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Abstract
The world is faced with numerous global problems. Among the potentially threatening and severely debated are: economic recession, ecosystem decline, carbon dioxide pollution, climate change, energy crisis, over population, extensive poverty in developing countries, food crisis in under developed countries, epidemic diseases in developing countries, depletion of resources worldwide, and pending clean water shortage.

Parallel to addressing these monumental issues are unprecedented opportunities: unprecedented economic cooperation among the G8, BRIC and G20 countries, worldwide understanding of ecosystems and sustainable concepts, creative concepts in carbon dioxide pollution reduction, global research and analysis on climate change, development of sustainable concepts for energy and resources, world organizations developing population control principles, creation of new plant and food technologies, refinement of medical research solutions for medical problems and diseases, and development of advanced water purification systems.

How do we orchestrate the delivery of solutions to solve the world’s problems?

By using the world network of science park organizations IASP, AURP, CASTIP, APEC we can focus national economic development, education, and technology solutions to solve the numerous problems and create a vehicle for the creation of dynamic programs in both the developed and underdeveloped regions of the world. The technology is available to communicate, trade, and travel worldwide. By initially using communication systems located at science parks we can enhance economic development, education and research worldwide.

What is needed is a strategic plan to focus the collective world wide science park community on solving problems in a synergistic manner. By solving sustainability problems worldwide with technology we are: 1) developing cooperation worldwide, 2) creating economic development in different regions tailored to those local conditions, 3) solving health problems worldwide, 4) reducing food problems for developing countries, 5) using our resources efficiently and recycling, and 6) creating more pure water systems for future generations. Programs addressing these situations have the overreaching effect of creating more stable social and political environments as well.

The research paper explores the global ecosystem trends, science park trends, research and development trends and synergistic opportunities to meet these challenges. The research paper documents a potential
plan to promulgate and implement the development of this global sustainable science park initiative worldwide.

It is important to note, that fundamental to the objectives of this paper, an initiative for global cooperation was established in 2003 in Montreal, at the annual conference of the International Economic Development Council (IEDC). Under the auspices of the IEDC, more than a dozen international development agencies, including IASP signed the “Montreal Accord,” an agreement among these agencies to promote multinational cooperatives agreements in all aspects of economic development, especially in science and technology. To that end, IEDC and IASP are engaged in their first cooperative conference programs at the 2009 IEDC annual conference at Research Triangle Park, in Charlotte, NC.

Global Trends: Ecosystem decline, climate change, rapidly rising world population, extreme poverty for over 1/6 of the world’s population, nanotechnology revolution, and changing national power structures among others.

Science Park Trends: Green planning and design for science parks, science parks for national & regional economic development, worldwide science park competition for technology companies, nanotechnology integration into science parks, science park mixed-use campuses or “life-style campuses” (live, work, play and educate), and development of technology incubators.

Technology Trends: The following are technology trends in the world’s research laboratories: Robotics use in research, growing sophistication in imaging, nanotechnology research, environmentally sensitive product design (Cradle to Cradle), focus on telecommunications and satellite based transmission, nanotechnology used in medicine delivery systems, nanotechnology technology incubators, lower ambient environments due to higher resolution instruments, and convergence of technologies based on nanotechnology.

Identification of Synergistic Opportunities: The following are synergistic opportunities to be investigated: science park relationships worldwide in both developed & developing countries, biotechnology & nanotechnology resolving pollution problems, development of drought resistant plant systems, global ecosystem repair & maintenance, nanotechnology research for future building products, in-field- use healthcare diagnosis for developing countries, biotechnology solutions for “orphan healthcare drugs”, population planning solutions for under developed countries, educational opportunities bundled with science park development worldwide, and distance science and technology learning opportunities worldwide coordinated with science parks.

Identification of Worldwide Trends

Global Trends: Ecosystem decline and climate change, diminishing water and food supplies, rapidly rising world population, extreme poverty for over 1/6 of the world’s population, biotechnology and nanotechnology revolution, and changing national power structures.

Ecosystem Decline and Climate Change

Overview
The population increases, pollution, over fishing, and climate change have placed stress on the numerous ecosystems. Population reduction, reduced pollution, and sustainable fishing management are needed; otherwise the marine ecosystems will be depleted beyond recovery. The status of the various ecosystems is summarized below. By the year 2050, if change is not forthcoming approximately 90% of the marine ecosystems will be significantly degraded and the related fish yield will be greatly reduced. This will have a significant impact on the world food supply.

Oceans / Aquatic Ecosystems
Oceans / Aquatic Ecosystems are significantly being depleted due to over fishing, pollution, and global climate change. Wild fish catch has increased from 18+ million tons in 1950 to 95+ million tons in 2000, an increase of 500%.[6]. Farm raised fish have increased from 6 million tons in 1950 to 35+ million tons in 2000 an increase of over 580%. The fish production per person has increased from over 7 kilograms in 1950 to 21+ kilograms in 2005 a 300% increase. The human population is increasing and the amount of fish consumed per person is also increasing. Since approximately 1950, the large fish ecosystem has been depleted to approximately 10% of the 1950 level. [18]. There have been significant losses in yellow fin tuna, blue fin tuna, albacore tuna, Antarctic cod, blue marlin, tropical groupers and Canadian cod. One cause of the over fishing is the fishing industry is subsidized by numerous countries worldwide with billions of dollars.

The Oceans / Aquatic Ecosystems are also being polluted with chemicals such as Polychlorinated Biphenyls (PCBs), pesticides, toxins, dioxin, and radioactive waste. Additional damage to entire marine ecosystems is caused by global warming. Global warming of the oceans contributes to loss of coral reefs that are the base of many ocean ecosystems. Approximately 1/2 of the coral reefs are dead or in a process of dying.

