The Dimensions of Diversity
Humanity, Nature, and Sustainable Development

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Power Point Presentation comprising some 42 Slides
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Note (1998 to 2017)
This presentation by invitation has been given previously since 1998 in Cambridge UK, Washington USA, Singapore, Bangkok Thailand, Lahore Pakistan, Nairobi Kenya, Vienna Austria, Denpasar Bali, Stockholm Sweden, Oslo Norway, Johannesburg, South Africa, Aleppo Syria, Santiago Chile, Warsaw Poland, Rio De Janiero Brazil, New Delhi India, Rome Italy

Abstract: Dimensions of Diversity

Humanity has reached a defining moment. Unless we learn to understand, respect and mobilize the wealth of diversity in nature and in the human world, a progressive and secured future will not be tenable. Diversity is of critical importance as it and its inter-connectedness endows humanity with collective potential and similarly in nature the web of interdependency, of ecosystems and species, creates the enabling environment for evolution of biodiversity and its survival resilience.

No one sets out to destroy diversity, but the cumulative consequences of conscious and unconscious human behavior, so often in the short-term interest of "me" rather then "us", cause disparities, the disenfranchisement of societies, the degradation of ecosystems, and loss of biodiversity. We have a responsibility to current and future generations to ensure sustainability in all its dimensions of societal, environmental and economic development.

In the 21st century, the transition towards sustainable development cannot be realized without building strategic and effective human capital. We must be innovative in mobilizing diversity in education and knowledge. We need to put a humane face on ingenuity and innovation with commitment and a partnership of mutual respect and responsible actions towards others and in harmony with nature. Only then will we and the generations to come prevail.

The second part of the presentation focuses on issues facing Bali in the 21st century and a strategic vision of positioning Bali tourism in the 21st Century

1. Introduction: Dimensions of Diversity

"Nature never breaks her own laws"
"The noblest pleasure is the joy of understanding"
Leonardo da Vinci, c 1496

Diversity results from the capacity of systems to respond, adapt, and evolve through self-organization on the basis of differing time and space dependent environment, experience, symbiosis, relationships, and reciprocity. The interconnectedness and interdependencies in diversity creates the tensions and synergies that lead to sustaining evolution and more robust outcomes.

The biological diversity of nature lies in the variety of life and its processes. It includes the vast array of organisms, the genetic differences among them, the communities and ecosystems in which they occur, and the ecological and evolutionary processes that keep them functioning yet ever changing and adapting. Biodiversity is interconnected in that different types of organisms live side by side in complex ecological networks of interdependency, each relying for nutrients and energy on those that share its habitat.

Human diversity is the common heritage of humanity. It is the uniqueness and plurality of identities and individuality; it is the source of harmonious relationships and the sharing of ideas and experiences enabling collective creativity and innovations, and the generation and accumulation of knowledge. The diversity here is important for human progress including, artistic and intellectual development, emotional stability and ethical behavior, material and spiritual well-being, and living sustainably in and with nature.

Diversity in a system is high if each component brings uniqueness to the system, be it different ideas and approaches, varying experiences and diverse information, and inter-relationships. In contrast diversity is low if the system components are similar and contribute the same information.

In science and technology, the more the diversity of ideas, disciplines, and different thinking, the greater is the scope for discovery and innovations. Here diversity plays a particularly critical role during the process, but the end scientific goal is to reduce the uncertainties and complexities, thus enabling robust conclusions and outcomes. The recent successful genome sequencing of the human DNA required the integration of a diversity of disciplines, including, biological sciences, engineering, mathematics, computer science, etc.

The mono-culture of the agricultural green revolution focused on a few varieties high yielding varieties of rice, wheat, and maize, in comparison to the mix and diversity of tens of thousands crop varieties in farmers' fields. While crop diversity was reduced in the name of efficiency, environmental impacts and biodiversity consequences highlight the need for more diversity with regard to long-term sustainability.

In education, the diversity of students and staff not only brings the wealth of their unique experiences, values, and ability to reason, act, and participate in the pursuit of knowledge, but it also mirrors the diversity of society at large, and thus a foundation for effective dialogue with and empowerment of the community.

The world's diversity of cultures, traditions, religion, and languages, arts and entertainment, transport and communications, science and technology, and knowledge is rapidly changing. Some changes are no doubt for the better but others are of concern, especially those driven by dominating external influence and power.

Recognizing, understanding and respecting the dimensions of diversity are a prerequisite to mobilizing the wealth diversity. Some fundamental questions relate to, how to value and respect diversity, what influences reduce diversity, what comprises the right balance of diversity, can there be too much diversity, can diversity be irrelevant, and how to make diversity more productive. The wealth of diversity in nature and the human world is immense and the realization of its potential is the key to promoting development.

2. Demography and Human Diversity

"I want the cultures of all the lands to be blown about my house as freely as possible. But I refuse to be blown off my feet by any"
Mohandas Gandhi, c 1930

The history of the human species dates back more than three million years ago. Some one and a half million years ago, *Homo erectus* started to walk upright and thus began the first of countless human journeys to all corners of the world, marveling the beauty and bounty of nature's diversity.

