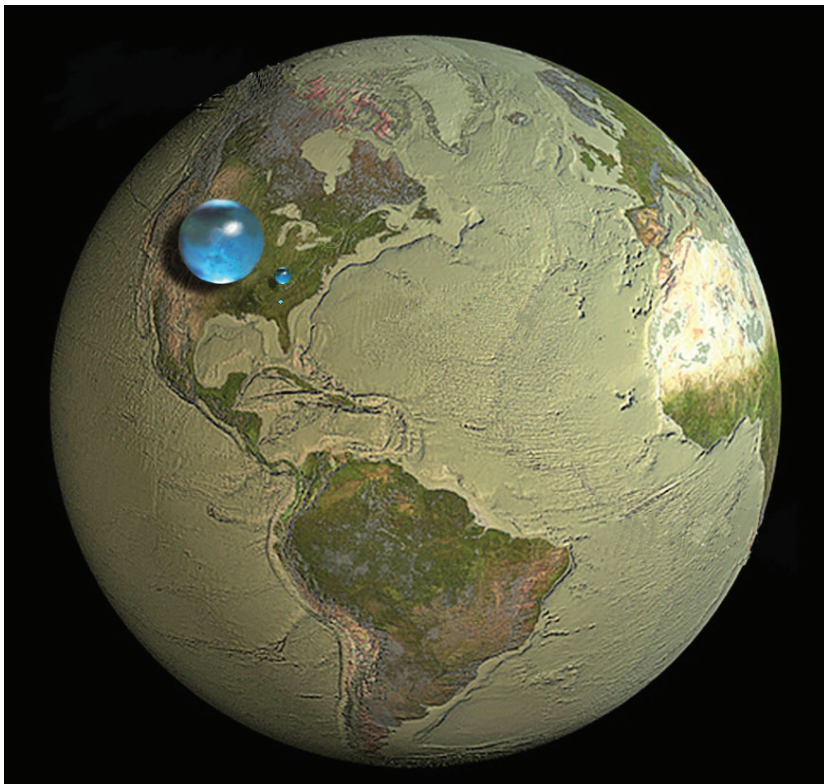
We are used to think of the Earth as "blue planet", more than two-thirds of the surface of which is water. But the world's oceans is a very thin layer of water when you compare it to the scale of the planet. Experts of the U.S. Geological Survey created the infographic that demonstrate how small – in comparison with the Earth – the volume of water we have.

The biggest blue sphere – it is all the water on our planet, including the one that is inside the bodies of plants and animals and people. The diameter of the sphere is 1,384 kilometers, and its volume is 1.386 billion cubic kilometers. Scope of smaller volume – a liquid fresh water in all the rivers, lakes, wetlands and groundwater. Its volume – 10,633,450 cubic kilometers.

Finally, a tiny blue dot – this is fresh water of all the lakes and rivers on the planet, which amounts to 93,113 cubic kilometres.

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[*] Department of the Interior/USGS, U.S. Geological Survey/photo by Jane Doe

Climate Policy after Doha:
Turning Obstacles into Solutions

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Abstract

The international climate policy is in big trouble. The governments of the world cannot agree on a reasonable, enforceable cap on global CO_2 emissions – not today and not in the future. Concerning a strict enough cap, this issue is politically not handleable today, because this would directly interfere with the options of countries to generate future economic growth. Problems in this respect are politically unfeasible.

The present text, therefore, argues for a new approach, for thinking out of the box, for overcoming the traps the negotiations are stuck in at the moment. The idea is to have governments agreeing only on a relaxed instead of a strict cap. This is politically much easier to achieve. In the text, we show that a relaxed cap is sufficient to solve the climate issue, if the private sector can be motivated to do the rest, given that there is an enforceable relaxed cap in place. The private sector can use at least two wild cards to contribute to this aim, and it can do this within the framework of climate neutrality for companies, organizations, and individuals to take legal CO_2 certificates out of order on the one hand, and, on the other hand, to plant trees (all over the world for the purpose of biological sequestration) and to do this in huge volumes.

The so-called Copenhagen Accord is taken as an anchor for a global climate regime to reach the 2°C aim. The regime consists of two parts: a moderate dynamic global CO_2 cap guaranteed via globally binding governmental accords, and a second part using two wild-cards. These are used to fulfill the so-called WBGU budget restriction in spite of the relative weakness of the agreed upon dynamic cap: (1) a massive decomprising of emission rights in a wealth-compatible manner to close the so-called negotiation gap and (2) a massive forest and landscape restoration program to close the so-called sequestration gap. Implementing the wild cards is financed by the private sector (organizations, companies, individuals) to achieve individual climate neutrality for ethical or reputational reasons. This process has already started and has been activating millions of dollars of private money annually with additive positive effects on development of non-industrialized countries.

1. Prevailing Frustration

International negotiations on climate are stalling. Tens of thousands of traveling mediators are urging NGOs and journalists to play their part, since the volume of climate gas

emissions continues to grow and there is frustration all over the place. Many observers have long since abandoned the 2°C target and no longer argue in favor of climate protection but in favor of population protection against the consequences of a climate disaster which can no longer be prevented.

2. Do we still stand a Chance?

There is still a chance, however, only if there is a change in the current negotiation logic. Over time, the present negotiation logic has outlived itself; the situation has changed drastically. What is now required are new approaches: increase system-related intelligence in order to get the global community out of the rat-race of the present negotiation logic.

"The world needs a new negotiation approach and a strong wildcard combined with an understanding of the fact that insisting on the present approach will bring about the ultimate climate risk."

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3. All Balance Sheets have Two Sides

The present negotiation logic aims at the reduction of annual global climate gas emissions to a sufficiently low level. This should allow humanity to stay within the limits of a continually decreasing total budget of still acceptable CO_2 emissions from fossil sources, summing up the emissions over the years until 2050. This **amount** is called the WGBU-budget restriction and is almost 750 billion tons (WBGU, 2008 and WBGU, 2011). There have been year-long debates as to the actual size of such a budget, its distribution among the nations and the related monetary transfers from the North to the South. A workable compromise has never been reached. Today, a climate contract as per the above logic is factually no longer feasible as the limitation of emissions would have to be to such an extent that it would render the preservation of wealth worldwide as well as the **legitimate economic growth ambitions** of emerging countries impossible. No government would be able to provide an answer to such a situation to its citizens. In the short term, present wealth is more important than potential future climate problems.

This is exactly why the world needs a new negotiation approach and a strong wildcard combined with an understanding of the fact that insisting on the present approach will bring about the ultimate climate risk. Increasingly stringent limitations while adhering to a continually decreasing remaining budget for still acceptable emissions until 2050 will no longer suffice. In the short term, we will not be able to implement a limitation to the necessary extent. The new task at hand is now to actively manage the atmosphere's CO_2 content. In doing so, the following observation is critical:

The CO_2 balance of the atmosphere has **two sides.** Besides the climate gas emissions aspect, there is the aspect of CO_2 retrieval from the atmosphere.

The latter must be massively pursued in the future in order to win time for the still indispensable climate-sensible reconstruction of our global civilization.

4. A New Logic

A potential new logic for a global climate contract, which is a pragmatic approach, was developed in Copenhagen in the form of a common understanding between China and the USA. This needs to be appreciated, pursued and implemented. This pragmatic proposal makes sense even today, though it is admittedly incomplete. The Copenhagen formula conceived by China and the USA is a realistic compromise which smartly extends and improves the Kyoto formula, which was renewed at the last minute in Doha for welcoming the time of transition. The Copenhagen formula may function as a basis for a global climate contract which could be signed in 2015 for validity till 2020 (or even earlier). As per the following logic, it would result in a significant improvement of the Kyoto formula:

> The **industrialized nations** will absolutely lower their emission levels and declare individually and voluntarily how much their emission levels are. The **non-industrialized nations** will lower their emission levels relatively to their economic growth rate and declare their current emission levels individually and voluntarily. Voluntary payments of industrialized nations into a climate fund for the benefit of non-industrialized nations shall support the non-industrialized nations.

The core of this compromise is voluntary self-obligation by the nations. Such a scenario is politically sustainable and allows the nations to orient themselves with their respective individual possibilities. All nations will be involved with the emerging nations, and will be required to curb limitations relative to their economic growth in the coming years. This will result in a (dynamic) cap of the overall emission volume, depending on the economic growth rates of the non-industrialized nations (Herlyn, E. L. A., Radermacher, F. J., 2012 and Radermacher, F. J., 2010). This is not yet the full solution to the climate problem but may be smartly amended in a modular way with other building blocks in order to finally form a complete solution. **The solution's weakness which lies in its incompleteness ultimately becomes its strength,** as it (1) can be accepted by almost all states and (2) is extendable by including the private sector in the right way. All major nations have already signaled their participation. This fact allows for the integration of **WTO border tax adjustments** with regard to non-participating nations as a powerful additional lever for the implementation of an airtight climate regime. It is almost a "Munchausen" scenario. The perfect solution is within reach because its "anchor" part is sufficiently unambitious to allow broad approval. However, still missing is the second half for which proper design and implementation are crucial. In this situation, wildcards are badly needed.

5. The Wildcards

Who will see to the decommissioning of emission rights in a wealth-compatible manner (closure of what is known as the **negotiation gap**) and who will subsequently see to the

retrieval of the emissions from the atmosphere which will still be too high despite the conducted decommissioning (closure of what is known as the **sequestration gap**)? What mechanisms can be employed for this task?

*Figure 1: A climate contract in line with Copenhagen and Cancún
– some caps and reduction paths*
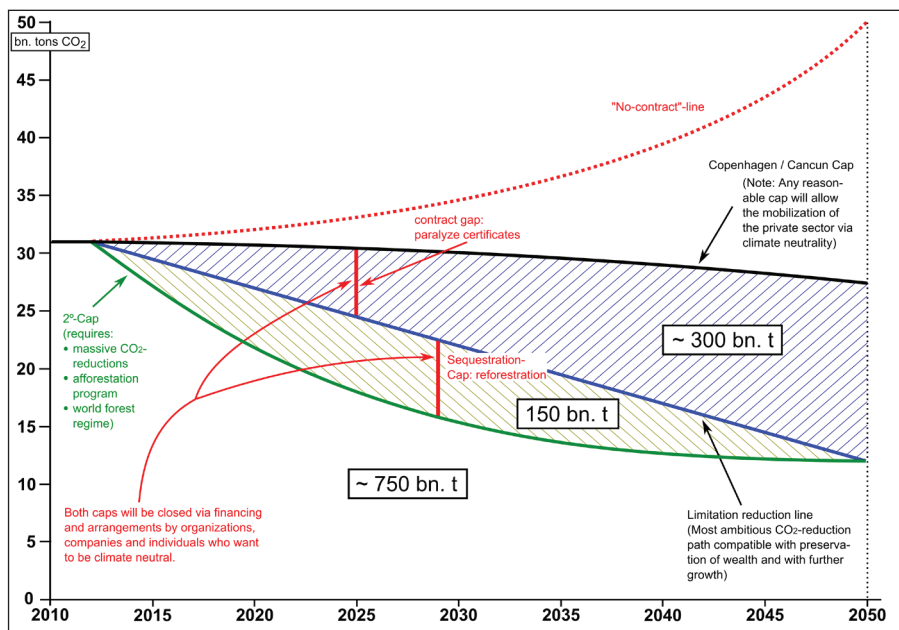
Fig. 1 shows the **present development** of global CO_2 emissions from fossil sources (red line), which is a disaster, and a (black) cap-line of the Copenhagen type, propagated as sufficient for the "anchor" part of a working global climate regime in this text. It shows further the approximated position of the **limit-reduction line,** compatible with global economic growth and development conditions, which has to be fixed every year politically at a technical level. And it shows the $2°C$ curve (green), which would be sufficient to stay within the WGBU budget restriction. The area between the black and the blue lines represents the **contract-gap**; the area between the blue and the green line, the **sequestration-gap.** These gaps have to be closed.

For the tasks described, e.g. to close the gaps, we have two wildcards on the table: (1) The **decommissioning of emission rights** to the extent in which it is compatible with global wealth and growth perspectives. The volume allowed to this end can be negotiated and agreed upon among the nations of the world on a yearly basis at the working level (and can be oriented along the experience lines of the previous years). (2) The retrieval of CO_2 from the atmosphere by means of forest protection, a **global reforestation program** and the intensification of land management.

Who is to pay for such measures? The implementation of the wildcards would cost a lot of money and the nations cannot bear this. Luckily, many actors from the **private sector** hurry to fill this gap today for **reasons of reputation,** for political ambitions, and for ethical reasons. Companies, organizations, private persons and an increasing number of actors want to position themselves in a **climatically neutral** manner. Large enterprises have already announced their climatically neutral position, just as the German land of Hesse (Hölscher, L., Radermacher, F. J., 2012), which targets climate neutrality by 2030 and which takes on a political vanguard role with regard to this topic. The important economic sector of customer brands of high value is already acting and puts pressure on its sub-suppliers under **CSR aspects.** Well-paying consumers and high-performance investors voice the respective demands towards brand manufacturers. **Hundreds of actors** are already involved in the field of **climate neutrality** today and many **millions of dollars** are activated annually for this purpose, see examples (Hölscher, L., Radermacher, F. J., 2012), (Deutsche Bahn, 2012) and (Handelsblatt, 2012). Switzerland will legally entrench the climate neutralization of its entire power generation sector. In Germany, the German chimney sweepers, the nation's lucky charms, who are experts on the environment and climate matters and visit each and every household at least once a year, have also already begun to take action (Bundesverband des Schornsteinfegerhandwerks). And the children's initiative "Plant for the Planet" has already mobilized hundreds of thousands of people on the issue and coordinated the planting of millions of trees (Finkbeiner, F., 2010). On top, the so-called Berlin Appeal (Emse, H., 2011) asks every citizen to make themselves climatically neutral.

The funding of climate neutrality through the private sector is the key to a functioning global climate regime. The annual 100 billion US dollars which are necessary for the **global climate fund**, also agreed upon in Copenhagen, which is to fund the cooperation of the North and the South in the field of climate protection, can be raised by selling certificates for decommissioning purposes. Today, nobody knows which money is to furnish the fund. The politicians' task at hand under the described approach is to establish the "anchor" part of the global climate regime according to the Copenhagen formula and then **merely** to create a platform for trade certificate (decommissioning; reforestation) which is free of risks for the reputation of the involved actors from the private sector and to "lean" with respect to bureaucratic requirements. This will not only satisfy the fairness requirements between the North and the South but also satisfy the **fairness requirements** between premium consumers and normal citizens (Chakravarty, S., Chikkatur, A., de Coninck, H. , Pacala, S. , Socolow, R. and Tavoni, M., 2009). The Gulf States, China and India, Mexico and Brazil already count a similar number of premium consumers as the wealthy part of the world.

6. "Out of the Box"

What is the new aspect of the second chance introduced for a functioning global climate regime, a chance, however, open for only 10-15 years to come and which may not be seized anyway? The governments of the world understand that they can no longer solve the climate problem on their own and not through the previously followed contractual logic. They also understand that a limitation of emission volumes alone no longer represents a sustainable

option. They understand that a stringent cap at the government level cannot be reached and that there is actually no need for such a stringent cap at the government level at all. A dynamic cap in compliance with the Copenhagen formula would suffice. This is one half of the solution. The second half is opening a "stage" for private actors such as organizations, companies and private persons who intend to position themselves in a climatically neutral manner in a way which is risk-free in terms of reputation and "lean" with respect to bureaucratic requirements. This affects the two available wildcards for achieving climate neutrality, that is to say the decommissioning of emission rights and the biological sequestration of emissions. Both wildcards are expensive and effective at the same time. The latter will withdraw CO_2 from the atmosphere on a large scale.

"We need to quickly abandon the dominating old negotiation logic and practice a new way of thinking."

CO_2 will become a productive resource for new wealth, especially in some poorer parts of the world. At the same time, this allows for partnerships for climate protection between the North and the South without which the global climate problem cannot be solved anyway.

"Only a massive dedication of systematic intelligence will open a window for the solution of the climate problem."

An airtight contract can be negotiated by 2015. A first draft of such a contract including a great variety of aspects to be considered can be found in (Radermacher, F. J., 2010). This contract could come into effect in 2020, if not earlier. If we implement large-scale reforestation day by day from today, even without a working global climate regime, then even the abundance of **additional emissions** prevailing in the meantime as a result of the global community's inability to reach its target of negotiating a climate contract by 2012 could be neutralized.

There is still a chance to reach the 2˚C target. However, even this window will close in some time since the areas for reforestation in the southern hemisphere with their 500 million hectares may be vast but not inexhaustible (World Resources Institute, 2010). For this reason, we need to get **out of the box** quickly, we need to quickly abandon the dominating old negotiation logic and practice a new way of thinking. We have maneuvered ourselves into such a precarious situation that only a massive dedication of systematic intelligence will open a window for a solution for the climate problem. Imagination and agility will become decisive resources in this matter.

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Bibliography

1. Bundesverband des Schornsteinfegerhandwerks, Zentralinnungsverband (Remark: German Federal Association of Chimney Sweepers, Central Guild Association). CO2OL - Aufforstung für aktiven Klimaschutz. (Remark: CO2OL - Reforestation for Active Climate Protection) www.co2ol.de

2. Chakravarty, S., Chikkatur, A., de Coninck, H. , Pacala, S. , Socolow, R. and Tavoni, M. (2009). Sharing global CO_2 emission reductions among one billion high emitters. *PNAS* Published online before print July 6, 2009, doi:10.1073/pnas. 0905232106; *PNAS* July 21, 2009 vol. 106 no. 29 11884-118882009

3. Deutsche Bahn (2012, November), (Remark: German Railway Organization). As of 1st April 2013 Bahncard and time ticked holders are offered the possibility to travel on ICE, IC and EC trains of the German railway organization powered by 100% green power at no additional cost. November 2012 news of the German railway organization. www.bahnnews.info/aktuelles/bernov12.htm

4. Emse, H. (2011). "Berliner Appell," *Klimaneutral handeln* www.klimaneutral-handeln.de (Remark: Appeal by the city of Berlin towards its citizens for climatically neutral behavior)

5. Finkbeiner, F. (2010). Baum für Baum. Jetzt retten wir Kinder die Welt. oekom Verlag

6. Handelsblatt (2012). "Paketdienst DPD wird grün," *Handelsblatt* No. 33, 27

7. Herlyn, E. L. A., Radermacher, F. J. (2012). "Klimaneutralität und 2-Grad-Ziel – Warum globale und regionale Bemühungen miteinander verbunden werden müssen" In Hölscher, L., F. J. Radermacher (Eds.): *Klimaneutralität – Hessen geht voran* (pp 36-41). Springer Vieweg

8. Hölscher, L., Radermacher, F. J. (2012). *Climate Neutrality - Hesse Leads the Way.* Springer Vieweg Verlag

9. Radermacher, F. J. (2010). *Towards a Working Climate Regime after Copenhagen*

10. Radermacher, F. J. (2011). "Wege zum 2-Grad-Ziel – Wälder als Joker" *Politische Ökologie* 127, Bürgerbeteiligung 3.0,. 128-131

11. Wissenschaftlicher Beirat der Bundesregierung für Globale Umweltveränderungen (WBGU; Eds.). (2008). Kassensturz für den Klimavertrag – Der Budgetansatz. Sondergutachten

12. Wissenschaftlicher Beirat der Bundesregierung für Globale Umweltveränderungen (WBGU; Eds.). (2011). Welt im Wandel: Gesellschaftsvertrag für eine Große Transformation. Hauptgutachten

13. World Resources Institute (2010). "Global Map of Forest Landscape Restoration Opportunities" http://www.wri.org/map/global-map-forest-landsape-restoration-opportunities. Washington DC, www.wri.org/

"BIOPOLIS"
Biopolicy for Greener and More Livable Cities

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Abstract

Urban centers are the engines which must bear the brunt of required changes to meet climate change mitigation goals, whilst continuing to provide social and economic opportunities. Restoring nature to the city is not a luxury; it is vitally important to our health and well-being. Biopolicy can help international decision-makers find new ways for understanding the relationships between cities and their environments and how environmental burdens may be mitigated or resolved. A "biopolis" model, as proposed and supported by the principles of biopolicy, can evolve into a coordinated program of action in sustainable urban management that limits emissions, preserves and expands green spaces, protects waterways, encourages urban farming, enhances cultural development, creates green jobs and promotes educational opportunities for all.

1. Building a "Biopolis" – The Road to Climate Resilient Cities

The biggest challenge for the 21st century will be the development of climate-efficient urban growth. With rates of urbanization increasing and per capita energy consumption on the rise, cities around the world are an important part of the climate change problem, but they can be an important part of the solution as well. For twenty eight years, the Biopolitics International Organisation (B.I.O.) has been sensitizing experts, decision-makers and the local authorities to promote new and innovative ways of achieving greener and more livable cities. Progress in this area has been extensive, and today, urban management policy is largely being developed with due concern for the environment. Moreover, green construction materials are increasingly sought after, while energy savings in buildings are promoted through renewable energy options and applications. Clean vehicles, public transportation based on alternative energy, optimum recycling, heating and cooling technology with the use of low-emissions/ low polluting systems, are a few examples of technologies which are vital to the development of green cities. Partnerships between governments, community groups and the private sector have proven very useful in shaping the urban landscape of tomorrow in an environmentally responsible manner.

Cities are home to about half of the world's population, and this proportion increases with each passing year. However, living in a modern city need not exclude experiencing the joys of nature. Cities in many countries have taken steps to restore the ambiance of natural

systems within their boundaries. They strive to become a "biopolis," an environmentally sustainable city, in which human and natural populations can live in harmonious balance.

Restoring nature to the city is not a luxury; it is vitally important to our health and well-being. Cities must become more livable places for their human populations and more inviting for wildlife. They should capitalize on their green assets and expand the presence of natural systems found within their boundaries. They can achieve this through a coordinated program in sustainable urban management that preserves and expands green spaces, protects waterways, encourages urban farming, and develops educational opportunities for all. In addition to providing vital environmental functions, such initiatives can greatly benefit the physical and mental health of the inhabitants, not to mention the local economy and the job market. The participation and empowerment of all citizens are vital to the success of any such program.

1.1 Reducing Urban Sprawl and Increasing Green Spaces

Land development affects the demand for transportation, and the provision of transportation facilities changes how land is used. Real progress toward sustainable urban management cannot be made without addressing this interconnection. Designing communities so that the demand for transport is less, discouraging urban sprawl, and supporting more compact communities where people can move more easily from home to work, shopping, etc., are essential for achieving livable cities with enhanced quality of life for all their citizens.

All green spaces help urban areas adapt to the impact of climate change and are vital in climate change mitigation efforts. Cities developing open space plans that provide for interconnected systems of green spaces, including parks, gardens, walkways and stream corridors, can reap multiple benefits. Increasing urban green spaces can be achieved by a variety of techniques, including outright purchase of undeveloped tracts, gifts and bequests of land, laws and regulations requiring that a certain percentage of new development be retained as open space, conservation easements restricting the use of land in the future to green space, and the creation of urban farms and gardens. In addition, cities should adopt programs for continuous tree planting along boulevards, in parks and along streams. Tree species should be carefully selected for their suitability to the individual area, and consideration should be given to native species, water needs, susceptibility to disease, and other factors. Trees with minimal maintenance requirements should be preferred.

1.2 Taking Advantage of Urban Waterways

Rivers and streams are natural corridors that transect many urban areas. They provide a great opportunity for recreation, education and contact with nature. Fishing, boating, and even swimming, depending on the water quality, are common activities along urban riverbanks. Urban waterways are vital urban environmental assets that should be protected and made an integral part of the open space system of a city. Pathways should be provided along stream corridors that connect to other paths in the city's pedestrian and open space network. Where appropriate, measures should be taken to protect wildlife, such as the enchancement of waterfowl nesting areas, while at the same time providing sites for passive, non-intrusive observation.

1.3 Clean Transport

To respond to the climate change challenge, urban transport policy must contribute both to solving traffic congestion and to reducing the demand for fossil fuels. Clean vehicles and public transportation based on alternative energy and greener transport practices and policies can reduce CO_2 emissions and improve efficiency. In addition, an ongoing evaluation of technologies is crucial in order to make sure that policies are well fitted to growing trends and that investment is not being made on unproductive schemes.

1.4 Employment and Education

Cities are areas of enhanced economic growth and opportunity. Urban areas have always created jobs, and attracted and trained talented and energetic individuals. From their origins as trading facilities to their emergence as centers of resource development and manufacturing, cities are the loci of economic activity for the majority of the world's population. Many people migrate to urban areas in search of employment and a better life, some successfully, others unsuccessfully. Some bring skills with them, but many do not. Because of this, cities have always struggled with balancing the needs of residents with the needs of the economy, especially during periods of economic downturn.

By training/re-training unemployed persons, urban communities can enhance their available human capital and promote positive economic improvement within their areas. Practical experience in the field, while making a direct difference to the community served, comes with extra benefit to the individual, as people experienced in sustainable development practices are highly employable in many economic sectors.

Furthermore, making cities adapt to climate change will require a well-trained cadre of professionals who understand the implications of climate change for urban development. City-specific educational programs about climate change in urban environments are also instrumental in achieving the mitigation of the impact of urban activities and climate development.

1.5 Agriculture in the City

Urban agriculture is often viewed as a holdover from the past and a use that will eventually give way to development. This view should be re-considered however. Farming and vegetable gardens in cities are valuable assets that can be encouraged and protected through appropriate city policy that supports the existence of urban agriculture and provides for its continuance. Organic farming, which eliminates the need for pesticides, is a preferable approach for urban areas in order to protect public health.

New concepts in urban design should incorporate natural elements and better integrate humans with the environment, wildlife and greenery. As proposed by B.I.O. since 1985, an extension of the existing roof that allows plants, trees and shrubs to grow in a light-weight growing medium, can be an effective strategy to address several environmental conditions facing urban environments, including management of storm water runoff and pollution miti-

gation. In this context, algae beds can be used to reduce greenhouse gas emissions, while creating an additional feedstock for renewable fuel production.

1.6 New Technologies – "Smart Cities"

Optimum recycling regimes, water management systems, heating and cooling technology with the use of low-emissions/ low polluting systems, are a few examples of new technologies which are vital to the development of climate resilient cities. Furthermore, technology can radically change the way people interact with the urban environment and allow them to get more engaged in decisions about where they live, a key part of shaping zero-emission cities in the future. The challenge of fast urbaniza- tion is opening the way for the development of highly "smarter" cities, as more and more urban functions rely on emerging

> *"Restoring nature and culture to the city would be a great step toward the creation of a true biopolis."*

technologies. The differentiating factor that can make cities "smart" is the integrated use of information and communication technologies (ICT) in optimizing the flow of informa- tion among infrastructure and services such as administration, education, healthcare, public safety, real estate, transportation, and utilities.

