EU-US S&T Collaborations, Challenges and Opportunties for Development

INNOVATION DIPLOMACY

SPECIAL CASE IN POINT: THE HELLENIC-AMERICAN INNOVATION BRIDGE AND ITS UNDERLYING DIMENSIONS

Elias G. Carayannis, PhD, MBA, BScEE, CPMMA
Professor of Science,Technology, Innovation and Entrepreneurship
Editor-in-Chief, Edward Elgar Book Series on Science, Technology, Innovation and Entrepreneurship
Editor-in-Chief, Springer International Journal of the Knowledge Economy
Editor-in-Chief, Springer Book Series on Technology, Innovation and Knowledge Management
Editor-in-Chief, Springer Encyclopedia of Creativity, Invention, Innovation and Entrepreneurship
Editor-in-Chief, IGI International Journal of Social Ecology and Sustainable Development
Director of Research, Science, Technology, Innovation and Entrepreneurship, European Union Research Center (EURC)
Co-founder and Co-Director, Global and Entrepreneurial Finance Research Institute (GEFRI),
School of Business, George Washington University, Washington, DC 20052
Email: caraye@gwu.edu

EURC ACES REPORT
OCTOBER 2012

Adapted from Springer Journal of the Knowledge Economy (JKEC), Fall 2011

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ABSTRACT

Developed and developing economies alike face increased resource scarcity and competitive rivalry. Science and technology increasingly appear as a main source of competitive and sustainable advantage for nations and regions alike. However, the key determinant of their efficacy is the quality and quantity of entrepreneurship-enabled innovation that unlocks and captures the pecuniary benefits of the science enterprise in the form of private, public or hybrid goods (for instance, bio-entrerpeneur-millionaires, knowledge for the public good - ie public health awareness, and new public-private research centers funded partly by bio-entrepeneur-millionaires and monies levied as taxes on bio-ventures).

In this context, linking university basic and applied research with the market, via technology transfer and commercialization mechanisms including government-university-industry partnerships and risk capital investments, constitutes the essential trigger mechanism and driving device for sustainable competitive advantage and prosperity. In short, university researchers properly informed, empowered, and supported are bound to emerge as the architects of a prosperity that ***is founded on a solid foundation of scientific and technological knowledge, experience, and expertise and not in fleeting and conjectural " financial engineering" schemes.***

Building on these constituent elements of technology transfer and commercialization, ***Innovation Diplomacy*** encompasses the concept and practice of bridging distance and other divides (cultural, socio-economic, technological, etc) with focused and properly targeted initiatives ***to connect ideas and solutions with markets and investors ready to appreciate them and nurture them to their full potential.***

Key Terms of Art: Innovation Diplomacy, New Technology Venture Co-location, Diaspora Entrepreneurship and Innovation Networks and Clusters, Sustainable Entrepreneurship, Robust Competitiveness

I. INTRODUCTION AND DEFINITION OF TERMS OF ART

"Imagination is more important than knowledge. To raise new questions, new possibilities, to regard old problems from a new angle, requires creative imagination and marks real advance in science."
[Albert Einstein]

Words of Wisdom to remember...

"The innovator has for enemies all who have done well under the old, and lukewarm defenders in those who may do well under the new law."

Nicolò Machiavelli

Diplomacy

The art and practice of conducting negotiations between nations

A skill in handling affairs without arousing hostility

- http://www.merriam-webster.com/dictionary/diplomacy

Diplomacy is the art and practice of conducting negotiations between representatives of groups or states. It usually refers to international diplomacy, the conduct of international relations[1] through the intercession of professional diplomats with regard to issues of peace-making, trade, war, economics, culture, environment and human rights. International treaties are usually negotiated by diplomats prior to endorsement by national politicians. In an informal or social sense, diplomacy is the employment of tact to gain strategic advantage or to find mutually acceptable solutions to a common challenge, one set of tools being the phrasing of statements in a non-confrontational, or polite manner.

- http://en.wikipedia.org/wiki/Diplomacy

Science Diplomacy

What is "Science Diplomacy"? Science Diplomacy (SD) is the exchange of Science and Technology across borders. A valuable resource and little understood tool of awareness, understanding, and capacity building, its power is not widely known or considered often enough.

- http://mountainrunner.us/2007/04/science_diplomacy.html

Cultural Diplomacy

Cultural diplomacy specifies a form of diplomacy that carries a set of prescriptions which are material to its effectual practice; these prescriptions include the unequivocal recognition and understanding of foreign cultural dynamics and observance of the tenets that govern basic dialogue.

Milton C. Cummings Jr. draws out the meaning of these cultural dynamics in his description of cultural diplomacy as "... the exchange of ideas, information, art, lifestyles, values systems, traditions, beliefs and other aspects of cultures...."

- http://en.wikipedia.org/wiki/Cultural_diplomacy

Economic Diplomacy

Berridge and James (2003) state that "economic diplomacy is concerned with economic policy questions, including the work of delegations to conferences sponsored by bodies such as the WTO" and include "diplomacy which employs economic resources, either as rewards or sanctions, in pursuit of a particular foreign policy objective" also as a part of the definition.

Rana (2007) defines economic diplomacy as "the process through which countries tackle the outside world, to maximize their national gain in all the fields of activity including trade, investment and other forms of economically beneficial exchanges, where they enjoy comparative advantage.; it has bilateral, regional and multilateral dimensions, each of which is important".

- http://en.wikipedia.org/wiki/Economic_diplomacy

Innovation Diplomacy

Science, despite its international characteristics, is no substitute for effective diplomacy. Any more than diplomatic initiatives necessarily lead to good science. These seem to have been the broad conclusions to emerge from a three-day meeting at Wilton Park in Sussex, UK, organised by the British Foreign Office and the Royal Society, and attended by scientists, government officials and politicians from 17 countries around the world. The definition of science diplomacy varied widely among participants. Some saw it as a subcategory of “public diplomacy”, or what US diplomats have recently been promoting as “soft power” (“the carrot rather than the stick approach”, as a participant described it).

INNOVATION DIPLOMACY DEFINED

•***Innovation Diplomacy*** *encompasses the concept and practice of bridging distance and other divides (cultural, socio-economic, technological, etc) with focused and properly targeted initiatives to connect ideas and solutions with markets and investors ready to appreciate them and nurture them to their full potential (Carayannis et al, JKEC, 2011).*

Others preferred to see it as a core element of the broader concept of "innovation diplomacy", covering the politics of engagement in the familiar fields of international scientific exchange and technology transfer, but raising these to a higher level as a diplomatic objective.

- http://scidevnet.wordpress.com/category/science-diplomacy-conference-2010/

"Science and innovation together have a role that can be used to promote global equality and sustainable development," Seabra da Cruz said. He pointed out how Brazil's surging capacity in science and technology has provided a new channel for establishing relations with other countries, particularly emerging economies such as China and India, and those in other parts of the developing world:

> "The big challenge to us and other emerging economies is to find ways of using scientific knowledge to enhance our competitiveness and create a new international division of labour. Without linking scientific knowledge to innovation policy, it is impossible to have sustainable development." As an example of innovation diplomacy in action, he pointed to how technical knowledge can be exchanged between countries about the best ways of using cheap, sustainable sources of energy – as Brazil is doing with its experience in biofuels — helping to improve relations between the providers of such knowledge and those that receive it. "This is an example of where we can exchange information about best social

and innovation practices – which are all likely to involve science to a greater or lesser degree – and also provide an immediate and relatively easy way of making innovation work for diplomacy." He admitted that, as with science diplomacy, innovation diplomacy presents a number of challenges. Diplomats need to be well informed on innovation-related issues, embassies need to develop "observatories " that monitor the innovation landscape of the countries in which they are based, and ways need to be found to engage a country's scientific and technological diaspora.

INNOVATION DIPLOMACY DEFINED

•*Innovation Diplomacy* ***is in effect "conducting and promoting peace – and not war – with entrepreneurship and innovation means,*** *and in this manner unleashing and helping realize the creative potential and aspirations of people around the world so that markets will serve society and society individual to the fullest possible extent" (Carayannis et al, JKEC, 2011).*

More specifically, Innovation Diplomacy leverages Entrepreneurship and Innovation as key drivers, catalysts and accelerators of economic development and envisions in particular the development of efforts and initiatives along the following axes concerning in particular the socio-economic condition and dynamics in Greece currently:

1. ***Re-engineer mindsets, attitudes and behaviors in Hellas*** to help people - and especially the younger ones - realize the true nature and potential of innovation and entrepreneurship as a way of life and the most powerful lever for and pathway to sustainable growth and prosperity with positive spill-over effects staunching the braindrain, reduced cynicism and increased optimism and trust in the future and each other, reduced criminality and social unrest, higher assimilation of migrant groups, etc.