Encounters and varying experiences with the environment in different regions of the world have led to the evolution of a variety of traditions and cultures, values and behavior, and reasoning and knowledge, all of which form the core of this rich human diversity.

The period of early human history from *Homo habilis* to *Homo sapiens* was characterized by man's precarious existence as hunter, gatherer, and forager, with the constraints of the local environment and the limited means of survival keeping the human population down to between 3 and 10 million for a period of over two million years.

The advent of agriculture some 10 millennia ago, and the resultant establishment of local communities with interaction, cooperation, and cohesion, marked the creation of the socially concerned and caring "modern man". It took another five millennia for the arrival of the wheel and sail power to enable journeys further a field so that new places could be discovered, explored, and inhabited. The sharing of ideas and experiences catalyzed early technological advances, such as the implements of the Bronze and the Iron Ages, which in turn contributed to improved prospects of survival and well-being and thus became a foundation for population growth.

By the first year AD, the human population had reached some 250 million, but it took another 1500 years for the population to double to 500 million. Epidemics such as the plague in the mid 14th century killed 25 million people, a quarter of Europe's population.

By 1750 the world population had increased to some 750 million. The beginning of the industrial revolution in Europe, as well as heath improvements due to the expansion in food supplies and improved hygiene through the use of soap, all contributed to improved human health and well-being. By 1900 the world population had increased to some 1.6 billion.

The 20th century era of unprecedented scientific and technological progress gave rise to the most rapid population increase, with an almost fourfold increase to around 6.1 billion by 2000, with a regional distribution of 3,700 million in Asia, 730 million in Europe, 790 million in Africa, 520 million in Latin America, 310 million in North America and 40 million in Oceania.

The social, economic, and environmental impacts and consequences of the exponential growth in population as well as health improvements, including reduced child mortality, development of contraceptives, and improved longevity, all contributed to fertility declines in the closing decades of the 20th century. There is expected to be an end to population growth in the 21st century. However, the continuing momentum of population growth will still mean an overall increase to some 9 billion by 2050. Regional population distribution is projected to be 5,320 million in Asia, 1,780 million in Africa, 820 million in Latin America, 630 million in Europe, 400 million in North America, and some 50 million in Oceania.

The 21st century will be marked by ageing of world's population, with the number of people aged 60 years and older increasing from 600 million in 2000 to some 2 billion in 2050. The developed countries and also China will be most affected. During this period, the median age of the world population will increase from approximately 26 years to 38 years. By 2050, over 60% of the world population will be living in urban areas.

There will also be a shift in the world's share of broad ethnic groups, with for example, the world share of the population in Europe, North America, and Oceania, declining from 18% in 2000 to 12% in 2050, whereas Africa's population share will increase from 8% in 2000 to 20% in 2050.

The above changes in demographic diversity will have wide ranging impacts and implications for the cultures, traditions, religion, and language as well as human capital, labor force, economic growth, savings and investments, social security, health care, education, environment and natural resources, science and technology, and knowledge.

We live at a time of profound social change. Around the world, traditional value systems and practices and the very fabric of family life are changing rapidly; and in many cases tolerance and compassion are on the decline. People today live in fear and insecurity that threaten their own well-being. Increased crime, violence, hooliganism, and conflict often have their roots in social change including the breakdown of family values. We need to question such changes and the evolving culture of "me" rather than "us". We cannot be complacent, and we must not accept this situation as an inevitable consequence of so-called modern development and of the dominance of a few over the many. .

The 20th century was a period of revolutionary changes. There were great socio-political upheavals in China, Russia, and around the world the era of colonization came to an end, giving rise to social if not economic independence, and an increasing thirst for democracy and good governance.

The 20th century was also an age of war and tyranny, with mass production and use of weapons and armaments, including guns, land mines, rockets, and even the atomic bomb. It is estimated that some 180 million people, a far larger toll then in any other century, were massacred in these episodes of diverse killings that involved rich and poor, big and small countries, people of all colours and religious backgrounds, and political leanings

from dictatorships to democracies. Famines, that the world had the means to confront, claimed some 70 million lives.

These inhumane and atrocious events triggered the international recognition and establishment of human rights, including the right to food, water, education, health care, social security, clean and safe environment, freedom from harassment and discrimination, and opportunities for participation. However, in spite of these rights and commitments, at the dawn of the 21st century, a fifth of the world's population lives in debilitating poverty, while another fifth, politically and economically dominating, lives in relative luxury, consuming four-fifth of the world's resources.

We have the wealth of human diversity and the scientific and technological means to achieve sustainable and more equitable development, but we need a global development partnership that respects our cultural differences and mobilizes our collective strength.