1.7 Bio-culture for Sustainable Urban Management

Culture is an essential element of a climate-friendly city. The environment is affected by our culture, which is, in turn, shaped by the environment. Bio-culture represents a conscious effort to reach this interdependence. Aesthetic values, music, science, the arts, politics, and economics can all come together in the struggle for a better quality of life. Bio-culture in the city can provide the needed momentum and life-supporting policies to contribute to a more efficient implementation of urban policies with a vision capable of reinventing cities adapted to the challenges of the 21st century.

Partnerships between governments, community groups and the private sector have proven very useful in shaping the urban landscape of tomorrow in an environmentally responsible manner. A climate resilient city also encourages its citizens to commit to sustainable actions in the areas of transportation, energy use, recycling, water, food, health, and community education. Cities that adopt a program of sustainable management with the ultimate goal of zero emissions will reap many benefits, both now and in the future. They will become more attractive, healthful and livable places, and the cleansing of pollutants from the air and the absorption of carbon by trees will provide long-term benefits for both humans and wildlife. Restoring nature and culture to the city would be a great step toward the creation of a true biopolis.

2. Climate Change Mitigation Through Urban Adaptation

Cities accommodate more than half the world's population and account for two-thirds of energy consumption and over 60% of greenhouse-gas emissions. Productivity levels are also generally higher in metropolitan areas and the increasing trade and capital flows give rise to

increasing flows of people, goods, services and ideas. In this context, urbanization is viewed as the primary cause of many problems, including climate change, but also as the primary stage for a more sustainable development in the 21st century.

In addition to being one of the biggest development challenges of this century, climate change also offers opportunities to improve the way we plan and participate in cities, and decide on how best to manage the role of urban centers with respect to local, regional and global environmental changes. Achieving inclusive and sustainable growth in cities can help to build vital social networks, and help individual citizens and the community as a whole to be involved and productive. It is also a means for improving employment options and creating green jobs with staying power.

Urban centers are the engines which must bear the brunt of required changes to meet climate change mitigation goals, whilst continuing to provide social and economic opportunities. Moreover, in an era of globalization in which cities are inter-connected through flows of trade, technology, investment, finance, and people, new environmental burdens and scales of applicable governance are constantly evolving that require fresh perspectives from management. Together, these pressures are rendering cities all over the world more vulnerable to both natural and human-induced threats. Therefore, planning policies to help alleviate complex environmental stresses requires new ways of understanding the relationships between cities and their environment and how environmental burdens might be mitigated or resolved.

At its most basic level, the core principle of sustainable urban planning is that we should plan for a better future. Establishing a better understanding of the urban decision-making process and how the principles of sustainable development can be incorporated at each level of decision-making can maximize the opportunities afforded by urbanization. Remedies for curbing urban growth and its negative effects often lead to other problems. As a result, city leadership in partnership with civil society and the private sector is crucial in guaranteeing growth which can meet the challenge of urban sustainability.

With urban activities being the main source for CO_2 emissions, the choices made by urban centers over the next few decades will play a crucial role in determining worldwide greenhouse gas emissions and natural resource depletion. Cities consume 60% to 80% of the world's energy production, and with the urban population of the developing world projected to reach more than 5 billion by 2050, ideas about how to combine urbanization and sustainability are of a critical and urgent nature.

Although climate change has become increasingly prominent on the international development agenda, historically the focus has been on the effects it has on the rural environment and agricultural production. This is slowly changing, as urban populations are likely to be among those most severely affected by future climate change, being especially vulnerable to changes associated with warming temperatures. Many of the world's growing urban areas, especially in developing countries, will likely suffer disproportionately from the impacts of a changing climate. Major cities are at risk of flooding from rising sea levels. Heat-trapping

urban landscapes – buildings and paved surfaces – can raise the temperatures and lower the air quality dangerously through the urban heat island effect. In cities of the developing world, one out of every three people lives in slums, making them particularly vulnerable to the health and environmental risks posed by climate change. Also, climate change may worsen access to basic urban services and compromise urban livelihoods.

Low-carbon emissions and low pollution levels are essential components of quality of life in cities. Better urban planning and policies can reduce energy use and greenhouse gas emissions and improve the resilience of urban infrastructure to climate change, thus shaping future trends. Competitive cities that are eager to attract human and financial capital in order to enhance jobs and prosperity need to curb air pollution and ensure a healthy environment. Energy-efficient housing, measures to reduce traffic and vehicle emissions and to promote non-motorized transport, contribute directly to the reduction of CO_2. Cutting emissions will also reduce local pollution from industries and transport, thus improving urban air quality and the health of city dwellers.

Significant action by cities on climate change will have positive economic returns in the future. Making cities adapt to the effects of climate change requires a commitment from city governments to allocate and invest resources in infrastructure and technology. Such a commitment may be hard to conceive in situations where resources are scarce at the local level, and other needs require urgent attention. However, action on renewable energy and energy efficiency in cities can significantly reduce municipal service operating costs and has enormous long-term benefits, as much of what needs to be done to reduce risks from climate change also reduces other risks. For instance, better drainage systems protect health and reduce risks of flooding, and good healthcare systems can support disaster preparedness and rapid post-disaster response.

The concentration of people and production in cities facilitates the creation of increased employment opportunities through actions to keep down energy requirements and support waste reduction and recycling. Modest adjustments to investment by choosing low-carbon technologies can, over time, bring much lower greenhouse gas emissions, even in cities with booming economies. Such adaptation does not require additional government spending, but is achieved by changing regulatory frameworks that influence individual, household, community, corporate and public investments (adjustments to building regulations, land use plans, pollution control, waste management, etc.). Some indicative actions, which are also sources of green jobs, may include:

- increasing the energy efficiency of urban infrastructure such as buildings and transportation systems
- using resources more effectively, i.e., through advanced waste and water management regimes
- producing clean energy at the district-level, as well as sourcing clean energy from large-scale suppliers
- encouraging and engaging all citizens in climate change efforts and making them aware of the consequences of climate change

It is up to high-income nations to show how a transformation to sustainable urbanization can be combined with high living standards. However, urgent action is also needed in the urban areas of low-income and middle-income countries, both through mitigation to curb greenhouse gas emissions, and adaptation to the serious risks that climate change brings. Each city shares challenges and has unique needs. Finding smart and efficient ways to provide for more people with fewer resources will make cities more resilient to climate change and reduce drastic environmental changes.

3. Zero-carbon Urban Networks

Climate protection essentially means addressing local problems in a way that significantly improves efficiency and prudence in the use of energy and natural resources. Many campaigns and initiatives are enhancing international efforts to curb greenhouse gas emissions by implementing measures at the local level in the transportation, energy, building and waste sectors. These measures call for integrated and collaborative planning and management regimes to transform conventional urban areas into environmentally sustainable districts based on a cyclical urban metabolism. Furthermore, these actions are instrumental in protecting urban environments and slowing global warming, and can ultimately lead to zero-carbon urban networks with virtually no carbon footprint.

Zero-carbon urban networks served by renewable energy are emerging increasingly in France for heating homes and commercial units. In the U.S.A., the city of Dallas, Texas, derives 40% of its urban electricity supply from renewable energy sources, and approximately 76,750 employees are involved in energy efficiency services, including lighting, heating and cooling, transport regulation systems, personnel and site protection. In Salt Lake City, Utah, municipal operations have reduced greenhouse gas emissions by 31% since 2001, well below the targets of the Kyoto Protocol. Over 20% of the electricity used at the City-County Building is from renewable wind energy that does not contribute to global warming. The city also encourages its citizens to commit to sustainable actions in the areas of transportation, energy use, recycling, water, food, health, and community education.

Barcelona, Spain, has installed a district heating and cooling network which engages 65,900 employees in the water management and waste sectors, who offer services in consultancy, water treatment plants and infrastructure, water cycle management, waste services, recovery, recycling and remediation. Amman, Jordan, recently constructed a wastewater treatment plant for 2.2 million inhabitants that is 95% self-sufficient in energy.

District heating is also widely implemented in Sweden, where strict environmental legislation guides public authorities to cooperate with the private sector in the creation of green cities. In this context, an initiative themed SymbioCity was launched by the Swedish Government in 2008 to promote collaboration between the Swedish government and the Swedish industrial sector in the creation of circular, carbon neutral systems. By 2009, the initiative had created business opportunities worth the equivalent of SEK 2.6 billion. It was assessed that employment for Swedish environmental technology companies could increase by 8% annually.

An ambitious plan is under way to make Perth the world's first geothermally cooled city with the goal of achieving zero emissions under a new $20 million Australian Government-funded project which involves CSIRO, Australia's national science agency, and The University of Western Australia. To achieve this goal the project is aiming to develop a geothermal solution to meet the cooling needs of the new Pawsey Centre supercomputer, one of the world's most powerful computers. The project will significantly reduce water use through direct cooling with groundwater and thereby save over 38 million liters of water each year compared to the standard cooling tower solution.

In China, Hong Kong boasts large modern landfill facilities with biogas recovery and on-site use, while a circular economy is generated from recycling sludge in Shanghai. Energy recovery is achieved using drying technology and the dry sludge is subsequently used as a combustible at a local power plant. The whole procedure, which serves 610,000 inhabitants, is carbon-neutral.

In Tehran, the capital of Iran, the preservation of non-renewable energy resources and efforts to use clean energy are among the most important issues the local administration has paid attention to. "Energy garden parks" have been established and solar cells have been placed on over 100 buses, 1000 traffic lights, 100 flyovers and other urban infrastructure. Large garden parks offer extensive green recreational spaces, while most highways are flanked by hillsides of green. A 70-hectare military base was turned into a park with recreational and sports facilities. Furthermore, 250 km of cycling track has been set up.

Climate change is an important issue to the citizens of Sønderborg in Denmark. The city is dedicated to creating and demonstrating new solutions, robust measurable CO_2 reductions, new green jobs and a talented generation of young people before 2029. A public-private partnership – Project Zero – was created to inspire and drive Sønderborg's conversion into a zero-carbon community, based on improved energy efficiency, conversion of energy sources into renewables and by uniting all of the area's stakeholders to reach a clear goal: carbon-neutral growth and sustainable urban development. Residents are collaborating on new green investments, while farmers are erecting their own wind turbines, demonstrating broad support for the Project Zero vision.

Energy-efficient technology is scattered throughout the German city of Freiburg, from the Strandbad swimming pool, which is heated with solar energy, to the university's clinic, which uses solar technology for cooling. Solar energy cells appear on many building facades and solar thermal tanks line the rooftops. The clustering of solar manufacturing firms, research institutes and policies for deployment in commercial, industrial and residential buildings earned Freiburg the nickname, the "Solar Region of Germany." In Vauban, a neighborhood on the outskirts of the town, 2,000 newly built environmentally friendly homes are located, including a 50-home solar village project that feeds more power into the grid than it uses. A nearby development incorporates a biomass heat and power plant that uses only 15% of the energy required by other homes in the city. In fact, Germany's low carbon framework explains why several other cities are leaders in energy efficiency. For example, Hamburg has also adopted its own strict climate action plans that support development of more efficient and technologically sophisticated buildings and transport networks.

4. Clean Energy Transforms the Transport Sector

The contribution of transportation to global emissions is 13%, and spurs climate change, releasing pollution and greenhouse gases into the atmosphere.[1] It is also a main source of noise and vibration. The air quality in most cities worldwide is poor as a result of vehicular traffic and represents a threat to human health. The construction and operation of highways and transit systems disrupt biotic habitats, pollute the water and permanently alter the landscape.[2] If our transportation patterns continue in the ''business-as-usual'' path, the global vehicle fleet will have reached 2 to 3 billion by 2050.[3, 4]

The possibilities of the use of clean and renewable energy in the transport sector are endless. The broad range of prototype fuel cell and hydrogen developments currently taking place is creating a new concept of car technology that has led to better functioning electric automobiles with no noise pollution and no exhaust gases. In the effort to reduce CO_2 emissions and improve efficiency, more innovative technologies have allowed a wider use of fuels and power sources and also the combination of more than one propulsion technique for a vehicle. Soon, conventional modes of transportation will be almost fully replaced by electric vehicles. These developments will lead to a greater and wider use of hydrogen cells, which are quickly becoming the wave of the future and resulting in new areas of research and development.

The efficient provision of transport services is crucial for this effort to succeed. To effectively respond to the climate change challenge, transport policy must contribute both to solving traffic congestion and to reducing the demand for fossil fuels. In addition, an ongoing evaluation of technologies is crucial in order to make sure that policies are well fitted to growing trends and that investment is not being made on unproductive schemes. This kind of analysis should be performed along with broader cost benefit analyses, taking into account environmental, social and economic benefits. The side effects of policies should also be carefully assessed, so that policies do not result in harmful outcomes.

Governments may have a role to play in supporting commercialization of innovative car technologies and fuels. New business models and ideas are important for the diffusion of green cars, so encouraging venture capital investments may be a fruitful possibility. Programs in support of the commercialization of eco-innovations have had mostly positive outcomes in terms of private fund mobilization and employment creation, although some concerns about management and effectiveness have been raised.

5. Urban Agriculture – Resilient Urban Food Systems

Across the globe, urban farms that provide fresh, local produce to city dwellers and create jobs for their communities are steadily thriving. An urban agriculture movement has been quietly gaining momentum for several decades, in the developed and developing worlds alike, evolving out of the need to address such pressing issues as food sustainability and security, urban population growth, year-round crop production, a safe and varied food supply, farmland and forest land loss due to development, creative use of wastelands in urban areas, and recycling of food wastes in cities. With city growth pushing cultivation land further and

further from city centers, urban agriculture also becomes more and more sensible because it can avoid the increasing costs of transport, packing and refrigeration and the losses of produce.

As a result of this spreading movement, poor urban populations have been encouraged to grow their own food in their own neighborhoods with impressive outcomes: urban farms have turned empty sites and abandoned lots of inner city neighborhoods into productive oases that contribute to sustainable urban development, and help to bring in income and improve local diets. For example, in Peru, small urban farms located in the poorest slums in Lima provide food security and food safety for some of the most vulnerable urban communities. There are currently over 100 urban farmers in Lima, 83 of whom grow vegetables, 52 raise small animals, 45 grow fruit trees, 31 grow aromatic herbs and 18 produce ornamental plants.

Employment potential also increases as several work opportunities arise in helping urban farmers to improve soil qualities and water sequestration and conservation techniques, which require specific skills. Value-added products and approaches for tapping new markets can be created in the process and become a source for new employment. Educational curricula can also be developed and implemented, especially in cases where urban farms are located near schools or educational and/or training centers.

Horticulture, the branch of agriculture concerned with intensively cultivated plants, supplements urban agriculture and has been shown to empower the urban poor, contributing to their food security and nutrition. It also helps to make the city greener and to enhance social and environmental resilience, from slum improvement and waste management, to an increase in employment and community development. To support horticulture and urban agriculture, especially in developing countries, the FAO has helped direct multidisciplinary projects in cities to improve policies and institutional frameworks. These projects include the promotion of irrigated commercial gardening at urban peripheries, hydroponic micro-gardens in slum areas and green rooftops in city centers.

But even in the developed world, urban farmers have been receiving land, training, financial support, supplies, and even compost from municipalities and NGOs to establish urban farms. In many cities in the U.S.A., for instance, sites designated for urban agriculture are able to receive protective status from the onslaught of developers anxious to turn them into high-priced developments, making them evolve into lucrative businesses. The Red Hook Farm, in the city of Brooklyn in New York, started by a local youth group in 2003 on an abandoned asphalt ball field, sold more than US$ 25,000 of produce by 2007. Another urban farm in Philadelphia took in some US$ 67,000 from its production of carrots, lettuce and radishes, while the Growing Power NGO in Milwaukee sold over US$ 220,000 worth of lettuces, winter greens, sprouts and fish to commercial enterprises and consumers. These successful organizations are helped not only by land and financial support; training has proven equally important to get these projects going, making the idea of urban farming particularly suitable for the unemployed. This training includes many aspects, from how to run an urban farm to organic farming methods. There is even a formal sixth-month training program available at the Center for Agroecology and Sustainable Food Systems in the state of California which urban farmers throughout the U.S.A. can attend.

Similarly in Europe, urban agriculture has been making promising inroads. In the metropolitan area of Delft in the Netherlands, effective and integrated land use policies have led to the creation of a unique organic farm on the outskirts of the town that has been providing not only healthy produce but also a recreational outpost and educational resource for a decade, while over 800 hectares of public land in London were already being used for gardening by the turn of the century both within the urban area and on its outskirts.

Asian countries have also seen a rise in urban agriculture. In and around the capital city of Vietnam, Hanoi, more than 150,000 tons of fruits and vegetables are produced each year. China has been including food production into its city plans since the 1960s and today receives more than half of its vegetable supply from its own market gardens, which are cheaper than trucking them in from distant sources. In Beijing, a growing number of urban farms have helped double the income of local farmers and improve the nutrition of the local populace. In Shanghai, 60% of vegetables, 100% of milk, 90% of eggs and 50% of pork and poultry come from urban and peri-urban areas.

In many regions of Africa, urban agriculture is extensively applied for the reduction of poverty and food insecurity, and the enhancement of urban environmental management. In the 1990s, urban agriculture in Nairobi offered the greatest self-empowerment earnings for small-scale enterprises and the third highest profits for urban Kenya. Correspondingly, Dakar, the capital and largest city of Senegal, is responsible for 60% of vegetable and 65% of poultry production nationally, while in Accra, Ghana, 90% of the city's fresh vegetable consumption is from production within the city. In the Democratic Republic of Congo, the FAO has helped devise measures regulating 1,600 ha of garden space to be operated by 20,000 full-time growers in five cities, introducing improved vegetable varieties and upgraded irrigation structures which extend water availability year round. To ensure safety and quality of production, 450 growers' associations were trained in good practices with organic fertilizers and bio-pesticides. In Kinshasa, 75,000 to 85,000 tons of vegetables, or 65% of the city's supply, come from market gardens.

Next to food security, local economic development and poverty alleviation, the environmental implications of urban agriculture and horticulture are also vital, as many environmental problems that accompany urbanization may be tackled with urban farming. Bogotá, Colombia, and Sao Paulo, Brazil, have benefited immensely from the improved soil structure and porosity caused by urban gardens, avoiding landslides and flooding. Urban agriculture can also help the "greening" of a city, by turning unattractive, abandoned open spaces, which are often used as garbage dumps, into green zones with positive micro-climate effects, including cooling and carbon sequestration. Many municipalities on Peru's arid coast were made "green" with the help of urban agriculture.

An exploration of the possible role of urban agriculture in future megacities is carried out in Casablanca, Morocco. Given the highly varied landscape of the urban area and the complex nature of the project, a multi-strategic approach is followed with the use of several specific goals pursued in a variety of ways. The key directives are to raise awareness about urban agriculture, begin implementing it and evaluating how it works and how it can be

improved in various contexts while observing what benefits it has for issues of sustainability and poverty alleviation in the city.

Urban agriculture is a powerful means for social integration as well. Disadvantaged groups, such as orphans, the elderly and the unemployed, have been involved in urban agriculture programs set up by NGOs or municipalities which are aimed at helping them integrate into the urban fabric and improve their livelihoods. Participants may feel enriched and empowered by these community projects in addition to the benefits reaped nutritionally and economically. In developed countries, the aesthetic and recreational aspects (recreational routes, fresh food educational functions, animal contact) of urban and peri-urban farms may play a bigger role in the promotion of urban agriculture. Indeed, with cities throughout the world already producing one-third of the food for local consumption, this trend is likely to continue as urban residents realize the dietary, economic, environmental and social benefits of growing their own food.

6. Zero-emission Cities Generate Employment

In view of climate change mitigation, cities around the world are re-examining their urban assets in terms of competitiveness, vibrancy and quality of life. Cities need to plan for the longer term to manage waste and conserve resources in order to be environmentally sustainable, socially progressive and economically competitive. Good governance and institutional frameworks are fundamental to sustainable urban management.

The goal of zero-emission cities has the potential to drive the development of new technologies and business opportunities. Development policies that fully harness the benefits of natural systems and protect and nurture these assets for future generations can enable local governments to lead an urban renewal process that delivers significant benefits, both economically and socially, and caters to the needs and priorities of key stakeholders.

"Sustainability can become established only when the mentality throughout the entire developmental process changes."

Cities everywhere are seeing the changes ahead, as well as the opportunities and commercial benefits associated with early action for climate change mitigation, such as the transition to a low-emissions economy. This recognition is already driving a range of employment opportunities across industries and services, such as the creation and implementation of alternative technologies and products, more efficient logistics and production processes, and associated services for better urban development.

Solutions addressing climate change strengthen community development, increase the livability of cities, improve the well-being of citizens and create green jobs. Green jobs can be found across traditional and new sectors, as many urban services make climate-smart improvements in their operations. Environmentally sound urban practices save money from reduced waste disposal and energy costs, create shared value and improve productivity through better environmental performance. Green jobs can result from the creation of new

employment opportunities or from the transformation of existing jobs through the upgradation of skills, and through organizations that green their existing practices to meet the growing demands of creative urban development.

Increasing transportation alternatives, reducing infrastructure costs, creating more affordable housing, improving air quality, preserving natural and cultural resources, and restoring local economic and social vitality are just some of the approaches for creative urban development. The building sector can make a substantial contribution to a sustainable world, but sustainability can become established only when the mentality throughout the entire developmental process changes. Cities that are not livable places are not likely to perform important economic functions in the future.

Green job programs are rapidly becoming high-profile centerpieces of many cities' environmental and economic development agendas. An example is set by the city of Vancouver in Canada, which has approximately 14,900 green jobs in eight sectors, based on numbers and surveys from March 2010 and April 2011. These jobs make up for more than 3% of the total jobs in the city. Indicative green jobs include, but are not limited to, green development officers, energy advisors, green funds managers, carbon offset aggregators, ICT networking specialists, smart grid engineers and technicians, smart meter manufacturers, industry association directors, green purchasing managers, policy analysts and researchers, and sustainability educators.

New York City has also launched several long-term sustainability initiatives to expand green jobs citywide. PlaNYC 2030 is a program created in 2007 which comprises 127 initiatives with 10 major goals, ranging from a 10-minute walk to a park to achieving the cleanest air quality of any big city in the U.S.A., in order to meet the goal of reducing citywide greenhouse gas emissions by 30% by 2030. Attempts to meet these goals create opportunities in many green employment fields, including building retrofits, urban forestry, renewable energy and storm water management, resulting in a 10-year planned investment of almost US$1 billion in municipal retrofits and new technologies.

Addressing the diverse aspects of urban environmental challenges will continue to be an aspiration and vision for many urban planners worldwide. Economically viable zero-emission communities can evolve from critical collaborations between developers and their city government counterparts, and foster urban development that improves the local environment and quality of life, and creates jobs. Such communities are underway in Melbourne and Sydney, Australia, in Palhoça and São Paulo, Brazil, in Toronto and Victoria, Canada, in Ahmedabad and Jaipur, India, outside Panama City, Panama, in Pretoria, South Africa, in Seoul, South Korea, in Stockholm, Sweden, in Sonderborg, Denmark, in London, U.K., and in San Francisco and Oberlin, in the U.S.A.

Information and educational resources should also become available to all citizens as tools for understanding and appreciating what it means to live sustainably and to become motivated to act as stewards of a sustainable city. Integrating environmental dynamics with urban systems must be viewed as a challenge and opportunity in helping cities contribute to sustainability. All these actions can serve as an inspiration and guide to communities around

the world that want to participate in the effort to reverse global warming and environmental degradation, while creating new sources of employment.

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Notes

1. Agni Vlavianos Arvanitis, *Green Salary. Reversing Unemployment in a Changing Climate* (Athens: B.I.O, 2013). 272

2. A. Vlavianos Arvanitis (2008) *Green Salary. Reversing Unemployment through Environmental Protection.* (Athens: B.I.O, 2008)

3. Biopolitics International Organisation, "Sustainable Urban Management" 2007 www.proudcities.gr/sustainable_urb_management.htm

4. Organic Urban Agriculture 2012 http://serviceinternships.com/internship/organic-urban-agriculture

Bibliography

1. *Future Cities: Lively, Livable, Productive* (2010) Annual Report on Cooperation with Developing Countries. Kfw and DEG Bank groups, www.kfw-entwicklungsbank.de

2. USAID, ICMA (2008) "CityLinks: Global challenges, Local Solutions" http://icma.org/en/icma/about/organization_overview

3. CNN (2012) "Hacking the City for a Greener Future", www.cnn.com

4. Cohen B. (2013) "The Top 10 Smartest Cities In North America and The Top 10 Smartest Cities In Europe", *Fast Coexist* http://www.fastcoexist.com/1680967/the-top-10-smartest-cities-in-north-america

5. Vlavianos Arvanitis A. (1995) "Biopolitics – the Bio-Environment – Bio-Culture and Business Opportunities" In A. Vlavianos Arvanitis (ed.) *Business Strategy for the Bio-Environment II.* A Symposium at the Harvard Club of New York City. Biopolitics International Organisation, Athens, pp. 7–19

6. Vlavianos Arvanitis A. (1996) "Biopolitics: A New Dimension of the Concept of Profit." In A. Vlavianos Arvanitis (ed.) *Business Strategy for the Bio-Environment III.* Biopolitics International Organisation, Athens, pp. 14

7. Vlavianos Arvanitis A. (2002) *Bio-Economics. In: Bio-Syllabus for European Environmental Education.* Athens: B.I.O. pp. 101–106

8. Earthwatch Institute (2012), www.earthwatch.org/europe/newsroom/corporate partnerships

9. Vlavianos Arvanitis A. (ed.) (2001) "Biopolitics – the Bio-Environment VIII Resolving the Environmental Crisis – The Need for an International Court of the Environment", Athens: B.I.O. International Conference 41–150 pp

10. Vlavianos Arvanitis A. (ed.) (1990) *Biopolitics – the Bio-Environment III. International University for the Bio-Environment.* Athens: B.I.O. 683 pp

11. Vlavianos Arvanitis A. (1996) "The Bio-Environment – Bio-Culture – Bio-Peace for the Next Millennium" In *Biopolitics – The Bio-Environment Vol. V* A. Vlavianos Arvanitis (ed.) Athens: B.I.O., 1996, pp. 51-66

Book Review –The Climate Bonus:
Co-benefits of Climate Policy

Alison Smith (UK). London & NY: Earthscan/Routledge, Jan 2013, 408p, $59.95pb.

Review by Michael Marien
Director, Global Foresight Books;
Fellow, World Academy of Art and Science

For several decades, we have heard, over and over, that climate change is a very bad development, and that addressing climate change and evolving to a sustainable or low-carbon society are a necessary response—seemingly painful in the short term, desirable in the long-term however. But how desirable?