2. ***Engage in sustained, succinct and effective dialog with stakeholders and policy makers within Hellas as well as the European Union*** to pursue the reform and as needed re-invention of institutions, policies and practices that can make

flourish entrepreneurship and innovation in areas such as related laws, rules and regulations, higher education, public and private Research and Development, civil society movements and non-Governmental organizations, etc.

3. ***Identify, network and engage purposefully and effectively with the Hellenic Diaspora professional and social networks around the world*** to trigger, catalyze and accelerate their involvement and intervention in a focused and structured manner to help with goals 1 and 2 above as well as help establish, fund and manage entrepeneurship and innovation promoting and supporting initiatives and institutions such as business plan competitions, angel and other risk capital financing of new Hellenic ventures, mentoring of and partnering with said ventures to ensure their survival, growth and success both within Hellas and in the global markets. Of particular interest and importance would be communities of practice and interest among the Hellenic Diaspora that would include the ship-owners, large trading concerns, and technology entrepreneurs in countries such as the US, Canada, Australia as well as the European Union and the rest of the world.

INNOVATION DIPLOMACY DEFINED

•Innovation Diplomacy leverages Entrepreneurship and Innovation as key drivers, catalysts and accelerators of economic development and envisions in particular the development of efforts and initiatives along the following axes concerning in particular socio-economic condition and dynamics of a country and region:

- *1. **Re-engineer mindsets, attitudes and behaviors***
- *2. **Engage in sustained, succinct and effective dialog with stakeholders and policy makers***
- *3. **Identify, network and engage purposefully and effectively with the related Diaspora professional and social networks around the world***

•Innovation Diplomacy may have a strong positive effect on the National "Brand-name" thus enhancing geo-economically, geo-politically and geo-technologically the position of a country (for instance, reducing cost of borrowing, providing more effective leverage in traditional diplomacy initiatives, etc)

But, if all this can be achieved, "like science diplomacy, innovation diplomacy is a way of broadening the scope and functions of traditional diplomacy".

- http://scidevnet.wordpress.com/2010/06/27/innovation-diplomacy-an-alternative-concept/

THE WORLD TODAY:

- *A World of **Natural and Artificial** Scarcities*
- ***Geo-economic vs. Geo-political vs. Geo-technological Multi-polarity vs. Oligo-polarity***
- *A World of Divides (**SPECKD** – pronounced "specked"):*
  - ***Social***
  - ***Political***
  - ***Economic***
  - ***Cultural***
  - ***Knowledge***
  - ***Digital***
- ***Failed and Failing Developing and Developed States…and the SPECKD Fall-out…(for instance, Somalia, Afghanistan, etc…, and Egypt, Tynisia, and Greece, Ireland, Belgium, and so on???)***
- ***For that matter, how many countries are China and India really made out of and how will that play out in the years ahead???***
- ***Challenges & Opportunities vs. Uncertainties & Risks:***
  - ***People, Culture & Technology – Role of Diasporas…***
  - ***Dogma vs. Democracy, Tolerance vs. Inclusion***
- ***4As & 3Cs:***
  - ***Availability, Awareness, Accessibility, Affordability***
  - ***Communication, Cooptation, Coordination***

EUROPE TODAY: A Social, Political, Economic, and Technological "Snap-shot" Or: Why Politics & Policy Matter for Innovators

- ***EUROPE AT A CROSS-ROADS:***
  - ***GEO-POLITICAL, GEO-ECONOMIC, GEO-TECHNOLOGICAL ISSUES***
  - ***WAR(S) OF STANDARDS (EURO & EURO-FIGHTER)***
  - ***WAR(S) OF CULTURES (GIBRALTAR & PARSLEY, JIHAD & McWORLD)***
  - ***FEDERALISM VS. NATIONALISM VS. REGIONALISM***
- ***CHALLENGES & OPPORTUNITIES: GLOcAL CROSS-ROADS OF PEOPLES, CULTURES, AND TECHNOLOGIES***
  - ***PROSPERITY VS. DEMOCRACY***
  - ***SECURITY VS. PRIVACY***
  - ***SAFETY VS. FREEDOM***
- ***INCREASING CONVERGENCE OF STANDARDS AND PLATFORMS –***
  - ***LESS DEGREES OF FREEDOM***
- ***INCREASING DIVERSITY OF APPLICATIONS AND NEEDS –***
  - ***INCREASING COMPLEXITY OF INTER-DEPENDENCIES & VERSATILITY OF SOLUTIONS***
- ***SCARCITY OF RESOURCES VS. FUZZINESS OF VISION???***
  - **L'EUROPE DE LARGEUR *ET* DE PROFONDEUR ??? *(INNOVATION UNION 2020)***
  - **AMBIENT INTELLIGENCE SOLUTIONS ???**
  - **SELF-SIMILARITY AT WORK ???**

Technology

Technology is defined as that "which allows one to engage in a certain activity …with consistent quality of output.", the "*art of science and the science of art"* (Carayannis, 2001) or "*the science of crafts*" (von Braun, 1997). Diwan adds that technological foundations are market size, standards, innovation, high motivation, and supply of capital (Diwan, 1991) The impact of innovation may be directed to multiple sectors. For example, Jonash lists product/service, process, and business innovation as the key impact areas. Product/service is the development and commercialization of hard goods, process is new ways of producing and delivering cost-time-quality advantages, and business innovation is new models of conducting business for competitive advantage (Jonash and Sommerlatte, 1999).

Technology is a Greek word derived from the synthesis of two words: "techne" (meaning art) and "logos" (meaning logic or science). So loosely interpreted, technology means the art of logic or the art of scientific discipline. Formally, it is defined as "a design for instrumental action that reduces the uncertainty in the cause-effect relationships involved in achieving a desired outcome. A technology usually has two components: (1) a *hardware* aspect, consisting of the tool that embodies the technology as a material or physical object, and (2) a *software* aspect, consisting of the information base for the tool" [17]. Although technology is often embodied in a product, technology in general should instead be conceived of as a process, as dynamic rather than static and as social rather than disembodied. It is a combination of both creative and structured tangible artifacts, codified knowledge and tacit know-how embedded in individual, group, and organizational routines. Thus, technology is systematic knowledge, which from an information theoretic and meta-cognitive/linguistic perspective emphasizes the role of knowledge stocks and flows in linking technology management and technology strategy with business strategy [18].

Technology management is the set of policies and practices that leverage technologies to build, maintain, and enhance the competitive advantage of the firm on the basis of proprietary knowledge and know-how. The U.S. National Research Council in 1987 defined Management of Technology (MOT) as linking "engineering, science, and

management disciplines to plan, develop, and implement technological capabilities to shape and accomplish the strategic and operational objectives of an organization" [19]. While technology management techniques are themselves important to firm competitiveness, they are most effective when they complement the overall strategic posture adopted by the firm. The strategic management of technology tries to "build advantage on the basis of technology", or "bring the potential opportunities that technology creates to bear on the formulation of corporate strategy" [20].

Invention

Before a definition of innovation can be discussed, the related term invention must be understood. Florida considers invention as a breakthrough and innovation as an actualization (Florida, 1990). Hindle further clarifies invention by labeling it as the creative origin of new process and the enabler of innovation (Hindle, 1986), which has impacts on social, economic, and financial processes. Thus the emerging definition of invention may be stated as the creative process of progress while innovation is defined by the impact on societies and markets (actualization). "Innovation generally lowers the cost of responding to a change in the commercial environment." (Wallace, 1995). Thus, innovation has the connotation of market influence.

Creativity

"Management is, all things considered, the most creative of all arts.
It is the art of arts, because it is the organizer of talent."
[Jean-Jacques Servan-Schreiber]

Starting at the individual level, **creativity** may be defined as the capacity to *"think out of the box"*, to think laterally, to perceive, conceive, and construct ideas, models, and constructs that exceed or supersede established items and ways of thinking and perceiving. Creativity is related to the capacity to imagine, since it requires the creator to perceive future potentials that are not obvious based on current conditions. From a cognitive perspective, creativity is the ability to perceive new connections among objects

and concepts—in effect, reordering reality by using a novel framework for organizing perceptions.