Farmland Ecosystems
Farmland Ecosystems rely on soil quality for both agriculture and livestock grazing. Approximately 1/10 of the world’s surface is dedicated to crop land while another 2/5 is rangeland. Soil erosion from both wind and water has a negative impact on the quality of the soils which in turn reduces the entire ecosystem. It is estimated that 1/3 of the world’s crop land is losing topsoil at a rate that has a negative impact on the world food supply. The topsoil loss is greater than the top soil growth therefore the top soil is being managed in an unsustainable manner that will ultimately impact the quantity of food production. Currently 2/3 of the worldwide soil loss is in Africa and Asia. Critical soil loss is occurring in Afghanistan, Algeria, Brazil, Chad, China, Costa Rica, Ethiopia, Iran, Kenya, Kazakhstan, Malawi, Mali, Mexico, Nigeria, Pakistan, Russia, Rwanda, Sudan, Somalia, and Zimbabwe which are all facing loss of crop land from either soil erosion or desertification. The loss of crop land is critical since the population in these developing countries is rapidly increasing and the food supply may not meet the demand. Some non productive land has less than 1/7 of the yield capacity of sustainably managed farmland. Over grazing of rangeland ecosystems and deforestation contributes to loss of vegetation, soil erosion and ultimately desertification. [2][3]

Forest Ecosystems
One critical role forests play is turning carbon dioxide into oxygen; the fewer the trees the less oxygen there is to breath. A single tree turns 48 pounds of carbon dioxide into oxygen each year. It takes 200
trees to turn the 9,600 pounds of carbon dioxide back into oxygen. Each year the average automobile traveling 10,000 miles produces approximately 9,600 pounds of C0². Automobiles are now using less fossil fuels per mile than just a few years ago however the population, automobiles, and other C0² producing factors are increasing geometrically. As far back as 650,000 years ago C0² levels where not over 300 ppm (parts per million), now in 2009 C0² levels are currently at 375 ppm and at current trends will increase to 485 ppm by 2050. Since C0² is a greenhouse gas, the 375 ppm level of C0² will probably increase the temperature of the earth to approximately 60 degrees (average global surface temperature) by 2050. This will be an average surface temperature rising from under approximately 57 degrees Fahrenheit in 1850, 58 degrees in 2000; to 59 degrees in 2025, and 60 degrees by 2050. The increases could continue on to reach 62 degrees by 2075 and 63 degrees by 2100. [7][8]

**Desert Ecosystems**

Desert Ecosystems are increasing in Afghanistan, Algeria, Chad, China, Costa Rica, Ethiopia, Iran, Kenya, Kazakhstan, Malawi, Mali, Mexico, Nigeria, Pakistan, Russia, Rwanda, Sudan, Somalia, and Zimbabwe due to over grazing, soil erosion, dropping water tables, and forest reduction relate to wood fuel use in developing countries. Desertification is extremely difficult and costly to reverse and much less difficult to prevent. Developing countries are susceptible to desertification due to the local over grazing, wood foraging, and lack of soil erosion programs. [2][7]

**Tundra Ecosystems**

Tundra Ecosystems are located in mostly northern continents from Alaska, Canada, Greenland, Iceland, Northern Europe, Himalayan Mountains, and Northern Russia. The critical change in the tundra ecosystem is methane gas production, due to global warming. As the earth warms, the perma frost in the tundra will warm, melt, and produce methane, a greenhouse gas. According to the USEPA, methane is over 20 times more detrimental than C0² in producing climate change and global warming. The result is an ever increasing cycle of geometric global warming and climate change. This chain reaction and geometric global warming is the most important of all the sustainable parameters since resultant melting in Antarctica, North Pole, Alaska, Canada, Greenland, Iceland, Northern Europe, Himalayan Mountains and Northern Russia and other ecosystems will precipitate global flooding of coastal areas and global population relocations of approximately 150 million people around the world. [2][7]

**Glacier Ecosystems**

Glacier Ecosystems have been on the decline since the early years of the industrial revolution. Glaciers around the world have been receding at an unprecedented rate. Examples of receding glaciers all over the world: Adomello-Mandrion Glacier, Italy; Boulder Glacier, Montana, USA; Columbia Glacier, Alaska, USA; Grinnel Glacier, Montana, USA; Himalayan Mountains, Asia. The glaciers are important to numerous ecosystems. One of the most significant glacier systems for water supply is the Himalayan Mountains glacier ecosystem since it supplies fresh drinking water to the Asia region affecting approximately 50 million people. [2][7]

**Polar Ecosystems**

Polar Ecosystems of both the North Pole and Antarctica are affected by rapidly rising C0² levels and average surface temperatures. The North Pole has warmed to such a point that portions are not frozen over during portion of the year. The depth and the amount of frozen artic sea have been decreasing year after year. The reflectance of the ice and snow are very high (90%) while the absorption of the open ocean is approximately 90%. The more the North Pole warms the more open water will continue the increase in the warming effect. Since 1970 there has been a 40% decrease in the amount, extent and thickness of ice in at the Artic ice cap. There has also been a dramatic warming at Antarctic. [7]
Rapidly Rising World Population

Overview
The world population was at 978 million in 1800; 1,650 million in 1900; and 6,071 million in 2000. This shows a tremendous geometric increase in the 1900’s. We are currently adding approximately 1 billion people to the world’s population every 12 to 13 years. By 2050 the population will be approximately 8.5 billion and by 2100 could even reach 9.5 billion or more. Most of the population levels are increasing in developed countries between 1.99% per year in Asia, 2.34% per year in Latin America, to 2.65% per year while the population in the developed countries is rising at a much slower rate of .58% per year in Europe and 1.25% per year in North America. The population is increasing dramatically in the worst possible location that will cause even greater environmental stress, water shortages, and food shortages. Note: % yearly increases are based on the past fifty year average. [2] [4]