Smith, an environmental policy consultant to the UK government and the EC, who has been a lead author for the IPCC, provides a detailed, systematic overview of the many benefits of a green economy, concluding that *"Far from being a burden on society, tackling climate change presents us with an opportunity to move to a cleaner, safer and healthier world."* (p.334)

The climate debate has polarized into one of the pressing immediate economic needs vs. the long-term, uncertain, and largely invisible threats of climate change that are easy to ignore. "Yet this misses the bigger picture. *Low-carbon policies often provide a whole range of additional environmental, social, and economic benefits. These often-overlooked co-benefits can help to offset the financial cost of the technology and boost its political acceptability…*

Many of these benefits are far more immediate and visible than the impacts of climate change, and can provide a much stronger motivation for supporting the move to a low-carbon society. For many low-carbon policies, we might argue that the co-benefits alone would justify their adoption even if climate change did not pose a threat." (p.2)

Great progress has been made in reducing air pollution over recent decades, but these technical advances have been partly offset by the rapid growth in vehicle use and electricity demand, such that "air pollution limits are still being exceeded." Many of the co-benefits of climate policy are linked to reducing use of fossil fuels. The ***main policies*** for cutting the climate impacts of fossil fuels are 1) improving energy efficiency and promoting energy-saving behavior; 2) switching to low-carbon energy sources such as renewable energy and nuclear power, or switching from high-carbon coal to medium-carbon gas; 3) reducing methane emissions from coal mines and oilfields by collecting the gas and using it instead; 4) reducing waste of materials by re-use and re-cycling; 5) carbon capture and storage; 6) geo-engineering to reflect sunlight. The first four options give rise to three major sets of co-benefits: cleaner air, safer and cleaner energy, and energy security (which reduce risks of price spikes, supply disruption, and conflict).

Six chapters enumerate the many co-benefits, while also discussing conflicts and "the way forward."

1. ***Cleaner Air: Cutting Pollution.*** Co-benefits for health, ecosystems, and the economy include: 1) lower incidence of premature death and illness from heart and lung diseases and cancer; 2) lower health costs; 3) less work time lost due to pollution-related illness; 4) healthier forests, streams, lakes, and other ecosystems; 5) reduced damage to buildings from acid rain and soot; 6) increased crop yields due to reduced ozone concentrations; 7) cost savings of installing and operating pollution control equipment.

   Air quality benefits offset much of the climate policy cost, and can even exceed it. However, policies to address climate change and air quality have been separate: air quality has typically been the responsibility of local or regional governments, while climate change is a global issue. "There is an urgent need for a more integrated strategy to maximize the synergies and minimize the conflicts between the two goals." Twelve "win-win options" good for both climate and air quality are listed.

2. ***Greener Land: Forests, Food, and Farming.*** Better land management is essential to meet climate targets. Deforestation and agriculture account for about 24% of GHGs, yet with best practice both could be carbon-neutral by 2030. Co-benefits include: 1) protecting biodiversity, which is currently declining at an alarming rate (the main driver of this decline is habitat loss); 2) water catchment, flood protection, and soil protection (trees perform a vital function in stabilizing soil, providing clean water, and preventing floods); 3) reduced air pollution from forest fires (the risk of fires increases significantly when forests become degraded, leading to lost tourism revenue, healthcare costs, more carbon emissions, etc.); 4) preserving livelihoods for indigenous people and workers in the forestry sector; 5) preserving ecosystem services to poor communities (estimated at >$1 trillion per year); 6) preserving aesthetic, cultural, and spiritual values of forests; 7) reducing soil erosion, as well as air and water pollution; 8) improving farm incomes by cutting fertilizer costs, boosting yields, and enhancing resilience to climate change (by adding organic matter to soils or leguminous cover crops, and conservation tillage); 9) agroforestry (planting trees and shrubs) can diversify and improve farm incomes.

   Badly-designed policies, however, can undermine the co-benefits or even make the situation worse, e.g. support for biofuels can lead to clearing natural habitats, and payments for forest carbon can lead to land grabs, corruption, and fraud. The way forward is to expand protected areas (some 14% of forests are currently protected—in theory), put an economic value on forest carbon through a well-designed REDD system (Reduced Emissions from Deforestation and forest Degradation), cut perverse subsidies, curb rising demand for paper and timber, clarify ownership of forests and improve governance, support certification schemes (promoting sustainable timber, paper, and food), reduce emissions from nitrogen fertilizers and methane, eat less meat and dairy products, and increase carbon in agricultural soils by burying biochar and by integrated pest management.

3. ***Secure and Safe Energy. Adapting to Peak Oil.*** Dependence on fossil fuels poses risks for energy security. There is a consensus that we face a future of rising oil prices, more frequent supply disruptions, and escalating oil-related conflict. The "drill, baby, drill" approach to energy security, including exploitation of shale gas, will not prevent dangerous climate change. Gas supplies are more secure than oil supplies, but "Peak Gas may be closer than we think" (p.121) because data on gas reserves are less reliable than for oil reserves.

    The co-benefits of a strategy based on cutting energy consumption and waste, and shifting to low-carbon energy: 1) more secure energy (fewer blackouts and brownouts; reduced rationing, long queues, and steep price increases); 2) more affordable energy (lower prices in the long term), cheaper energy services, better price stability; 3) safer and cleaner energy (reduced risk of oil spills, coal mine accidents, and ecosystem damage from fossil fuel extraction); 4) reduced use of water for fracking shale gas (about ten times more than the quantity used for conventional drilling); 5) clean energy access for all (1.3 billion people still have no access to electricity, and 2.7 billion people rely on traditional biomass for cooking); 6) switching to shale gas will not keep us within safe climate targets, and displaces development of renewable energy; 7) "total coal production could peak between 2020 and 2050" (p.123); 8) "peak uranium" is possible: the best reserves are becoming depleted and rising demand for nuclear power could lead to a major risk of short-term supply shortages.

4. ***Less Waste: A Resource-Efficient Economy.*** Material efficiency is just as important as energy efficiency, because over half of GHGs come from making material goods such as houses, cars, food, clothing, and appliances. We can choose low-impact materials, cut waste, minimize packaging, and increase recycling, reuse, and repair.

    The co-benefits: 1) avoiding resource-related conflict and instability; 2) reducing impacts of extracting and processing resources (e.g., pollution, landscape danger); 3) reducing costs and impacts of waste disposal in landfill sites and incinerators; 4) saving money for households by improving the durability of goods and reducing food waste; 5) making businesses more competitive by saving money on materials, water, energy, and waste disposal; 6) conserving scarce resources as we face possible "Peak Minerals" and increasing cost of extraction.

    A consensus is emerging on several priority areas: the growing problem of electronic waste, construction materials (the bulk of waste in most countries), food waste (large amounts of food are wasted due to storage problems and wasteful consumer habits; cutting this waste can alleviate a wide range of problems such as use of land, water, fertilizers, and energy), eco-design of products and processes, etc.

"To facilitate the transition to a low-carbon economy, new economic thinking is needed that expands the definition of progress and well-being beyond the GDP measure."

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5. ***A Stronger Economy: Long-term Stability and Prosperity.*** For most of the 20th century, the economy and the environment were seen as being in conflict. "This old view of climate policy as an economic burden is giving way to a new vision of a dynamic, prosperous green economy" (p.222). Co-benefits include: 1) more jobs because low-carbon businesses are often more labor-intensive (fear of job losses has been a major barrier to climate action); "compared to fossil fuels, renewable energy creates more jobs per dollar invested, per unit of installed capacity, and per unit of power generated" (p.227); 2) cost savings to households and businesses (likely to become more important as prices for energy, materials, food, and water continue to rise); 3) a low-carbon future will encourage rapid introduction of smart, clean, and efficient technologies; 4) protection from resource price shocks and shortages, which lead to economic and social instability.

   To facilitate the transition to a low-carbon economy, new economic thinking is needed that expands the definition of progress and well-being beyond the GDP measure. Alternatives to GDP are briefly discussed (p.277). "Because of our fixation on growth as the means to solve all problems, we have not even started to discuss and research the best method of adapting our economy to fit within the ecological limits of the planet" (p.279). Conventional economists have avoided debate, and "lack of debate is in fact the main obstacle to achievement of a prosperous low-carbon economy" (p.282).

6. ***Health and Well-Being: Benefits of a Low-Carbon Lifestyle.*** Active travel (walking, cycling), a low-carbon diet, and less materialistic lifestyles can mitigate public health problems related to physical inactivity, poor diet, and stress. Co-benefits include: 1) health and fitness (1 billion people eat too much or too much of the wrong type of food and are physically inactive; low-carbon diets tend to be healthier); 2) walking and cycling can lead to safer and quieter streets; 3) shifting toward shorter working hours (rather than more material consumption) can reduce unemployment, redress the work-life balance, and improve community cohesion.

   The way forward involves promoting lifestyle changes (to make sustainable behavior easy, cheap, and attractive compared to the alternatives), encouraging low-impact diets, enabling sustainable travel choices, and highlighting the benefits for well-being of a less materialistic lifestyle.

Conclusion

"For too long, governments have looked at climate change in isolation, failing to consider the impacts of climate policy on other areas and missing the co-benefits and conflicts" (p.322). To reap the full benefits of *The Climate Bonus,* we must look at the big picture and integrate it fully with other concerns such as energy security. "We need to take all the co-benefits and conflicts of different policy options into account, and set up an integrated policy framework" (p325). This is illustrated with two visions of the future: one in which we continue with isolated policy initiatives and fossil fuel lock-in (business as usual), and one in which we move to joined up policies for a green economy, after listening to scientific advice on safe levels of greenhouse gas emissions. In this scenario, carbon emissions by 2050 are

reduced to the point where the worst impacts of climate change have been avoided, and the natural world is thriving, with vibrant forests, clean air and water, and abundant wildlife. Total costs of a strong and coordinated climate policy are affordable (about 2% of GDP) and are outweighed by the co-benefits.

COMMENT

Many books have been published on sustainability; this one is different because of its strong positive focus on "the climate bonus." It is an excellent example of the much-needed integrative thinking, identifying some 37 overlapping and reinforcing co-benefits in six major categories: cleaner air, greener land, safe and secure energy, less waste, stronger economy, and improved lifestyle. Many of these arguments for sustainability have been made extensively, but in relatively piecemeal fashion and without the emphasis on positive co-benefits, as well as conflicts and cautious ways forward. This synthesis is backed up with some 450 references, including recent thinking by OECD (e.g., *Towards Green Growth;* GFB Book of the Month, August 2011), the International Energy Agency, the World Bank (e.g., *A Smarter GNP: Factoring Natural Capital into Economic Decision-Making*), and the UNEP's 2011 report *Towards a Green Economy.*

> *"Diversity is often a strength, but too many fragmented approaches to promoting sustainability may weaken progress in realizing this necessary and desirable transition."*

The 37 co-benefits, taken together, make a powerful case for sensible climate-relevant policies. The major problem, however, is that this encyclopedic work is difficult to digest and communicate, compounded by the $59.95 price which will deter many would-be users. The message of many attractive co-benefits needs to be widely disseminated in a number of ways so that it enters general political discourse, with this book ideally serving as a foundation. A more popularized version of this message, for example, is James Gustav Speth, **America the Possible: Manifesto for a New Economy** (Yale University Press, Sept 2012, 272p; brief version in Solutions journal, 4:1, April 2013). Also see the Worldwatch Institute, **State of the World 2013: Is Sustainability Still Possible?** (Island Press, April 2013, 441p), with 34 chapters on getting to sustainability—but without Smith's focus on co-benefits.

Diversity is often a strength, but too many fragmented approaches to promoting sustainability may weaken progress in realizing this necessary and desirable transition.

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New Paradigm in Human Development:
A Progress Report

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The current socio-economic-political paradigm is destroying our most precious capital – natural, human and social. The current paradigm is non-sustainable. It has to be changed! The required paradigmatic change will have to be one of the most dramatic in the history of humankind, comparable to or even more profound than the agricultural, commercial, democratic, and industrial revolutions of the past.

Recent WAAS conferences at the United Nations in Geneva and Library of Alexandria in June 2013 and at round tables in Washington DC and Ottawa this September have advanced the Academy's systematic exploration of the need and potential for the emergence of a radically new global paradigm of human development.

A clear understanding of the past and present constitutes essential foundations for knowledge of the future. Therefore, considerable attention has been focused on radical social changes that have occurred in the past, such as the unprecedented transitions in society and politics marked by the New Deal in the 1930s, the founding of the UN after World War II, the end of the Cold War, and the progressive emergence and expansion of the European Union. Our study includes an investigation of the forces that compelled these transitions and the circumstances that precipitated them. These turning points show that radical changes can and do occur, often suddenly and with surprising swiftness.

Equal importance is being placed on trying to more fully comprehend the characteristics of the present paradigm, including the intellectual premises on which it is based, the social institutions through which it acts, the entrenched values that support its continued existence, and the fundamental flaws that compel its eventual demise. The Academy's meetings are exploring fatal weaknesses in the present system, including flawed concepts such as unlimited national sovereignty and competitive security; flawed institutions such as unregulated financial markets and governance by plutocracy; and flawed policies that support destabilizing speculation, ever widening inequalities and ecological destruction at the expense of full employment, human security and sustainable development.

Radical change can only be effected by irresistible forces of social evolution that will not be denied. Therefore, the Academy also seeks to identify the deep drivers that are active

today beneath the surface emanating weak signals of more powerful tumultuous future events. These drivers include intellectual changes such as the growing understanding of the role of complexity and uncertainty; technological forces revolutionizing communications, education and the media; the persistent force exerted by the claim of human rights and social justice; the forces of democratization; demographic forces that are shifting the epicenter of global society; rising levels of unemployment in the West combined with rising levels of prosperity in the developing world; the emerging global Middle Class and the frustrated expectations of those that have been left behind; and ecological warning signs that refuse to disappear and will not be ignored.

Our endeavor to formulate a new paradigm draws substantially on earlier activities of the Academy. Recent WAAS programing on individuality, limits to rationality, employment, new economic theory, international security, global rule of law and human capital coalesce in the realization of the need and outlines a new human-centered social, economic, political paradigm designed to enhance human and social capital and preserve the richness and diversity of our natural capital.

This creative exercise to envision alternative pathways for human development also involves an examination of new concepts such as a more comprehensive notion of human security; of financial and economic institutions rededicated to their original purpose of promoting human welfare rather than fostering rising levels of insecurity, inequality and unsustainable exploitation of the natural environment; of political institutions of global governance responding to and reflecting the collective will of humanity as a whole; and of social institutions capable of delivering quality education and healthcare to all people everywhere.

Envisioning a new paradigm is an act of creative imagination. The effort initiated by the Academy is far from complete. But our early explorations have convinced us that viable solutions do exist for the pressing problems confronting humanity today, provided we have the courage to ask challenging questions and the willingness to entertain new approaches. Creativity is required to define and develop and imagination is required to formulate the new paradigm and to formulate effective strategies for realizing it in practice.

Our endeavor is based on the premise, indeed the deep conviction, that the human being is the source of unlimited creative potential and that the present paradigm falls far short of fully developing the potential of its members. Solutions exist because unutilized human potential exists in abundance waiting to be developed and released. There must be and is a better way. History compels us to seek to find it. Humanity's remarkable achievements in the past give us confidence that we are capable of fashioning a better future.

This endeavor to define, develop and formulate a new paradigm demands, on one side, research, education and creativity and, on the other side, an integrated activity by a network of committed global organizations. Therefore, parallel to its intellectual effort, the Academy is seeking to establish an umbrella group in which several global organizations can work together to envision and promote a new and better paradigm for all humanity.

Seeking Alternatives in a Global Crisis

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"The 21ˢᵗ century will finally be the century of the people".

Abstract

Replacing the United Nations system and large international institutions with plutocratic groups (G-7, G-8, G-20) and universal principles with the laws of the market has led to multiple crises that require immediate reaction to prevent them from becoming irreversible.

Neoliberalism has placed military, energy, economic and media power in the hands of a very few (the "great domain"). The markets – for the most part undeservedly "rescued" – are now harassing political leaders, making democracies progressively more vulnerable and even appointing governments without elections (including in Greece, the cradle!).

For the first time in history we have the means for mobilizing people and involving citizens in local and global government, which enables us to affirm that we are living in fascinating times in which radical changes are now feasible.

The possible solutions – that may render many of today's impossibilities as realities of tomorrow – must inevitably be based on equal dignity for all human beings and on social justice. Placing ethical and democratic values at the forefront of public and private activities so that social justice rather than the markets manages the economy at all levels will enable us in a few years to rectify our present misguided direction and get back on course.

The "refounding" of the United Nations is one of the most important and urgent means of rectifying the present trends, to endow humanity with the required guidance, coordination and justice systems.

The reforms at the UN for global governance and actions to be urgently undertaken are presented. Access to food, water, health services, education and environment care is essential for the historical transition from a culture of imposition and violence to a culture of conciliation and peace. From force to word.

1.1 It is impossible to continue sticking to old conventions as we have done until now

As is to be expected, replacing the United Nations system and large international institutions with groups of plutocrats (G-7, G-8, G-20) and universal principles with the laws of the

market has led to multiple crises that require immediate action to prevent them from becoming irreversible:

- Food crisis
- Climate crisis
- Social crisis
- Financial crisis

Neoliberalism has placed military, energy, economic and media power in the hands of a very few (the "great domain"). The markets, undeservedly "rescued" for the most part, are now harassing political leaders, making democracies progressively more vulnerable.

1.2 We are now at a Turning Point

Although the majority of political decision-making is still in the hands of men, for the first time in history the percentage of women in decision-making positions has increased; gender equality is advancing and civil society is becoming aware of its power, heralding a rapid transition from subjects to citizens which will prompt transformations that were previously unthinkable.

1.3 The Crucial Role of Communications

Communication has increased globally and despite the huge amount of biased and partisan information emanating from the media, there are still audiovisual and print media that provide reliable and independent news. Noteworthy among them is the emergence of *Al Jazeera* in the Arab world, which has prompted the dissemination of information and dialogue among other cultures and countries that until recently were virtually isolated.

But in that regard the most important change (to the extent that it will shortly prompt not only an epoch of change but also a change of epoch) is the "new beginning" proclaimed in the *Earth Charter*, which, thanks to cyberspace and new communications technology, will be facilitated by distant participation and will have an extraordinary impact in shaping the other possible world that humanity longs for and deserves.

2.1 The Current Great Challenges

- Attempts at world governance by the "G groups".[1]

- An economy based on greed, speculation and outsourcing of production. The result of neoliberalism, in which the market has replaced values, has been catastrophic for mankind as a whole: social inequality has increased; multinationals have not only received economic power from nation-states but political responsibility as well, which is very troubling; and the lack of regulatory and sanctioning mechanisms to address supranational transgressions promotes sinister trafficking in weapons, drugs, people, patents and capital with total impunity… The existence of tax havens is likewise one of the greatest challenges for "normalization", which is required on a global scale.

- Immense military spending (4,000 million dollars daily) with the aggravating circumstance that the majority consists of outdated military hardware appropriate for past wars, which is useless in present-day conflicts.

- Exploitation instead of international cooperation, frequently implemented through huge consortia that blur the political responsibilities of governments and open wounds that are very difficult to heal in co-existence on an international scale.

- Untenable social inequality. Only 17% of mankind lives in the world's "wealthy neighborhood", the rest being distributed in progressive levels of hardship, with over 1 billion people living in conditions below poverty line. In that regard, food security[2] undoubtedly deserves special attention.

- Undue delays in courts, mechanisms, and legal institutions in charge of enforcing International law, resulting in numerous delinquents and offenders who act with total impunity.

The majority of these challenges began in 1989 or have increased ever since – the end of the "Cold War" – when expectations of global understanding, particularly through actions coordinated by a United Nations system duly endowed with the necessary personal, technical and financial resources, could have responded to the hope generated by the bloodless fall of the Soviet Union, the elimination of racial apartheid in South Africa and the successful conclusion of several peace processes (in El Salvador, Mozambique, Guatemala etc.).

"The possible solutions – that may render many of today's impossibilities as realities of tomorrow – must inevitably be based on equal dignity for all human beings and on social justice."

However, in just two decades, neoliberal "globalization" has prompted multiple (social, economic, food, environmental, democratic, ethical…) crises in which we are presently immersed; but for the first time in history we have the means for mobilizing people and involving citizens in local and global government, which enables us to affirm that we are living in fascinating times in which radical changes are now feasible.

3.1 Possible Solutions

…*"to face great challenges it is necessary to surpass the limits of what is possible".*

Dilma Rousseff, Brasilia, January 1, 2011

The possible solutions – that may render many of today's impossibilities as realities of tomorrow – must inevitably be based on equal dignity for all human beings and on social justice. Placing ethical and democratic values at the forefront of public and private activities, so that social justice, rather than the market, manages the economy at all levels, will enable us in a few years to rectify our present misguided direction and to get back on course.

- The "refounding" of the United Nations is one of the most important and urgent means of rectifying our present course, to endow humanity with the required guidance, coordination and justice systems. A transition from the current plutocracy to the "democracy" that the United Nations represents − certainly including within its scope the International Monetary Fund and the World Bank for Reconstruction and Development, as well as the World Trade Organization (deliberately placed in the early 1990s outside of the System's institutions), which along with a General Assembly with representation from member nations, international institutions and civil society − would provide the broad framework for governance and the international reference that the world needs. This multilateral framework must rapidly be adopted, if necessary through an immense mobilization of citizens, so that the power unduly ceded to the 20, 8, 7, 6… 2… 1 most wealthy countries of the world may cease. A diverse world urgently requires a plural system of governance, which must immediately be endowed with all the necessary resources.[3]

It is certainly true that the UN cannot be replaced by G groups that lack the institutional framework to enable them to implement any decisions taken.[4]

With all of the appropriate weighting of votes, but without veto rights, there would be three councils:

- Security Council
- Social and Economic Council
- Environmental Council

Together with BRIC (Brazil, Russia, India and China), other regional associations would be promoted: in addition to the United States (with Canada) and the European Union, in a few years, UNASUR in Latin America, the African Union, Central Asian and Southeast Asian organizations would become well established to facilitate world governance and the rapid formation of great alliances in the aforementioned areas, to avoid conflict to the maximum extent possible.

The capacity for foresight that must be present, especially in this type of systems, would likewise facilitate adoption of preventive measures and the means for reducing the impact of natural catastrophes.

In addition, the International Court of Justice and its associate legal institutions must be afforded greater efficiency to ensure strict enforcement of international law.

In that regard, over the years the United Nations has issued a series of essential document guides that, if implemented, would resolve many of the problems addressed.

In addition to the "classic" documents (United Nations Charter, Universal Declaration of Human Rights, Agenda 21, Commitments for Social Development, Declaration and Action Plan for a Culture of Peace), I would like to mention other more recent ones that could free us from the latest "pitfalls" of neoliberal globalization, such as the Declaration of the Latin American and Caribbean Unity Summit and the Cancun Declaration (on the international

financial crisis; trade; energy; science and technology; social programs and the eradication of hunger and poverty; food and nutritional solidarity; education, health and public services, migration, gender; sustainable development, climate change; natural disasters; human rights; the global drug problem; terrorism …).[5] In that regard the Cancun Declaration addresses practically all of the great challenges of our times… The problem is that the market still dictates the guidelines for politicians' conduct. But as I have already indicated, this undoubtedly won't last much longer.

Regarding Spain, an excellent report entitled "Global Change for Spain 2020/2050 – Energy, Economy and Society"[6] was recently published.

"It is important to rapidly implement a genuine policy of alliances, summits and dialogues to increase transparency in relationships and behavior that at present, and unfortunately as is quite obvious, is motivated exclusively by profits."

3.2 Some of the measures that should be adopted by the abovementioned councils of the new United Nations "System":

Security Council

- Nuclear Disarmament. Implement the decisions concerning progressive arms reduction (September 2009) recently agreed at an extraordinary session of the Security Council presided by President Barack Obama.

- New strategies. New weapons. The weapons industry "colossus" must adjust itself to the world's real security needs, ceasing to manufacture and impose on the "allies'" military equipment designed for past conflicts.

  - A "reasonable" level of disarmament is essential in the fight against poverty and in promoting universal access to education.[7]

- Coordination to reduce the impact of natural and man-made catastrophes. It is as incomprehensible as it is unacceptable that powerful countries that are armed to the teeth are totally helpless when faced with natural disasters, even recurring ones. There already exist appropriate closely-studied measures for different types (earthquakes, floods, fire volcanic eruptions etc.).[8]

- Capacity to arbitrate and resolve conflicts. When warranted, Blue Helmets and technology can be deployed proportionally in those conflicts that can't be prevented. They would likewise have the capacity to resolve disputes involving authoritarian regimes such as China, and in inadmissible situations of dominance, as is the case of Israel with respect to Palestine.

- Broad powers concerning legal systems that contravene human rights (the death penalty, for example).

- Peaceful co-existence. Security forces must ensure compliance with law, progressively reducing the hugely expensive military installations that to-date represent a large part of domestic spending in addition to the armed forces, with citizens being obliged to submit to the will of the states with power. The transition from a culture of violence and war to a culture of dialogue and peace would provide not only positive benefits in welfare and quality of life, but also boost citizens' self-esteem and reduce one of the largest and most inefficient areas of national economies. For this reason it is important to rapidly implement a genuine policy of alliances, summits and dialogues to increase transparency in relationships and behavior that at present, and unfortunately as is quite obvious, is motivated exclusively by profits, while distractedly looking the other way.

  - "It is important for us… to make sure that we are talking with each other in a way that heals, not that wounds", declared President Obama recently in an excellent speech in Tucson, Arizona. As he likewise did in El Cairo in June 2009 when offering an outstretched hand to Islam instead of declaring it an "axis of evil" as his predecessor George Bush did, the current President of the United States is attempting both at home and abroad to prompt a genuine "change of culture", which would have so much impact and significance on the legacy that we must leave to the coming generations.

Social and Economic Council, to achieve throughout the world:

"[The world needs] Foresight and capacity for immediate action to correct speculation and outsourcing of production, with profits that conceal precarious living and working conditions."

- Monetary, financial and trade regulation, especially through the corresponding, duly "remodeled" institutions (IMF, WB and WTO).

- Immediate elimination of tax havens.

- Strict supervision of supranational trafficking, particularly of drugs that, like tobacco and alcohol, would be available at moderate prices, since it has been proved that high prices have no dissuasive effect and only promote mafias and narco-terrorism – currently experienced by conflict-prone countries such as Mexico – especially because the largest consumers (such as the United States) insist on reducing offer (exterior) rather than demand (interior).

- Foresight and capacity for immediate action to correct speculation and outsourcing of production,[9] with profits that conceal precarious living and working conditions.