Creative types such as artists, scientists, and entrepreneurs often exhibit attributes of *obsessed maniacs* and *clairvoyant oracles* (Carayannis, 1998-2002, George Washington University Lectures on Entrepreneurship) as well as the capacity and even propensity for creative destruction that is how Joseph Schumpeter qualified innovation. Albert Scentzgeorgi, a Nobel Prize laureate, defined creativity as "*seeing what everyone sees and thinking what no one has thought before*".

Key Resources of the Knowledge Economy and Society…

Adam Smith defined *Land, Labor and Capital* as the key input factors of the economy in the 18th century.

Joseph Schumpeter added *Technology and Entrepreneurship* as two more key input factors in the early 20th century

In the late 20th and the beginning of the 21st century, numerous scholars and practitioners such as Peter Drucker, have identified *Knowledge* as perhaps the sixth and most important key input and output factor of economic activity.

When, Why and How Creativity Arises

"Imagination is more important than knowledge. To raise new questions, new possibilities, to regard old problems from a new angle, requires creative imagination and marks real advance in science."

[Albert Einstein]

The problem with "creativity" is that it is an intangible. While we generally know when something is creative, we often don't know why. It seems difficult to articulate a precise definition of the topic.

Aristotle, for example, suggested that inspiration involved a form of madness whereby great insights began as a result of a person's own thoughts progressing through a series of associations (Dacey and Lennon, 1998, p. 17). This view of the creative individual as mad, or potentially, so continued through the nineteenth century.

Freud believed creative ability was a personality trait that tends to become fixed by experiences in the first five years of life (Dacey and Lennon, 1998, p. 36). He maintained that creative expression was a means of expressing inner conflicts that otherwise would result in neuroses. Creativity was a sort of emotional purgative that kept men sane (Kneller, 1965, p. 21). During the first half of the twentieth century, B. F. Skinner and other behaviorists considered creative production to be strictly the result of "random mutation" and a product of appropriate reinforcers provided by society (Dacey and Lennon, 1998, p. 138).

Cognitive view of creativity (personal creativity)

Kneller (1965, p. 3) suggested that definitions of creativity seem to fall into four categories. Creativity is considered from the standpoint of the person who creates, in terms of mental processes, in terms of its products, or focuses on environmental and cultural influences. He states that "an act or an idea is creative not only because it is novel, but also because it achieves something that is appropriate to a given situation"

(1965, p. 6). We create when we discover and express something that is new to us. The operative phrase is "new to us;" even if another person has discovered something, it is still creativity if we have re-discovered it for ourselves.

Amabile (1996, p. 33) appears to provide the most complete definition available to date. She suggests a two-part definition of creativity: (1) that a product or response is creative to the extent that appropriate observers independently agree it is creative. Appropriate observers are those familiar with the domain in which the product or the response articulated (p. 33); and, (2) that a product or response will be judged as creative to the extent that it is both a novel and appropriate task at hand, and the task is heuristic rather than algorithmic. She defines algorithmic tasks as those for which the path to the solution is clear and straightforward; heuristic tasks are those for which algorithms must be developed. She calls these tasks "problem discovery" (p. 35).

Amabile (1996, p. 90) also lists personality traits that appear repeatedly in summaries of empirical work on the characteristics of creative persons:

- High degree of self-discipline in matters concerning work
- Ability to delay gratification
- Perseverance in the face of frustration
- Independence of judgment
- A tolerance for ambiguity
- A high degree of autonomy
- An absence of sex role stereotyping
- An internal locus of control
- A willingness to take risks
- A high level of self-initiated, task-oriented striving for excellence

Of their nine principal traits, it may be helpful to further define three: stimulus freedom, functional freedom, and flexibility. Stimulus freedom (Getzels, Taylor, Torrance, cited by Dacey & Lennon, 1998, p. 100) occurs when people are likely to bend the rules to meet their needs, if the stated rules of a situation interfere with their creative ideas. Functional freedom is the ability to use items for other creative, or unique uses. Dacey and Lennon contend that the more education a person has, the more rigid his or her perception of function is likely to become. Also, because education tends to

encourage complexity of thought, this may produce a convoluted thinking style which works against producing simple ideas – the ones that comprise many of the world's greatest solutions. Flexibility is the capacity to see the whole of a situation, rather than just a group of uncoordinated details.

Gestalt psychologists believed that creative problem solving is similar in important ways to perception. They argued that it is primarily a reconstruction of gestalts, or patterns, that are structurally deficient. Creative thinking begins with a problematic situation that is incomplete in some way. The thinker grasps this problem as a whole. The dynamics of the problem itself and the forces and tensions within it, set up similar lines of stress within his/her mind. By following these lines of stress, the thinker arrives at a solution that restores harmony of the whole (Kneller, 1965, p. 27). Restructuring and productive thinking often do not occur because problem solvers tend to become fixated on attempting to apply past experience to the problem, and thus do not deal with the problem on its own terms (Weisberg, 1992, p. 51).

Creativity in an organizational context

"*Culture* is the invisible force behind the tangibles and observables in any organization, a social energy that moves people to act. Culture is to the organization what personality is to the individual - a hidden, yet unifying theme that provides meaning, direction, and mobilization."

[Killman R., Gaining Control of the Corporate Culture, 1985]

In the business context, creativity now is championed by certain authors as the critical element enabling change in organizations. Kao (1996, xvii) defines creativity as:

> the entire process by which ideas are generated, developed and transformed into value. It encompasses what people commonly mean by innovation and entrepreneurship. In our lexicon, it connotes both the art of giving birth to new ideas and the discipline of shaping and developing those ideas to the stage of realized value.

Kao views creativity as the "result of interplay among the person, the task, and the organizational context" (cited in Gundry, et al., 1994). Drazin et al (1999) agree with this assertion. They conclude that creativity is both an individual and group level process. Complex, creative projects found within large organizations require the engagement of many individuals, rather than just a few. It is often difficult to assign credit to any one individual in a creative effort (Sutton & Hargadon, cited in Drazin, et al., 1999). Creativity, they believe, is an iterative process whereby individuals develop ideas, interact with the group, work out issues in solitude, and then return to the group to further modify and enhance their ideas. Their sense making perspective of creativity illustrates the notion that individuals are influenced in their creative efforts by such factors as conflict, political influence, and negotiated order at the group level.

Environmental effects on creativity

'When I am, as it were, completely myself, entirely alone, and of good cheer... it is on such occasions that my ideas flow best and most abundantly. ***Whence*** *and* ***how*** they come, I know not; nor can I force them. Those ideas that please me I retain in memory.'

[W.A. Mozart, quoted in Brewster Ghiselin, 1952, p.34]

Woodman and Schoenfeldt (1990, p. 18) stress the importance of social environment. They state: "it is clear that individual differences in creativity are a function of the extent to which the social and contextual factors nurture the creative process. Research on creativity has led to a recognition of the fact that the kind of environment most likely to produce a well-adjusted person is not the same as the kind of environment most likely to produce a creative person." Because of the dearth of research in this area, we will briefly examine the factor through an ever-widening circle of social influences – from family to culture.

Amabile (1996, p. 179) reports that there appear to be three social factors that are important for creative behavior:

- Social facilitation (or social inhibition), brought about by the presence of others: She reports that the presence of others can impair performance on poorly learned or complex tasks, but enhance performance on well-learned or simple tasks (p. 181). In addition, there is much evidence that subjects perform more poorly on idea-production tests when they work together than when they work alone.
- Modeling, or the imitation of observed behavior: Research suggests that a large number of creative models in one generation will stimulate general creative production in the next generation (Simonton, cited on p. 189). At the individual level, the pattern of influence seems to be complex. At the highest levels of creative eminence, modeling may be relatively unimportant. In addition, although exposure to creative models may stimulate early high-level productivity, it may be important at some point to go beyond the examples set by one's mentors.
- Motivational orientation, or an individual's intrinsic or extrinsic approach to work: Studies suggest that intrinsic orientation leads to a preference for challenging and enjoyable tasks, whereas an extrinsic orientation leads to a preference for simple, predictable tasks (p. 192).

There is some evidence that cultures may promote or inhibit creativity. Arieti (1976, p. 303) explored cultural influences on creativity and suggests that the potentiality for creativity is deemed much more frequent than its occurrence. Some cultures promote creativity more than others and he labeled these cultures as "creativogenic." He held that people become creative (or to use his term, "genius") because of the juxtaposition of three factors:

- The culture is right. He uses the example that the airplane would not have been invented if gasoline had not been invented.
- The genes are right. The person's intelligence, which is known to be genetic, must be high. Creativity, which may or may not be genetic, must also be high.