Extreme poverty for approximately 1/6 of the global population

Extreme Poverty Globally
In 2009 extreme poverty exists in over 1/6 of the world. This means that 550 million people are living on less than $1 per day and 550 million are living on less than $2 per day. In a number of the regions the countries are particularly having difficulty in creating a growing economy that creates employment for its citizens. Regions in the world that have the poverty problems are: Africa, Asia, Latin America, South America and portions of the Middle East. Countries that are having very difficult problems providing full employment (over 25% unemployment) and/or have extensive % of their population under the poverty level (30% under the poverty level) are: Afghanistan, Angola**, Benin, Bosnia and Herzegovina, Burkina Faso**, Burundi***, Cambodia, Cameroon, Central Africa Republic, Chad***, Columbia, Comoros***, Democratic Republic of Congo, Cote D Ivoires, Djibouti**, Dominica, Dominican Republic, Ecuador, El Salvador, Equatorial Guinea, Eritrea, Ethiopia, Georgia, Grenada, Guatemala, Guinea, Guinea-Bissau, Guyana, Haiti***, Honduras, Iraq, Kosovo, Kyrgyzstan, Laos, Lebanon, Lesotho, Liberia**/**, Libya, Macedonia, Madagascar, Malawi, Mali, Mauritania, Mayetta, Mongolia, Mozambique***, Namibia, Nauru**, Nepal, Nicaragua, Niger***, Nigeria***, Panama, Papua New Guinea, Peru, Philippines, Rwanda***, Sao Tome and Principe, Senegal, Sierra Leone***, Somalia, Sudan, Suriname***, Swaziland***, Tajikistan***, Tanzania, Timor**, Togo, Turkmenistan**, Uganda, Ukraine, Uzbekistan, Venezuela, West Bank, Yemen, Zambia**/**, and Zimbabwe***. Note: Those countries with over 20% unemployment **; and those countries with over 30% of their population under the poverty level ***. [4]

Nanotechnology Revolution

Overview
Nanotechnology Revolution has been termed the “next industrial revolution”. During the past few years investment in nanotechnology has grown from approximately $423 million in 1997 to $3 billion in 2003 [NSTC, 2000; M.C. Roco 2001 and M.C. Roco and W.S. Bainbridge eds., 2001] It has been estimated by the National Science Foundation that by 2015 nanotechnology will be responsible for global products worth over $1 trillion with a workforce of about 2 million. [12]

Nanotechnology Competition by Nation and Region
The United States of America, Japan, and the European Union and the rest of the world are each spending about $1 billion each for nanotechnology funding. Another $4 billion has been spent annually from commercial companies. Nanotechnology facilities are being constructed at a fast pace due to the international competition to capture the future nanotechnology markets with their associated high technology employment base. The Asia nanotechnology is growing very rapidly especially in China and Singapore. France has recently constructed their $1 billion Minatec Center in Grenoble employing approximately 3500 people. Other significant nanotechnology centers are located in the Unites states at the NIST Facility in Gaithersburg, Maryland and Boulder, Colorado; Cornell University, Ithaca, New
York; Nuance Center, Northwestern University, Evanston, Illinois; and Institute for Soldier Nanotechnologies at MIT, in Cambridge, Massachusetts. Around the world major nanotechnology centers are being built: National Institute for Nanotechnologies, Edmond, Canada; Nanoscience at Chalmers University of Technology Gothenburg, Sweden; National Center of Nanoscience & Nanotechnology, Zhongguancun Science Park, Beijing, China; and NUSNNI Laboratories, NUS Nanoscience and Nanotechnology Initiative, Singapore.

[12]

Changing National Power Structures

Overview
The world power structure has been changing and will continue to evolve. During the turn of the twentieth century the world power structures were the major European countries: England, France, Germany, Spain, and Italy.

Post-World War II
Post-World War II; the power was among: England, France, USSR, and United States of America. The two super powers, USA and USSR, were active throughout the world in terms of the “Cold War”. Their space race drove both countries into the advanced technology of clean rooms, computer technology, nuclear technology, and rocket technology.

Recent World Power Structure Changes
Recent world power structure changes involving China’s entry into the World Trade Organization and the breakup of the USSR has influenced the world balance of power. There has also been stronger influence in BRIC countries of Brazil, Russia, India and China. The recent population increases in growth in both China and India additionally influence the balance of power. Growing potential among Brazil and other larger South American countries for the future that include rich natural resources also is influencing the world power structure. The G8, G20 and the BRIC countries are all very influential in the world today. The breakup of the Soviet Union; spinning off many new independent nations in the Balkan region show promise in the shadows of ancient infrastructures.

This is an unprecedented time of worldwide cooperation and opportunities to maximize these relationships.

Science Park Trends

Overview
Science Park Trends: Green planning and design for science parks, science parks for national & regional economic development, worldwide science park competition for technology companies, nanotechnology integration into science parks, science park mixed-use developments or “life-style campuses” (live, work, play and educate), and development of technology incubators.

Green Planning and Design for Science Park

Green Planning and Design for Science Parks is a popular trend worldwide. The trend is very popular in more developed countries and is particularly strong in Europe, China and the United States of America. In Europe, the green building rating systems are: BREEAM, Energy Performance of Buildings (EPBD), GPR, and Greencalc. In the United States world standards are set primarily by the United States Green Building Council (USGBC). The new United States government facilities are mostly focused on the USGBC LEED® certification. The LEED requirements stand for (Leadership in Energy and Environmental Design). Each state has their own criteria and tax incentives for “green facilities”. In addition to the states local governments and universities also have there own requirements for “green
facilities. The United States of America’s “American Recovery and Reinvestment Act of 2009” also has very specific green facility requirements. The “green facilities in the United States also include: New Construction (LEED NC), Existing Building (LEED EB), Core and Shell (LEED Core and Shell), and Schools (LEED for Schools). There are LEED requirements and certification for campuses as well. China and other countries are also making significant changes to incorporate sustainable design into their planning system.