  - "The financial markets have demonstrated their nearsightedness", wrote Nobel Prize winner Joseph Stiglitz[10]… "Only political change will put Europe and the United States back on the road to growth". Only with this global capacity can

foresight prevent not only the markets' harassment of political governance but also the emergence of new "bubbles", such as the communications technology bubble in 1993 and the real estate bubble of 2008, while preventing tax fraud.[11]

- Raising funds by charging <u>fees on electronic transactions,</u>[12] essentially to be used in the fight against poverty[13] and major social objectives. Income generated by copyright of works in the public domain must also be used.[14]

- <u>Implementation of a "basic income"</u> in ways that are most appropriate for the most vulnerable sectors of the population.[15]

- Redesign global economic directives based on a new general consensus (such as the <u>Barcelona Consensus</u>)[16] and inspired in recent practice which deserves close analysis, such as the sustainable "blue economy" expressed in GNH (Gross National Happiness) implemented in Bhutan.[17]

- <u>Economy based on sustainable global development</u> to ensure the minimum conditions for a reasonable quality of life for all citizens. Specifically:

  - *Nutrition:*[18]

    - agriculture
    - aquaculture
    - biotechnology

  - *Water:*[19] collection, transfer, management, and adequate production through desalinization, particularly through the use of thermo-solar energy.

  - *Health:* access to the appropriate technical, clinical and therapeutic services. Demographic decrease has been compensated by greater longevity, which increases chronic treatment and neuro-degenerative illnesses. Promoting preventive measures, particularly with respect to potentially irreversible diseases such as loss of mental faculties resulting from genetic or post-natal alterations, undoubtedly constitutes the greatest victory both in medical as well as social and economic terms.

  - *Education:* Access for all citizens to an education that would enable them to make full use of their distinctive aptitudes (the capacity to think, imagine, invent, create) based on their own reflections and without being subjected to the dictates of others.

Environmental Council

This Council would coordinate and supervise compliance with guidelines for maintaining the world's conditions for habitability, based on important documents such as the Earth Charter.[20] In that regard Leonardo Boff has written about "safeguarding our Common Home".[21] Containing climate change and ensuring an ecological future are our personal daily responsibility and commitment. Briefly summarized, the following matters must be addressed:

- Sustainable energies:[22] Consumption of oil and other fossil fuels that produce carbonic anhydrase and other greenhouse gases is largely the cause of climate change and environmental degradation. The greed of oil producers is manifested in the fact that for many years they have attempted to hide the negative impact of using oil as practically our sole energy source.[23] In the present crisis, oil prices have played the greatest role in financial collapse, posing a serious threat to the slight economic recovery that was just commencing. It is essential to increase the renewable energy consumption levels to 40-45% within the next few years, especially in cities, using solar energy (photovoltaic and thermo-solar), wind energy, sea energy, nuclear fusion when possible and, in the meantime, nuclear fission, progressively introducing other sources such as thorium. Only then will it be possible to slow climate change before irreversible damage is done to the environment. Production of large quantities of thermo-solar energy in deserts could now be achieved with the use of graphene, obtained from an abundant mineral (graphite), which given the difficulty of storing energy would enable massive amounts to be transferred from production sites to distant places where it could be used.

  Moreover, it is limiting consumption of oil and other fossil fuels that would ultimately enable us to enjoy this fundamental substrate for all organic chemistry syntheses for a longer period.

  The geostrategies of "black gold" will rapidly change in a very short time. In fact, the petroleum industry's center of gravity is now shifting toward China, Russia and Brazil.[24]

- Quality of the seas: The majority of carbonic anhydride recapture takes place in the oceans in which phytoplankton, with chlorophyll (as is the case with green plants), captures the most oxidized form of carbon (CO_2) together with the most oxidized form of hydrogen (H_2O) and produces reduced compounds (fuels), thanks to solar energy. In consequence, deforestation must be regulated and the quality of the seas monitored; seas are presently affected by large oil tankers that, once again due to greed, discharge tank washing oil sludge into them instead of using the appropriate in-port installations, thus creating low-density oil residue on the ocean surface that asphyxiates phytoplankton cells, depleting their capacity as the "world's lungs". They occupy over 70% of the earth's surface.

- Soil quality: Particularly, regulation of the use of fertilizers and pesticides by the appropriate use of transgenics, conducting thorough research projects such as the transfer of nitrogenase systems typical in legumes to rice roots, rendering them capable of directly capturing atmospheric nitrogen, thus significantly reducing the consumption of nitrogen fertilizers.

"How can the transition be made at the speed required by the most powerful from nation-centric governance to world governance within the framework of a truly efficient United Nations system?"

4.1 At this point we have made concrete proposals to meet the current great challenges and to be able to commence genuine "world governance based on knowledge and scientific rigor".

But a question immediately arises: How can the transition be made at the speed required by the most powerful from nation-centric governance to world governance within the framework of a truly efficient United Nations system? Until now the answer was really difficult because the intervention of citizens in public matters was very limited. But finally, in the last few decades the possibility of participation via cyberspace has opened previously unimaginable opportunities not only to strengthen democracy, but also to promote policies, strategies and actions through massive virtual mobilizations that were heretofore impossible. The enormous powers of the media[25] attempt to maintain us as passive spectators, as distracted recipients, but I have no doubt – and this is our greatest present hope – that thanks to new communications technologies, citizen participation will greatly increase, intervening directly in decision-making. Citizen power and awareness of the need to speak for the voiceless, for those who are invisible,[26] will provoke profound changes throughout the world.

> *"Each citizen must be aware that he is capable of inventing his own future."*

Now more than ever, it is essential to recapture time, to eradicate the political inefficiency, detachment and indifference of so many citizens who have been badly misinformed by the partisan and biased communications media.

The outward changes required must commence with changes in each person's daily behavior. To achieve this great historic change, each citizen must be aware that he is capable of inventing his own future, fleeing the fatalism of what is perceived as inevitable or invincible.

Only then will it be possible to achieve the "new beginning" announced in the Earth Charter as the great objective of an inhabitable world for all, without exclusions. Yes, the 21st century can indeed be the century of the people because, as in Miquel Martí i Pol's poem, everyone will repeat: "…let me say that now is the time for love".

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Notes

1.   Carrillo Salcedo and Juan Antonio in "Las formaciones G en las relaciones internacionales contemporáneas. Entre el poder y la legitimidad: dos modelos para la gobernabilidad mundial", November 23, 2010, *Real Academia de Ciencias Políticas y Morales*

2.   Federico Mayor, *Tiempo de acción* (Granada: University of Granada, 2008)

3.   Mario Soares, "Los grandes desafíos de nuestro tiempo," *Other News,* 15th April 2008

4.   Federico Mayor Blogs *"Naciones Unidas, sí. G-8, no; G-7 à G-8 à G-13 à Gà 20 ... à¡G-192!"; "Inermes frente a las catástrofes"; "¿El mundo tiene arreglo?"; "Alianza contra la pobreza"; "¡Peligro!: no hay tiempo para pensar; ¡La incontenible marea del ciber espacio ha comenzado!"; "Precio del petróleo y de los alimentos... ¿volvemos a las andadas?"*

5. "Declaration of Cancun," *Cuadernos Americanos* 2, no. 132 (2010): 184-208

6. *Cambio global España 2020/2050. Energía, Economía y Sociedad* (Madrid: Centro Complutense de Estudios e Información Medioambiental, 2011)

7. *Una crisis encubierta: conflictos armados y educación* (Paris: UNESCO, 2011)

8. Federico Mayor, *Normas internacionales para la reducción del impacto de catástrofes naturales* Inaugural speech included in the published papers delivered during the International Conference on Natural Disasters held to commemorate the 75th anniversary of MAPFRE, Madrid, October 8-9, 2008

9. Heriberto Araujo and Juan Pablo Cardenal, "El mundo chino ya está aquí," *El País,* 11th February 2011

10. Joseph Stiglitz, "¿Qué nos depara el 2011?," *Other News,* 18th January 2011

11. Guillermo De la Dehesa, "¿Cómo recuperarse de la recesión?," *Revista de Occidente,* no. 348 (2010): 71-90

12. UBUNTU, "¡Es la hora de aplicar un impuesto sobre las transacciones internacionales de divisas!", *Comunicado* 30, September 17, 2010

13. "Manifiesto en favor de la vida, la paz y la igualdad," *Fundación Cultura de Paz,* 2006

14. Propuestas de *tasas de propiedad intelectual en obras de dominio público.* UNESCO proposal, Meeting in Castellón, 1998

15. *En tiempos de crisis, soluciones para la gente,* Fundación Cultura de Paz, December 10, 2008

16. *Nuevo Consenso: por un mundo habitable para todos,* Barcelona, Nova and Fundación Cultura de Paz, 2011

17. Gunter Pauli, *The Bhutan Blue Economy Initiative Global Signatories* (Winterthur: Club of Rome, 2010)

18. Federico Mayor, "Hambre, nutrición y crecimiento: panorámica mundial," *Real Academia Nacional de Medicina* 127, no. 1 (2010)

19. Federico Mayor, *La gestión del agua más allá de los países* (Zaragoza: EXPOAGUA, 2008)

20. *Earth Charter,* 2000

21. Leonardo Boff, *Teología para otro mundo posible* (Mexico City: PPC Ediciones, 2011), 220-230

22. Federico Mayor, *"Monografía sobre el mercado de emisiones de carbono"*, published in an issue of Revista de *Política Exterior* devoted to climate change and carbon trade (Winter, 2011)

23. "The Truth about Denial," *Newsweek,* 13th August 2007

24. Miguel Ángel García Vega, "El petróleo estrena geoestrategia," *El País,* 6th February 2011

25. Ignacio Ramonet, "El desastre mediático," *Other News,* 29th April 2008

26. Federico Mayor, "Los invisibles," *La Vanguardia,* 25th October 2007

The New Sciences of Networks & Complexity:
A Short Introduction

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Abstract

This paper is the result of two recent e-workshops organized by The World Academy of Art and Science (WAAS), one on the Science of Networks, the other on Complexity. These Sciences have emerged in the last few decades and figure among a large group of 'new' sciences or knowledge acquisitors. They are connected with one another and are very well exposed in the diagram available under the name 'Map of Complexity Science' on Wikipedia. Networks exist in extremely diverse contexts: in the biological world, in social constructions, in urbanism, climate change and many more. The novelty appears in the correlations and the laws (e.g. power laws), which were discovered recently, and indicates a totally different appraisal from what was generally expected to exist. The Science of Complexity is directly related to networks. Networks are an essential part of the complexity phenomenon. Their applications, which are highly diverse, are recommended by several scientists; decision makers and politicians have to make use of this knowledge for better evaluation of the impact of their decisions in increasingly complex societies and as a function of time. The paper mentions a recent report on Complexity in Economics and the Economic Complexity Index.

1. Preamble & Frame

Networks and complexity have been recognized since quite a few decades. In recent years, real breakthroughs have taken place with the help of new mathematical instruments. Other 'new sciences' have emerged, say in about half a century, as illustrated by the comprehensive diagram published in Wikipedia;[1] the diagram comes from a book by Brian Castellani and Frederic Hafferty[2] titled *Sociology and Complexity Science: A New Field of Inquiry (2009),* and is called the *Map of Complexity Science*. It was a helping hand for drafting this paper, and is further highly recommended to be consulted. A multitude of new knowledge 'providers' have shown new ways and insights for exploring entities, ensembles and behavior of groups in very different domains. According to the diagram, quite a number of new sciences have emerged since the mid-20th century: the essential pillars for new ideas are Systems Theory,[3] Cybernetics[4] and Artificial Intelligence; a series of specific approaches emerge from there.

Cybernetics plays a central role in the acquisition of new or additional knowledge. Merriam-Webster defines the term this way:

> *"Cybernetics is the science of communication and control theory that is concerned especially with the comparative study of automatic control systems (as the nervous system and brain and mechanical-electrical communication systems)."*

According to the diagram, the Science of Complexity was preceded and followed directly or in parallel by a series of new methods and approaches such as self-organization/autopoiesis, New Sciences of Networks and Global Network society. Not to forget the importance of the Dynamics of Systems Theory in which Jay Forrester of MIT occupies a major role which led to the publication of *The Limits to Growth* (1972), the first report to the Club of Rome.[5]

We all agree that our societies evolve to more complex entities; the evolution is expressed by economic globalization, planetary communications – wired and wireless – geopolitical conflicts, and the like. However, the decision processes at the political and societal levels continue to rely on habits and practices from ancient times: the rule of thumb method is still used in decision processes. The linear analysis in decision processes still remains the most used approach in management and governance questions, although we are aware of the complexity of societal situations. Therefore, the new sciences,[6, 7] in particular networks and complexity, provide excellent new methods for analysis and prospective insights. As a matter of fact, we may treat networks as patterns or structures but complexity is an implicit property of such structures.

> *"The New Sciences are to be understood as complementary to the 'classical' sciences."*

Focusing on New Sciences looks to be a very promising endeavor, in particular for WAAS. Although the field of these new 'knowledge producers' is extremely broad, it provides new understandings, and establishes specific relationships between actors in many branches of sciences and contributes beyond present assumptions.

The New Sciences are to be understood as complementary to the 'classical' sciences; they 'uncover' new relationships, new laws (of mathematical character), and new characteristics among the parameters. The new sciences enable us to take non-linear relationships within systems into account, which was almost impossible before.

There are several fundamental problems where the applications of the Sciences of Networks & Complexity provide new insights in pure scientific domains, for example in the functioning of metabolisms in micro-organisms; applications in the domain of climate change and eco-biosphere are expected to bring a better understanding on the regional and planetary scale. In the fields of sociology and economics, these problems include new methods which enhance diagnostics that were not available before.

The governance of complex industrialized societies requires a better understanding of their underlying trends and institutional political decision processes. The methods applied so far do not appear to be able to provide appropriate guidelines. New insights into the organization of very large institutions, ministries and businesses, of international governing bodies,

and perhaps in the governance of financial world, etc. require approaches which the science of networks and complexity can offer.

For long, scientists have expressed the need for cross-domain analyses, overcoming the exclusive approach of specialized understanding and arriving at an overarching understanding, denominated as a *holistic* methodology. The Western science and culture of the Renaissance have made tremendous progress based on *reductionist* analytical methods. However, these assumptions are frequently insufficient for a deeper understanding of reality. The well-known phrase *'The whole is more than the sum of the parts'* (attributed to Aristotle) is not only correct but now much more practicable than a reductionist approach. With the emergence of the Systems Theory, Complexity Science and related methods, a holistic understanding is at reach.

2. The Science of Networks

Several models of networks[8] have been described over time: *Random Network* known as the Erdös-Rényi Model[9] (1959); *Scale-Free Model* known as the BA Model called after Barabasi & Albert[10, 11] (1999); *Small World Model* known as the Watts-Strogatz algorithm[12] (2008).

It must be stressed that mathematical tools have contributed substantially to analyses of the descriptions, characteristics and properties of networks, thus contributing to an understanding of reality which is yet to be recognized.

2.1 Scale-Free Networks and Power Law[13, 14]

Over the past few years, investigators from a variety of fields have discovered that many networks – from the World Wide Web to a cell's metabolic system to actors in Hollywood – are dominated by a relatively small number of nodes that are connected to many other nodes.

Networks containing such important nodes or hubs tend to be what is called "scale-free" in the sense that a lower number of hubs has higher links and many nodes have less number of links. The surprising discovery was that these networks do not behave in the expected random behavior, which is a generally accepted description of phenomena in physics, resulting frequently in the well-known 'bell' curve coming from a usual statistical distribution, characterized by log-log relationships which form the 'power law'.

It is important that the scale-free networks behave in certain predictable ways: for example, they are remarkably resistant to accidental failures but extremely vulnerable to coordinated attacks.

As an example, counting how many webpages have exactly k links showed that the distribution followed a so-called *power law*: the probability that any node is connected to k other nodes is proportional to $1/k^n$. The value of n for incoming links is approximately 2. Power laws are quite different from the bell-shaped distributions that characterize random networks. Specifically, a power law does not have a peak like a bell curve does (Poisson distribution), but is instead described by a continuously decreasing function. When plotted on a log-log

scale, a power law is a straight line. In contrast to a 'democratic' distribution of links seen in random networks, *power laws* describe systems in which a few hubs dominate.

2.2 Some Important Properties of Networks

2.2.1 Resilience /Robustness[15]

As humanity becomes increasingly dependent on electricity grids and communication webs, a much-voiced concern arises: Exactly how reliable are these types of networks? The good news is that complex systems can be amazingly resilient against accidental failures. In fact, although hundreds of routers routinely malfunction on the Internet at any moment, the network rarely suffers major disruptions. A similar degree of robustness characterizes living systems: people rarely notice the consequences of thousands of errors in their cells, ranging from mutations to misfolded proteins.

What is the origin of this robustness? Intuition tells us that the breakdown of a substantial number of nodes will result in a network's inevitable fragmentation. This is certainly true for random networks: if a critical fraction of nodes is removed, these systems break into tiny, non-communicating islands.

Yet, simulations of scale-free networks tell us a different story: as many as 80 percent of randomly selected Internet routers can fail and the remaining ones will still form a compact cluster in which there will still be a path between any two nodes.

It is equally difficult to disrupt a cell's protein-interaction network: measurements indicate that even after high levels of random mutations are introduced, the unaffected proteins will continue to work together.

In general, scale-free networks display an amazing **robustness** against accidental failures, a property that is rooted in their inhomogeneous topology. The random removal of nodes will take out the small ones mainly because they are much more plenty than hubs. And the elimination of small nodes will not disrupt the network topology significantly, because they contain few links compared with the hubs, which connect to nearly everything. But a reliance on hubs has a serious drawback: vulnerability to attacks.

In a series of simulations, it was found that the removal of just a few key hubs from the Internet splintered the system into tiny groups of hopelessly isolated routers. Similarly, knockout experiments in yeast have shown that the removal of the more highly connected proteins has a significantly greater chance of killing the organism than the deletion of other nodes. These hubs are crucial; if mutations make them dysfunctional, the cell will most likely die.

2.2.2 Strengths and Weaknesses

A reliance on hubs can be advantageous or not depending on the system.

First, one has to note that resistance to *random* breakdown is good news for both the Internet and the cell. In addition, the cell's reliance on hubs provides pharmaceutical researchers with new strategies for selecting drug targets, potentially leading to cures that

would kill only harmful cells or bacteria by selectively targeting their hubs, while leaving healthy tissues unaffected.

Second, the ability of a small group of well-informed hackers to crash the entire communications infrastructure by targeting its hubs is a major reason for concern.

"How can systems as fundamentally different as the cell and the Internet have the same architecture and obey the same laws?"

2.3 Some Examples of Applications

Over the past several years, researchers have uncovered scale-free structures in a stunning range of systems which include

- the **World Wide Web**;

- some **social networks**. A network of sexual relationships among people (from a research in Sweden) followed a power law: although most individuals had only a few sexual partners during their lifetime, a few (the hubs) had hundreds;

- the network of people connected by **e-mail**;

- the network of **scientific papers**, connected by citations, follows a power law: collaborations among scientists in several disciplines, including physicians and computer scientists;

- **business networks**; a study on the formation of alliance networks in the U.S. bio-technology industry discovered definite hubs;

- the network of **actors in Hollywood**: popularized by the game Six Degrees of Kevin Bacon, in which players try to connect actors via the movies in which they have appeared together. A quantitative analysis of that network showed that it, too, is dominated by hubs;

- **biological realm**: in the cellular metabolic networks of 43 different organisms from all three domains of life, including *Archaeoglobus fulgidus* (an archae-bacterium), *Escherichia coli* (a eubacterium) and *Caenorhabditis elegans* (a eukaryote), it was found that most molecules participate in just one or two reactions, but a few (the hubs), such as water and adenosine triphosphate, play a role in most of them;

- **protein-interaction** network of cells. In such a network, two proteins are "connected" if they are known to interact with each other. Investigating **Baker's yeast**, one of the simplest eukaryotic (nucleus-containing) cells, with thousands of proteins, a scale-free topology was discovered: although most proteins interact with only one or two others, a few are able to attach themselves physically to a huge number; a similar result was found in the **protein-interaction** network of an organism that is very different from yeast, a **simple bacterium** called *Helicobacter pylori*.

Indeed, the more scientists studied networks, the more scale-free structures were discovered. These findings raised an important question: How can systems as fundamentally different as the cell and the Internet have the same architecture and obey the same laws? Not only are these various networks scale-free, they also share an intriguing property: for reasons not yet known, the value of n in the k^n term of the power law tends to fall between 2 and 3.

A compelling question arises: How many hubs are essential? Recent research suggests that, generally speaking, the simultaneous elimination of as few as 5 to 15% of all hubs can crash a system.

3. The Science of Complexity

3.1 General Remarks

The focus lies on the innovative character of this new science, in terms of **scientific development**: mathematical, biological, as well as in terms of societal behavior, in particular in **sociology** but also in **economics**. Will industrial societies evolve to a new pattern of evolution/development under the influence of these new network facilities created by entirely new technologies? Relationship between individuals, or inter-subjectivity, will depend on the availability and accessibility of network and complexity methodologies. Therefore, uncovering new types of relationships enables more sustainable prospective scenarios on how our industrial societies will or could look like by the mid-21st century.

Important issues to be examined are democratic processes through the existence or 'spontaneous' emergence of networks. This new phenomenon becomes an important parameter in electoral campaigns, in major political processes as overthrowal of leaders, local and community issues. This very interesting domain is open for debate and reflection.

The state of knowledge about networking and complexity will play an increasing role in understanding the organization and functions of societies. Some most recent events and tendencies, in a large variety of domains, indicate the richness of applicability of these sciences: analysis and search for remediation of the worldwide financial crises; underlying political channels and possible solutions regarding the events in the Middle East; nature and size of social developments in nations with emerging economies; health research and disease dissemination; impact of diminishing bio-diversity on human society and on a planetary scale etc.

The issues which have not yet found appropriate and durable (sustainable) answers will most likely find substantial progress with the application of these new sciences. The understanding of such phenomena requires other type of approaches – more holistic than reductionist – necessary for improved diagnosis and resulting in a better understanding and increased acceptance of proposed solutions.

In the case of world problems, the search for appropriate solutions by international organizations within the present political frame shows quite clearly that progress can only be made by other approaches than the one used until now, based on scientific analysis and understanding, in which these new sciences will play a substantial role.

3.2 The Science of Complexity: Definitions, Properties & Tools

3.2.1 Definitions

Defining complexity remains not an easy task. Some definitions below are taken from publications and depend strongly on the viewpoint of the authors.

From Melanie Mitchell (2009):[16]

> *"Complexity is a system in which large networks of components with no central control and simple rules of operation give rise to complex collective behavior, sophisticated information processing, and adaptation via learning or evolution."*

From Roger Lewin (1993):[17]

> *"Complexity science offers a way of going beyond the limits of reductionism, because it understands that much of the world is not machine-like and comprehensible through a cataloging of its parts; but consists instead mostly organic and holistic systems that are difficult to comprehend by traditional scientific analysis."*

From the OECD Global Science Forum *Applications of Complexity Science for Public Policy: New Tools for Finding Unanticipated Consequences and Unrealized Opportunities* (2009):[18]

> *"Government officials and other decision makers increasingly encounter a daunting class of problems that involve systems composed of very large numbers of diverse interacting parts. These systems are prone to surprising, large-scale, seemingly uncontrollable, behaviors. These traits are the hallmarks of what scientists call complex systems.*
>
> *An exciting, interdisciplinary field called complexity science has emerged and evolved over the past several decades, devoted to understanding, predicting, and influencing the behaviors of complex systems. The field deals with issues that science has previously had difficulty addressing (and that are particularly common in human systems) such as: non-linearities and discontinuities; aggregate macroscopic patterns rather than causal microscopic events; probabilistic rather than deterministic outcomes and predictions; change rather than stasis."*

3.2.2 Some Properties

The promise of complexity science for policy applications is, at its core, the hope that science can help anticipate and understand the key patterns in complex systems that involve or concern humans, thus enabling wiser decisions about policy interventions.

Some important characteristics of complex systems are:

– *Adaptability:* independent constituents interact changing their behaviors in reaction to those of others, and adapting to a changing environment;

– *Emergence:* novel pattern that arises at the system level not predicted by fundamental properties of the system's constituents;

- *Self-organization:* a system that operates through many mutually adapting constituents where no entity designs it or directly controls it;

- *Attractors:* some complex systems spontaneously and consistently revert to recognizable dynamic states known as attractors. While they might theoretically be capable of exhibiting a huge variety of states, in fact they mostly exhibit the constrained attractor states;

- *Self-organized Criticality:* a complex system may possess a self-organizing attractor state that has an inherent potential for abrupt transitions of a wide range of intensities. For a system that is in a self-organized critical state, the magnitude of the next transition is unpredictable, but the long-term probability distribution of event magnitudes is a regularly known distribution (a "power law");

- *Chaos:* chaotic behavior is characterized by extreme sensitivity to initial conditions;

- *Non-linearity:* non-linear relationships require sophisticated algorithms, and are sometimes probabilistic in nature. Small changes might have large effects, large changes could have little or no effects;

- *Phase Transitions:* system behavior changes suddenly and dramatically (and, often, irreversibly) because a "tipping point", or phase transition point, is reached. Phase transitions are common in nature: boiling and freezing of liquids, the onset of superconductivity in some materials when their temperature decreases beyond a fixed value;

- *Power Laws:* probabilistic distribution characterized by a slowly decreasing function (log-log), different from the 'familiar' bell-shaped curve.

3.2.3 Tools and Techniques for Complexity Science

Some of the most important complexity tools being used in public policy domains at this time are:

- *Agent-based or Multi-agent Models:* in computerized, agent-based simulations, a synthetic virtual "world" is populated by artificial agents who could be individuals, families, organizations, etc. The agents interact adaptively with each other and also change with the overall conditions in the environment;

- *Network Analyses*: a common feature of many complex systems is that they are best represented by networks, which have defined structural features and follow specific dynamic laws. Scientists seek to identify configurations that are especially stable (or particularly fragile); some network patterns have been identified as predictors of catastrophic failures in real-life networks: electricity-distribution or communication infrastructures.

Additional complexity-related techniques deserve a special mention, although their use is not unique to complexity science: Data Mining, Scenario Modeling, Sensitivity Analysis, Dynamical Systems Modeling.

3.3 Possible Applications in the Public Policy Domain

Several examples of application domains have been explored, e.g.: epidemiology & contagion; traffic, identification of terrorist associations. Of more general interest is climate change, in particular the social and human aspects – connection between economy, finance, energy, industry, agriculture and the natural world. These new degrees of sophistication can only be achieved using complexity science.

Complexity science techniques can be useful in identifying dangerous tipping points in the human-earth system, which can occur independently of purely geophysical transitions. Perhaps, the most likely disruption of this type involves the management of water resources. Drought and water stresses occur regularly across large sections of Europe and the developing world. There are indications that a tipping point may be near, leading to massive long-term water shortages.

3.4 A Recent Topic: Economic Complexity[19]

The recently published The Atlas of Economic Complexity and the Index (ECI) defined in that publication have largely inspired what follows.

Gross Domestic Product (GDP) is the most used indicator to measure the level of economic activity and its evolution in time in terms of economic growth. GDP per capita is used to express the average wealth of the population of a country. However, GDP falls short when it comes to evaluating the well-being of a society.