Throughout history religion has been the foundation and source of values, morals, and behavioral norms. The diverse religions around the world have mainly ethnic origins, although there have been conversions from one religion to another. There are some 2 billion Christians, 1.3 billion Hindus and Buddhists, 1.2 billion followers of Islam, about 850 million secular and nonreligious people, 250 million followers of primal-indigenous and African traditional religions, 225 million followers of Chinese traditional religions, and some 300 million people practicing other religions, including Judaism, Shinto, and Cao Dai.

Without exception there is much common ground in all religions regarding values and norms of behavior toward fellow human beings and respect for nature. Yet at the dawn of the 21st century there is a growing tendency toward mistrust and exclusion on the basis of religion and cultural differences. The acts of a few hundred terrorists should not compel us to disengage and disenfranchise millions of people on the basis of religion. Moreover, the banning of head scarves or skull caps in the interest of national identity and security makes little sense if, at the same time, we are preaching tolerance and compassion and celebrating the diversity of the world's peoples. Fundamental to such celebration is the universal recognition of the brotherhood of mankind, which means the universal equality of all men and women.

There are over 6,800 languages spoken in the world today. The world's languages are currently dying out at the rate of at least two languages each month, and linguists predict that more than half of today's languages will disappear in the next 100 years. The increasing dominance of a few languages has come in the interests of communication efficiency; but there is a need to recognize that the loss of languages, for example those spoken by indigenous groups, will also mean a permanent loss of precious traditional knowledge and practices, accumulated over centuries.

The diverse world of exquisite and colorful traditional costumes and clothes, which give an individual identity and pride of belonging, are being replaced by a culture of jeans and tee shirts. And yet, a few decades ago, so many of us felt regret at a billion peoples all

having to wear the same gray tunic and trousers. The world of fashion thrives on creating new trends, often conceived on the basis of the diversity of historical attire and design, but too many of us are beginning to wear the same mass-manufactured fabrics and apparel.

People around the world have evolved diverse and unique culinary styles. However, the increasing mass marketing by multinational food corporations is successfully persuading more and more consumers around the world to switch to "universal" fast foods, including hamburgers, french fries, and cola beverages. Many of these processed foods often contain high levels of fat, salt, and sugar which increase the risks of obesity and other serious health-related consequences. The loss of the world's diversity of foods and their preparation, presentation, and flavor is worrying, as people do not just eat for the nutritional content of food – they more often eat to satisfy the palate and the senses.

Literally hundreds of thousands of different music and musical instruments have evolved over the centuries around the world. The audio and visual mass media allow us to access the world's music, but at the same time the evolution of "electronic" pop culture, especially among youth, is resulting in a loss of musical diversity.

Throughout history acting and drama formed the foundation of face to face entertainment by millions of many amateur and some professional actors, including children and adults. The opportunity for personal interaction contributed to social relationships as well as character and personality building. The arrival of the cinema and television resulted in a revolutionary change that enabled fewer productions with just a few actors to capture literally a worldwide audience. In addition to this loss of artistic diversity, the new screen media entails passive watching by the audience in contrast to the potential for active interaction in live plays and theater.

However the electronic media does offer a tremendous potential for learning and appreciating the wealth of human diversity. The dominance of the global media by a few corporations in a handful of countries also means an increased risk of bias and restrictions in coverage and scope. Also the recent trends of media productions, depicting violence and crime as the basis for mass entertainment, are threatening the very fabric of society and social behavior. Adults can make the choices of what they view or not, but the young can be highly vulnerable.

While the wheel and the sail power arrived some 5000 years ago, the 20th century was the period of development of the widest diversity of transport means, beginning with the horse and carriage, moving onto cars, trains, ships, buses, and airplanes and ending with private space travel. The motor cars, totaling over 500 million in the world today, have become the most dominating means of individual transport and also the most polluting and a major contributor to the threats of global warming and climate change.

"Traditional knowledge" is represented by the diversity of practices and innovations that indigenous and local communities use and adapt to their own environment and culture. This knowledge, accumulated over centuries, has been transmitted from generation to

generation, orally as in parts of Latin America and in written form as in such countries as China, Egypt, and India. The international community, notably in the preamble to the Convention on Biodiversity, has recognized the importance of the wealth of this traditional knowledge. More then 80 percent of the population in developing countries rely on traditional medicines and on the health advice and care of hundreds of thousands of indigenous experts. However, the diversity of traditional medical knowledge, important in the context of the local environment and culture, is increasingly coming under threat from a handful of multinational pharmaceutical corporations, which are marketing modern medicines that many poor people cannot afford.

The remarkable scientific and technological achievements of the 20th century have included, in the realm of physics, the discovery of radioactivity, subatomic particles, relativity, and quantum theory; these advances have changed the fundamental way we view matter and energy. The medical sciences have witnessed the identification of viruses and the development of vaccines and organ transplants. In technology there has been space travel, and in the 1960s we put men on the moon. Then, in agriculture, there was the green revolution of the 1970s that more than doubled world food production. The information and communication revolution of the 1980s enabled knowledge to be shared at the touch of a button. The genetic revolution of the 1990s ended with the mapping of the human genome and the rice plant, laying the foundation of a new era of progress in human health and environmental conservation.