- The interactions are right. He offers the example of Freud, Jung, and Adler. If Jung and Adler had not had Freud to compete over, and against, it is questionable whether either Jung or Adler would hold such a high position in psychology today.

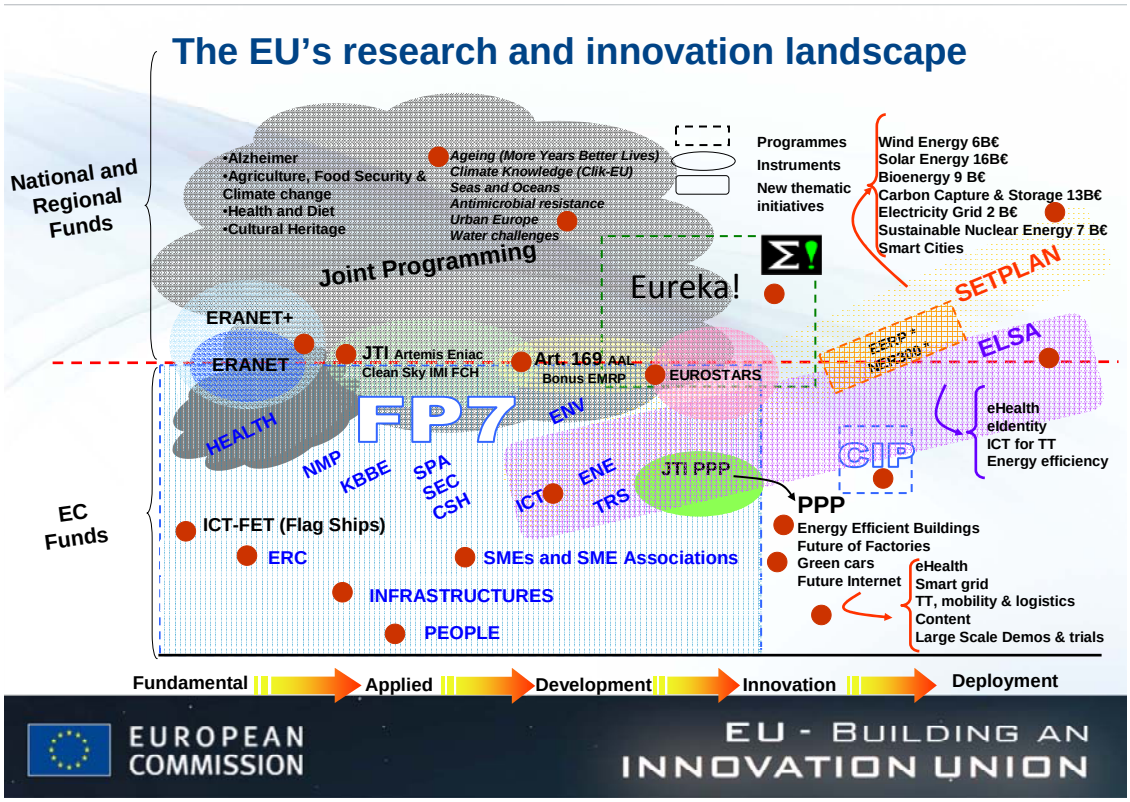
Hofstede (1980, p. 43), in a study of the culture of forty independent nations, found four criteria by which their cultures differed: power distance, uncertainty avoidance, individualism-collectivism and masculinity-feminity. These dimensions appear to have a powerful influence on the "collective mental programming of the people in an environment." They are also grounded in our collective cultural history. Americans, for example, tend to exhibit high individualism, small power distance, and weak uncertainty avoidance. That they show these tendencies reflects American history which has placed high value on equality, independence, and willingness to take risks.

This cultural influence is qualitatively different than the social influences mentioned in previous creativity models. For want of a better term, we call it "cultural embeddedness," because it implies more than a society's norms, values, and mores. It is what defines our reality. In light of this additional component, we are proposing a new model of creativity which not only illustrates the components of creativity, but the creative process as well. In this model, personality and cognitive factors interact with the individual and vice versa. The social environment interacts with the three factors and vice versa; the individual initiates and participates in the creative process. Cultural embeddedness influences not only all of the creative factors but all steps of the creative process.

Innovation

Discovery consists of looking at the same thing as everyone else
and thinking something different.

Albert Szent-Gyorgyi - Nobel Prize Winner



Innovation is a word derived from the Latin, meaning to introduce something new to the existing realm and order of things or to change the yield of resources as stated by J.B. Say quoted in Drucker (Drucker, 1985).

In addition, innovation is often linked with creating a sustainable market around the introduction of new and superior product or process. Specifically, in the literature on the management of technology, technological innovation is characterized as the introduction of a new technology-based product into the market:

> *'Technological innovation* is defined here as a situationally new development through which people extend their control over the environment. Essentially, technology is a tool of some kind that allows an individual to do something new.

A technological innovation is basically information organized in a new way. So technology transfer amounts to the communication of information, usually from one organization to another.' (Tornazky & Fleischer, 1990)

The broader interpretation of the term 'innovation' refers to an innovation as an 'idea, practice or material artifact' (Rogers and Shoemaker, 1971:19) adopted by a person or organization, where that artifact is 'perceived to be new by the relevant unit of adoption' (Zaltman et al, 1973). Therefore, innovation tends to change perceptions and relationships at the organizational level, but its impact is not limited there. Innovation in its broader socio-technical, economic, and political context, can also substantially impact, shape, and evolve ways and means people live their lives, businesses form, compete, succeed and fail, and nations prosper or decline (see Figure 1).

Specifically, Figure 1 attempts to illustrate the nature and dynamics of an emerging globalization framework in which creativity and innovation -as enabler of technological effort in manufacturing and as an engine of industrial development- can lead to improved competitiveness and sustained development.

On the other hand, lack of creativity and innovation constitutes a factor for failure in manufacturing performance and, as a result, is a factor for failure in economic performance, too. For those countries in which creativity and innovation is applied effectively, globalization can be an engine of beneficial and sustainable economic integration. However, globalization can be a powerful force for deprivation, inequality, marginalization and economical disruption in those non-competitive countries.

Government or market success or failure is determined by how they take advantage of the four major elements that shape the setting for creativity, innovation and competitiveness in the globalized world: (1) The coordination and synergy in the relationship between governments, enterprises, research laboratories and other specialized bodies, universities and support agencies for small and medium enterprises (SMEs); (2) The power of information and communication technology; (3) The efficiency that managerial and organizational systems can bring to production and commerce; and (4) The international agreements, rules and regulations. All the four elements of this framework will impact on creativity and innovation at the micro level (firm level) as well as on innovation and competitiveness at the macro level (industry, national, global).

From a business perspective, an innovation is perceived as the happy ending of the commercialization journey of an invention, when that journey is indeed successful and leads to the creation of a sustainable and flourishing market niche or new market. Therefore, a technical discovery or invention (the creation of something new) is not significant to a company unless that new technology can be utilized to add value to the company, through increased revenues, reduced cost, and similar improvements in financial results. This has two important consequences for the analysis of any innovation in the context of a business organization.

First, an innovation must be integrated into the operations and strategy of the organization, so that it has a distinct impact on how the organization creates value or on the type of value the organization provides in the market.

Second, an innovation is a social process, since it is only through the intervention and management of people that an organization can realize the benefits of an innovation.