Many attempts have been undertaken to improve or find better indices to express real progress in well being. In the frame of the Science of Complexity, an interesting approach has been proposed, rather recently, with the creation of the Economic Complexity Indicator (ECI), which focuses on the structure of the economy of a country and enables the diagnosis of its further development or progress, essentially based on the amount of knowledge available in a society for producing goods and services.

In a way ECI shows substantial progress in the evaluation of the economy of a country compared to what the GDP does. The many attempts for elaborating a 'new' economic system cannot oversee this innovative approach in using new sciences such as Networks and Complexity.

3.4.1 What is Economic Complexity?[20]

The complexity of an economy is related to the multiplicity of useful knowledge embedded in it. For a complex society to exist, and to sustain itself, people who know about design, marketing, finance, technology, human resource management, operations and trade laws, must be able to interact and combine their knowledge to make products. These same products cannot be made in societies that are missing parts of this capability set. Economic complexity, therefore, is expressed in the composition of a country's productive output and reflects the structures that emerge to hold and to combine knowledge.

Knowledge can only be accumulated, transferred and preserved if it is embedded in networks of individuals and organizations that put this knowledge into productive use.

Knowledge that is not used, at least as used in this economic context, however, is also not transferred, and will disappear once the individuals and organizations that have it retire or die.

Complex economies are those that can weave vast quantities of relevant knowledge together, across large networks of people, to generate a diverse mix of knowledge-intensive products. Simpler economies, in contrast, have a narrow base of productive knowledge and produce fewer and simpler products, which require smaller webs of interaction. Because individuals are limited in what they know, the only way societies can expand their knowledge base is by facilitating the interaction of individuals in increasingly complex webs of organizations and markets. Increased economic complexity is necessary for a society to be able to hold and use a larger amount of productive knowledge, and we can measure it from the mix of products that countries are able to make.

3.4.2 The Economic Complexity Index (ECI) & the Product Complexity Index (PCI)

First, the amount of embedded knowledge that a country has, is expressed in its productive *diversity*, or the number of distinct products that it makes. Second, products that demand large volumes of knowledge are feasible only in the few places where all the requisite knowledge is available. We define *ubiquity* as the number of countries that make a product. Using this terminology, we can observe that complex products – those that are based on much knowledge – are less ubiquitous. The ubiquity of a product, therefore, reveals information about the volume of knowledge that is required for its production. Hence, the amount of knowledge that a country has is expressed in the diversity and ubiquity of the products that it makes.

Economic Complexity Index (ECI) refers to countries. The corresponding measure for products gives us the Product Complexity Index (PCI). The mathematical approach exploits the combination of these indices as well as the diversity and ubiquity to create measures that approximate the amount of productive knowledge held in each of these countries.

In short, economic complexity matters because it helps explain differences in the level of income of countries, and more importantly, because it predicts future economic growth. Economic complexity may not be simple to accomplish, but the countries that do achieve it, tend to reap important rewards.

4. Complexity Science: New ways of Thinking for Policymakers
(see OECD Report)[21]

The suggested new ways of thinking focus their attention on dynamic connections and evolution, not just on designing and building fixed institutions, laws, regulations and other traditional policy instruments:

– **Predictability:** the science of complex systems focuses on identifying and analyzing trends and probabilities, rather than seeking to predict specific events. It will be challenging, though necessary, for policymakers and scientists alike to move beyond strict determinism if they wish to effectively engage in decision making under conditions of uncertainty and complexity.

–   ***Control:*** control is generally made possible by identifying cause-and-effect chains and then manipulating the causes. But cause and effect in complex systems are distributed, intermingled and not directly controllable. Complexity science offers many insights into finding and exploiting desirable attractors; identifying and avoiding dangerous tipping points; and recognizing when a system is in a critical self-organizing state.

–   ***Explanation:*** analyses done using complexity science methods, insights about the underlying mechanisms that lead to complex behavior are revealed. Although deterministic quantitative prediction is not generally achieved, the elucidation of the reasons for complex behavior is often more important for comprehending what might otherwise be puzzling real-world events.

–   ***Changing the Mindset:*** *understanding the basic ideas of complexity of the world together with unpredictability. One should not forget that Albert Einstein has warned: "Not everything that counts can be counted, and not everything that can be counted counts".*

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Notes

1.   Brian Castellani, "Complexity Map Overview," *Wikipedia* http://en.wikipedia.org/wiki/File:Complexity-map-overview.png
2.   Brian Castellani and Frederic Hafferty, *Sociology and Complexity Science: A New Field of Inquiry* (New York: Springer, 2009)
3.   Immanuel Wallerstein, *World-Systems Analysis: An Introduction* (Durham: Duke University Press, 2004)
4.   *Merriam-Webster Online,* http://www.merriam-webster.com/dictionary/cybernetics
5.   Donella H. Meadows et al., *The Limits to Growth* (New York: Universe Books, 1972)
6.   Melanie Mitchell, *Complexity: A Guided Tour* (Oxford: Oxford University Press, 2009)
7.   Roger Lewin, *Complexity: Life at the Edge of Chaos* (London: Phoenix paperbacks, 1993)
8.   M. E. J. Newman, "The Structure and Function of Complex Networks" http://arxiv.org/pdf/condmat/0303516.pdf
9.   Stefano Boccaletti et al., "Complex Networks: Structure and Dynamics," *Elsevier, Physical Reports* 424, no. 4-5 (2006): 175-308
10.   Albert-László Barabási, *Linked: The New Science of Networks* (Cambridge: Perseus Publishing, 2002)
11.   Albert-László Barabási and Eric Bonabeau, "Scale-Free Networks," *Scientific American* 288, no. 5 (2003): 50-59 http://www.barabasilab.com/pubs/CCNR-ALB_Publications/200305-01_SciAmer-ScaleFree/200305-01_SciAmer-ScaleFree.pdf
12.   Duncan J. Watts, *Six Degrees: The Science of a Connected Age* (New York: W.W. Norton, 2003)
13.   "Report on: Applications of Complexity Science for Public Policy: New Tools for Finding Unanticipated Consequences and Unrealized Opportunities," *OECD* http://www.oecd.org/sti/sci-tech/43891980.pdf
14.   Gérard Weisbuch and Sorin Solomon, eds., *Tackling Complexity in Science: General Integration of the Application of Complexity in Science* (Gloucester: Renouf Publishing Company Limited, 2007)
15.   Barabási and Bonabeau, "Scale-Free Networks"
16.   Melanie Mitchell, *Complexity*
17.   Roger Lewin, *Complexity*
18.   "Report on: Applications of Complexity Science for Public Policy"
19.   Ricardo Hausmann et al., *The Atlas of Economic Complexity- Mapping Paths to Prosperity* (Cambridge: MIT Press, 2011) http://atlas.media.mit.edu/book/
20.   Guido Caldarelli et al., *Ranking and Clustering Countries and their Products; A Network Analysis, PLoS ONE* 7, no. 10 (2012): e47278
21.   "Report on: Applications of Complexity Science for Public Policy"

A Note on the Difference Between Complicated and Complex Social Systems

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Abstract

The distinction between complicated and complex systems is of immense importance, yet it is often overlooked. Decision-makers commonly mistake complex systems for simply complicated ones and look for solutions without realizing that 'learning to dance' with a complex system is definitely different from 'solving' the problems arising from it. The situation becomes even worse as far as modern social systems are concerned. This article analyzes the difference between complicated and complex systems to show that (1) what is at stake is a difference of type, not of degree; (2) the difference is based on two different ways of understanding systems, namely through decomposition into smaller parts and through functional analysis; (3) complex systems are the generic, normal case, while complicated systems are highly distinctive, special, and therefore rare.

1. Introduction

During the past five or six decades, 'complexity' has been defined in many different ways.* As a consequence, the difference between 'complex' and 'complicated' problems and systems has become unclear and difficult to trace. The following is possibly the golden rule for distinguishing 'complex' from 'complicated' problems and systems. Complicated problems originate from causes that can be individually distinguished; they can be addressed piece-by-piece; for each input to the system there is a proportionate output; the relevant systems can be controlled and the problems they present admit permanent solutions. On the other hand, complex problems and systems result from networks of multiple interacting causes that cannot be individually distinguished; must be addressed as entire systems, that is they cannot be addressed in a piecemeal way; they are such that small inputs may result in disproportionate effects; the problems they present cannot be solved once and for ever, but require to be systematically managed and typically any intervention merges into new problems as a result of the interventions dealing with them; and the relevant systems cannot be controlled – the best one can do is to influence them, learn to "dance with them", as Donella Meadows aptly said.†

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* Here I use "complexity" with regard to both non-linear phenomena (complexity proper) and infinite sensibility to initial and boundary conditions (what is usually called "chaos" or "deterministic chaos"). Both are based on an internal machinery of a predicative, algorithmic, i.e. mechanical, formal nature.

† The following are some further aspects that a less cursory analysis will have to consider: (1) the "complicated" perspective point tends to work with closed systems, while the "complex" perspective point works with open systems; (2) the former naturally adopts a zero-sum framework, while the latter can adopt a positive-sum framework; (3) the former relies on first-order systems, while the latter includes second-order systems, that is systems that are able to observe themselves (which is one of the sources of their complexity).

Unfortunately, the vast majority of decision-makers ask their consultants to give them 'solutions' that can solve problems once and for all. That is, they ask their consultants to treat complex problems as if they were complicated ones. Complexity and the nature of contemporary science show that the claim to 'solve' (complex) problems is often ungrounded.[1] 'Learning to dance' with a complex system is definitely different from 'solving' the problems arising from it.

The situation becomes even worse as far as modern social systems are concerned – not the least because "most modern systems are both hideously complicated and bewilderingly complex".[2] According to the golden rule above, the difference between 'complicated' and 'complex' systems is a difference of type, not a difference of degree. In this sense, a complex system is not a system that is remarkably more complicated than a customarily complicated system. A complex system is a system of completely different type from a complicated system. This understanding is apparently at odds with the quotation from Mulgan and Leadbeater. According to that quote, a system can be *both* complicated and complex. The apparent contradiction vanishes as soon as one recognizes that the qualities or properties that make a system complicated are different from the qualities or properties that make a system complex. The properties used to classify a system as complicated are different from the properties used to understand a system as complex. This difference explains why the same system can be classified as pertaining to two otherwise different categories – and explains also why decision-makers tend to keep their focus on the side of complicatedness and downsize or misinterpret the issue of complexity. Many contemporary problems are made worse by trading one type of problem for the other, because the problems arising from what makes a system complicated can eventually be solved, while those arising from what makes a system complex can at best be transformed or modified, but not solved once and for ever. This is precisely the meaning of Meadows' learning to 'dance with them'.

In this regard, reductionism is the thesis that the type-difference between complicated and complex systems is only apparent because the properties that make a system complex are based on the properties that make a system complicated. Or that the latter can simulate, or approximate, as far as one likes, the former. On the other hand, a non-reductionist position maintains that the difference between complicated and complex systems is a type-difference that cannot be bridged, and all simulations of the latter from the former miss relevant information.

This observation introduces the theme of 'adequate' models. In short, one can always use physical models in non-physical contexts. This does not mean, however, that these models are able to capture the *proprium* of different situations. One can measure the weight and volume of a cat – and these measures provide authentic information – but neither the weight nor the volume of a living being properly characterizes the human being's nature. Similarly, it is always possible to quantify psychological and social phenomena, without being able to capture their nature.

It is our claim that the difference between complicated and complex systems is of the same kind: one can always exploit complicated systems to understand complex ones – e.g.

by developing simulations of the latter that come as close as possible – but in doing so, something essential is systematically lost.

To see what is at stake, I shall now dig deeper into the difference between complicated and complex systems.

2. The Difference between Complicated and Complex Systems

If, as we claim, the difference between complicated and complex systems is a difference of type and not of degree, suitable reasons should be provided. As a matter of fact, quite a few reasons can be proposed. The following are the three most obvious reasons for the difference between complicated and complex systems:

1. The primary way to understand complicated systems is through their structural decomposition – that is, through the segmentation of the whole system into disjoined structural parts and their relations, and the further subdivision of these parts into smaller subparts and their relations. On the other hand, the primary way to understand complex systems is through functional analysis – that is, through the activities exerted by the system. Structural and functional analyses mirror each other only in very special cases. In general, they are different, and the relations among them are far from trivial. One way to see their difference is to note that the same structural part can perform different functions, and the same function can be performed by different structural parts. The 'one structure-one function' assumption works only in very rare cases, which implies that it is a highly non-generic assumption.

"Everything changes, but not everything is creative."

2. Whilst systems have a definite number of structural parts, the functions that a system is able to perform are potentially unlimited. The primary way to constrain the range of functions that a system can perform is to delimit its environment, e.g., by allowing the system to interact with only selected types of systems. That is to say, functions can be delimited either by closing the system (no interaction) or closing its environment (limited or constrained interactions).

3. The above two reasons show that the complexity of a system is not directly connected to the amount of available data or knowledge. Collecting more data or developing better theories will not transform complex systems into complicated ones. This introduces the third reason for the difference between complex and complicated systems. Complicated systems can be – at least in principle – fully understood and modeled. They can be entirely captured by suitable models. Whilst it may not be feasible to build these models with all the necessary details – e.g. because it will be too costly or because some information would be missing – in principle they can be constructed. Complex systems, on the other hand, are such that they are never fully graspable by any model whatsoever: models of them – even in principle – are always incomplete and diverge over time.

The main reason why complex systems have these apparently strange features is that they are creative. Being creative includes the capacity to change, learn, and over time become different from what one was before. But it is more than this. Everything changes, but not everything is creative. To mention but one component of creativity, the capacity to (either implicitly or explicitly) reframe is one of the defining features of creativity. Creativity also includes some capacity to see values and disvalues, and to accept and reject them. Therefore, it is also the source of hope and despair. None of these properties are possessed by complicated systems.

"The first is the idea that "physics is the queen of science" – meaning that the other sciences are authentic sciences only if they force themselves into the straitjacket of the physical framework (the positivist or reductionist attitude)."

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3. Which Systems are Generic?

The proposed acceptance of complexity (and complex systems) is far less trivial than it may at first appear. According to our understanding of complexity, almost everything that falls under the heading of complexity pertains instead to the science of complicated (even extremely or 'hideously' complicated, as Mulgan and Leadbeater put it) systems. Complexity is an entirely different matter. The irony is that complex (in the proposed acceptation) systems are not rare. Complex systems are the usual, normal case. All living systems, all psychological systems, all social systems are complex. It is complicated systems that are highly distinctive, very special, and therefore rare.[*]

Two obstructions block our capacity to acknowledge that complex systems are the generic – i.e. the usual – type of system. The first is the idea that "physics is the queen of science" – meaning that the other sciences are authentic sciences only if they force themselves into the straitjacket of the physical framework (the positivist or reductionist attitude). This is not meant to be a criticism of physics, not even an implicit one: physics deals with complicated systems, not with complex ones, and its methods have proven exceedingly successful in yielding an understanding of complicated systems. There is no reason, however, to believe that its methods can be used to understand complex systems as well. When the objects are remarkably different, this may happen, and it should not be surprising that different viewpoints and methods are required.

By further developing this train of thought, one arrives at an idea of science that is more general than the competing mainstream acceptance of science presently available: to wit, instead of distinguishing between the Queen (physics) and the pawns (all the rest), the new vision distinguishes between the general framework underlying all sciences (what Rosen called the modeling relation) and a variety of different concretizations of that framework

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[*] During the past fifty years or so, many scholars have tried to contribute to this body of ideas, including Bateson, Capra, Hofstadter, Luhmann, Maturana, Rashevsky, Rosen, and Varela. The clearest and most complete treatment, however, is Rosen's (1991).

where each concretization depends on specific assumptions or constraints. In this view, physics is a highly specific – that is, non-generic – science, while other sciences, notably biology and all the sciences that rely on it (i.e. all the human and social sciences), will require less demanding constraints.

The foregoing is a highly compressed presentation of Rosen's ideas as developed in his groundbreaking trilogy (see references). Needless to say, I have had to omit many otherwise necessary details.

> *"Science is for the most part a set of techniques for closing open systems in order to scrutinize them."*

The second reason is that, willy-nilly, most decision-makers are positivists, and they regularly ask their consultants to give them definitive 'solutions' to problems. What they have in mind are (again!) complicated systems, and they want complex systems to be managed as if they were complicated ones. Complexity and the nature of contemporary science show that the claim that (complex) problems can be 'solved' is ungrounded.

To call attention to one of the major transformations exhibited by contemporary science, I have found it helpful to contrast the present situation with the basic understanding of traditional modern science. In a variety of papers I have presented the following summary, according to which Newtonian science teaches us that natural systems are closed (only efficient causality is accepted; bottom-up, top-down, 'final' causes are forbidden), atomic (fractionable), reversible (no intrinsic temporal direction), deterministic (given enough information about initial and boundary conditions, the future evolution of the system can be specified with any required precision), and universal (natural laws apply everywhere, at all times, and on all scales). By contrast, contemporary science shows that these claims are *all* false, in the literal sense that they work only for some special kinds of systems (technically, they are not generic).[3, 4, 5, 6, 7] The framework currently under development in many scientific quarters includes open, non-fractionable, irreversible, non-deterministic and context-dependent systems.[*]

Since, as they say, the devil is in the details, this is the point to note: there is something even more important than the static opposition between closed and open systems. It is the opposition between the *processes* of opening or closing a system.[8] More often than not, when dealing with a system, we have to modify it in order to be able to understand its functioning or develop a policy. The ways in which a system is opened or (more usually) closed is of utmost importance. Science is for the most part a set of techniques for closing open systems in order to scrutinize them. The problem is, it is in this way we study other systems, systems that are different from the original ones.

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[*] While the traditional, reductionist strategy has proved enormously successful and cannot be simply abandoned, the problems that prove refractory to a reductionist treatment are growing, and this calls for complementary non-reductionist strategies. Reductionist methods work well when a system can be decomposed (fragmented) without losing information. On the other hand, for many systems, any fragmentation causes a loss of information (Poli 2011b). The most promising alternative strategy is to substitute analysis via decomposition (the reductionist mantra) with analysis via natural levels (i.e. the theory of levels of reality), introduce indecomposable wholes and substitute Humean causation with powers and propensities. Note that, since indecomposable wholes are not (entirely) understandable from their parts, manipulation of parts may engender unexpected consequences (Popper 1990, Rosen 1985, Bhaskar 1988, Poli 2010a,b, Poli 2011a, Louie and Poli 2011, Poli 2012a,b).

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Notes

1. Roberto Poli, "Complexity, Acceleration, and Anticipation," *ECO* 14, no. 4 (2012): 124-138

2. Geoff Mulgan and Charlie Leadbeater, "The Systems Innovator," *Nesta* http://www.nesta.org.uk/library/documents/System-sinnovationv8.pdf

3. David Depew and Bruce Weber, *Darwinism Evolving: System Dynamics and the Genealogy of Natural Selection* (Cambridge: The MIT Press, 1995)

4. Barbara Adam and Chris Groves, *Future Matters* (Leiden: Brill, 2007)

5. Robert E. Ulanowicz, *A Third Window: Natural Life beyond Newton and Darwin* (West Conshohocken: Templeton Foundation Press, 2009)

6. A. H. Louie and Roberto Poli, "The Spread of Hierarchical Cycles," *International Journal of General Systems* 40, no. 3 (2011): 237-261

7. Roberto Poli, "Overcoming Divides," *On the Horizon* 21, no. 1 (2013): 3-14

8. Robert Rosen, *Essays on Life Itself* (New York: Columbia University Press, 2000)

Bibliography

1. Bhaskar, R. 1998. *The Possibility of Naturalism,* London, Routledge (3rd edition)

2. Louie, A. H. 2009. *More Than Life Itself: A Synthetic Continuation in Relational Biology*, Frankfurt, Ontos Verlag

3. Poli, R. 2010a. "The Many Aspects of Anticipation," *Foresight,* 12(3), 7-17

4. Poli, R. 2010b. "An Introduction to the Ontology of Anticipation," *Futures,* 42(7), 769-776

5. Poli, R. 2010c. "The Complexity of Self-reference - A Critical Evaluation of Luhmann's Theory of Social Systems," *Journal of Sociocybernetics,* 8(1-2), 1-23

6. Poli, R. 2011a. "Ethics and Futures Studies," *International Journal of Management Concepts and Philosophy,* 5(4), 403-410

7. Poli, R. 2011b. "Analysis—Synthesis," in V. Petrov (ed.), *Ontological Landscapes,* Frankfurt, Ontos Verlag, 19-42

8. Poli, R. 2012a. "The Many Aspects of Anticipation," in M. N. Seel (ed.), *Encyclopedia of the Sciences of Learning,* New York, Springer, 2092-2094

9. Poli, R. 2014. "Anticipatory Governance, *Auftragstaktik,* and the Discipline of Anticipation". Forthcoming in the *Journal of Futures Studies*

10. Popper, K. R. 1990. *A World of Propensities,* Bristol: Thoemmes

11. Rosen R. 1991. *Life Itself. A Comprehensive Inquiry into the Nature, Origin, and Fabrication of Life,* Columbia UP, NY, 1991

12. Rosen, R. 2012. *Anticipatory Systems. Philosophical, Mathematical and Methodological Foundations,* New York, Springer (1st ed. Pergamon Press 1985)

Making Central Banks Serve The Real Economy

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Abstract

The challenge is to redirect central bank money into the real economy and to the needs of society. If new money is issued to expand the productive capacity, there is no reason for inflation. Long-term financing could become available at an affordable price. Central bank money must not replace a sound tax system and the distribution of income and wealth, but complement them. The remaining task, apart from the financing of real needs, is the prevention of speculative asset price inflation. For this, central banks and regulators should install debt brakes for the financial sector. Furthermore, independent monetary policy calls for capital account management. It enables national central banks to find space for the conduct of their own policies in an interdependent global economy. Coordination between central banks and governments might increase as policies combine monetary, fiscal and regulatory facets. The future role of central banks should particularly lie in their insights regarding capital flows and leverage cycles and in their ability to create and withdraw money, depending on economic conditions.

> *"A crisis is a window into the soul of the economy, like Plato's republic was the soul writ large. If non-standard policies saved the economy during the crisis, they surely should play a role in normal times."*[1]

Central banks shall supply money for the economy by supplying money for banks. The paradox here is that they lack influence on what banks do with the money. The problem with low key interest rates is that they are not targeted. Quantitative easing measures (QE), such as the purchases of securities by central banks, can help the financial sector in systematic liquidity and solvency problems. QE can also reduce government debt servicing costs by lowering the sky-high interest rates of state bonds. That has, for example, been the case with the European Central Bank's bond-buying programme for struggling member-states.

However, the current QE has not been targeted towards stimulating real economic activity. It has failed to spur real economic lending and securities emissions. The monetary transmission mechanism did not work: the central bank money has remained in the financial sector itself. That is why it risks feeding leverage-driven asset bubbles in the financial sector instead of funding real needs.[2] As Dominic Lawson points out:[3]

> *"If the real assets remain unimproved either by investment or by advances in productivity, and all that happens is that their monetary value on the markets increases in nominal local currency terms, this is merely the classic recipe for a financial bubble."*

Hence, the challenge is to redirect central bank money into the real economy and to the needs of society. Whereas taxes refer to the re-distribution of money, the task here tackles its pre-distribution.

1. Central Banks should Contribute to the Funding of Real Needs

Central bank money should not solely be used to fund private banks; it shall also engage in the financing of public investment expenditures: renewable energies, public transport, communication infrastructure, public health and climate protection; the world is full of unfulfilled investment needs. Not everything suits the profit-orientated expectations of private investors. Or if you attempt to fit them by increasing the profit through higher consumer prices and spreading the risks via excessive securitisation, the price may be social exclusion and financial instability.

"Central banks should use their ability to create new money and channel it into meaningful investments."

For example, research in Alzheimer's disease might take 20 years; and some parts of that research may yield inconclusive results. Yet, it is human life, and we need sustainable finance for it. We should not stand and watch the pharmaceutical industry prioritise more lucrative botox research. Central banks should use their ability to create new money and channel it into meaningful investments.They can also finance the retraining of employees in the fossil fuel industry to enable them to carry out similar work in the renewable energy sector. At the global level, the UN Green Climate Fund was established in 2010. It planned to raise US$100 billion, but is still out of money. Central banks could cooperate with the International Monetary Fund and development banks in order to employ monetary financing to break this funding deadlock.

Among the proponents of a broader mandate for monetary financing are Adair Turner, chairman of the Financial Services Authority in the UK, and Martin Wolf, economic journalist of the Financial Times.[4] Wolf argues that it is impossible to justify the conventional view that monetary financing should operate almost exclusively via today's system of private borrowing and lending.

The benefits of such monetary financing will be substantial:

- Long-term financing will become available at an affordable price. Partnerships between governments, financed by new central bank money, and long-run institutional investors like foundations, insurance companies and pension funds are also possible. New government money can, for instance, act as a catalyst during the start-up phase of long-term infrastructure projects. By contrast, private-equity funds aim at above-average returns up to super returns. Thus, it often turns out that they are unsuitable as sponsors for sustainable development. Additionally, their high consultancy fees and special dividends can even hamper investment.

- The deleveraging process of private banks can be accompanied by new central bank money. Thus, a credit crunch can be avoided.

- New central bank money can contribute to overcoming austerity. This will promote social equity too. Poorest people suffer the most from austerity because they can barely afford the better equipped private hospitals and private schools.

- This will also strengthen democracy, as austerity is a means to exert power. New central bank money can prevent the real economy from being held hostage by unreliable financial markets. It can end unreliable conditions of structural adjustments, be it through the International Monetary Fund towards its poorer member states or through the Troika in Europe.

- Finally, instead of waiting any longer, socially and environmentally required investments could be put into practice. Every necessary investment, which is not taken today, goes at the high expense of present and future generations. This ranges from neglected safety standards for public transport to environmental consequences and public education.

Consequently, the widespread taboo of monetary financing should be broken. The key is always where the money goes to and on what terms—in times of stress as well as every day.

"Provided that the amount of new central bank money is in pursuit of the gross domestic product level, it can also be spent on dance performances."

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2. ... But What About Inflation?

Monetary financing of governments is still a taboo though. This is not without reason as economies have been affected by hyperinflation as in Brazil, Germany and many African countries.

Therefore, some conditions must be met:

- First, if new money is issued to expand the productive capacity, there is no reason for inflation. At the same time, there is no necessity to limit central banks' support of governments' financing needs during times of crisis. Rather it can contribute to public finance on a regular basis. Turner, among others, proposes that central banks allow a defined amount of monetary financing as a percentage of the gross domestic product. Matthias Kroll of the World Future Council recommends, depending on economic trends, up to five percent.[5] Since this will be a decision by the central bank, not the Treasury, the independence of central banks can be maintained. In doing so, central banks should take democratically agreed criteria as the basis, including the degree of the utilisation of production capacity. Whether they adopt the amount of monetary financing before any one budget year, the Treasury can take this into account and

balance it with fiscal measures such as taxes and debt. Provided that the amount of new central bank money is in pursuit of the gross domestic product level, it can also be spent on dance performances, theatre plays and on the funding of foundations.