The development of the world-wide-web has opened tremendous new opportunities to share knowledge and experiences, but the growing digital divide between developing and developed countries is worrisome. For example, whilst over 50% of the population in the United States and Western Europe use the Internet, less then 0.5% of the population in Asia and Africa do so. There is also a wide and prohibitive disparity in costs of accessing the Internet, varying from an equivalent of 2 months average wage in Bangladesh to less then 1% of the average monthly wage in the United States.

There is a similar great disparity in the number of scientists and researchers. This varies from over 2,700 scientific researchers per million population in the United States to 130 in India and fewer than 70 in Africa. Continuing progress in scientific knowledge will only further divide developed and developing countries, increasing inequities and hindering progress toward goals of sustainable development.

However, it is worrying that science and technology are increasingly becoming proprietary: owning knowledge is becoming the order of the day. Does this mean that those who cannot afford it will be denied the fruits of scientific participation and progress? The number of patent applications has grown from 1 million in 1985 to over 7 million today. Recently a U.S. company even attempted to patent turmeric, an herb valued for centuries in India for its medicinal properties! Fairness, justice, and ethics – which way do we turn?

In the 21st century diversity of knowledge, both scientific and traditional, can play a vital role in helping us understand the wealth of diversity in the human world and in nature, in

managing and resolving the emerging challenges in environmental and developmental sustainability. Knowledge empowers and enables. In an open forum, it promotes synergy, transparency, and accountability.

Diversity is increasingly threatened as the world moves towards uniformity in the name of efficiency and under the dominating influence and power of a few over many. We have the intellect to recognize the relevance of diversity, but we are failing to respond in spite of knowing that any loss will be detrimental in the long-term.

3. Environment and Nature's Diversity

"It should not be believed that all beings exist for the sake of the existence of man. On the contrary, all the other beings too have been intended for their own sake"
***Moses Maimonides**, c 1190*

Humans cannot exist without the biodiversity inherent in a healthy environment. Natural diversity comprises a web of interdependent ecosystems, species, populations, and genes that, in combination, create an enabling environment for the provision of nutritious food, clean water, fresh air, and a beautiful natural world.

The wealth and intricacy of nature are increasingly being threatened as growing human populations and their desire for ever-increasing consumption ravage the environment. The damage is evident: loss of ozone layer, global warming and climate change, air and water pollution, arable land lost to erosion, salinity and desertification, water scarcities, disappearing forests, extinction of biodiversity, and depletion of mineral resources. The cumulative consequences of human activities will, in the long run, threaten nature's life-supporting capacity and resources.

For the sake of our heritage, we must make a firm commitment to respect Earth's environment and its wealth of biological diversity, and we must mobilize ingenuity and innovation as we work to secure our planet's sustainability.

For Planet Earth – the only location in the universe known to support life – is endowed with an incredible array of natural diversity – diversity of size, shape, color, movement, and function – across a great variety of ecosystems around the world.

All flora and fauna species are interconnected in the web of life, and each has its own genetic diversity. These species live and evolve in environments and biotic cycles encompassing physical, chemical, and behavioral relationships that protect and promote continued evolution. The symbiotic relationships between species hold knowledge that is not only invaluable for the future well-being of the human race but also ensures the sustainability of the Earth's life-supporting capacity.

We have yet to discover and understand the wealth of diversity in the genetic material of many known species. Some progress is being made in relation to the genetic composition of species used in agriculture and pharmaceuticals, but our knowledge is infinitesimal in terms of the extent and intricacy of overall genetic diversity.

Scientists estimate that there are between 5 and 30 million biological species on Earth, of which only about 1.75 million have been identified thus far. Moreover, a large share of these is found in tropical areas, particularly forest ecosystems. Most of this diversity is in invertebrates, plants, and other groups. The vertebrates, including mammals, birds, reptiles, amphibians and fish, account for only around three percent of the total known biodiversity in the world.

In the natural world, species loss occurs at the rate of one species per million per year. However the loss of a single species has potential for extinction of many other species. In the 20th century species extinction rates increased 10 to 100 fold. At this rate, by the end of the 21st century, the Earth's biological and geochemical cycling systems may be put at risk.

Over a third of the world's known mammals, birds, reptiles, and amphibians are found on only about 1.4% of global land surface, amounting to some 2 million sq km. These habitats make up the "hot spots" of threatened biodiversity and currently only about a third of such areas are technically under protection.

Agriculture is by far the largest user of the Earth's ecosystems and has the greatest impact on the environment and its biodiversity. Over the past half century, more than a quarter of the world's 8.7 billion hectares of crop-lands, pastures, forests and wood lands have been degraded through misuse or over use.

Biodiversity is the source of genetic resources for all crops, livestock, and fish. It also determines the productivity of land and water resources. The increasing trends of mono cropping and genetic uniformity and high level of chemical inputs not only pose risks to wild biodiversity but also increase the risk of production failures due to pests and diseases. For example, in China there were once 10,000 landrace varieties of wheat. Today are fewer than a thousand. No one knows what genetic traits leading to insect and disease resistance, stronger plants, higher yields or more nutritious and better tasting crops have been lost.