**Science Parks for National & Regional Economic Development**

Science Parks for national and regional economic development are a world wide trend. There are currently over 400 science and technology parks (STP) in the world today. These STP started in the United States in 1951 at the Stanford Research Park in Menlo Park, California, USA. The second science park development was located at the Research Triangle Park, North Carolina, USA in 1959. In Europe the Science and Technology Parks started at Heriot-Watt University Research Park in Edinburgh, Scotland. The growth of the USA science parks was fostered by the passing of the Baye-Dole Act in 1980. This allowed the universities to profit from the federal research. Now in the United States most of the universities have their own science parks that are close if not contiguous with the university campus. This permits the university to commercialize the intellectual property on campus. The additional revenue stream from the formation of companies at the science parks also enhances the universities economics. [10]

Besides university science parks there are federal research institutions that focus on very large scale research projects of a more national interest. Examples of this are: Jet Propulsion Laboratory, NASA Space Center, and Sandia National Laboratory. These are often promoted by leading government leaders to bring economic development to their states. States in the United States that have extensive and very sophisticated Economic Development that stimulate their regions are: Massachusetts, New York, California, Texas, North Carolina, Florida, and Illinois. [10] A good example of Science Parks used as national and regional development is Singapore. Refer to the Strategies of national technology management in building up a knowledge –based economy- The case of Singapore by Yuelhua Zhang at the Centre for Research Policy, Faculty of Commerce, University of Wollongong, Australia. [22]

Finally, it should be observed that more and more science parks are initiating “sister park” programs whereby they engage in everything from MOUs to formal participatory agreements with science parks outside their own country locations. In some instances, the models use arrangements whereby the tenants in a given park agree to foreign expansion projects in their relative “sister park(s).”

**Worldwide Science Park Competition for Technology Companies**

Worldwide Science Park Competition for Technology Companies is very common world wide and is increasing. The annual conferences by the IASP and AURP in the Europe and the United States are very well attended by science park leaders worldwide. Companies are often completing for research world wide. The research park directors aggressively pursue companies that would add value to their own science parks. Often localities and states have tax incentives to enhance the attractiveness to bring these companies and “high technology” jobs to a region. Magazines such as Site Selection are good sources for both science parks and corporate entities to exchange their information and find appropriate sites for high technology companies and research institutions to locate. Another source in the United States is NAIOP (National Association of Industrial and Office Properties) conferences and magazine.

**Nanotechnology Integration into Science Parks**

Nanotechnology integration into Science Parks is a recent phenomenon due to both the advances in nanotechnology research and the completion world wide. Currently the United States, Japan, European Union and all other countries are set in direct competition to obtain the economic development
opportunities for their respective governments. Each entity has been investing nationally approximately a billion dollars annually to promote nanotechnology within their country. There is approximately another 4 billion is being invested commercially worldwide. In the United States the following centers have recently been established: NIST Advanced Measurement Laboratory AML in Gaithersburg, Maryland and Boulder, Colorado; Advanced Science and Technology Initiative (ASTI) Cornell University, Ithaca, New York; Nuance Center, Northwestern University, Evanston, Illinois; Center for Nanoscale Science and Technology, Rice University, Houston, Texas; and Institute for Soldier Nanotechnologies (ISN) Massachusetts Institute of Technology, Cambridge, Massachusetts. [12] For Science and Technology Parks that have questions about how to integrate nanotechnology into their science parks; a study of site analysis factors to consider related to nanotechnology and the consultants is available in the R&D 2007 Laboratory Handbook noted in the resources at the end of the paper. [1]

Science Park Mixed-Use Campuses “life-style” Campuses

Science Park Mixed-Use Campuses; “life-style campuses” are being developed at numerous science and technology parks around the United States and world. One of the closest to the IASP conference is the Centennial Campus at the University of North Carolina. The campus was developed to promote a Live, Work, Play and Educate type of environment within the science park. Included in the campus are: research facilities, government facilities, corporate facilities, middle school, golf course, executive conference center, hotel, housing, commercial town center facilities, and recreational amenities. Another mixed use “life-style” science park campus is the MIT science park that incorporates research facilities, hotel, housing, and conference facilities within the science park and adjacent to the MIT campus. European, China and other countries are introducing their own Science Park Mixed-Use Campuses “life-style” Campuses.

Development of Technology Incubators

In the last twenty-five years Technology Incubators have been created at numerous science parks in the United States of America, Europe, Asia and South America. There are approximately over 200 technology incubators world wide. The phenomenon is described more fully in “Technology Incubators Around the World” as published in the International Facilities Management Association publication FMJ in the November / December 2003 issue. These facilities in the USA, Europe, and South America generally are between 35,000 to 60,000 square feet (3,252 to 5,574 square meters) and house both research space and office support areas. The function of the incubators is to facilitate the creation of new companies. This can create a significant revenue stream for a Science Park and its related University. It also has a significant benefit to the surrounding regions since it creates high technology employment.

Technology Incubation is not just laboratories and office support facilities. The significant features relate to the business expertise, marketing knowledge, entrepreneur track record, and mentoring ability of the often times virtual incubation activities surrounding and available to the incubator. In Hawaii, USA their High Technology Development Corporation, Manoa Innovation Center, HiBEAM (an accelerator for high technology start up companies), and Hawaii Venture Capital Association all play a part in the High Technology success in Hawaii. This is similar to other parts of the world where high technology infrastructure clusters around the high technology companies.

Technology incubation in China is happening at a rapid pace. Born of the TOURCH program there are now 58 incubators in Beijing alone. China is helping the young Chinese entrepreneurs by offering rent subsidies and guaranteed bank loans to foster new business developments. One of the inhibiting factors is the lack of a mature investment industry to support the new start ups with various capital formations like angel funds, venture funds and IPO’s. This is an opportunity of expertise in one part of the world such as London, England; Cambridge, Massachusetts, USA (Harvard and MIT); San Diego (biotechnology economic infrastructure) and San Francisco (Silicon Valley), California, USA or other areas rich in
economic and entrepreneurial infrastructure to network with Asian or other developing countries incubator programs.