- Second, although appropriate timing and sequencing are sensible, exit strategies are implementable when economic conditions are boosted. For that, central banks have various tools. They can, for instance, increase minimum reserve requirements. Japan in the early 1930s under Finance Minister Takahashi Korekiyo provides a remarkably good example for the use of new central

"Most crucially, leverage can be more important to asset prices than interest rates. As leverage cannot be stopped by increasing interest rates, it must be managed directly."

bank money combined with a well-tailored exit strategy. In order to escape from the Great Depression, spending increases were financed with government bonds which were underwritten by Japan's central bank, the Bank of Japan. Thereby, new central bank money was channeled into government spending. Later, to prevent inflation in a boosting economy, the Bank of Japan sold − part of − these bonds to private financial institutions. This was the appropriate exit strategy to suck off money by transforming it into liabilities. Furthermore, the Japanese government employed its rising tax revenues to keep its debt at a sustainable level.[6]

- Third, new central bank money must not replace a sound tax system and the distribution of income and wealth, but complement them. While it can be used in a certain corridor without being inflationary, taxes are the basis of public finance.

- Yet, the remaining task, apart from the financing of real needs, is the prevention of speculative asset price inflation. For this, central banks and regulators should install debt brakes for the financial sector.

3. Debt Brakes for the Financial Sector

Leverage within the financial sector plays a primary role in creating asset bubbles as well as in making financial institutions too big and too connected to fail. It is nearly impossible to close highly leveraged financial institutions without systemic consequences. Moreover, and most crucially, leverage can be more important to asset prices than interest rates. As leverage cannot be stopped by increasing interest rates, it must be managed directly.[7] Thus, central banks should focus on leverage cycles and the overstretching of collateral. To a great extent, money creation takes place in the shadows, namely banks interacting with non-banking financial institutions such as investment funds, hedge funds, private equity funds, endowments and insurances.

Policies to be developed as debt brakes for the financial sector:

- An effective policy regarding the overstretching of collateral would be a preventive testing of financial innovations − a finance TÜV.* The purpose of some financial

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* TÜV is German name for road safety tests.

innovations − such as collateralized debt obligations and credit default swaps − is to stretch the available collateral further. Securitisation can be useful up to a point; savings banks use it to diversify regional risks. However, re-securitisation is not needed by the real economy and should be prohibited. Other financial innovations should be bound by specific conditions such as position limits for certain derivatives.[8]

• A further form to overstretch collateral is the re-pledging of securities in handling credit intermediation chains. This clearly has to be limited. Otherwise, the liquidity illusion would be everywhere.

• The value of collateral is also subject to cyclical volatility. Thus, central banks and regulators should focus on the value of that which serves as collateral: in the case of overvalued assets, they should curb the permitted value of these assets as collateral. Regulating leverage based on loan-to-value ratios (asset-based leverage) rather than according to debt-equity ratios of banks (investor leverage) solely will include the whole financial sector. A central bank or regulator should, for instance, say:[9] "You cannot loan at two percent down on houses."

• Furthermore, leverage from mergers and acquisitions (M&A) should be constrained. Pavan Sukhdev proposes that the capital structure of M&A transactions which exceed a given transaction amount − such as US$10 billion − ought to be reviewed by central banks.[10]

These policies are crucial to avoiding fictitious liquidity and leverage-based asset bubbles. They go beyond the potential leverage ratio in the framework of the Basel Accord for capital requirements which refers only to banks. There will be resistance from the financial sector, as decreasing leverage means a decreasing return on equity. However, the real economy and society need sustainable wealth, not permanent fragility. This real need has to be the priority.

4. Central Banks can Conserve the Taxpayer's Money

Different from private companies, central banks cannot default as they can create their own money in their own currency. Their privilege is thus that they need no fiscal backing from the government.[11] Central banks can finance tax cuts in a recession as well as debt cancellation for the benefit of present and future generations. In a historical review, published by the Bank for International Settlements, Charles Goodhart writes:[12]

> *"For over three centuries (1694-1997) a prime function of the Bank of England was to manage the national debt. But as the debt declined, both as a percentage of GDP and in relation to the size of the financial market, debt operations became simpler, falling into a routine pattern. Much the same happened in other countries. But now many countries face the prospect of rising debt levels. During the coming epoch of central banking, they should be encouraged to revert to their role of managing the national debt."*

As a lender of last resort, it is the job of central banks to buy troubled assets or to accept them as collateral. The purchasing of bonds with long-term maturities − for example in the secondary market − can even lower long-term interest rates.

5. Independent Monetary Policy Calls for Capital Account Management

The monetary policy of systemically important economies affects capital flows and borrowing costs in the global financial system. The mere announcement that the Federal Reserve Bank might exit its bond-buying programme has led to capital flight and currency crashes in emerging economies like the "Fragile Five" − Brazil, India, Indonesia, South Africa and Turkey. It made borrowing costs jump up in the euro periphery too − in Greece, Italy and Spain.

Hélène Rey aptly describes the transformation of an old macroeconomic trilemma (impossible trinity) into a new dilemma (irreconcilable duo):[13]

> *"Whenever capital is freely mobile, the global financial cycle constrains national monetary policies regardless of exchange rate regime. For the past decades, international macroeconomics has postulated the "trilemma": with free capital mobility, independent monetary policies are feasible if and only if exchange rates are floating. The global financial cycle transforms the trilemma into a "dilemma" or an "irreconcilable duo": independent monetary policies are possible if and only if the capital account is managed."*

Capital account management enables national central banks to find space for the conduct of their own policies in an interdependent global economy. It includes the management of capital inflows and outflows. Some countries, Israel, Korea and Thailand for instance, already have an active management of capital account.

Additionally, excessive trading which causes systemically risky volatility should be addressed. That is, apart from raising revenues, the purpose of a financial transaction tax should be addressed. For this reason, the tax rate should be scalable; it would enable the tax to efficiently contribute to preventing price bubbles. A scalable tax rate has already been suggested by economist Paul Bernd Spahn in 2002 in his report commissioned by the German Federal Ministry for Economic Cooperation and Development.[14]

To conclude, coordination between central banks and governments might increase as policies combine monetary, fiscal and regulatory facets. This concerns even the financial transaction tax which involves fiscal and regulatory aspects, along with cyclical trends if the tax rate is scalable. The future role of central banks in these exercises should particularly lie in their insights regarding capital flows and leverage cycles and in their ability to create and withdraw money, depending on economic conditions.

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Notes

1. John Geanakoplos, "What's missing from Macroeconomics: Endogenous Leverage and Default," *Cowles Foundation paper,* no. 1332 (2011): 225 http://cowles.econ.yale.edu/~gean/art/p1332.pdf

2. Bluford H. Putnam, "Essential Concepts Necessary to Consider when Evaluating the Efficacy of Quantitative Easing," *Review of Financial Economics* 22, no. 1 (2013): 1-7 http://www.sciencedirect.com/science/article/pii/S105833001200064X

3. Dominic Lawson, "Coming Soon: Credit Crunch 2 – and This Time It's Personal," *Sunday Times,* 19th May 2013 http://www.thesundaytimes.co.uk/sto/comment/columns/dominiclawson/article1261046.ece

4. Lucrezia Reichlin, Adair Turner and Michael Woodford, "Helicopter Money as a Policy Option," *VoxEU,* 20th May 2013 http://www.voxeu.org/article/helicopter-money-policy-option "Transcript of interview with Lord Turner," *Financial Times,* 6th February 2013 http://www.ft.com/intl/cms/s/0/42f943be-6fcd-11e2-956b-00144feab49a.html Martin Wolf, "The case for helicopter money," *Financial Times,* 12th February 2013 http://www.ft.com/intl/cms/s/0/9bcf0eea-6f98-11e2-b906-00144fea-b49a.html

5. Matthias Kroll, *Monetäre Stabilität und die Finanzierung von Staatsdefiziten durch Zentralbankkredite bei endogener Geld-menge* (Berlin: Lit-Verlag, 2008) 68f

6. Matthias Kroll, "Takahashi Korekiyos Wirtschaftspolitik als Grundlage einer "Best Policy" zur Rezessionsüberwindung," *World Future Council policy brief* http://bit.ly/18biZxK

7. John Geanakoplos, "Incorporating financial features into macroeconomics," *Cowles Foundation Paper,* no. 1331 (2011): 4 http://cowles.econ.yale.edu/~gean/art/p1331.pdf

8. Suleika Reiners, "Introduce precautionary principle for financial products, or they will fail us," *EurActiv.* http://www.euractiv.com/euro-finance/introduce-precautionary-principl-analysis-518903

9. Geanakoplos, "What's missing from Macroeconomics: Endogenous Leverage and Default," 224

10. Pavan Sukhdev, *Corporation 2020: Transforming Business for Tomorrow's World* (Washington, D.C.: Island Press, 2012) 157

11. Paul De Graume and Yuemei Ji, "Fiscal Implications of the ECB's Bond-buying Programme," *VoxEU,* 14th June 2013 http://www.voxeu.org/article/fiscal-implications-ecb-s-bond-buying-programme

12. Charles Goodhart, "The Changing Role of Central Banks," *Bank for International Settlement, Working papers,* no. 326 (2010): 25f http://www.bis.org/publ/work326.htm

13. Hélène Rey, "Dilemma not trilemma: The Global Financial Cycle and Monetary Policy Independence," *Federal Reserve Bank of Kansas City* http://www.kansascityfed.org/publicat/sympos/2013/2013Rey.pdf

14. Paul Bernd Spahn, "On the Feasibility of a Tax on Foreign Exchange Transactions," *Goethe University* http://www.wiwi.uni-frankfurt.de/professoren/spahn/tobintax/

The Balance Sheet of the Parallel Action carried out by the Secretariat of the Soul and Precision, 100 Years Later[1]

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Abstract

Exactly 100 years ago, Austrian writer Robert Musil's book "The Man Without Qualities" foresaw the cultural challenge that Relativity and Quantum Theory would pose to the Newtonian mechanistic worldview of the 19th century. His book anticipated the transition that would eventually compel a deterministic, reductionist science of predictability to enter into dialogue with the emerging subjective and intuitive perception of uncertainty, complexity, freedom and creativity, which promises to revolutionize our way of thinking in the 21st century. Musil anticipated the reconciliation of science and the arts – universal, immutable, scientific truth and dynamic, indeterminate human nature. This essay traces the evolution of Economics from a deterministic material science seeking to emulate the mathematical precision and predictability of Physics into a human-centred social science compatible with indeterminism and uncertainty. The notion of Newtonian equilibrium in Economics is rapidly giving way to dynamic, evolutionary disequilibrium.

Economic thought is heavily conditioned by cultural paradigms. An economist's thoughts concerning Musil could arouse some surprise. Central Europe, the breeding ground of ideas, therefore constitutes great interest for my discipline and the reflection on Musil is an example of this.

Interest in Musil is born from the fact that, like contemporary society, economics too is troubled by problems of uncertainty and radical change. Economists today are searching for a new definition of wealth so as to be more precise about the common objectives to be achieved and the means for realising them.* Trieste has a very special cultural tradition which has the taste of what Prof. Johnston calls "Skurrile", which is absorbed right from birth along with mother's milk.†

Musil was closely linked to Geneva. It was at the foot of the Salève, the last spur of the Jura which serves as a frame for the city where Martha, Musil's wife, scattered his ashes in 1942. Musil, in fact, spent the last years of his life in Geneva, in two different houses, one of which no longer exists: It stood along the Rieu road that goes towards Carouge, where a series of modern buildings now stand. Earlier he had lived in Grangettes Street where a clinic with the same name and its car parking area are based. Next to it there was an old house

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* The author lives in Trieste, an Italian city in Central Europe, and is proud of hailing from a Central European city.

† See Vienna, Budapest Prague…., p.9, PUF, Geneva, 1988.

which was later used as a store room for materials belonging to the clinic. It was here that Musil lived. He provided lots of details on this place in notes published in French some time ago.[2]

For the purpose of completing this review, I would like to recall a dialogue that introduces the ideas that I put forward here.[3]

My thesis principally concerns an assessment of the balance sheet which is the plot of Musil's book *The Man Without Qualities*. It involves a fairly paradoxical balance sheet, pretty typical of Mitteleurope, given that it means examining something that has never had a beginning and has never really existed. Ulrich's projects are assessed. He is the protagonist of Musil's book, who in 1913 was charged with creating a Secretariat that dealt with precision and the soul. What was the purpose of the initiative for establishing the Secretariat?

It was the month of August 1913 and at that time some German patriots came up with the idea of celebrating the silver jubilee anniversary of Wilhelm II. To clearly underline the fact that they were not completely captivated by the allure of Prussia and Germany, Austria wanted to organise large demonstrations to celebrate. Franz Josef would celebrate 70 years of his reign as Emperor in 1918 – an impossible initiative when one considers the fact that when Musil wrote the book the Emperor and his Empire no longer existed.

But why then evoke the balance sheet of a Secretariat and its activity?

Musil's novel ends up fading away from the reader's mind little by little like sand that dribbles through the fingers and is scattered. The reason is that, paradoxically, what basically was a mere project is today a Secretariat that can boast a positive balance sheet 100 years later.

On what is my thesis of a positive balance sheet based? Here are some points in support of my belief.

The basic idea of celebrating the seventieth anniversary of Franz Josef's reign concerned the possibility of overcoming the cultural barriers which at that time (though in part still today) divided what Musil in his novel calls the two half truths. On the one hand was a world based on the "scientific" ambition to find certainties through physics and mathematics; it is the world of science understood as the realisation of the 19th century utopia that aimed at assuring society of a future made up of certain definitive and absolute knowledge. On the other hand however, Ulrich, the protagonist of the novel, is condemned to impotence because human reality and what it is to become are often based on more or less irrational intuitions and ideas (it is not possible to relate them to defined certainties in the Cartesian manner), thus challenging the mechanistic and deterministic expectation of the inevitable. Is Musil, therefore, as many have superficially defined him, the expression of a form of European decadence that leaves only a half part of truth to deterministic science? I am not of this opinion; quite the contrary. Musil opens up the way to a new culture in which science is no longer only deterministic but postulates a dialogue with indeterminism which is rooted in the soul, in human nature. Seen thus, he represents the beginning of a possible European rebirth. This thesis is supported today by many.[4]

But let us proceed in an orderly fashion. In the first place, it should not be forgotten that Musil spoke of "two half truths" because he knew them both well. He had written a thesis on Mach, was an engineer and liked mathematics. Moreover, in the novel Ulrich himself often recalls that mathematics represents the field in which he seeks to fulfill his aspiration toward precision. However, right from his previous book *The Confusions of Young Törless,* one sees that Musil finds the irrational and instinctive aspects of the human being very attractive. Despite this, he does not allow himself to be influenced by the stereotypes and the atmosphere of Vienna at that time. In fact, the judgement that Musil often expresses on Vienna – everything is documented – is that Vienna is a provincial world, decadent, incapable of arranging its own survival in contemporary reality. The place one had to go to at the beginning of the twentieth century in order to find a more consolidated European culture was Berlin. Musil, like Karl Kraus, is often pretty caustic in his criticism of Vienna of that time. *The Man Without Qualities* begins with the account of how strange things were in the kingdom of "Kakania" (Kakanie = Kaiser und König). A world which no longer had enough self belief to fight and to offer the synthesis "of the soul and precision". Ulrich would end up alone and lost. The whole of Europe would be lost in its mad attempt to transform a half truth into an increasingly totalising whole truth.

"A civilisation cannot truly give itself or create for itself a future if it schizophrenically separates the ambition for scientific precision from human cultural ambition."

Little by little as the novel develops we realise that what Musil is trying to free is the New Man, the man who will arise in the crisis situation in which Europe finds itself, a Europe seen as the extrapolation of the Viennese world of the Austro-Hungarian Empire of 1913 on which few hopes could any longer be founded. At that time there was no longer the spirit to give birth to a new culture, a new model capable of dealing with uncertainty rather than being subjugated by it. Another proof of Musil's positive and optimistic will is found in his pretty severe criticism of Oswald Spengler and his thesis concerning the crisis in the West. This crisis, terrible though it was, was not inevitable according to Musil; it was not envisaged among inescapable "scientific events". We should understand that we are not *one* absolute truth, that man is not complete, that man is a project and that a civilisation cannot truly give itself or create for itself a future if it schizophrenically separates the ambition for scientific precision from human cultural ambition, in the broader sense. There is then an unbridgeable gap into which it becomes dispersed and disappears.

Why then do I today allow myself to suggest the idea that the Secretariat succeeded? If we think of what the humanistic disciplines, particularly economics, have tried to do till now, we would not have the impression that this was the case. Even today my fellow economists try to be taken as seriously on the scientific level as a physicist, a chemist or a biologist. They believed in this possibility when many years ago some Nobel prizes were awarded for economics. Until very recently this discipline's ambition was to try to offer a clear and certain identifica-

tion to the socio-economic analyses as was the case with the natural sciences. The big innovation from the beginning of the century, from Musil's time, was the fact there was a reversal of positions in the natural science field, and particularly concerning physics. Indeterminism, the uncertain, gained greater space increasingly in the territory of philosophy and science, whether it involved Karl Popper,[5] another "Austrian oldie" or Ilya Prigogine.[6] All this took place against a background of the development of quantum physics.

> *"There is no room for an absolute truth fixed in time. Even the very notion of time is changing."*

What do these great intellectuals deal with if not with the fact that the Secretariat suggested by Musil for uniting the two half truths, the scientific truth and the truth of the much more undefined and indeterminate human nature, might be able to find a meeting point? Here was the new world, culturally, socially and psychologically capable of bearing the uncertainty that gives meaning to any project whatsoever, avoiding the danger that it might become totalitarian. It is about a battle therefore to obtain greater freedom, greater conscientiousness and responsibility in freedom. Everything began when Einstein struck a bitter blow, however reluctantly, against Newton's world of reality, despite the fact that he spent a large part of the last thirty years of his life seeking to prove that physics could again be founded on certainties fixed and absolute in time and space.

So, what occurred in scientific thought? It happened that the concept of uncertainty gradually but increasingly replaced that of certainty. Today, for most scientists, modern science is no longer a kind of edifice in which a sure definition of a reality is established, one that preserves its validity in time and space once and for all.

Science is not an edifice to which bricks are added from time to time and in which every element represents a certainty that is valid forever. Every time science produces a brick, a new building material, this material makes it necessary to review the whole construction system concerned. What is needed therefore is a dynamic vision and not a vision in which an <u>eternal, universal and immutable truth</u> is set definitively in time and space. Truth will never be found, only a greater truth. Any truth whatsoever from the past is redefined and changed into new "truths". There is no room for an absolute truth fixed in time. Even the very notion of time is changing.

The history of evolution itself appears increasingly not so much as a series of balanced situations, but as a sequence of situations of imbalance. It is the identification of an imbalance that allows us to suggest a purpose and to highlight the alternatives in which the possibilities of development are even greater. The definition of "balance", in fact, defines a purpose that can prove to be an "imbalance", if the circumstances affecting observation and perception change. Some books on mathematics can also be quoted, such as Klines in particular, that highlight how for a given problem, the sustainable logical and mathematical possibilities can offer differing, yet equally valid, solutions.[7] So what we discover, then, is the impossibility of turning to the ideas of the deterministic era of the last centuries on natural science in order to justify deterministic visions or visions according to which the future can be considered only within the inevitable development of an evolution whose only way out is held to be scientific.

Evolution can take different directions: These appear determined only a posteriori, while everything that happens in the future is uncertain. Fortunately. In other words, it is through the acceptance of the notion of uncertainty in the natural sciences that the rift can, para-doxically, be welded into a new union between the human sciences and the so-called exact sciences. The latter, which are actually not exact except for a limited period in time and space, are different from human sciences only in a different degree of uncertainty and in the high level of empirical verification. In this case, it is a matter of a cultural influence which appears in some publications and which justifies the idea that the Secretariat of precision and the soul suggested by Musil, through Ulrich in his novel, really has achieved its work a hundred years later. One can speak of a positive balance sheet, even when starting from an idea that was never actually realised from the organisational point of view. The two semi truths are no longer schizoprenically separate. We find ourselves in a post-Cartesian reality in which ideas are no longer eternally distinct. If they remain so they often become irreconcilable. The fact that between the field of human knowledge and another one there are grey superimposing areas is increasingly gaining consensus. There are no necessarily irreconcilable gaps between poetry, literature, economics, political sciences, chemistry, physics etc. The inspiration of the great poet meets the intuition of the great physicist. The custom of cutting up reality like slices of salame has not been a useful tool for advancing research in a number of fields. This ancient school of thought was at the base of the European disaster in the first half of the last century. Responsibility for this can be laid at the door of the exclusive nation-state and the lack of understanding of political federalism can be condemned as being "confused" because it admits and in fact stimulates and guarantees a division of sovereign powers at various levels.

> *"Uncertainty constitutes the true possibility of progress."*

This way of presenting the thesis on uncertainty is clearly too quick and perhaps excessively ambitious. It will probably be a long time before European (and world) culture will have enough courage and maturity to welcome and develop these ideas, to accept uncertainty without having recourse to such ideas, stupefying substances and intellectual or ideological drugs in the hope of eliminating life's problems both in daily life and in their historic context.

Let us, however, seek to avoid building castles of a new Middle Ages in the false hope that we will be able to hide behind those walls. Others would not understand what we are doing, and besides in this way we can enjoy greater security. It is precisely through this behaviour that psychoanalysts will easily understand that we are building walls to protect us from our insecurity thus preparing our own ruin in the "unstable" reality of the contemporary evolving world. It is a question of understanding that uncertainty is within things. Uncertainty constitutes the true possibility of progress. When we run through risks by breaking the limits of particular sectors, greater survival and growth are guaranteed.

The future of Europe revolves around the level of such uncertainty: I believe that the day the full importance of Musil's Secretariat of precision and the soul is recognised, the whole of Europe will take a step forward towards civilisation and towards its integration into a world that might otherwise forget Europe, just as it has forgotten the reign of Franz Josef of Austria.

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Notes

1. Robert Musil, *L'Homme sans qualités* 2 volumes (Paris: Seuil, 1979) and the many translations in several languages. The first version of this commentary was written in 1988

2. Robert Musil, *Journaux* (Paris: Seuil, 1981)

3. Orio Giarini, "Dialogue à propos d'un centre de réflexion sur l'incertitude," *CADMOS,* no. 32 (1985)

4. Marie-Louise Roth, *Robert Musil, l'homme au double regard* (Paris: Balland, 1987)

5. Karl Popper, *The Open Universe, An Argument for Indeterminism,* ed. William Bartley (London: Hutchinson, 1982)

6. Ilya Prigogine and Isabelle Stengers, *La Nouvelle Alliance* (Paris: Gallimard, 1979); Orio Giarini, "L'incertitude de Newton à Heisenberg un nouveau paradigme pour," *I Quaderni di Ginevra* 9, no. 33 (1984) : 396-409

7. Morris Klime, *Mathematics – The Loss of Certainty* (Oxford: Oxford University Press, 1980)

Global Governance:
A New Paradigm for the Rule of Law*

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Abstract

This article seeks to appraise the Rule of Law in the context of international sovereignty and the growth of international non-governmental organizations. The article explores the meaning of the Rule of Law and suggests that it is better understood as a symbol representing the most basic values that underline our global constitutional system. When we relate the global Rule of Law to the values and the global constitutional framework, we recognize that the Rule of Law and the global constitution are better secured if their authority base can be strengthened. The obvious way this can be done is by strengthening the role of non-governmental organizations within the framework of global governance. If we see the Rule of Law as a defense and promotion of basic values, we may then pose the question about the Rule of Law as an agent of change in a novel developmental construct. Here the author notes that the dynamism of technological change will only increase in the future. But technological change will result in more use of technology and less employment. The question then is, should the benefits of technology not be shared with the workers as well? If that is true, one of the obvious benefits of technology in relation to labor is to reduce the number of hours or days that the worker has to work. Leisure time could result in an aggregate distribution of human happiness. It could evolve into an incentive to generate enhanced human co-creative activity. We could possibly even imagine a second renaissance in the impact of human imagination on society. A modern renaissance. In short, such a development could stimulate the evolution of a human rights based aesthetic.

1. The Global Rule of Law: Paradigm Shift

'The Rule of Law' is a disarming phrase. It suggests ostensible simplicity. Any person of average intelligence will be able to determine that a rule which governs his behavior and for which there may be consequences if he violates the rule, has the quality of the Rule of Law. However, the phrase actually implicates greater complexity. Unpacking its complexity is of course important to us. At the risk of extreme reduction we could suggest that the Rule of Law idea was largely an idea generated by legal culture and juris consults to limit the arbitrary capacity of sovereign decision making. Leonard Shapiro, a great student of

totalitarian political culture, suggested that the most fundamental difference between totalitarianism and democracy was a working Rule of Law: an operational restraint on arbitrary and expedient sovereign action.

"'Rule of Law' implies an aspirational future of realizable global justice and dignity."

To a large extent this version of the Rule of Law was reflected in the evolution of modern constitutional democracy. It was therefore the Constitution of law which limited sovereign absolutism. After WWII, we the people of the earth/space community promulgated a global constitution. This constitution and the processes that preceded it and proceed from it, form the United Nations Charter. What is distinctive about the Charter is that it did not seek to establish itself as a neutral umpire between the competing stakeholders. The Charter was not value-free. It was rooted in the most fundamental values that humanity has identified for its survival and future prosperity. This has implicated a Rule of Law of global dimensions. A Rule of Law rooted in the fundamental values of human coexistence and aspiration, and rooted as well in the promise of a constitutional culture which seeks to give specific prescription and application in concrete instances of decision-making responsibility.

In a recent article, Garry Jacobs and I provided an outline and guidance on the need for a new paradigm for a global Rule of Law.[1] Implicit in our article was an understanding that a new paradigm for the global Rule of Law, which implicates a global constitutional law and a global interest in good governance at every level of society, must present some kind of developmental vision of a realizable and more promising future. In these brief remarks, I plan to explore these issues further.

It may be useful to commence by asking the question "What is meant by the Rule of Law?"