Agricultural expansion has already resulted in the loss and fragmentation of the world's forests, wetlands, streams, estuaries, lakes, and coastal and marine ecosystems. Ecosystems not only produce food for all species, they also perform essential services such as purification of air and water, binding of toxins, decomposition of wastes, watershed and flood management, stabilization of landscapes, and regulation of climate.

Forests play an important environmental role in the production of timber, wood, fuel, and other products, in the livelihoods of resident human populations, in the protection of habitat and conservation of biodiversity, watershed management, and in the mitigation of climate change. During the last decade, some 127 million hectares of forest have been cleared, with some 40 percent cleared just to enable agricultural expansion. Recent surveys in Brazil show that forest clearance by fire has provoked a downward cycle in terms of preserving biodiversity, with burning frequency increasing and thin-barked trees that are not fire-resistant being destroyed. Furthermore, the fragmentation of small forest stands is disastrous for many animal species as they need large patches for survival. When a forest is cleared, a rich treasure of biodiversity is lost. Currently just eight countries –Russia, Brazil, Canada, the United States, China, Congo, and Indonesia, account for over 60 percent of the current world forest area.

Oceans and fresh waters cover some three quarters of the Earth's surface and account for half of the production of biomass in the world. About half a million water-based species have been identified, in comparison with over a million species on land.

Over 70 percent of fresh-water resources are used in agriculture. Two thirds of the world's population lives in areas that receive a quarter of the world's annual rainfall, while sparsely populated areas such as the Amazon Basin receive a disproportionately high share. Some 30 countries are already facing water scarcity.

More than 70 percent of world marine fisheries resources are overexploited and will not be able to regenerate unless fishing pressures are reduced and stocks are allowed to recover. In the case of codfish, recovery may have been constrained by the fact the cod populations are too small to escape predator pressure and not large enough to produce enough eggs. Large fish produce exponentially more sperm and eggs than small fish.

Global warming threatens to "bleach" a significant fraction of the world's coral reefs, with the concomitant loss of unique biodiversity and the livelihoods of millions of coastal dwellers. Space travel has taken us to the moon but we have yet to travel to research and discover the ecological and biological wealth of the deep oceans.

During the 20th century, human influence on the functioning of the Earth's systems altered the global carbon pools. As a result, carbon-dioxide concentrations in the atmosphere have increased by over a quarter and concentrations of methane, another important greenhouse gas, have doubled. There is now convincing scientific evidence that greenhouse gases are contributing to climate change and variability. The emerging threat of global warming and changes in precipitation, especially in many areas of the tropics, will cause significant and irreversible damage to ecosystems and loss of biodiversity.

Nature's wealth is abundant but finite. We cannot forever mine it, nor can we go on using the environment as a sink for waste and pollutants. We must act in a pre-cautionary manner and take responsibility for the impact of our actions. We tend to use the excuse of incomplete knowledge and uncertainties for our inaction. In the 21st century we must mobilize scientific efforts and use the wealth of traditional knowledge to understand the complexities of the natural environment and its biological diversity.

4. Diversity and Sustainable Development.

"Our biggest challenge in this new century is to take an idea that sounds abstract - sustainable development – and turn it into reality for all the world's people"
Kofi Annan, 2001

Humanity is at a defining moment in time. It must either make the transition to sustainable development, or put at risk its own future and that of all other life forms on Earth. Diversity is of critical importance as it and its inter-connectedness endows humanity with tremendous potential, and similarly in nature the web of interdependencies among species and ecosystems, creates the enabling and sustaining environment for evolution. Without nature's biodiversity, humans cannot survive.

Sustainable development is defined as "*development that meets the needs of the present without compromising the ability of future generations to meet their own needs"*. The concept of needs goes beyond simply material needs and includes values, relationships, freedom to think, act and participate, all amounting to sustainable, moral, spiritual, and healthy living.

The 33-year journey, taking in three World Summits from Stockholm to Rio de Janeiro to Johannesburg, has put the world on notice that achieving sustainable development in the 21st century is not an option but an imperative – and that it cannot be achieved without understanding, respecting, and mobilizing the wealth of diversity in nature and in the human world.

The 1972 UN conference in Stockholm highlighted the concerns for preserving and enhancing the environment and its biodiversity to safeguard the basic human right to live in a healthy and productive world. The developing countries argued that the core problem was development while most-developed countries made a case for environment as the prime issue.

Over the next two decades the environmental dialogue continued, and the result was the adoption of over 200 regional and international agreements and conventions for environmental protection and conservation. Most of these agreements were negotiated individually and treated as "separate entities", and many lacked systemic integration within the social, economic, and environmental framework of sustainable development.