[11]

Technology Trends

Overview
Technology Trends: The following are technology trends in the world’s research laboratories: Robotics use in research, growing sophistication in imaging, nanotechnology research, environmentally sensitive product design (Cradle to Cradle)[16], focus on telecommunications and satellite based transmission, nanotechnology used in medicine delivery systems, nanotechnology technology incubators, lower ambient environments due to higher resolution instruments, and convergence of technologies based on nanotechnology.

Robotics Use in Research

Robotics use in research is a trend that first appeared in the 1960’s. The concept is used extensively in different types of specialized science: protein crystallography, medical diagnostics, genetic research, combinational chemistry, automated blood sampling, artificial intelligence, nanotechnology, surgical robotics, and molecular robotics. Note that the dimensional constraints in robotic equipment have different parameters than the traditional laboratory bench based modules.

Growing Sophistication in Imaging

Growing sophistication in imaging is being used in many research applications: nanotechnology, biotechnology, medical research, and material research. A few of the locations in the United States have the most sophisticated imaging are: Northwestern University, Cornell University, MIT, and Harvard. Advanced imaging is also found in China, France, Sweden, Canada, Singapore, England, and other advanced economies. The growth of sophistication in imaging is expected to be increasing in most of the research areas due to the growth of nanotechnology and miniaturization in the electronics field. The main requirements for adaptation of this sophisticated imaging are vibration, temperature, humidity control, and higher quality HVAC systems.

Environmentally Sensitive Product Design

Environmentally Sensitive Product Design “Cradle to Cradle” design was introduced by William McDonough and Michael Braungart in their book Cradle to Cradle. It speaks to a much more aggressive approach to making products more sustainable. The waste streams before and after product use are researched, analyzed, and changed to be more ecologically sensitive. Products are often shipped back to the factories to be recycled into new products. Process water used by some of the facilities that produce Cradle to Cradle products is often cleaner when it comes out of the manufacturing plant than before it goes into the manufacturing plant. [16]

Focus on Telecommunications and Satellite Based Transmission

The telecommunications industry has changed significantly over the last 15 years. We have seen the break up of large telecommunications companies in the USA; change from analog to digital equipment, development of miniaturization of telephone products, and the development and merging of telephone, music and video technologies. The Unites States has just gone through its move from analog based television to digital television. Satellites take an ever increasing share of the “telephone traffic”. The developing countries are moving directly from the agricultural society to a faced paced digital society.
Nanotechnology Used in Medicine Delivery Systems & Self Assembling Nanostructures

At Northwestern University the nanotechnology department has been developing “self-assembling” nanostructures for use in medicine. Pharmaceutical manufacturers are working on future drug delivery systems that will deliver the medicines to specific regions of the body.

Nanotechnology Technology Incubators

Nanotechnology incubators are being developed world wide to help speed commercialization of nanotechnology products into the economy. The largest and most ambitious nanotechnology incubator in the world is the Minatc facility in Grenoble, France that will encompass over 538,000 square feet and housing 3,500 employees and cost over $1 billion. The Institute for Soldier Nanotechnologies at MIT is focused on incubation of nanotechnologies related to soldier applications.

Lower Ambient Environments Due to Higher Resolution Instruments

The development of the new research facilities often requires much greater sophistication in vibration criteria, temperature, airborne particulate, magnetic interference parameters, radio frequency interference (RFI) parameters, noise, humidity, safety, magnetic interference parameters and security. Some of the requirements are as low as .1 degree Celsius for temperature, <50 micro inches per/sec for vibration, 1% humidity, NC-55 to NC-65 for noise, and Class 1 clean rooms. These design and construction requirements take a level of specialized consultant and architectural expertise previously unknown until recently. [12]

Convergence of Technologies Based on Nanotechnology

Convergence of Technologies Based on Nanotechnology In the area of technology and in particular nanotechnology there is a “convergence” of technologies. Computer technology, biology, medicine, electronics, nanotechnology, video, and other technology subsections are in the process of merging. There are now multidisciplinary conferences focused on this “convergence” worldwide.

Identification of Synergistic Opportunities

Overview

The following are synergistic opportunities to be investigated: create science park relationships worldwide in both developed & developing countries, biotechnology & nanotechnology resolving pollution problems, development of drought resistant plant systems, global ecosystem repair & maintenance, nanotechnology research for future building products, in-field use healthcare diagnosis for developing countries, biotechnology solutions for “orphan health-care drugs”, population planning solutions for under developed countries, educational opportunities bundled with science park development worldwide, and distance science and technology learning opportunities worldwide coordinated with science parks.

Create Science Park Relationships Worldwide in both Developed & Developing Countries

A number of science parks around the world have developed “sister park” relationships to further knowledge and promote market sector networking. These relationships can be promoted by the use of conferences, researcher exchanges, and video conference lectures. An opportunity in the future would be to promote “sister park” relationship in developing countries. This can again be accomplished on common research or market sector basis. This could include market networking to the advantage of both parties. This networking can also include solving more altruistic opportunities in the area of healthcare, pollution abatement, population control, building technologies, and distance learning.
Biotechnology & Nanotechnology Resolving Pollution Problems Worldwide

Both biotechnology and nanotechnology are opportunities for pollution abatement. Biotechnology can customize organisms that attack pollution and neutralize pollution affects. Nanotechnology can be use to neutralize chemicals since the small particles increase the overall reactive surface of a neutralizing substance. Nanotechnology can also be used to detect even small qualities of biological or chemical hazard. Nanotechnology places a large part in national security in the United States by being able to detect very small amounts of nitrates used in explosives. Nanotechnology is also used in hazardous chemical spill containment. A firm that is working at the Nottingham Science Park is conducting research and product development on using nanotechnology to provide clean water in developing countries.