The UN General Assembly recently adopted a Resolution giving a wide ranging and important clarification as to what it means by the global Rule of Law. According to the declaration of the High-level Meeting of the General Assembly on the Rule of Law at the National and International Levels, United Nations A/RES/67/1, General Assembly, 30 November 2012, Sixty-seventh session,

2. *We recognize that the rule of law applies to all States equally, and to international organizations, including the United Nations and its principal organs, and that respect for and promotion of the rule of law and justice should guide all of their activities and accord predictability and legitimacy to their actions. We also recognize that all persons, institutions and entities, public and private, including the State itself, are accountable to just, fair and equitable laws and are entitled without any discrimination to equal protection of the law.*

7. *We are convinced that the rule of law and development are strongly interrelated and mutually reinforcing, that the advancement of the rule of law at the national and international levels is essential for sustained and inclusive economic growth,*

> *sustainable development, the eradication of poverty and hunger and the full realization of all human rights and fundamental freedoms, including the right to development, all of which in turn reinforce the rule of law, and for this reason we are convinced that this interrelationship should be considered in the post-2015 international development agenda.*

We may provide a shorter and possibly, a more suggestive answer. The term 'Rule of Law' symbolizes an inspiration about basic values and seeks to guide authoritative and controlling decision making (for which we reserve the term law) to secure the most ancient objective of all law: to defend and to promote the common interest of all the people. The common interest today is broadly seen in terms of universal well-being and a celebration of human dignity. Additionally, the symbol 'Rule of Law' implies an aspirational future of realizable global justice and dignity. In short, it implicates the vision of a desired developmental future for humankind. That in short is the challenge symbolized by the global Rule of Law idea. It was precisely this challenge that Garry Jacobs and I addressed in our article that a new paradigm of the Rule of Law is urgently needed to give the Rule of Law idea an optimum meaning. The central institutional mechanism, which gives the Rule of Law idea operational relevance, is the constitutional form that it inspires. Constitutions are generally seen as instruments reflecting Rule of Law values.

"My colleagues in the World Academy have drawn attention to the failures in global economic development and see as a missing component of a solution to our current economic crisis the importance of human capital as a driving force of social capital."

At the global level, it is therefore quite appropriate to identify a global constitutional process. That process includes the text and practice of international society under the UN Nations Charter. However, it is by no means clear that the UN Charter, which clearly is our global constitution, has universal traction among all stakeholders that it is a constitution with fully enforceable international obligations as law. The weakness of the Charter as a global constitution is that it has to contend with the concentration of effective power among key sovereign state participators. It has sometimes been admitted that a directorate of super sovereign states drives key decisions of the UN. We believe that this retards the full promise of the global constitution and its capacity to respond to the major issues and problems that we confront in the global environment. In short, the practice has gravitated to a high level of sovereign state influence as well as the leverage of control that such entities generate. This suggests that the control factor, a residue of sovereign abolitionism, seriously weakens the authority foundations of the global constitution. It will be recalled that unrestrained sovereign claims to absolutism led to the demise of the League of Nations. It was for this reason that the drafters of the Charter confronted the problem of authority behind it. The very first terms, which introduce the UN Charter, locate its authority in a statement, which says, "We the people…determine."

The Preamble in Chapter 1 identifies peoples and individual rights in terms of the need for security, human rights and dignity, humanitarianism, economic and social justice, and respect for law. Most of the rest of the document deals with the membership of states and the powers allocated to them.

Garry Jacobs and I have followed a tradition of scholarship established by leading figures in the World Academy of Art and Science, seeking to address the question of how to broaden the authority foundations of the global Rule of Law. In our paper, we stress the notion that at any level of society, problems emerge from the human participators and it is those problems that require law to respond in the form of responsible authoritative and controlling decision making. The first task that we thought would provide some insight into the nature of global authority and global problems was to understand that there is such a thing as a global or planetary community. This planetary community is made up of many and diverse participant stakeholders. Realism requires that we acknowledge their existence, roles, and potentials for improving or diminishing the human prospect. What we see, as a critical normative salience is that, humanity is organized institutionally, at the back of every institution are human agents who claim identity, who assert claims for basic values and who also claim recognition of settled expectations. We believe that important elements that recognize the individual as a fundamental unit of legal and political analysis in the global environment are reflected in the text of the UN Charter, especially the human rights references and subsequent developments in the area of human rights, humanitarianism and development. We can connect this to the notion of an evolving or emerging paradigm of inclusive global governance. We can for convenience identify the prior paradigm as the largely territorially organized sovereign state paradigm. This paradigm is increasingly challenged by the creation of other participatory stakeholders in the global social, power and constitutional processes. These other stakeholders include not only intergovernmental organizations or cosmo corps, but include humanity as a whole which is increasingly expressing itself through globally identifiable institutions of civil society. This is a fact increasingly recognized by the UN itself. [*, 2, 3]

My colleagues in the World Academy have drawn attention to the failures in global economic development and see as a missing component of a solution to our current economic crisis the importance of human capital as a driving force of social capital. The central insight here is that individual human beings represent capital resources, which if properly developed, generate social capital, at all levels of economic organization. The fundamental idea may also be seen as a cornerstone of human rights. Individuals who claim human rights, and who are the activists for the realization of human rights, are in effect recognizing that human rights are an aspect of political capital and an important component of an improved human prospect.

The critical question for the UN and enlightened decision makers is how to create more space, politically, culturally and economically for the individual subjects of the global community process. I suggest as well that this is a matter of importance because this universe of participators would deeply strengthen the authority aspect of the global constitution and

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[*] UN Civil Society, see http://esango.un.org/civilsociety/login.do. See also, http://www.civilsoc.org/whatisCS.htm, http://www.un.org/partners/civil_society/home.htm and http://gcsknowledgebase.org/

involvement as stakeholders may well change the global expectations of limiting powers to a small group of states.

At present, we live in a world in which we have already seen the emergence of many sectors of global civil society. Recently, we saw the emergence of the Earth Summit in Rio, the Cairo World Population Conference and the World Conference on Women in Beijing. The Global Campaign for Climate Action (GCCA) is an *alliance* of 300 non-profit organizations around the world whose objective is to mobilize civil society and galvanize public support for a safe climate future. The GCCA led a campaign against the XL pipeline. They also led the push for European leaders to support a financial transaction tax for the purpose of grappling with poverty and climate change. We should also note that the World Association of Non-Governmental Organizations website lists some 22,885 NGOs in North America alone. In addition, global society is permeated with professional organizations in law and medicine, the sciences, and the arts. Indeed, we are here today representing the World Academy of Art and Science, an organization we think can contribute to the future of global Rule of Law. Our central problem is to modify the UN Charter or creatively interpret it to provide non-state actors access to this important forum on international decision making. This will require complex strategic thinking but at the back of this approach there must be the realization that expanding civil society participation and influence also broadens the authority foundations of the UN itself. A mobilization of the professions, the civil society organizations, the humanitarian and human rights NGOs, could provide a form of leverage where the UN can confront the crunch issues looming on the horizon. It could influence decision making in constructive ways and possibly permit important discussions on a variety of issues such as the impact of technology on working hours. In short, is there a human prospect in which individuals will have more free time to focus on aesthetic rights and possibilities that may improve the happiness factor in a future scenario?

It has been my contention that a realistic understanding of the Rule of Law and its potentials for improving the human prospect must be rooted in the social reality of a global social process. It will be apparent that what emerges from the global social process are demands and problems that are crucial to human well-being. These demands are also changing and greatly implicate the idea of global governance. Sovereignty holds a crucial position in the global, social, political, and juridical context. It should be noted that there have always been pressures in the evolution of sovereignty to modify or change it. In the current global social process, we witness a very wide range of non-state, non-sovereign actors. The emergence and salience of these actors have served to limit in some degree the centrality of sovereignty in the global stream of governance. The emergence of these other stakeholders has been greatly facilitated by the global communications revolution. This revolution has permitted the emergence of newer forums outside of the boundaries of sovereignty and which for want of a better term are conceptualized as global civil society.

A new paradigm for the Rule of Law has witnessed an evolutionary trend in the development of sovereignty and its placement within the context of the fluid notion of globalization. This development presses us to explore more critically the conceptual and normative bases of sovereignty in our time and to appraise it in terms of the notion of authority in the idea

of governance itself. In general, authority is rooted in the people's expectations and therefore the idea of authority itself resists the notion that it should be collapsed into a form of sovereignty, which implies the monopolization of power and at the same time diminishes the popular expectation of authority rooted in the people. Contemporary international relations have their legal foundation in the Charter of the United Nations.

> *"The recognition of the importance of people as a source of authority for a new paradigm for the Rule of Law is a critical shift in focus."*

The Charter limits membership to sovereign nation-states. However, the Charter proclaims that it communicates with the authority of the people of the earth/space community. Indeed, the normative foundations of the Charter are rooted in the people's expectations of peace, security, human rights, and social progress. This represents an important challenge to the Rule of Law, that this idea finds its authority in the people of the world community. The recognition of the importance of people as a source of authority for a new paradigm for the Rule of Law is a critical shift in focus. It might challenge the idea that the values relating to the very existence of humanity are to be monopolized by a small directorate of powerful states whose foundations in the authority of people's expectations are vastly limited. This challenge requires the powerful to restrain themselves from the temptations of the exercise of power and to seek and act with the authority, as well as the objectives of universal well-being and dignity.

> *"A Rule of Law that gives full recognition to the individual in the global environment may have a positive influence on how future challenges are confronted. An unadulterated recognition of the individual is recognition of the human capital inherent in all human beings."*

2. A New Paradigm for the Rule of Law: A Glimpse of Future Developmental Constructs

I had earlier mentioned that the global Rule of Law idea could partake in a generation of a desirable sequence of global developmental constructs for the improvement of the human prospect. Therefore, apart from the subject on our agenda today, there are theorists such as James Martin who stress some other dimensions of problems of global importance. Reference is made to the crisis of climate change, demographics and overpopulation, the shift of global economic power to the corporate form of economic organization; the possibility of future pandemics of global destructive capacity. With these thoughts and their connection to the Rule of Law, it is worth a reminder that a Rule of Law that gives full recognition to the individual in the global environment may have a positive influence on how future challenges are confronted. An unadulterated recognition of the individual is recognition of the human capital inherent in all human beings. This would seem to tie in with the idea of human capital and its importance for a global developmental construct. One aspect of this should be

whether human capital and global development may be used as indicators of human happiness. Indeed, if we consider the inevitability of technological innovation and its impact on economic productivity, we may well have to confront the challenge that a newer paradigm of development may require a sharing of the benefits of technological innovation. Sharing may implicate the prospect of more leisure time for humanity. This in turn may suggest an important challenge for a developmental construct. This may be a point when conditions favor an opportunity for a renaissance in human affairs in which human capital is highly valued for its imaginative, co-creative capacity.

This human potential may be facilitated in an unleashing of innovation and creativity as a form of aesthetic development. It is worthy of consideration within the new Rule of Law paradigm that aesthetics may constitute one of the most fundamental of human rights. There is no aesthetic experience without the subjectivity of the individual and the protection of the individual needs as well, the protection and promotion of individual creativity, which encompass aesthetic values. As a component of human rights values, it would seem to be important at every level of society that individual freedom be secured and encouraged. In short, a very reasonable developmental construct for a new Rule of Law paradigm provides the normative guidance at an inclusive global level that functions as a liberating force for human creative possibility. This could be directed at individual creative capacity, hopefully as a humane and socially liberating force that gives voice to and is rooted in the expression in global civil society in which individuals are both the controllers and the controlled.

"New initiatives based on new thinking are urgently needed and organizations like the World Academy of Art and Science, the Club of Rome, the Pugwash Society and such academic innovations as the Oxford Martin School, are an indicator that there is an incipient move to develop a new Rule of Law for a new age."

This perspective, idealistic as it sounds, is rooted in important contemporary social fact. It is fit for the common understanding of the Rule of Law, as we now understand it. A central value objective of the UN Charter focuses on the well-being and dignity of the individual. Inherent in the constitutional foundations of the Charter is an appreciation of the close link with its fundamental base of authority: we the people. This base of authority is global in its potential reach. Current practices encourage engagement in civil society. The constitutional system needs to find the means and the methods to dramatically open up its processes to civil society.

Global communications processes are a critical technique for the engagement of civil society. A closer alliance with communications networks, associations of journalists and academies of the sciences and the arts, could facilitate the creation of a newer paradigm of global expectation. Additionally, there are efforts to facilitate people-to-people diplomacy, such as sister city alliances; cultural diplomacy could also be a vehicle pointing the way to a new order of the global renaissance.

We can of course generate other developmental constructs such as a world completely free of nuclear weapons, a world in which war is abolished universally, a world in which need is globally secured for all; a world in which educational values are universally defended and promoted, a world that would seek to maximize universal respect, a world that would make the giving and receiving of affection a major expectation of interpersonal as well as cultural aspiration. If affection is given its due, humanity will have a profound basis for global solidarity because affection and empathy are the essential ingredients of solidarity on a global scale.

It seems clear to me that the domination of global governance by territorially organized sovereign states cannot solve the great global problems of our time, which threaten the survival of all. New initiatives based on new thinking are urgently needed and organizations like the World Academy of Art and Science, the Club of Rome, the Pugwash Society and such academic innovations as the Oxford Martin School, are an indicator that there is an incipient move to develop a new Rule of Law for a new age.

I conclude this paper with a warning about the dire consequences for humanity of a weakening of the global Rule of Law. This warning I discovered in the papers of my late wife, Judith Mattox Nagan who passed away on April 5th this year. She saw in the demise of the global Rule of Law a real threat to humanity; these are her last words:

> *"I fear for mankind's survival. I believe we will most likely destroy life on this planet in the not too distant future. With so much suffering that man creates, it seems almost inevitable. Nuclear destruction is how we will end. Quickly. But life will begin again of course – and it will all start all over again – and we will have learned nothing. Perhaps it makes no difference. Perhaps life is random. Only man creates meaning for himself, nature does not care who lives or dies – everyone dies."*

– From the papers of **Judith Mattox Nagan** (1944-2013)

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Notes

1. Winston Nagan and Garry Jacobs, "New Paradigm for Global Rule of Law," *Cadmus* 1, no. 4 (2012): 130-146 http://www.cadmusjournal.org/article/issue-4/new-paradigm-global-rule-law

2. John A. Hall, *Civil society: Theory, History, Comparison* (Cambridge, UK : Polity Press, 1995)

3. John Keane, "Global Civil Society?," *Foreign Affairs* 26 September 2003 http://www.foreignaffairs.com/articles/59214/g-john-ikenberry/global-civil-society

Cooperative Security:
A New Paradigm For A World Without Nuclear Weapons?

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Abstract

If there is a loose consensus on aiming at a world free of nuclear weapons in the future, there are clear oppositions as to the timeframe as well as the means for achieving this goal. The approach to nuclear disarmament followed to date has only yielded limited success because it has been conceived in isolation from global and regional security environments and threat perceptions. A new paradigm should thus be sought in order to reconcile nuclear powers' security doctrines with global aspirations for a safer world, and ensure that nuclear powers derive their security less from others' insecurity but from mutually beneficial cooperative security. This should not become a pretext for preserving nuclear weapons for ever. It will on the contrary require parallel tracks addressing the initial motivations for acquiring nuclear weapons and other weapons of mass destruction (WMD), in particular in the context of regional conflicts, as well as dealing with the current issues necessarily related to nuclear disarmament (missile defence, weaponization of space, conventional imbalances and future weapon systems). Ultimately, in a globalised nuclear-weapon free world, state security will not require nuclear weapons because it will be inserted into a broader network encompassing all aspects of security addressed in cooperative and multilateral approaches.

1. Disagreements on the Best Route to Nuclear Disarmament

The ultimate goal of ridding the world of nuclear weapons, expressed in the very first resolution of the United Nations General Assembly, is regularly reaffirmed by all states, including the nuclear powers. It is at the heart of the Non-Proliferation Treaty (NPT) and the commitments adopted at its Review Conferences in 1995, 2000 and 2010. It was solemnly proclaimed by President Obama in his 2009 Prague speech. However, 68 years after Hiroshima and Nagasaki and two decades after the end of the Cold War, the world's nuclear arsenals are still estimated to total more than 17,000 warheads, nearly 94% of which are

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in the hands of the United States and Russia.[*] This is a real improvement compared to the 65,000 weapons active in 1985, but the fact that all nuclear powers keep modernizing their arsenals and some increase theirs shows how much progress is still needed to achieve the common goal of nuclear disarmament. The firepower of the sole US and Russian deployed nuclear weapons still equals 700 times the explosive firepower of all the bombs exploded during World War II (expressed in tons of TNT).[†]

"If the process of nuclear disarmament has to proceed further or to be initiated, considering the current failures, a new security paradigm will need to be elaborated."

Because of the primary responsibility of the two main nuclear powers, their bilateral negotiations and agreements have until now remained the principal channel for both preventing further "vertical" proliferation, i.e. ceilings on numbers of delivery vehicles and warheads, and reducing actual stockpiles by dismantlement of delivery vehicles or non-deployment of warheads. This process, started in the early 1970s, did yield the above-mentioned reductions. However, since 1949, in parallel, the number of states having manufactured and exploded nuclear weapons increased from two to eight (with the addition of UK, France, China, India, Pakistan, and North Korea) or nine counting Israel (which has not exploded a nuclear device). While the US and the Soviet Union followed by Russia had begun reducing their stockpiles, some new nuclear weapon-states increased their stockpiles. However, the UK and France also carried out reductions in their smaller arsenals after the end of the Cold War (France is actually the only nuclear power to have cut its total stockpile by half, reduced by one third the number of its active nuclear submarines and airborne weapons, missiles and aircraft, scrapped its land-based component, and dismantled both its testing site and fissile material production site).[1]

Between the main protagonists of the Cold War, the process of nuclear disarmament, albeit limited, was closely related to an evolution of the global security environment. The relaxation of tensions during the 1970s, followed by Mikhail Gorbachev's policy of *glasnost and perestroika* culminating in the collapse of the Soviet Union and the end of the Warsaw Pact facilitated unilateral and bilateral disarmament initiatives. The most effective approach was an incremental building of mutual confidence through direct communication lines, data exchange centres, reciprocal verification of ceilings and dismantlement. The same approach was followed in the conventional domain, with confidence – and security-building measures gradually allowing actual elimination of the most destabilizing heavy armaments in huge quantities in Europe.

If the general political environment and the reduction in the level of potential military confrontation have favoured a sense of strengthened security among the former Cold War

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[*] Federation of American Scientists, "Status of World Nuclear Forces", Nov. 2012 (http://www.fas.org/programs/ssp/nukes/nuclearweapons/nukestatus. html)

[†] See http://www.nucleardarkness.org/

enemies, those countries have not felt secure enough to move faster and closer to the goal of nuclear abolition. At the same time, new nuclear powers have emerged and developed their capabilities and stockpiles for reasons of their own. In both categories, if the process of nuclear disarmament has to proceed further or to be initiated, considering the current failures, a new security paradigm will need to be elaborated.

"Even when the actual risk of aggression from any potential enemy tends to disappear, nuclear-weapon states find in the power conferred upon them by nuclear weapons a new reason for maintaining them."

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2. Addressing Motives and Threat Perceptions: Fear and Power

In order to build this new security doctrine, one will need to review the motives which have led governments to join the nuclear club. Basically, those motives can be boiled down to two: **fear and power.** Even former Cold War protagonists have not drawn all the consequences of the disappearance of their former enemies. Their reliance on nuclear weapons to protect their vital interests is still predicated on a **zero-sum game security concept:** their security will be preserved only if their potential enemies (even currently undefined) feel insecure and thus dissuaded* to launch any aggression against them. **Nuclear deterrence is based on nuclear powers' fear of potential enemies and on the latter's fear of potential damage that should outweigh the benefits of aggression.** But, even when the actual risk of aggression from any potential enemy tends to disappear, nuclear-weapon states find in the *power* **conferred upon them by nuclear weapons a new reason for maintaining them.** This nostalgia of nineteenth and twentieth-century power politics by a small number of potent states is still prevalent in the minds of leaders who are considering what their countries would become without nuclear weapons. Meanwhile, the world has changed: power comes less from the traditional instruments of state power such as nuclear weapons and more from economic and/or demographic dynamism, capacity for technological innovation, digital transformation, and intellectual influence, qualified by Joseph Nye as *soft power.*[2]

> *"Reducing the benefits conferred by nuclear weapons in terms of power will thus need to be pursued along with mitigating the justified fears or perceived threats that now justify resorting to nuclear weapons."*

In regions of protracted conflict, nuclear weapons have appeared as an attractive means of guaranteeing security in the **same zero-sum game approach** and combination of fear and power, even if they have played the role of an **equalizer of conventional imbalances** (like in the case of Israel versus the Arab world and now a potentially nuclear Iran, or Pakistan versus India) and, as for Cold War protagonists, their possession has so far prevented a nuclear war but not direct or proxy conventional wars. While military might has ceased to be

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* In French, deterrence is translated to dissuasion which carries less connotation of terror and relies more on a rational decision to abstain from aggression.

the sole criterion of power for western states, emerging countries like India or China cannot conceive asserting themselves without strengthening their military capabilities, including nuclear power. When North Korea and Iran crave for recognition, drawing inspiration from the most powerful country, the US, they develop their nuclear programmes. They cannot ignore the precedents of Iraq and Libya, which became subject to military intervention after they had renounced, voluntarily or not, their WMD programmes.

For both categories of states, **reducing the benefits conferred by nuclear weapons in terms of power will thus need to be pursued along with mitigating the justified fears or perceived threats that now justify resorting to nuclear weapons.** Of course, this is easier said than done. The UN Security Council has identified the key objective in its historic resolution 1887 which was unanimously adopted at the level of heads of state or government on 24 September 2009: *"to seek a safer world for all and to **create the conditions for a world without nuclear weapons,** in accordance with the goals of the Treaty on the Non-Proliferation of Nuclear Weapons (NPT), in a way that promotes international stability, and based on the principle of undiminished security for all*." Several tracks could be pursued simultaneously in that direction.

3. Four Steps Towards Cooperative Security

Cooperative security has been defined as: *"a process whereby countries with common interests work jointly through agreed mechanisms to reduce tensions and suspicion, resolve or mitigate disputes, build confidence, enhance economic development prospects, and maintain stability in their regions."*[5] In order to make progress towards the emergence of such a system and create the conditions for a world without nuclear weapons, four steps should be envisaged.

1. The first one would be to **disconnect the permanent membership of the UN Security Council from possession of nuclear weapons.** Actually, from 1971 (when the People's Republic of China joined the Security Council) to 1998 (when India became a nuclear-weapon state), there was a strict equivalence between the status of a Permanent Member (with veto power) and that of a nuclear-weapon state. Obviously, there are other reasons for the attractive character of this coincidence why other countries acquired nuclear weapons. However, if countries such as Germany, Japan, Brazil, and Egypt do become Permanent Members while they do not possess nuclear weapons, this attractiveness would be reduced. It would be demonstrated that **it is possible to acquire power and influence over world affairs without a nuclear arsenal.** The role currently played by Germany in the "P5+1" negotiations with Iran on its nuclear programme or by Japan in the "Six-Party Talks" with North Korea (beyond both countries' contribution to the funding of the UN or other organisations) can be a justification in advance for such a move.

2. The second step would consist in **vigorously addressing the regional conflicts which fuel nuclear proliferation:**

   – In **South Asia,** it is true that India did not become a nuclear-weapon state because

of Pakistan (but mainly because of China) while the reverse is true. Therefore, India and China should be encouraged to resolve their disputes including territorial ones, possibly with the mediation of the UN Secretary-General or his envoy, and consider a set of confidence-building measures to move towards cooperative security for their mutual benefit. This could lead to negotiated or unilateral but coordinated steps towards conventional and nuclear disarmament. Between India and Pakistan, although confidence-building measures such as direct communications links and an agreement on the non-attack of nuclear facilities are already being implemented, no major breakthrough can be expected until a negotiated solution to the Kashmir conflict (and other territorial disputes) is achieved. The US, which aggravated Pakistan's frustration by granting India a nuclear cooperation agreement despite its non-NPT membership, has a critical role to play. Some compensation for Pakistan will need to be found, especially to encourage it to accept a multilateral negotiation on the prohibition of production of fissile material for weapons purposes ("Cut-off Treaty"). Beyond South Asia, it is also clear that persisting tensions between China and the US (mainly about Taiwan) as well as territorial disputes between China and Japan must be addressed to avoid escalation in the Chinese military build-up.

– In the **Korean Peninsula,** the Six-Party Talks must be revived to ensure the implementation of the 1992 and the 2005 agreements on the denuclearization of the Korean Peninsula. Here too, the US has a crucial role to play to alleviate the fears of the North Korean regime stemming from a perceived policy of regime change and unqualified support to South Korea. With the needed support from China, Pyongyang should be convinced of the benefits it may derive from denuclearization that should outweigh the costs of the status quo, including sanctions and isolation. Beyond that aspect, both Koreas should get incentives for concluding a far-reaching normalization agreement.

– In the **Middle East,** another volatile region, priority should of course be given to the central issue of a peace agreement between Israel and the Palestinians allowing the recognition of the state of Palestine and consequently the mutual recognition of Israel and all Arab states. It is an illusion to think that anything will happen in the area of arms control or *a fortiori* disarmament unless this preliminary step is achieved. Beyond that essential milestone, threat perceptions and military asymmetries in the region will still need to be addressed, especially because they are affected by a perception of Western double standards in favour of Israel.[4] As for Iran, a parallel can be established with North Korea: until Tehran receives some form of recognition for its legitimate regional role from the US, amounting to a definitive abandonment of the regime change policy, Iran will continue to develop the capacity to deter what it perceives as a threat from the US and Israel. Some, like Gen. James Cartwright, go as far as suggesting that the US offer extended deterrence to Iran.[5] Presumably, this would be part of a Grand Bargain whereby Iran would accept to forego nuclear weapons in exchange for continuing low enrichment of uranium for peaceful purposes. Of course, the best way of ensuring an end to proliferation in the

region will be an agreement on a WMD-free zone including Iran and Israel, with external guarantees.[6]

3. The third step would be, assuming that regional conflicts are addressed to open the way to regional security architectures, to **promote synergies between regional and global disarmament.** Indeed, even if regional tensions can be reduced by confidence- and security-building measures and commonly agreed constraints on the most destabilizing armaments, one major incentive for regional disarmament should come from global disarmament efforts by the most heavily armed states. The idea is to **move from the vicious circle of maintaining nuclear deterrence against current or possible proliferation to a virtuous circle of accompanying de-proliferation with reduced levels of armaments.** Any pursuit of the status quo, where the developed nuclear powers keep their nuclear weapons because of the growing threat of developing states' weapons, may amount to a **self-fulfilling prophecy.** In other words, letting existing or potential proliferation crises develop may in the end justify maintaining nuclear stockpiles or even building them up, consequently encouraging the proliferating states in their endeavour. How is it possible to avoid a sense of **double standards** when India is told to disarm while China increases its arsenal? When Pakistan is told to disarm while India benefits from a US nuclear cooperation agreement? When Iran is told to stop its nuclear programme while nothing is done about Israel's capability? When North Korea is told to disarm while South Korea enjoys US extended deterrence? On the contrary, the power of example may be strong and at minimum must be tried: if the US ratified the Comprehensive Nuclear Test Ban Treaty (CTBT), it could have a domino effect on the other key states missing (China, Egypt, India, Iran, Israel, North Korea, Pakistan) and allow the treaty to enter into force. At least the US would be credible in campaigning for this non-proliferation instrument. If the US and Russia returned to a **Reykjavik-type[*] approach** (elimination of all ballistic missiles and 50% of all strategic weapons within 10 years), the onus would be on the other nuclear powers, including China, the UK, and France to follow suit in taking part in some negotiation. Obviously, all the contentious issues preventing a breakthrough in the negotiations between the US and Russia must be tackled: **missile defence** and in particular the European Adaptive Phased Approach (still perceived by Russia as a threat to its retaliation capability and thus to strategic stability); weaponization of **outer space** (related to missile defence capabilities with anti-satellite potential); **conventional imbalances** to the advantage of NATO, a reversal of the Cold War situation (and the related value of Russian tactical nuclear weapons); Russian fears about US conversion of submarine-launched nuclear-tipped missiles to conventional warheads or the development of **new conventional**

"If the US ratified the Comprehensive Nuclear Test Ban Treaty (CTBT), it could have a domino effect on the other key states missing and allow the treaty to enter into force."