In 1992 the Earth Summit brought the world's governments to deliberate and negotiate an agenda for environment and development in the 21st century. At the parallel Global Forum, nongovernmental organizations from around the world also discussed the issues and agendas for action leading to sustainable development. While there was little formal interaction between these two meetings, the world's civil societies succeeded in making their voices heard. It was an important step toward dialogue and the active participation of civil society in sustainable development regimes from local through to global levels.

The Earth Summit unanimously adopted Agenda 21, a comprehensive blueprint for actions leading to sustainable development, including detailed work plans, goals, responsibilities, and estimates for funding. Other important accomplishments included the Rio Declaration, a statement of broad principles to guide national conduct on environmental protection and development, as well as adoption of treaties on climate change and biodiversity and forest management principles.

The first principle of the Rio Declaration states "human beings are at the centre of concerns for sustainable development". The declaration also highlighted the "polluter-pays-principle" and the "precautionary principle", as important considerations for the protection and conservation of nature.

Whether addressing vulnerability to environmental change, responsibility for environmental degradation and loss of biodiversity, or policy priorities, careful consideration of the particular groups of people involved as well as their social, economic, and environmental conditions, is essential. Focusing on people – their rights, capabilities, and opportunities – has multiple benefits for individuals, for society, and for the relationship of each with the environment.

Agenda 21 pointed out that different populations had "common but differentiated responsibilities" for impacts on the environment. In Rio, the thinking was dominated by the goal of converging trends in different parts of the world. There was the clear hope that the developing countries would catch up, while the rich countries would become increasingly environmentally conscious and curb their excessive consumption and the related pollution and waste. This has not come to pass.

Consumption per se is not something to be avoided as it is one important aspect of improving human well-being. Equally important is the recognition that the relationships between well-being, levels of consumption, and environmental impacts depend on the value systems, the effectiveness of institutions, including forms of governance, as well as on science, technology, and knowledge.

The lack of progress in turning Agenda 21 into actions for sustainable development, lead to the 2002 Johannesburg World Summit on Sustainable development. Johannesburg put the thrust on public-private partnerships for sustainable development thorough an endorsement of some 500 such partnerships. However less then a tenth of these agreements are still alive. While sustainable development may in a sense be considered as a social good, its achievement requires a substantial participation of the private sector, since economic incentives are essential to mobilizing the society, particularly the skilled and the educated community.

In September 2000, prior to the Johannesburg Summit, political leaders from around the world took the unprecedented step of setting concrete 2015 targets for Millennium Development Goals related to poverty, hunger, education, gender issues, health, environmental sustainability and a global partnership for development. All the issues mentioned are inter-related; one cannot be solved without others being tackled. The progress thus far indicates that the MDGs are unlikely to be realized by 2015. The urgent

need is to target development policies and resources to specific differentially vulnerable populations and environments.

The nations of the world at the Earth Summit failed to mobilize the financial resources for the implementation of Agenda 21, and the WSSD in Johannesburg failed to turn agenda into actions. The critical issues of education and human capital were also not on the WSSD agenda. The scientific and technological capacity is essential and universities around the world have a fundamental responsibility to contribute to this.

5. Human Capital and University Diversity

"A university should be a place of light, of liberty, and of learning"
Benjamin Disraeli, c 1873

The university challenge in the 21st century is the effective mobilization of the diversity of students, the diversity in science and technology, and the diversity of knowledge delivery systems to contribute to building human capital.

Education comprises a lifelong learning system to cope with the changing needs and aspirations of society. The United Nations Decade of Education for Sustainable Development, starting in 2005, lays the foundation to reform and mobilize education at all levels, from schools to universities, in support of sustainable development.

The mission of universities is to educate and train the next generation of professionally and socially responsible citizens, to carry out basic and applied scientific research, to generate knowledge and learning, and through expert dialogue, empower civil society and the Government.

Today university education is increasingly being treated as a means to an end to deliver a skilled work force in a competitive global knowledge economy. Education should not be considered only on utility grounds but also as means to personal enrichment and fulfillment, enhancing the common human heritage of values, relationships, as well as knowledge, innovation, and ingenuity.

No one with ability should be denied a university education. An individual's entry to university should be on the basis of merit and without any discrimination with regard to gender, ethnicity, religion, social distinction or economic wealth, or physical disability. The assessment of merit should not only include academic achievements but also take explicit account of experiences, perspectives, potential, and commitment. Universities have to be at the forefront of efforts to engage, involve, and ensure a representation of the nation's human diversity in its entirety.

Education for sustainable development requires integrated curricula and courses. A search on the World –Wide Web reveals some 1.3 million references on "sustainable development education"; yet finding a university anywhere in the world that offers an ordinary course on sustainable development is rare indeed. There is an urgent need to develop such courses and make them mandatory for students of all disciplines and subjects, as throughout life, the most important choices and decisions relate to how to live sustainably within society and in the environment.

The demand for higher education has grown rapidly, increasing from some 13 million in 1970 to about 85 million 2000. There has also been a substantial increase in overseas students in developed countries, rising from about 70,000 to some 500,000 in the same period.