Development of Drought Resistant Plant Systems.

By studying plant root structures and genetically modifying the root systems, plants can be made more drought resistant. A use for this type of technology could provide valuable plant types that might 1) provide food in more drought prone regions, 2) reduce desertification in regions such as Africa and China, and 3) provide plant systems that will help in prohibiting soil erosion where heavy rains promote soil pollution of rivers and oceans. Even in the United States areas of the Midwest are prone to droughts and could use plants with root systems that are more drought resistant.

Global Ecosystem Repair & Maintenance for Marine and Terra Systems

Global ecosystem repair starts with worldwide cooperation among nations. Currently over fishing is subsidized by governments around the world by providing support to their fisherman even when the global fisheries resources are being depleted. This will need to change or by approximately 2050 the fisheries world wide will be so depleted that the annual catches may not be profitable. Both biotechnology and nanotechnology could be used to reduce pollution in marine environments. With global cooperation the fisheries could be restocked with farmed fish. The Hawaii Institute of Marine Biology research park in Hawaii focuses on Aquaculture which has been used in the Hawaiian Islands since the Hawaiian Kingdom days (late 1700’s to late 1800’s). There is a large quantity of Aquaculture being conducted in the ocean areas off of the Hawaiian Islands.

Nanotechnology Research for Future Building Products

Nanotechnology provides the potential to creatively solve some of the world’s problems by creating new materials with new properties. New biotechnology systems that can reduce pollution, enhance existing ecosystems, and provide breakthrough healthcare opportunities. The strength of material can be enhanced to provide improved performance.

In-Field- Use Healthcare Diagnosis for Developing Countries

Opportunities exist for the development of “in-the-field” healthcare that is focused on the poor, malnourished, and sick in the underdeveloped countries. The goals are for science parks to provide a portion of their efforts to humanitarian causes around the world. Support by local, regional, national, and international development should be promoted by the local science parks.

Biotechnology Solutions for “Orphan Health-Care Drugs” and Diseases

Biotechnology solutions for “orphan health-care drugs” have not been a high priority for governments. Now research companies are taking the lead on development for such diseases like: West Nile Virus, Dengue Fever, Avian Flu, Ebola, Arena Virus, Hantavirus Pulmonary Syndrome, Severe Acute
Respiratory Syndrome (SARS), Multi-Drug Resistant Tuberculosis, Lyme disease, and Legionnaires Disease. There are new diseases that are in need of cures, especially in Africa and Asia.

**Population Planning Solutions for Under Developed Countries Need Higher Priority.**

To reduce environmental decline and environmental stress on the planet fast rising populations need to be brought under control to reduce starvation and potential epidemics. Populations in both Africa and Asia are in need of food, medicines, housing, fuel, and employment.

**Educational Opportunities Bundled with Science Park Development Worldwide**

Can the developed nations and the science parks worldwide find a system of helping the developing countries in a more positive manner? Can “sister science parks” in the developing countries be part of the worldwide science park network? Can research, development, trade be vehicles for changing the world? for the world’s poorer nations? Citizens of those developing countries will be the future customers for the developed countries.

**Distance science and technology learning opportunities worldwide coordinated with science parks.**

Most science parks have teleconferencing faculties that could be used for worldwide learning, research, and networking. The developed countries should anticipate more usage in the future to be able to communicate and network globally. These facilities could be used to enhance research training for the science park employees. Just within the past five years there has been a significant increase in “Web-based” seminars and training.

**Worldwide Plan of Action**


**Technology Strategy for Science Park Synergy.**

It is important that the leading science park organizations form a working group to improve communications among the entire science park associations world wide. This working group could include but not be limited to: International Science Park Association (IASP) Spain/ International; Association of University Research Parks (AURP), USA; China Association of Science and Technology (CASTIP) Beijing, China; Asia-Pacific Economic Cooperative (APEC), ANPROTEC (Brazil); National Business Incubator Association, and the United Kingdom Science Park Association. Tools that are common today need to be supported, Web based seminars, video conferencing, and Web based technical websites.

**Sustainable Strategy Plan**

Since the IASP is the world wide and global leader in science and technology parks, the membership needs to take a leadership role in developing a Global Sustainable Strategy Plan to be at the leading edge of the technology needed to solve the global sustainable problems. This leadership can cost very little and
be of such significant help in solving global problems. This leadership could be of significant help to develop opportunities with global organizations and nations to provide needed project development in the world wide change to an eco-economy. This concept could be implemented via a global web cast to include science parks that have interest or business interest in global environmental sustainable solutions.

**Economic Development Plan and Success Measuring Plan**

Some of the problems at science parks around the world relates to creation of equity participation of “angel investors” (early investment capital), global marketing of technologies, potential tenants, networking for investments, managing the incubation process, mentoring of fledgling companies, financing, design of incubation facilities, and virtual incubation concepts. A web based system that is integrated into all of the stakeholders would go a long way in promoting more interaction, more trade, more networking and more information exchange. A task force to oversee and run the Web-based system could be monitored to make it cost effective and responsive to the needs of the members. By organizing the entire science park system into a contiguous network, the IASP leadership along with the other science park entities would have a much strong voice with global entities, nations, and equity market stake holders. This would organize the information, the needs, and the opportunities to provide easier accesses by equity stakeholders. The cost effectiveness of the Economic Development Plan will need to be monitored on an annual basis.

**Funding Parameters Plan**

A funding plan for the Web based activities would be developed within the inter-science park network with leadership by the IASP. Each member group could contribute in proportion to their membership, currency rate, ability to pay, and other reasonable parameters. This funding could be flexible and change over time with an oversight board of the member groups. The cost effectiveness of the system could be measured to make sure that it is meeting the needs and is cost effective. Seeded by this initiative, the IASP could be in a strong position to approach national banks that have as their mandate, qualified programs for foreign direct investment (FDI). Leading nation agencies such as USAID, CIDA and even the World Bank should be attracted to engaging in this.