The discussion of innovation clearly leads to the development of a model, to understand the evolving nature of innovation. Innovation management is concerned with the activities of the firm undertaken to yield solutions to problems of product, process, and administration. Innovation involves uncertainty and dis-equilibrium. Nelson and Winter (1982) propose that almost any change, even trivial, represents innovation. They also suggest, given the uncertainty, that innovation results in the generation of new technologies and changes in relative weighting of existing technologies (ibid). This results in the ***disruptive process*** of dis-equilibrium. As an innovation is adopted and diffused, existing technologies may become less useful (reduction in weight factors) or even useless (weighing equivalent to "0") and abandoned altogether. The adoption phase is where uncertainty is introduced. New technologies are not adopted automatically but rather, markets influence the adoption rate (Carayannis, 1997, 1998). Innovative technologies must propose to solve a market need such as reduced costs or increased utility or increased productivity. The markets, however, are social constructs and subject to non-innovation related criteria. For example, an invention may be promising, offering a substantial reduction on the cost of a product which normally would influence the market to accept the given innovation; but due to issues like information asymmetry (the lack of knowledge in the market concerning the invention's properties), the invention may not be readily accepted by the markets. Thus the innovation may remain an invention. If, however, the innovation is market accepted, the results will bring about change to the existing technologies being replaced, leading to a change in the relative weighting of the existing technology. This is in effect ***dis-equilibrium.***

Given the uncertainty and change inherent in the innovation process, management must develop skills and understanding of the process a method for managing the disruption. The problems of managing the resulting disruption are strategic in nature. The problems may be classified into three groups, ***engineering, entrepreneurial, and administrative*** (Drejer, 2002). This grouping correlates to the related types of innovation namely, ***product, process, and administrative innovation***:

- *The engineering problem is one of selecting the appropriate technologies for proper operational performance.*

- *The entrepreneurial problem refers to defining the product/service domain and target markets.*
- *Administrative problems are concerned with reducing the uncertainty and risk during the previous phases.*

In much of the foregoing discussion, a recurring theme about innovation is that of ***uncertainty***, leading to the conclusion that an effective model of innovation must include a multi-dimensional approach (uncertainty is defined as unknown unknowns whereas risk is defined as known knowns). One model posited as an aide to understanding is the Multidimensional Model of Innovation (MMI) (Cooper, 1998). This model attempts to define the understanding of innovation by establishing three-dimensional boundaries. The planes are defined as product-process, incremental-radical, and administrative-technical. The product-process boundary concerns itself with the end product and its relationship to the methods employed by firms to produce and distribute the product. Incremental-radical defines the degree of relative strategic change that accompanies the diffusion of an innovation. This is a measure of the disturbance or dis-equilibrium in the market. Technological-administrative boundaries refer to the relationship of innovation change to the firm's operational core. The use of technological refers to the influences on basic firm output while the administrative boundary would include innovations affecting associated factors of policy, resources, and social aspects of the firm.

Innovation Posture, Propensity and Performance

We develop our conceptual model of organizational innovation from a resource-based perspective of the firm (Penrose, 1959; Barney, 1991). In particular, we draw upon the concept of knowledge as an intangible resource that flows throughout organizations to render new routines, technologies or structures that affect future performance (Nelson and Winter, 1982). In order to capture the multi-layered influence of organizational innovation, we conceive our framework for innovation routines as a procedural model. We focus on intangible resources that contribute inputs to the innovation process. We examine the firm's capabilities for engaging in innovating activities and finally consider the range of organizational outputs from innovation that span short-horizon outcomes to

long-horizon lasting impacts.

This composite of measures is housed within a "3P" framework for organizational innovation. Innovation emerges from three critical firm-level factors: ***Posture,*** ***Propensity***, and ***Performance***.

- ***'Posture'*** refers to an organization's position within the greater innovation system of its environment (i.e., region, industry, technological domain). Specifically, Posture comprises a firm's state along three dimensions: the organizational, technological and market lifecycles, reflecting its readiness to both engage in and benefit from innovation (Damanpour, 1991). It thus identifies the conditions influencing a specific firm within a specific technology regime serving a specific market.
    - Each firm's ability to engage in innovative activities will be constrained by its Posture, which is exogenous to the innovation process being measured. That is, regardless of whether and what type of innovation process is employed, a firm exists at a point in its lifecycle from formation to failure (organizational lifecycle). The firm also selects technologies to employ in the implementation of its strategies and thus is subject to the state of the technology regime lifecycle within which these technologies exist (technological lifecycle).
    - For example, a handful of stagecoach companies continued operation for a period of time after the introduction of the automobile and thus their place in the stagecoach technology regime could be measured. Finally, the firm exists on a competitive landscape within significant strategic activities in one or more markets. These markets exist at various points in their own lifecycle; therefore they also constrain the innovative actions available to the firm.
- ***'Propensity'*** is a firm's ability to capitalize on its posture based on cultural acceptance of innovation. In this way, propensity is an

intangible reflection of processes, routines and capabilities established within a firm. A firm may possess adequate resources and consequently higher externalized innovation stature, yet have an underdeveloped capacity for innovation due to cultural or other constraints.

- ***'Performance'*** is the lasting result of innovation. This part of the framework comprises three levels: output, outcome and impact. Outputs occur as the immediate, internalized results of innovation. New product introductions, patents and technology transfer licenses are among the outputs that emerge. Outcomes include mid-range results such as revenues contributed by new products. Finally, impacts represent more lasting, long-range benefits that accrue to the firm from its innovative competence and are transformed into results for the firm's environment too. Examples of impact performance include status as a top innovator in the industry.

All three factors – Posture, Propensity and Performance -- are captured empirically in the form of a combinatorial we define as the ***Composite Innovation Index*** (CII). This comprehensive measure demonstrates the superior evaluative results of measuring innovation across all facets of its process in concert (Damanpour, 1991).

Measurement of Innovation

Measurement of innovative performance at the firm level has been paid less attention than at a project level of analysis. Project-level studies provide more nuanced understanding of the mechanisms behind innovation and their impacts on the organization. Most of these studies exclude the controls managers possess to navigate uncertain and dynamic environments. The disparities of these studies have not lead to a generally accepted indicator of innovative performance or a common set of indicators at the organization level.

- Input indicators mainly measure resources that are put into the innovation process. These inputs include intellectual, human and technological capital (e.g. Baruk, 1997; Carayannis, et. al., 2003; Hagedoorn and Cloodt, 2003;

Iansiti, 1997; Leenders and Wierenga, 2002; Parthsarthy and Hammond, 2002).

- Process indicators reflect the organizational and innovation process management systems. They also embody the design of a firm's innovation system and its innovative (Howells, 1995; Kahn, 2002; Koen and Kohli, 1998). Performance indicators identify the results of organizational innovation.
- Output indicators represent the realized, *shorter term* success of innovative activity. Indicators of this group count patent numbers and rates, patent quotes, number of new products, percentage of sales with innovations and others (Baruk, 1997; Michalisin, 2001).
- Outcome indicators represent the realized, *longer term* success of innovative activity, e.g. medium to long term – firm profit margins or market share, firm growth rate, dominant designs or technological standards shaped by firm innovations, second and later stage innovations derived from an originating innovation, degree of disruptiveness (Carayannis, et. al., 2003).
- Impact measures the sustained advantage a firm enjoys as a result of innovation.

Many studies use a single input or output indicator to determine the innovative performance of a firm (Coombs, et. al., 1996; Evangelista, et. al., 1998; Feeny and Rogers, 2003). It has been shown, however, that there are measurement problems with innovation, especially with input indicators (Coombs et al., 1996). Critical issues include 1) some input measurements that do not capture process efficiency, 2) single measurements that do not reflect economic or qualitative value, and 3) lack of indication of technological complexity in the inputs.

Similarly, Santarelli and Piergiovanni (1996) have shown that output indicators that are based on patents might be problematic because technological level and the economic value of patents are highly heterogeneous, the nature of patent content varies widely across countries, not all innovations are patented, not all patents become innovations, and the propensity to patent varies greatly with firm size. Furthermore,

output indicators show limitations due to industry-level antecedents when multiple industries or firm sizes are compared. Other studies have criticized the isolated measurement of innovative business functions or parts (ex., Damanpour, 1991). Advancing that critique, we have identified three limitations of the existing literature. The emphasis is primarily put on (1) the manufacturing sector and (2) product innovations, while ignoring (3) process variables. As a result, existing innovation measures disregard some important indicators for innovative success and show limitations in considering different sizes, objectives and activities of businesses.

Competitiveness

Competitiveness is the capacity of people, organizations, and nations to achieve superior outputs and especially outcomes, and in particular, *to add value*, while using the same or lower amounts of inputs.

Moreover, entrepreneurial value-adding and entrepreneurial learning by doing, learning by analogy, and learning by failing, does not belong to the realm of for-profit entities only, but also in the domain of not-for-profit entities. This is shown in Figure 2 with the overlapping circles connecting creativity and innovation activities across for-profits and not-for-profits.

The standard for judging whether these results are ‘superior’ can encompass both prior capabilities of a particular organization or nation and a comparison with other organizations or nations. The critical assumption of competitiveness, then, is that it is accomplished through a process of organizational improvement, where the institutions in an economy leverage people, knowledge and technologies to rearrange relationships and enable higher states of production.