The world demographic transition in the 21st century will have substantial consequences for education and human capital development. The International Conference on Population and Development(ICPD) held in Cairo in 1994 set targets for developing countries to achieve universal primary education by 2015. There was little or no consideration of the goals for secondary, and particularly higher education levels in Cairo.

The International Institute for Applied Systems Analysis (IIASA) has added two components to the ICPD scenario, namely, all countries will achieve at least 75% participation in secondary schools by 2030, and the rate of enrolment in tertiary education in the developing world will incrementally increase from the current 10% to 40% by 2030. At present, the gross enrolment in higher education in the developed countries is about 60%,

The projections for this progressive IIASA/ICPD scenario indicates that the number of working age people with tertiary education in the world will increase from about 226 million in 2000 to some 642 million by 2050, with 33% in South Asia, 15% in the China region, 11% in Latin America, and 6% in Africa, 18% in Europe, and 17 % in North America.

In the year 2000 the working age population with at least tertiary education in North America and Europe amounted to 92 million and 49 million respectively. By 2050 these numbers are projected to increase to respectively, 109 million and 115 million. The results highlight that in the IIASA/ICPD progressive scenario, the South Asia and the China regions together would have some 310 million people of working age with tertiary education, thus surpassing the total for North America and Europe combined.

IIASA has also formulated another rapidly progressive "American" scenario, which assumes that all developing regions will experience linear improvements in their enrolment that would bring them by 2030 to the school enrolment levels of North America. This would mean universal access to primary and secondary school. The IIASA scenario also assumes that half of each cohort moves up to tertiary level studies. At present, the gross enrolment rate in higher education in North America is about 85%.

In this rapidly progressive "American Scenario", the projection results indicate that at the global level, there would there be some 1.7 billion people of working age, with tertiary level education by 2050. The regional distribution of this total would be 33% in South Asia, 23% in the China region, 18% in Africa, 13% in Latin America, 7% in Europe, and 6% in North America.

In many developed countries the declining and rapidly ageing population will have substantial impact on their human capital and prospects for economic growth in the coming decades. A number of such countries are already making efforts to attract professionals from developing countries to fill the potential human capital gap. These trends are likely to intensify in the future.

The relatively younger population in the developing countries, and the projected further increase of another 3 billion in the 21st century, offers a unique opportunity for a human capital revolution. The scientific and technological as well as the information and communications means that are available, together with the rapidly growing secondary school enrolments, can create an enabling environment for a rapid expansion of higher education in the developing countries. This in turn would enable rapid economic growth with the potential to eradicate the world-wide economic disparities.

A comparison of the national economic output and the number science and engineering students highlights the importance of higher education. In the 1990s, more two-thirds of the world's population lived in countries with GNP per capita less than $ 5000 and in this group of countries; the number of students in science and engineering education amounted to some 170 students per 100,000 population. In contrast, for countries with a GNP per capita above $ 5000, the number of students was over 780 per 100,000 population. Overall more then two thirds of all students in science and engineering students in the world resided in the richer countries. Higher education is no doubt the catalyst for rapid economic growth and rapid development in the developing countries.

The developing countries must grasp the unique opportunity to become an equal among equals in the world's globalizing economy, but this cannot be realized without effective and timely investments in higher education, especially at university level. In the absence of such progress, the best and brightest graduates and others in the developing countries will have little choice but to join the brain drain.

Enhancing the role, relevance, and effectiveness of universities in meeting the education and research challenges of sustainable development will require priority reforms and strategic choices and investments. Some exemplary recommendations related to education, research, and empowerment of civil society and government are presented below.

Education Diversity: The University challenge for reforms and strategic focus on education for sustainable development will require: diversity of students with a wide variety of backgrounds and experiences, cohesive and integrated curriculum development, diversity of inter and multi-disciplinary courses and education delivery systems including distance learning, and systemic problem solving case study methods focusing on issues of local relevance. While academic freedom of subject choice is important to students, in order to ensure that the right balance of science, technology and humanities to meet the national human capital needs, universities will need to consider targeted incentives such as scholarships, travel abroad and student exchange programs, as well as remunerated placements in professional environments

Human Diversity: National universities must endeavor to attract students and staff to facilitate a balanced representation of the nation's human diversity. Also scientific research efforts should be targeted to the issues of relevance to diversity of the population with regard to empowering all groups in all aspects of nation building and benefiting thereof. The relevance and scope of such research would benefit enormously from regular

consultations and knowledge and policy dialogue forums involving the diversity of civil society.

Nature's Diversity: As each country's environment and biodiversity is unique, it is important that university education and research focuses on generating knowledge relevant to setting goals and formulating policy actions to meet the local social, environmental and economic development priorities. National universities are ideally positioned to carry out such science for policy and field relevant research. University academic staff should endeavor to incorporate such examples in their teaching courses, thus enabling students to relate theory to practice in their own environment.