**Scientific Focus and Sharing Plan**

Part of any networking relationship is the free flow of information between members. As with any science park within different national boundries, there are concerns of national confidentiality, trade secret parameters, intellectual property concerns and national differences in doing business. The IASP can take a leadership role in developing a standard of disclosure that is agreeable to the entire stakeholder groups that could give guidance in communication standards so that the greatest open flow of information is possible within the given national parameters. This will not only help members deal with their national governments but also set guidelines for international users to more fully understand the boundries.

**Food Development Plan**

**Diversification of Food Supply Sources and Delivery Systems.**

Most Western nations have protein related food systems that are based on large central suppliers of protein based products that are severely limited to mass produce animal meats and by products. Focused on only a handful of animal species; the pressures to produce these basic foods in mass quantities have led to diminishing opportunities to develop other diverse animal populations. Increasing numbers of issues have been raised concerning the quality of these processes and the impact on health benefits. There is a trend to examine a new interest in traditional indigenous global food systems that incorporate a tremendous diversity of animal and plant resources which are highly sustainable in nature and offer huge supply potentials if appropriate delivery systems can be delivered.
This is not normally an area of interest or concern for the science park associations. A task force group within the networked science park community could convene and develop suggestions for research topics that science parks could promote appropriate food research. The networked science park leadership could interface with NGO’s (non governmental organizations) and global organizations to foster food related research opportunities for their membership. The information could be networked through a Web-based system for easy access for stakeholders. The idea is to use the IASP as a networking tool to interface with large organizations that have food needs, funding for food research, or research scientists in science parks. The system would act as a clearing house for food related research worldwide.

**Healthcare Standards and Plan**

The health care needs in the developing countries are a significant problem. Again the IASP and its networked science park associations can act as an information clearing house for health care needs, health care research and healthcare funding sources. This would be the place to communicate with other researchers around the world to quickly find what is needed, how the research can be orchestrated, and the funding sources that would support the work. A potential funding source might be the Bill and Melinda Gates Foundation which is focused on providing healthcare solutions worldwide especially in developing countries.

**Resource and Recycling Plan**

The need for resource planning and recycling is still not come to the attention of the media, global groups, nor governments. The IASP could lead the way within the science park community on developing standards of practice for Science Park recycling. A “green guidelines” section could be a subsection of the Web based system to provide needed information on sustainability, resource planning and recycling and other sustainable information. This could include but not be limited to campus planning and building techniques and consultants that do sustainable work.

**Population Planning Plan**

A very sensitive issue both nationally and globally. The sensitivity does not negate the need to help put forth a program and networking capability that will help nations, science parks, investors, entrepreneurs, researchers and philanthropic organizations deal with the number one sustainable problem around the globe today; geometric population growth that exceeds the planets carrying capacity.

**Monitoring of the Action Plan**

A monitoring system on an annual basis is needed to provide the best service and networking opportunities for the science park membership. The plan needs to be comprehensive, scaleable, responsive, changeable and cost effective.

**Need For Action**

The need for action is now. Both environmentally and economically, delay is not an option. The IASP needs to organize a steering committee to define a short and long term strategy to support the science park membership, develop economic development in difficult times, create better an more communication among the science park membership, identify equity sources, promote economic development from nations of member firms. A good example of what is needed is the type of response the AURP provided to the United States of America to interface with the government to obtain needed funding to rebuild the economy. The AURP played a leadership role in speaking for the science park community to define programs that would benefit the science park membership and the country. Quick action is need. Prioritization of needs is critical. Cost effective solutions with fast payback is mandatory.
**Economic Crisis**

It is clear that in the current global state of affairs, the gross net gains for employment and wealth building lie squarely on the shoulders of technology development. The most basic manufacturing bases rely on the fabrication issues dominated by science as it related to industry. Those industries ignoring global competition on technology, environmental, efficiency, conservation and other advancing issues are already in dire straits (the US big three automotive) come to mind immediately. The future opportunities lie in technology solutions that develop trade, learning, regional development for all countries. The developing nations and under developed nations become partners in worldwide development and trade, while solving the world’s sustainable challenges.

**Short Term Focus (Next 3 Months)**

1) Create a temporary steering committee for recovery and sustainability.
2) Providing information that would promote employment for science park companies.
3) Providing information regarding equity funding for research projects.
4) Provide interface with other science park entities to supply information regarding cost effective programs to create employment and stabilize the economies.
5) Provide information to science park membership on grant programs and philanthropic institutions, with equity for programs that they could benefit from.
6) Use current website to distribute information to all science park entities world wide.
7) Create primary steering committee to investigate options and develop strategic plan.

**Medium Term Focus (Next 6 Months)**

1) Create a permanent membership committee infrastructure.
2) Create concept for web based systems for medium and long term solution.
3) Creates medium and long term strategic game plan.
4) Create contacts list for new web based system.
5) Prioritize Sustainable Global Approach.
6) Create funding mechanisms for projects.

**Long Term Objectives**

1) Evaluate both short term and medium term actions.
2) Develop long term economic development objectives.
3) Develop sustainable global environmental objectives.
4) Develop sustainable food research interface objectives.
5) Develop sustainable healthcare research interface objectives.
6) Develop sustainable population increase objects.
7) Develop science park information interface objectives.

**Focus on Environmental and Climate Change**

Many believe the earth is approaching the “tipping point” at which recovery will no longer be possible. At the current rate of aquatic degradation and species extinction, those believe the oceans are moving toward being “ecosystem non-functional” by 2050. Whether the assertions are based on global warming or another more complex cycle there remains an urgency to better understand what these complicated changes mean for the world populations.