A Historical and Socio-Technical Perspective on Innovation

"But in capitalist reality, … it is not price competition which counts but the competition from the new commodity, the new technology, the source of supply, the new type of organization, … competition which… strikes not at the margins of the existing firms but at their foundations and their very lives"

Joseph A. Schumpeter, Capitalism, Socialism and Democracy, 1942

To review the history of innovation, one must look toward the classic works of Schumpeter. Schumpeter, an economist, wrote *"The Theory of Economic Development"* in 1934 as an inquiry into profit, capital, credit, interest, and the business cycles. His main contributions were a) the expansion of Adam Smith's economic principles of land-labor-capital into land-labor-capital-technology-entrepreneurship and b) the introduction of the concept of dis-equilibrium into economic discourse.

It is interesting to note that Schumpeter was a socialist and believed that the capitalist system would eventually collapse from within and be replaced by a socialist system. On this point he agreed with Marx, but his version of socialism was in many respects very

different. Marx felt very strongly that the economic model employed would determine the construct of society. The cornerstone of his theoretical structure was the "Theory of Value" (*Das Kapital*) where the value of a commodity, given perfect equilibrium and perfect competition, is proportional to the input of labor. Schumpeter disagreed with Marx on this issue offering the conclusion that both perfect equilibrium and perfect competition were problematic at best. Additional disagreements centered on the inclusion of the value of land in the equation. Another point on which Schumpeter disagreed, is Marx' contention that the capitalist system would implode (*Zusammenbruchstheorie*) as a result of its intrinsic inequities.

In Schumpeter's view, the natural evolution of capitalism would destroy the foundations of capitalism from within. In fact, he believed that the economic depression of the 1930's was an indication of a paradigm shift, reinforcing his beliefs. Schumpeter viewed capitalism in much the same way as he viewed the process of innovation. Both were generally considered stable processes (under perfect conditions) from a theoretical model perspective but Schumpeter introduced the conceptual theory of dis-equilibrium as the key influential factor and this could be further expanded into ***the concept of continuum of punctuated dis-equilibria (Carayannis, 1994b)*** to capture and articulate the concept of successive Fisher-Pry curves (S-curves) with discontinuous and / or disruptive innovations causing a change of curve and / or change of "the rules of the game" as we will see later:

> Michael Tushman and Charles O'Reilly suggest that discontinuous innovation involves breaking with the past to create new technologies, processes, and organizational "S-curves" that result in significant leaps in the value delivered to customers. Similarly, Clay Christensen, Gary Hamel and C.K. Prahalad, and James Utterback describe discontinuous innovation as involving "disruptive technologies," "discontinuities," or "radical innovations" that permit entire industries and markets to emerge, transform, or disappear (Kaplan, 1999).

Early capitalism is often referred to as "laissez-faire" but post-WWII capitalism is much more bounded by social, political and legal norms. In following Schumpeter's principle

of evolutionary capitalism, it may be that the bounded capitalism of the modern era is a logical extension of Schumpeter's theory.

The concept of innovation as a 'socio-technical' system is well established. Rogers (1995), for example, defined innovation in terms of the perceptions of the individuals or groups which adopt an innovation. Attempts to classify innovations in purely technical terms fall into the trap of portraying the result of a social process as something entirely divorced from human influence.

We propose an approach to classifying and subdividing the concepts of innovation along four fundamental dimensions:

i. The *process* of innovation (the way in which the innovation is developed, diffused, and adopted)
ii. The *content* of innovation (the specific technical or social nature of the innovation itself)
iii. The *context* of innovation (the environment in which the innovation emerges, and the effect of that environment on the innovation)
iv. The *impact* of innovation (the social and technological change which results from the completion of the innovation process) (Carayannis, 2002).

Using these four dimensions of innovation, we can delve more deeply into the social implications of disruptive and discontinuous innovation, which in turn facilitates the integration of innovation management concepts with those of organizational learning and knowledge management. In putting these elements in perspective, one needs to bear in mind the following key creativity and innovation drivers and qualifiers:

- **Context**: In what context do all of the above occur?
- **Process**: What is the process by which the above are realized?
- **Content**: What is the content of the above in terms of reaction on the others?
- **Impact**: What is the impact of each of the above on the others?
    - All of these attributes must be considered at all levels including the firm, industry, national and global levels
    - What you invent determines the content of the innovation
    - Commercialization is a necessary but not sufficient condition for innovation

- Creativity & competition may be exogenous factors to competitiveness
- Competition facilitates or suppresses competitiveness (see Figure 1)
- Consolidation may breed complacency
- Disruptive technologies can renew competitiveness

However, excessive rivalry may sap competitiveness leading to the ***Acceleration Trap*** (von Braun, 1997) and the ***Differentiation Trap*** (Christensen, 1997) (see Figure 1). These are situations of increasingly shorter and unsustainable product cycles and spiraling R&D costs with shrinking profit margins and market shares – the result of excessive competition and declining competitiveness (what we term *hyper-rivarly* in the private sector). In these situations, change takes place so fast that firms often fail to benefit fully from it (their learning curves are not steep enough) and they also end up using resources inefficiently and undermining their market position by engaging in price wars or frivolous innovation races. Then firms can find themselves "trapped" in a vicious spiral of increasing competition and declining competitiveness and end up rendering their market niches increasingly hard to sustain.

Common Frameworks and Typologies for Characterizing Innovation

"Comforted by idols, we can lose the urge to question and thus we can willingly arrest our growth as persons: "One must invoke tremendous counter-forces in order to cross this natural, ***all too natural progressus in simile, the continual development of man toward the similar, average, herdlike common !***""

Nietzsche, Thus Spoke Zaratustra, 58

Innovation may be generally categorized as product, process, or administrative (Tidd, 2001). Others classify innovation by regional influences (Evangelista et.al. 2001), or decision criteria (Rogers, 1995). Still others view innovation as product-process-radical-technological (Cooper, 1998). Another view of classifying types characterizes innovation by decision systems (Rogers, 1995). This method relies on the principle that adoption of innovation may be influenced by both individuals and entire social systems.

There is also a distinction between sustaining and disruptive innovations (Christensen, 1997) and continuous and discontinuous innovations (Tushman, 1990):

> Discontinuities are often described as technological breakthroughs that help companies rewrite industry rules or create entirely new industries. Rarely have distinctions been made within the concept of "discontinuity," not to mention how to identify these radical innovations. For the corporate strategist, a big question remains: how to actually structure opportunity identification so it becomes a rational process-one that yields breakthroughs reliably (versus waiting for opportunities to arise serendipitously) (Kaplan, 1999).

Process innovation refers to change in the methods employed by a firm in delivering products or services. An example is the use of internet technologies for supply chain management, where the process of ordering, tracking, and billing would be internet based. ***Product innovation*** reflects change in the end product or service of the firm. An example of product innovation is the addition of a new feature such as adding a remote to a television to improve the user interaction. ***Administrative innovation*** refers to change in the characteristics of organizational or institutional elements. A change in policy, organization structure, or resource allocation are examples of administrative innovations.

Using regional differences to classify innovation is a very narrow view, usually reserved to a specific technology innovation comparison. One of the drawbacks with this method is assessment of the regional nature of an innovation. For example, in the case of R&D measured by the number of patents, the region of patent invention may differ from the locale of registration – especially in the case of multinational corporations (MNC). A patent for an invention of Asian origin may be initiated in a US patent filing if the headquarters is a US MNC – thus the patent would be considered US if measured regionally.

Integrating numerous past studies on technological innovation (especially those by Abernathy, Anderson, Clark, Henderson, Tushman, and Utterback) produces a common framework distinguishing four generic types of technological innovation: ***incremental, generational, radical and architectural***.

Incremental innovations exploit the potential of established designs, and often reinforce the dominance of established firms. They improve the existing functional capabilities of a technology by means of small scale improvements in the technology's value adding attributes such as performance, safety, quality, and cost.

Generational or next-generation technology innovations are incremental innovations that lead to the creation of a new but not radically different system.

Radical innovations introduce new concepts that depart significantly from past practices and help create products or processes based on a different set of engineering or scientific principles and often open up entirely new markets and potential applications. They provide "a brand-new functional capability which is a discontinuity in the then-current technological capabilities".

Architectural innovations serve to extend the radical-incremental classification of innovation and introduce the notion of changes in the way in which the components of a product or system are linked together.

Another common distinction is the difference between ***evolutionary*** innovation, where technological change appears to follow a process of 'natural selection' (with technical improvements resulting from the 'survival of the fittest') and ***revolutionary*** innovation, where the change appears as a break or non-contiguous change in the course of the technology. These two approaches to envisioning innovation are not mutually exclusive, however.