Sustainable Development: There is an urgent need for universities to develop common course curriculum for sustainable development that should be generally mandatory for all disciplines and department at the undergraduate and postgraduate levels. This would empower students to think and act creatively in integrating the diversity of social, environmental, and economic challenges in their future professional career. As, in the context of national polices, the implementation of sustainable development is at the local level, universities have a responsibility to focus research and policy analysis related to each country's own unique situation.

Knowledge Revolution: Universities are ideally positioned to take a lead role in developing national knowledge systems. The driving force behind compiling and computerizing such information should be the utility of the information, be it for education, scientific research, policy making, or for public awareness. Many universities in developing countries are constrained by the lack of computer capacity and communication infrastructure, often due to high costs. We need to find innovative ways to fund the knowledge infrastructure, including, for example, persuading major computer and equipment manufacturers to consider providing discounts, at least at the level they normally give to large corporate purchasers. The corporations should have an interest in "socially responsible" discounting, as there would be future commercial benefits as student graduates are more likely to buy the same brand equipment in their professional life. The possibility of combined volume purchase by educational institutions can also be effective. Universities must mobilize the electronic media for cyber education, dialogue, and knowledge dissemination. This will be especially important as university student capacity in the short term is unlikely to be able to absorb the rapidly growing demand for higher education.

Entrepreneurship Support: In developing countries opportunities for entrepreneurs and innovators to have their locally relevant products and ideas independently assessed and to receive advice regarding commercial exploitation of such ideas and innovations. The availability of such a service would be a significant incentive to encourage indigenous technological and entrepreneurial capacity. The development of a local private sector that can be competitive in the world economy, is one of the greatest challenges for developing countries

Enfranchisement of Civil Society: The role and participation of the diversity of civil society groups in social and economic development at the local and national level is increasingly being recognized. Yet in many developing countries, civil society is often disengaged and disenfranchised from participatory policy dialogue. Universities have a fundamental responsibility to contribute to nation building and must thus develop innovative ways to dialogue with and empower civil society and thus contribute to capacity building.

Enfranchisement of Government: In most developed countries, governments often call on universities for specific research, expert advice, and knowledge for policy making. This is not the case in many developing countries, where there is a tendency to consult well-known institutions in the developed countries in this regard. National universities need to build their scientific and research capacity as well as their institutional credibility so that they can provide relevant and timely input in terms of policy and expert advice not only on national issues but also in the context of empowering national government negotiators in international forums on sustainable development.

University Funding: The substantial increase in the number of students demanding access to university education as well as the increasing call for university research to contribute to nation building requires innovative funding mechanisms. Consideration should be given to the establishment of a global endowment fund for university education and research, modeled on, for example, the Global Environmental Facility, but with a wider source of funding from bilateral and multi lateral donors, philanthropists and foundations, private-sector bodies, as well as university alumni and the public at large. Such an endeavor to invest in the world's human capital should raise public awareness and commitment from around the world. Similarly at the national level funding should be mobilized from diversified sources but this should be over and above stable and long-term government university funding. A number of universities in the United States have been able to build endowments of billions of dollars; their advice could be sought in relation to the above-mentioned national and global endowment funding.

University Governance: In many developed countries there is an increasing trend towards participation of students and civil society in all facets of university decision-making. This is important with regard transparency and accountability. In the developing countries with limited resources and fewer number of universities as well as an urgency to contribute to human capital development, much deeper thought needs to be given in the to identifying short, medium and long-term governance reforms, how they should be phased in, who should be involved, and at what stage. Such reforms will need an assessment of the right mix of teaching and science for policy research.

International Networking: A university can neither do research on all possible science and policy issues, nor provide teaching and training in all subjects. This has resulted in universities around the world having to choose to specialize in their research and academic courses which, in turn, has given rise to a diversity of university "centers of excellence" in education in particular disciplines and in research. Institutions such as the United Nations University and the International Institute for Applied Systems Analysis

have considerable experience of building strategic scientific and policy-relevant partnerships. These institutions should take the lead in forming a more inclusive network of collaborative education and research institutions from around the world. Such a network would also facilitate the development of university staff through exchanges in teaching personnel and research sabbaticals.

6. Concluding Remarks

"Development is another name for peace"
Julius Nyerere, c 1976

At the dawn of this 21st century, the international community made commitments and formed coalitions against threats of terrorism. However, we also need greater commitments and coalitions against poverty and hunger, and against environmental destruction and threats to natural biodiversity.

We have the scientific and technological means and world's demographic changes, offers an enabling environment for a human capital revolution in the developing countries. We need a global partnership to mobilize the wealth of human and nature's diversity to promote world-wide development. We must not fail to grasp this unique opportunity to contribute to bringing an end to the world's socio-economic ills and disparities.

For the last 50 years, the United Nations system has been the driving force behind the establishment and furtherance of human rights; it has brought into force agreements and conventions to protect natural biodiversity; it has set the agenda for sustainable development and international partnerships for peace and security. The governments and peoples of the world must heed the United Nations' millennium call for "freedom from want, freedom from fear, and the freedom of future generations to sustain their lives on this planet".