The global climate change, if continued to go unchecked, may precipitate worldwide severities in climate change of epic proportions by as early as 2050 by some estimates. By 2050 the carbon dioxide (global...
warming gas), one of the global climate change factors; currently at approximately 375 ppm will reach approximately 485 ppm if left unchecked.

Once the global warming starts to melt the perma-frost in Alaska, Canada, Greenland, Northern Europe, and Russia, it will further accelerate global climate change from the release of methane gas. This resultant climate will cause even more economic, social and environmental damage.

**Action Steps:**
1) Critical to reduce CO2 immediately before tipping point is reached.
2) Critical to promote sustainable oceans, since global food supply is at risk.
3) Critical to accelerate wind, solar and nuclear technologies (current oil, coal, gas cause global warming)
4) Critical to provide clean technologies for coal fired plants, to reduce global warming.
5) Critical to promote non fossil fuel technologies for automobiles.
6) Critical to recycle all resources.
7) Critical to promote Cradle to Cradle design strategies for product design.
8) Critical to promote sustainable design for buildings and science parks.

**Population Crisis Concerns**

Left unchecked the population in the developing areas of Africa and Asia will create unprecedented environmental stress on the planet related to clean water, food, mineral resources, and energy. The population is growing at approximately 1 billion every 12 to 15 years. The population growth coupled with the related problems of disease has the potential to create worldwide epidemics. Solutions need to be developed before large epidemics create even more stress to the environment, economy, and lives of 100’s of millions of people in the developing countries.

**Action Steps:**
1) Critical to promote family planning in developing countries.
2) Critical to provide healthcare solutions.
3) Critical to provide food and water assistance.

**Clean Drinking Water**

The glaciers are melting around the world due to global climate change. The glaciers that provide the drinking water for 1/3 of the world population, in Asia, they are melting at an unprecedented rate. Within a few years water shortages will affect the water supply of 100’s of millions of people if the solutions are not found.

**Action Steps:**
1) Promote research to solve clean drinking water globally especially in Asia and Africa. Use Nottingham Universities work as a model.
2) Stop global warming and the glacier melt in southern Asia, which will cause a lack of fresh water for 1/3 of the people in the world, if left unchecked.

**Resource Decline**

The population is consuming resources at an unprecedented rate. With such sustainable concepts as cradle to cradle design, it is possible to create an integrated new worldwide industrial development that takes into account the development of new products and enhances the environment at the same time. These concepts need to be supported by the Science Park and the worldwide economic development community. “Intelligent” recycling is also very important part of the new eco-economy.
Action Steps:
1) Promote recycling at every science park.
2) Promote sustainable planning and building design at every science park.
3) Promote recycling technologies.

Conclusion

IASP and Science Park Organizations Worldwide

By developing a plan of action the Science Park community can solve global problems and create the new Global Sustainable Science and Technology Park Strategy and Create Economic Development Worldwide.

Economic Solution

The first order of business is promoting economic development for the science parks, since if they economically go under they will not be able to complete the needed work on global sustainability. If completed successfully the science parks globally could foster in a high technology industrial revolution focused on a new Eco-Economy. The solution is to solve both the economic problems and create a new economy based on sustainability. Sustainability is also needed concurrently before the environmental decline matches or exceeds the economic decline. The further degrading of the environment will also have major economic ramifications.

Environmental Solution

Environmental Sustainability is a close second, since if global warming reaches a tipping point (point of no return), the tundra melts, methane increases and once the Artic, Antarctica and Greenland melt the resulting ocean level increases and may cause displacement of 150 million or more people. This would probably ultimately cause starvation, disease, and epidemics on a scale of global proportions. The concurrent melting of the glaciers in the Himalayas will place ½ of the world’s population with insufficient drinking water to survive. Concurrently the melting of Greenland would probably cause ocean currents in the Atlantic to reverse their flow (as they have done before), thereby placing Europe into a severe climate change (Ice Age conditions) that may probably also throw the Europe and the world into severe economic problems. [7]

There are still others who say that we are not in a climate change and that the above scenario is the wrong analysis. As we continue to monitor the global climate changes, we can be prepared to try to reverse any adverse affects that would be detrimental from any source. As we continue to evaluate human and global influences we need to be prepared to change our thinking and adjust our responses to the benefit of all populations of the world.

Attachment:

American Recovery and Reinvestment Act of 2009 Science and Technology Park Areas of Interest

Below are the generic categories related to the science and technology park community that may be within the final bill. These categories could be used in other countries to support an economic recovery plan. Note: We think that the omission of technology incubators, incubator grants funding and incubation support infrastructure is a serious oversight.
Advanced Battery Manufacturing
Aeronautics Recovery Funding
Alternative Fuel Vehicles Pilot Grant Program
Aviation Explosion Detection Systems
Construction and Development of Major Research Equipment and Facilities
Energy Research
Fossil Energy-Carbon Capture
Health Information Technology
Higher Education Repair and Modernization
Institutional Loan Guarantee Program
National Science Foundation
Institutes of Health- University Research Facilities
Institutes of Health Research
Non-Intrusive Inspection Technology
Pandemic Flu Research
Power Grid Transformations
Preventative Care
Renewable Energy Research
Science Park Infrastructure
Science Recovery Funding
Small Business Capital Availability
State Broadband Data / Development Grants
Wireless and Broadband Development

Resources / Biography/ Footnotes


[6] Earth Policy Institute; UN Food and Agriculture Organization, 2008

[7] Gore, Al; 2006; An Inconvenient Truth

[8] Hadley Centre for climate prediction and research, U.K. and National Geographic, September 2004

[9] Hawken, Paul; 2007, Blessed Unrest: how the largest movement in the world came into being and why no one saw it coming; Viking Penguin, the Penguin Group; New York, New York


[22] Zhang, Yuehua, 2000, Strategies of National Technology management in building up a knowledge-based economy – The Case of Singapore.

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