Using the four perspectives given above, we can show how these concepts relate to one another in a more complete framework for the analysis of innovation.

Process	**Content**
Evolutionary innovation	Incremental innovation or Generational innovation
Revolutionary innovation	Radical innovation or Architectural innovation

The complete framework with all four dimensions provides us with a way to relate ***discontinuous and disruptive*** technologies to these other concepts.

Process	**Content**	**Context**	**Impact**
Evolutionary innovation	Incremental innovation	Continuous Innovation	Non-disruptive *or* Disruptive innovation
	Generational innovation	Continuous innovation	
Revolutionary innovation	Radical innovation	Discontinous innovation	Non-disruptive *or* Disruptive innovation
	Architectural innovation	Discontinuous innovation	

Not all innovations are discontinuous and not all discontinuous innovations prove to be disruptive and not all disruptive innovations are discontinuous. This is determined by the scope, timing, and impact of the innovation under consideration and there are different strategies to deal with the challenges and opportunities arising from planned or serendipitous technological discontinuities and disruptions. Christensen (1997: 179) recommends three strategies for leveraging such contingencies and specifically in the case of "***technological performance over-supply***" that creates the potential for ***an acceleration and / or a differentiation trap*** (von Braun, 1997) (see Figure 2 and 3):

- *Strategy 1 is to ascend the trajectory of sustaining technologies into ever-higher tiers of the market*
- *Strategy 2 is to march in lock step with the needs of customers in a given tier of the market*
- *Strategy 3 is to use marketing initiatives to steepen the slopes of the market trajectories so that customers demand the performance improvements than the technologists provide.*

Kaplan (1999) discusses four strategies for leveraging such contingencies:

> Substantial growth over the long horizon requires discontinuous innovation - disruptive technologies, radical innovations and discontinuities that permit entire industries and markets to emerge. Soren Kaplan's experiences as process technology manager with Hewlett-Packard's Strategic Change Services in Palo Alto serves as a framework for all businesses dealing with the new innovation paradigms. He proposes 4 strategies: radical cannibalism, competitive displacement, market innovation and industry genesis. A strategy involving industry creation has a big advantage in that direct competition does not usually exist. It results in a new form of customer value with a new-to-the-world value proposition.

The Process of Innovation

"The lowest form of thinking is the bare recognition of the object.
The highest, the comprehensive intuition of the man who sees all things as part of a system."
Plato

An adequate definition of the process of innovation is inherently problematic. The field is nascent and there seems to be as many different definitions as there are researchers. However, there is sufficient information available to evoke a common understanding on many points.

The innovative process is defined by the correlation of its elements of study (Nelson, 1977). Inventions may be measured and the R&D process may be studied and defined. Science and invention may be linked, sources of innovation elaborated upon, organization factors investigated, the evolution of technology studied, diffusion of innovation measured, and the learning phenomena exposed. Invention is viewed as complimentary, cumulative, and leap-frogging (Rosenberg, 1982). ***Complementary invention*** is the invention of a new process/product that is related to an existing technology, the invention of the mouse to support computer-human interaction is an example. ***Cumulative inventions*** are those that build upon, or "tweak" an existing invention, such as a product improvement like the pouring spout on juice containers.

Leap-frog invention infers a radical change away form existing technologies and echoes discontinuity in markets.

In understanding the process, one must understand the concept of innovation "imperative" (Cooper, 1998) as a key driver. In a competitive environment, managers are driven to success, both individually and organizationally. In order to achieve organization success, the manager must do more than develop, implement, and approve innovation. They are compelled to constantly innovate in order to attain success, driving the organization to higher levels of innovation diffusion.

Most models of innovation are based on three basic ideas (Drejer, 2002). First, organization can act to create or choose their environment. Second, management's strategic choices shape the organization's structure and processes. Third, once chosen, the structure and processes constrain strategy. This is a very interesting insight into innovation models. If an organization can choose its environment, and if the choice is rational, it should be able to choose the best environment for success of its strategy. There are numerous examples of firm strategies that did not perform as expected. Is this principle negated by non-performance of strategy? It may be that exogenous factors influence the choice of environment. This is an interesting question for further study but it is not in the scope of this paper.

In the US, economic policy has an influence on innovation. In general, US policy may be categorized as selective targeting (Nelson, 1982). Historically, US policy could not necessarily be labeled as supportive of innovation. Advances have been uneven (disruptive) and slow to influence productivity and relative costs. This is evidenced by a review of ***Total Factor Productivity (TFP)*** comparisons:

> *Total Factor Productivity* (TFP) was developed by Solow in 1957 as the Growth Theory and has become the dominant approach to measuring productivity. Solow's theorem is that the *Productivity Residual* is uncorrelated with any variable that is uncorrelated with the rate of growth or in other words the *Productivity Residual* is a measure of the shift of the production function (increase in efficiency). TFP considers the traditional inputs to productivity of labor and output and adds the dimension of the influence of capital. TFP is often referred to as Solow's residual. Prior to TFP, measurement of productivity was subject to factors that may incorrectly influence the outcome, like a rise in

demand or a rise in price would cloud the real measurement. It is interesting to note that the TFP calculation is neutral to a rise in demand or a rise in price.

The TFP residual is considered to be an indicator of R&D performance and as such, can be a measure of the effectiveness of innovation -- at the industry or national level. Many researchers (Nelson, 1982) have concluded that TFP residual, as a measure of industry wide R&D effort, is more influential than measuring a single firm.

There are several key recurring principles of innovation. They are an integrated organizational approach, incentives for innovators, a systematic process to convert invention into innovation, team skills, communications, learning, and project management (Rolfe, 1999). These principles are instrumental in developing a innovation process. It is interesting to note the interdependencies of learning and team skills to innovation. Generally, in a team environment, individual members of a team do not possess sufficient knowledge in themselves but if collectively the team "knowledge sum" is greater than non-team knowledge, the team will be a successful implementor of innovation. Since the common construct of teams is subject to change, the ability of the team to retain knowledge through effective learning is an important criteria for long term success.

Identifying innovation as a process as opposed to a discrete event or outcome is generally credited to Peter Drucker (Cooper,1998; Drejer, 2002). The control of the process of innovation is referred to as innovation management. In this context, innovation management is defined by five key activities; technological integration, the process of innovation, strategic planning, organizational change, and business development (Drejer, 2002). Technological integration refers to the relationship between technologies and the product of the firm. The process of innovation is the set of cross functional activities that create and sustain innovation. Strategic planning involves the planning of technologies related to the innovation. Organizational change comprehends the disruptive nature of innovations on knowledge/skill requirements, new markets, new employees, etc. Business development refers to the creation of new markets for the products of innovation. It is interesting to note that innovation may be a driver of business development and also be driven by it. This dichotomy may be explained by the fact that, in the early stages, innovation causes a disruptive change in the organization by

its very nature, creating new markets for example. As the business evolves, “technology pull” becomes evident. As competition catches up or competitive innovations become evident, the requirement for more and more innovation to maintain market position will surface, thus causing the firm to drive innovation.

The organization is influenced by innovation in several ways. Creativity is driven by competition, change, externalities, learning, climate, communications, processes, and social interaction of individuals (Rolfe, 1999). While innovation is a purposeful act, the prime characteristic is uncertainty (Nelson, 1977). This characteristic tends to influence the set of drivers affecting the organization. In this way, as characteristics such as creativity drives innovation, the creativity itself is impacted. The impact may be positive or negative, thus the creativity may be changed and strategic plans may ineffectual. Soren Kaplan (1999) discusses the four types of discontinuities identified at Hewlett Packard and outlines a framework that could serve as a guideline for technology managers and policy makers alike:

> We have discovered four types of discontinuities through our work at HP. As a result, we have developed a framework to help leaders with discontinuous innovation opportunity identification-the process of exploring new revenue streams and identifying compelling propositions for providing heightened forms of customer value. This is the strategic intent that defines compelling new business possibilities capable of driving substantial growth. The framework takes the perspective of an organization that wishes to explore opportunities for discontinuous innovation and is founded upon three assumptions. First, we believe discontinuous innovation involves creating new forms of customer value within existing or new markets. Second, by pursuing discontinuous innovations, organizations create new competitive space or displace existing methods of delivering value to customers. Our final assumption involves the structure of the model itself. We define four discrete innovation strategies but suggest that these classifications not be regarded as mutually exclusive. Instead, these categories should focus efforts on opportunity identification by providing an understanding of "gray areas" that all too often cloud the definition of "discontinuity." (Kaplan, 1999).