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[*] US President Ronald Reagan and Soviet leader Mikhail Gorbachev met in the Icelandic capital in October 1986. Although the discussed ambitious disarmament plan was not finalized because of the disagreement on missile defence (Strategic Defense Initiative), it found some expression in the 1987 Treaty on the elimination of intermediate-range nuclear forces in Europe (INF Treaty).

weapons (such as the Prompt Global Strike)[7] that could be even more destabilizing than nuclear weapons especially if they substituted them in the future.

In order to make progress in the adoption of a new paradigm of cooperative security, the US and Russia should revive and update their **Cooperative Threat Reduction Program** which has already contributed to a substantial elimination of surplus armaments in Russia. They should also offer their expertise and support to other countries, including the identified regional conflict areas, in jointly implementing arms elimination programmes following the experience of the **G-8 Global Partnership** against the Spread of Weapons and Materials of Mass Destruction. Sharing in particular good practices and lessons learnt about on-site inspections within disarmament agreements may have a broad confidence-building effect.[8]

"The concept of security has dramatically evolved. It moved away from the sole protection of states (meaning often regimes or governments) against external threats by military means to ensuring the safety and well-being of individuals."

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4. The fourth step towards cooperative security to facilitate nuclear disarmament will be the **adoption of new security doctrines** by all current nuclear-weapon states, which they will be able to share with the rest of the world. This will be based on the explicit understanding that, in a 21st century globalised world, the concept of security has dramatically evolved. It has moved **away from the sole protection of states** (meaning often regimes or governments) **against external threats by military means to ensuring the safety and well-being of individuals** (some of whom may be threatened even by their own state or government), **confronted by multi-faceted transnational challenges.** These challenges facing both states and individuals can be traditional "hard security" threats such as terrorism, arms proliferation, organised crime or political violence, requiring effective law enforcement and occasional military instruments. But they are only partial security issues and encompass broader dimensions (social, economic, environmental) like pandemics, climate change, financial crises, uncontrolled migration, technological developments, uneven access to energy, food, water, or natural resources; such challenges necessitate comprehensive, multi-stakeholder approaches within states and, more importantly, multilateral or regional cooperation among states. In any case, **none of the above-mentioned threats can be deterred or combated with nuclear weapons.** Such weapons are thus increasingly condemned to irrelevance.

The other dimension of the new security environment compared to the one having led to the development of nuclear weapons is the fact that it is **less state-centric** and relies more on the contributions of **non-state actors or factors** that can be positive (civil society organisations, private sector, academic or scientific institutions) but also negative (criminal or terrorist organisations, traffickers, industry involved in irresponsible arms trade, uncontrolled

private security companies, etc.). Today, there would not be treaties banning antipersonnel landmines or cluster munitions, and tomorrow hopefully an Arms Trade Treaty, without the initiative of and a decisive push from civil society organisations. The implementation of the Chemical Weapons Convention (CWC) would be impossible without the cooperation of the world chemical industry. To prevent the use of biological agents as weapons, cooperation between states, the industry and the scientific community is being developed. In order to launch national debates in nuclear-weapon states on the irrelevance of nuclear deterrence, it is good that former high-ranking military and political leaders now campaign in that direction and express credible views based on experience; more of such debates are needed especially in the countries where nuclear policy has been kept away from public scrutiny.[9] In the end, **civil societies will demand more and more transparency, empowerment, and oversight,** as can be seen in the countries undergoing revolutions and transitions. This will be an important component of decision-making towards nuclear disarmament: any particular lobby, whether in the political sphere or the military-industrial establishment, must be aware of the will of the vast majority of people nationally and internationally and should give up the arrogant ambition of ensuring uneducated or uninformed people's security against their own will. Of course, **the real challenge is to convince as a priority the civil society of the nuclear-weapon states and their allies,** since in the other states, a majority is already persuaded of the irrelevance and dangers of nuclear deterrence. Needless to say, **wherever lobbies have vested interests in maintaining nuclear deterrence, such interests will have to be catered to,** by conversion to conventional or civilian work as it was largely done in the Russian industrial-military complex or in South Africa. Costs of such conversion could be shared internationally in the spirit of the G-8 Global Partnership, the results being in the interests of the whole international community.

4. The Conditions for a World without Nuclear Weapons

Once the process has started along these four tracks, it should be easier, especially for nuclear-weapon states and their allies benefiting from extended deterrence to **consider that most of the *"conditions for a world without nuclear weapons"*** mentioned in the UN Security Council resolution 1887 **have effectively been fulfilled.** In that sense, the nuclear-weapon states would not be credible if they continued to affirm that their ultimate security could still be achieved only with nuclear weapons. The above-mentioned "conditions" would then indeed appear as pre-conditions for moving ahead towards nuclear disarmament.

How to translate this situation into **legally binding commitments** that would ensure adherence by all the relevant states? Here again, two parallel tracks can be pursued.

- A **Convention banning nuclear weapons** has been proposed and endorsed by the UN Secretary-General, but is so far rejected by the US, Russia and France. It is true that nuclear-weapon states can have the legitimate impression that one puts the cart before the horse while they conceive nuclear disarmament as an incremental and conditional process. However, in 2008, a worldwide poll showed support for a Convention by 76% of the respondents, including those in nuclear-weapon states.[10] Without entering into the detail of the pro and con arguments, one can refer to the

precedent of chemical and biological weapons despite the specific nature of nuclear weapons. There was first a prohibition of use in war in the 1925 Geneva Protocol; it was of course deemed insufficient and weakened by reservations, but there is no doubt that this prohibition played an important role in limiting the actual resort to such weapons. And the second, much later step was the prohibition of development and possession, in 1972 for biological weapons and 1993 for chemical weapons. It took time to elaborate effective mechanisms, especially for chemical weapons, to ensure confidence in the implementation of the obligations by all states parties. But in the meantime, the universal condemnation of use as well as decreasing military relevance of those weapons convinced most states not to acquire them or to renounce them. The same process could take place with regard to nuclear weapons: in the first phase, a **general prohibition of use** accepted by all nuclear-weapon states (including the non-NPT parties) would allow temporary possession until sufficient **verification of elimination** would be negotiated and put into place. International safeguards, for instance on de-alerting or non-deployment of weapons, could be introduced.

• Revival of the **concept of general and complete disarmament** (GCD) is occasionally proposed.[11] To the disarmament community, this concept may sometimes seem outdated or completely obsolete if not totally utopian. The fact is that, in Article VI of the NPT, all states parties *"undertake to pursue negotiations in good faith"* not only on *"effective measures relating to cessation of the nuclear arms race at an early date and to nuclear disarmament"* but also *"on a Treaty on general and complete disarmament under strict and effective international control."* It is important to stress that this obligation covers both aspects and that there is no conditionality between the former and the latter. After unsuccessful negotiation attempts during the Cold War, the goal of GCD was put on the agenda of the UN General Assembly in 1959, and appeared in the US-Soviet proposal called the McCloy-Zorin statement.[12] In that major document, GCD was defined as the **goal of ensuring that states will have only** *"non-nuclear armaments, forces, facilities and establishments […] to maintain internal order and protect the personal security of citizens and to […] support […] a United Nations peace force."* This common goal was eventually adopted at the UN General Assembly Special Session on Disarmament in 1978.[13] But the Cold War environment and disagreements as the sequence (disarmament first or peace first?) prevented actual negotiations on a single treaty and the route of "**partial measures**" or the piecemeal approach was chosen, leading to separate multilateral agreements (the Partial Test Ban Treaty, the NPT, the Seabed Treaty, the Biological Weapons Convention, the Environmental Modification Convention, the Convention on Certain Conventional Weapons – CCW, – the CWC, the CTBT). This whole construction complemented the bilateral and regional disarmament treaties (including the nuclear-weapon free zones, or the Conventional Forces in Europe Treaty). In the multilateral framework, further progress was made in the adoption of Protocols to the CCW and the treaties banning antipersonnel and cluster munitions, as well as the UN Programme of Action on Small Arms and Light Weapons, some aspects of which have led to global or regional treaties. However important gaps remain: **not all states are party** to all instruments and some are non-compliant with

their commitments, which may undermine the effectiveness of the treaties (e.g. in the case of the NPT); **some critical armaments are not covered,** such as missiles, which can be both conventional weapons and delivery vehicles of WMD but are subject only to voluntary transparency measures in the far-from-universal Hague Code of Conduct; **military expenditures and arms sales continue to increase,** often stimulated by the defence industry and/or state suppliers.

One advantage of reviving the concept of GCD would be to offer a comprehensive and holistic view of all the current and potential **categories of weapons likely to be used for offensive or destabilizing rather than defensive purposes,** and all the interrelationships between them. It could defeat the argument consisting in refusing to deal with one category of weapon because other categories are deemed more threatening or destabilizing. This would force cooperation between policy makers and practitioners as well as non-state stakeholders dealing with only one category or one aspect, which often leads to deadlocks. It would also allow all sorts of **mutual conces-**

> *"In order to achieve cooperative securi- ty, major changes in the governance of the international system will need to be accelerated."*

sions and gains across the spectrum of security tools. If Israel felt less threatened by missiles from Iran, it could envisage more easily giving up its nuclear capability; in return, Syria and Egypt could join the ban on chemical weapons and Iran could accept limits of its nuclear programme. Similarly, if Russia felt less threatened by NATO's conventional superiority and missile defence capabilities, it would be encouraged to reduce its reliance on nuclear weapons, and NATO Allies could in return agree to the withdrawal of US tactical nuclear weapons from Europe while continuing to benefit from extended deterrence in the transition towards nuclear disarmament.

Eventually, the GCD approach would also allow the UN Security Council to fulfil one of its roles according to Article 26 of the UN Charter, i.e. the *"establishment of a system of regulation of armaments"* "[i]*n order to promote the establishment and maintenance of international peace and security with the least diversion for armaments of the world's human and economic resources."* In sum, it would in fact amount to ensuring for **all states defen- sive capabilities at the lowest possible level of armaments.**

5. Conclusion

The world is **already moving towards a new paradigm of cooperative security** leading states, out of necessity, to cooperate to meet health, environmental and financial challenges. Interdependence means that success by one or a few benefits all, and failure by some endan- gers many. For this reason, in order to achieve cooperative security, major **changes in the governance of the international system** will need to be accelerated. Regional security architectures will need strengthening and a long-overdue reform of the UN Security Council will finally render it capable of implementing the concept of *collective security* which is at the heart of the UN Charter, along with peaceful settlement of disputes and an end to the "scourge of war."

Ultimately, in such a win-win situation, all states and all stakeholders (apart from the spoilers) would acquire a feeling of global security, much stronger and more sustainable than mere national security dependent on unilateral choices, some of which, like nuclear deterrence, would appear irrelevant or an aberration in cost-effectiveness. This would be the best way of bridging the gap between the **realist** approach based only on national interests and the **multilateralist** approach promoting common goods.

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Notes

1.   French Ministry of Foreign Affairs, "France and Nuclear Disarmament", 2010

2.   Pierre Buhler, *La puissance au XXIe siècle* (Paris : CNRS Éditions, 2011)

3.   Michael Moodie, *Cooperative Security: Implications for National Security and International Relations. Volume 14 of Cooperative Monitoring Center occasional paper* (Livermore: Sandia National Laboratories, 2000)

4.   Christian Weidlichet al., "The First Two Steps to Cope Constructively with Military Asymmetries at the Middle East Conference (I) – Security Concepts and Motives behind Weapon Programs in Egypt, Israel, and Syria," *Academic Peace Orchestra Middle East Policy Brief* No. 13 http://academicpeaceorchestra.com/download.php?downloadid=50

5.   Diane Barnes, "Ex-Strategic Command Chief Floats Extended Deterrence Offer for Iran," *Global Security Newswire,* 7th February 2013 http://www.nti.org/gsn/article/cartwright-iran-nuclear-deal/

6.   Ayman Khalil and Marc Finaud, eds., "The Conference for a Middle East Weapons of Mass Destruction Free Zone – A Synopsis of Engagement of International and Regional Organisations, and Civil Society," *GCSP Report* http://www.gcsp.ch/Emerging-Security-Challenges/Publications/GCSP-Publications/Books-and-Edited-Volumes/The-Conference-for-a-Middle-East-Weapons-of-Mass-Destruction-Free-Zone

7.   Amy Woolf, "Conventional Global Prompt Strike Long-range Ballistic Missiles: Background and Issues," *Congressional Research Service* http://www.fas.org/sgp/crs/nuke/R41464.pdf

8.   International Group on Global Security, "On-site Inspections: A Major Arms Control Verification Tool," *GCSP Report* http://www.gcsp.ch/Emerging-Security-Challenges/WMD-Disarmament/Publications/GCSP-Publications/On-Site-Inspections-a-Major-Arms-Control-Verification-Tool

9.   Hans Born, "National Governance of Nuclear Weapons: Opportunities and Constraints," *DCAF Policy Papers,* no. 15 (2006) http://www.dcaf.ch/Publications/National-Governance-of-Nuclear-Weapons-Opportunities-and-Constraints

10. "Publics around the World Favor International Agreement to Eliminate All Nuclear Weapons," *World Public Opinion* http://www.worldpublicopinion.org/pipa/articles/international_security_bt/577.php

11. "Strategic Concept for the Removal of Arms and Proliferation (SCRAP)," *Centre for International Studies and Diplomacy* http://www.cisd.soas.ac.uk/Editor/assets/scrap%201.2.pdf

12. Randy Rydell, "Nuclear Disarmament and General and Complete Disarmament," in *The Challenge of Abolishing Nuclear Weapons,* ed. David Krieger (New York: Transaction Publishers, 2009), 227-242 http://www.posse.gatech.edu/sites/posse.gatech.edu/files/Nuclear%20Disarmament%20and%20General%20and%20Complete%20Disarmament.pdf

13. Ibid

Actions to Enhance Global Security[*]:
Focus on WMD and Terrorism

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Politicians are distracted with the on-going economic crisis and instability. While understandable this is far from the only challenge facing the world. If we are to seize the opportunities of the future then we have to address the legacy of the past and nowhere is this more evident than on defense and security issues. The blunt truth is that security policies in the Euro-Atlantic region, in NATO's back yard, remain on Cold War autopilot, strategic nuclear forces remain to be launched in minutes, thousands of tactical nuclear weapons remain in Europe, a missile defense debate remains stuck in neutral, while new security challenges

"We need a new paradigm for the 21st century which is not dependent on what worked in the 20th century."

such as cyber, conventional, prompt strike force and space remain contentious and inadequately addressed. The truth is this legacy contributes to tensions and mistrust across the Euro-Atlantic region and needlessly drives up risks and most importantly at a time when unprecedented austerity drives up the cost of defense. But this is about more than guns and butter. The likelihood of a major war in Europe may have practically disappeared since the end of the Cold War but this legacy with its attendant mistrust undermines any effort to build a true partnership in the Euro-Atlantic region and beyond to meet the challenges of the 21st century. The status quo, the legacy, divides our continent and sets both Europe and Russia up for a future of failure but worse, a future of irrelevance in the 21st century.

The overwhelming conclusion of our experts' deliberations is that we need a new approach, a new paradigm for the 21st century which is not dependent on what worked in the 20th century. Among other things, we considered the recommendations of Building Mutual

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Security, the report of deliberations by a group of experts and political leaders brought together by the Nuclear Threat Initiative, the European Leadership Network, the Munich Security Conference and the Russian International Affairs Council which was published on 4 April. The report's analysis, its key findings and matrix of steps for a new cooperative global security discussion commended itself to our participants and we recommend that it be given serious consideration by our political leaders.

The world faces unprecedented challenges to global and human security. The threats facing the world are interconnected and interdependent. Current crises destroy human capital and harm and humiliate human dignity. The frustration resulting from unfulfilled expectations provides fertile grounds for terrorism. Mistrust and tensions reinforce each other. War and violence make all problems and threats worse. Under these circumstances it is easy to lose sight of the existential threat posed by the use and threat of use of nuclear weapons and other weapons of mass destruction.

We must recognize the progress that has been made in reducing the number of nuclear warheads by about 75% since the end of the Cold War. And that number is decreasing still. But at the same time, we must acknowledge our collective failures. The number of nuclear armed states has increased, and this proliferation has taken place in the most unstable regions and in some of the unstable regimes of the world. The CTBT is still not ratified and stalemate prevents progress on the FMCT. We know terrorists are striving to obtain access to nuclear weapons and materials. Although the world has succeeded in avoiding use of these weapons for the past 68 years, there is no assurance that this record of no-use will be maintained in future as the present very dangerous confrontation with North Korea should make evident.

We are far from being able to guarantee the security of existing nuclear weapons and materials. Recent experience in both North Korea and Syria demonstrates that a deterrence strategy based on the threat of use of WMD has failed to deter both threats of use and actual use of WMD. Inconclusive evidence has emerged suggesting that chemical weapons have been used. If it is true, it would be a very serious precedent and maybe also the breach of a red line followed by impunity. New thinking is called for and NATO has a special obligation to take the lead in that thinking.

Before coming to specific proposals, we would do well to ponder some fundamental questions related to nuclear weapons. Answers to these questions will reflect our willingness to take the courageous actions necessary to address the threats that they pose.

- Is there presently a problem that nuclear weapons solve that is a greater danger than the weapons themselves?

- Can a non-proliferation regime based on the premise of do as we say and not as we do be sustained?

- When the world's most powerful military alliance in human history claims a need for these deployments for security, what message does a weak state in a dangerous region hear?

- Do the weapons provide prestige or military value?

- Can the resources of NATO not come up with a better way of enhancing security and thus set an example that can truly be emulated by all nations?

Our specific proposals are by necessity limited to a small number of priorities, but are part of a longer list of necessary steps.

1. Reduce the role of NW in NATO Strategic Concept and national security doctrines of NWS members of the Alliance.

   a. Elimination of US non-strategic NW from Europe

   b. Build up the non-nuclear aspects of NATO security concept and explore ways to provide US assurances of commitments without stationing of NW in Europe

   c. Commit not to use NW against a non-nuclear-weapon state under any circumstances

2. Make NATO-Russia missile defense cooperation more productive and report on results in spring 2014; US and Russia to engage in negotiations on further reductions in nuclear arsenals, including all types of nuclear weapons.

3. Demonstrate good faith commitment to achieving a world without nuclear weapons and, in this regard, engage seriously and constructively in the deliberations of the Open-Ended Working Group on taking forward multilateral nuclear disarmament negotiations, which commenced its substantive work in Geneva on May 14, 2013.

4. Call on NPT depositaries and co-sponsors of the 1995 Resolution on a Middle East zone free of nuclear weapons and all other weapons of mass destruction to exert all efforts to convene the Conference on the zone, as mandated by the final document of the 2010 NPT Review Conference as soon as possible. Call also on states in the region to engage constructively with the Facilitator (Ambassador Jaakko Laajava) and with each other to agree on modalities and agenda of the Conference at an earlier date.

5. Reaffirm that any use of chemical and biological weapons is unacceptable.

NATO is in many ways a unique structure. One of the three pillars of NATO is Science for Peace and Security. Scientific research is among the most important generators of our global fast changing world. The world is no longer a bipolar confrontation, but our common global home. NATO should and can fulfil a role of a significant actor guaranteeing global and human security.

"Non-proliferation in the absence of complete nuclear disarmament is wishful thinking and unachievable."

Additional Remarks

The current policy of the P5 nuclear powers has been to separate the issues of non-proliferation and disarmament as far as possible, implying that non-proliferation is the responsibility of all signatories to the Non-Proliferation Treaty whereas disarmament is an issue solely under the purview of the nuclear powers themselves. As a senior UN official pointed out, the failure to prevent the proliferation of nuclear weapons proves that this approach is inherently flawed. The issues of non-proliferation and disarmament are inseparable. Non-proliferation in the absence of complete nuclear disarmament is wishful thinking and unachievable. Lack of progress on disarmament is itself a stimulus to proliferation. The pressure and incentives for proliferation are growing, as these weapons have come to be perceived as a means of acquiring political power and prestige.

It was encouraging to hear a representative of the P5 acknowledge that any use of nuclear weapons would constitute a violation of international humanitarian law. Even in the event that North Korea should choose to use a nuclear weapon, it would not justify retaliation against that country by nuclear weapons, in which case huge numbers of innocent civilians would perish. Conventional weapons would be more than sufficient to totally destroy North Korea's military capabilities without resorting to nuclear weapons. The sole circumstances under which the International Court of Justice conceded that the use of these weapons might not be illegal is in the event of imminent threats to a nation's very survival, not as a means of retaliation against aggressors, even nuclear aggressors.

Harlan Cleveland, Former NATO Ambassador and WAAS President, has stated that NATO officials knew even in the late 1960s that nuclear weapons were unusable, an idea repeated by several NATO representatives during the conference. Retention of these weapons during the Cold War may have been understandable, but the continued inclusion of nuclear weapons in NATO and national military strategies more than two decades after the end of the Cold War is indefensible.

The emphasis placed by some participants on building trust between NATO and Russia cannot be sufficiently emphasized. Recent events in Syria demonstrate that it is difficult for the UN Security Council to address any international issue without the active cooperation of Russia. Indeed, the constitution of NATO as a cooperative security system makes it essential. The logic of cooperative security compels it. The larger the number of countries incorporated within a cooperative security system, the greater its strength and the less the potential threat from countries outside the alliance. Those omitted from its ranks necessarily regard it as a competitive threat and feel compelled to enhance their own military capabilities in response. Incorporation of Russia within NATO would represent a natural step in the evolution of the alliance from a regional to a global cooperative security system. Therefore it is reasonable to inquire of NATO what plans it has conceived and measures it is taking to bring about this most desirable outcome.

Today the world is subject to innumerable threats to its security, among which the proliferation or use of weapons of mass destruction is an important element, but certainly not

the one that poses the most immediate threat to the security of the greatest number of human beings. Rising levels of unemployment, persistent poverty, financial instability, climate change, terrorism in all forms are ever-present threats impacting on the lives of hundreds of millions of people daily. Therefore it is essential to keep in mind that a military alliance by itself can never assure security to its members or the world. Human security must be conceived and approached comprehensively. Efforts to contain terrorism are essential, but by themselves they will never eliminate the threat of terrorism unless the underlying causes are removed. This is the rationale for the work of the World Academy on a comprehensive approach to addressing global challenges in the 21st century, which was the theme of the conference co-organized by the Academy and the United Nations in Geneva on June 3rd, 2013.

PUBLISHER

THE RISK INSTITUTE

On the basis of a voluntary network, partly supported by The Geneva Association, The Risk Institute was established in order to extend the studies on the issues of risk, vulnerability and uncertainties to the broader cultural, economic, social and political levels of modern society. It is now in the process of becoming established as a Foundation.

The starting point defining the programme of action was an informal meeting held in Paris in 1986. Among the participants were Raymond Barre, Fabio Padoa, Richard Piani, Edward Ploman, Alvin and Heidi Toffler and Orio Giarini.

A first report, by Orio Giarini and Walter Stahel, was published in 1989, reprinted in 1991 and revised in 1993, with the title *The Limits to Certainty — Managing Risks in the Modern Service Economy* (Kluwer Academic Publishers, Dordrecht, The Netherlands), with an introduction by Nobel Laureate Ilya Prigogine. It was also published in French, Italian, Romanian and Japanese. A completely new German version was published in 2000 with the title *Die Performance Gesellschaft* (Metropolis-Verlag, Marburg).

The book stresses the point that uncertainty is not just simply the result of inadequate or insufficient information. Every action extending into the future is by definition uncertain to varying degrees. Every 'perfect system' (or ideology) is a utopia, often a dangerous one: the total elimination of uncertainty in human societies implies the elimination of freedom. Learning and life are about the ability and capacity to cope, manage, face, contain and take advantage of risk and uncertainty.

In 2002, The Risk Institute published with Economica (Paris) the book *Itinéraire vers la retraite à 80 ans*. Ever since the The Risk Institute has been mainly concerned with a research programme on social and economic issues deriving from extending human life expectancy (usually and wrongly defined as the 'ageing' society), which is considered the most relevant social phenomenon of our times. This is particularly relevant in the context of the new service economy. The Risk Institute has contributed to the organisation of the conference on "Health, Ageing and Work" held in Trieste and Duino on 21-23 October 2004. Followed by a second conference on similar issues, in Turin, October 2007. On this basis, it has taken the initiative to publish from 2005 the EUROPEAN PAPERS ON THE THE NEW WELFARE — The Counter-Ageing Society, in two versions (one in English and one in Italian), both freely available on www.newwelfare.org.

In 2010 the Institute has published in Italian *"Itinerario senza frontiere: dal Texas alla terza età"*. Furthermore it is now editing the CADMUS Papers.

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Cadmus Editorial Policy

The editors welcome submission of proposals, articles, ideas, abstracts, reviews, letters and comments by Fellows of the World Academy of Art & Science, Members of the Club of Rome and Pugwash as well as invited and unsolicited articles from the public. All proposals are reviewed by the editorial board to determine their suitability for publication in Cadmus.

The clear intention behind the founding of Cadmus is to publish fresh perspectives, original ideas, new approaches that extend beyond contemporary thinking with regard to the relationship between knowledge, public policy and society today and their impact on human wealth, welfare and well-being – human security defined in its broadest terms. It is summed up in the motto "Leadership in Thought that Leads to Action".

Special issues will also be published from time to time devoted to specific topics.

The primary guidelines for selection of articles are

- The article should address issues of broad social concern to the world today
- The article should not be one that naturally qualifies for publication in a more traditional journal devoted to a specialized discipline i.e. it should be multi- or trans-disciplinary in scope and implications
- The article should present an original perspective, conception or practical approach
- The article may be in the form of an essay of ideas, an annotated theoretical discussion or fact-based scientific evaluation of evidence. We accept all three.

These guidelines are general and not rigid. Acceptance or rejection of an article does not reflect at all on its academic or intellectual merit, only on the degree of its alignment with the specific objectives of Cadmus.

Submissions may be of any length but preference will be given to articles of 5-10 pages and shorter pieces of 1-3 pages.

Style guidelines and an MS Word style sheet are available for download from the Editorial Policy section of our website.

We encourage you to share any manuscript with us that you think might be what we are looking for.

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