II. KEY QUESTIONS AND ANSWERS TO MOTIVATE THE CONCEPTUAL DESIGN AND EMPIRICAL IMPLEMENTATION OF THE HELLENIC-AMERICAN START-UP CO-LOCATION EXPERIMENT

Entrepreneurship and Innovation are human endeavors and socio-economic phenomena that are ***intrinsic to human nature*** as well as constitute both social and political ***engines of positive change and growth*** provided they are balanced and guided by effective and transparent regulatory and incentive systems in place.

Current local (Greek), regional (European) and global economic and financial conditions and trends make the need to ***trigger, catalyze and accelerate high quantity and quality entrepreneurial initiatives*** that are based on ***high quality and quantity innovations*** (low-tech, medium-tech and high-tech) even more clear and present as this is one of the major ways and means to target and achieve ***real, sustainable and eventually accelerating GNP growth.*** Such growth is much more likely to come from new and qualitative different and superior initiatives (from "sunrise" industries) rather than re-structuring existing (and perhaps "sunset") industries. It may be strategically more prudent to invest scarce and precious resources in carefully calculated strategic "bets" rather than keep throwing them after waning industrial sectors and declining firms and in that sense, it may be best to provide aggressive socio-economic re-training, re-insertion and/or early retirement programs to allow for real growth strategies to be implemented.

Moreover, we believe that the concepts of ***robust competitiveness*** and ***sustainable entrepreneurship*** (Carayannis, 2008) are pillars of a regime called "***democratic capitalism***" (Carayannis and Kaloudis, 2009) (as opposed to "popular or casino capitalism"), where real opportunities for education and economic prosperity are available to all and especially the younger people (but not only).

This would be the direct derivative of a collection of ***top-down policies*** as well as ***bottom-up initiatives*** (including strong R&D policies and funding but going beyond that to the development of ***innovation networks and knowledge clusters across regions and sectors*** (Carayannis and Campbell, 2005):

- We define ***sustainable entrepreneurship*** (Carayannis, 2008) as *the creation of viable, profitable and scalable firms.* Such firms engender the formation of self-replicating and mutually enhancing innovation networks and knowledge clusters (innovation ecosystems) leading towards robust competitiveness.
- We understand ***robust competitiveness*** (Carayannis, 2008) as a state of economic being and becoming that avails systematic and defensible "unfair advantages" to the entities that are part of the economy. Such competitiveness is built on mutually complementary and reinforcing low-, medium and high technology, public and private sector entities (government agencies, private firms, universities, and non-governmental organizations). (see also excerpts from: http://search.barnesandnoble.com/Diversity-in-the-Knowledge-Economy-and-Society/Elias-Carayannis/e/9781847202116/?itm=5)

Existing and new small and medium enterprises (SMEs) that can provide better solutions for less will always be winners - even and perhaps especially in down markets and recessionary economic cycle stages - and this is the area where fiscal, monetary, institutional, intellectual property rights (IPR) -related and other public-private sectors programs and initiatives are needed to help unlock, capture and leverage fully the value-adding potential of the Greek knowledge creation infra-structure (ie universities, research institutions and private sector research and development (R&D) facilities) by providing incentives and establishing a large number, scale and scope of pilots connecting organically and effectively all stages of the value adding knowledge chain (from the lab to the market via world-class SMEs that will be both locally as well as globally oriented by design and the new ones from their inception).

THE WORLD TODAY IN TERMS OF DEVELOPMENT AND SECURITY CHALLENGES AND OPPORTUNITIES

- **SOME KEY ISSUES *(FORTHCOMING IN CARAYANNIS ET AL, INNOVATION DIPLOMACY, JOURNAL OF THE KNOWLEDGE ECONOMY, SPRINGER)***
  - ***SECURITY THROUGH EQUITY IN DEVELOPMENT AND KNOWLEDGE FOR DEVELOPMENT***
  - **GLOBALIZATION VS. GLOCALIZATION**
  - **GLOCAL KNOWLEDGE SERENDIPITY AND ARBITRAGE**
  - **KNOWLEDGE & ICT FOR DEVELOPMENT**
  - ***e-DEVELOPMENT in the KNOWLEDGE ECONOMY***
  - ***PROSPERITY FOR PEACE AND PEACE THROUGH PROSPERITY ???***
  - ***DEVELOPMENT AS COUNTER-INSURGENGY***
  - ***DEVELOPMENT AS ANTI-PIRACY***
  - ***DEVELOPMENT AS SOCIO-TECHNICAL NETWORKING AND CLUSTERING***

1. What the importance of technology innovation for the economic growth[1]?

Innovations (high, medium and low tech) are the oxygen of the economy and the key driver of economic growth.

a.. They are ***socio-technical solutions*** with higher value added (or units of benefit per unit of cost) compared to existing solutions thus resulting into the expansion and improvement of current markets and/or the creation of new markets.

b.. The more innovative an economy and a society is (the knowledge economy and society goal is pointing in that direction), the higher its productivity levels and thus the higher the rate of improvement of the standard of living (Per Capita Gross National Product) and the more sustainable those higher productivity levels thanks to their higher levels of competitiveness.

c.. In particular, a combination of high ***quality and quantity*** technology innovations allows an economy to keep winning in the global competition race by being sufficiently and consistently better in terms of value-added solutions (products and services) - Germany is a case-in-point with its Mittelstand (Small and medium size) firms.

[1] The following questions were adapted from an interview by the Lithuanian Business Daily provided by the first author in October 2010.

2. How can technology innovation help us exit from the economic crisis?

Per the above comments, the more innovation-driven an economy becomes, the more sustainably competitive it will become and thus the more market share will it be able to claim from competitors and NOT on the basis of being cheaper but on the basis of being better on a comparative value-added basis.

a.. In this context, the US is currently mistakenly - in my opinion - trying to compete on being cheaper via "competitive dollar devaluations" - this is only a temporary and limited solution with an increasing intrinsic risk for the US dollar to cease being the pre-eminent reserve currency and a potential spiralling of its already very high borrowing costs.

b.. In the EU context, this would require a combination of balanced and well-coordinated top-down government, university and industry sector policies and mandates as well as bottom-up initiatives and practices from individuals and grass-roots movements (civil society) (the elements of the Quadruple Innovation Helix discussed below).

c.. Otherwise, "the entrepreneurship and innovation fad" risks becoming just another concept with limited or unrealized potential that could further exacerbate the cynicism and disengagement of the polity.

3. What are the tools for firms to adopt innovations successfully and what are the accruing innovation' benefits for the business?

Companies (especially small and medium size firms) need to begin with as high quality tools and expertise at their disposal (in terms of business planning, risk capital financing guidance and sources as well as strategic partners, complementors, suppliers and customers - in short a business ecosystem they can thrive in both locally, regionally and globally).

a.. This should begin with a mindset shift from only short-term, survival mode thinking which is normal for entrepreneurs especially in their early business stages to more strategic, globally as well as locally attuned thinking and acting which nowadays could be greatly enabled and empowered via social networking tools and methodologies as well as blended (real/virtual) teaching/learning./consulting/mentoring environments.

b.. Moreover, in the case of a country like Lithuania, a local, regional and global perspective would be critical given the small size of the local market. In this regard, Lithuania should pursue an effective and efficient strategic integration of its knowledge-generating assets in the universities

(this is also furher discussed at the end) as well as its industry and its government sectors and leverage them fully along with EU and Lithuanian Diaspora resources, expertise and experience to promote the creation of a new breed of start-ups (preferably - but not excluisively - as high technology as is sustainable technologically and commercially).

c.. These start-ups would aim to form a critical mass of an entrepreneurial innovation ecosystem in the form of locally and globally inter-networked and competitive firms that would more organically and sustainably allow Lithuanian innovators and entrerpeneurs to tap and expand into the world's markets while remaining. researching and creating in Lithuania.

d.. I have called this concept ***"co-location"*** in the sense that it aims to retain the knowledge creators and potential entrepreneurs based in their mother country while enabling them to set up a bridgehead and become active in larger markets such as the US. I have been doing this for the last five years with some success with Hellenic high tech spin-offs from Research and Development Centers and Universities in Greece co-locating in the US.

4. Can you explain the ideal cooperation plan between business and education organizations seeking commercial success for products or services. Please, give some examples from the practice.

First of all, there is no "perfect" cooperation plan - any such plan needs to be a living and evolving entity adaptring to domestic and global socio-economic and technological trends and changes.

a.. Per my above comments, a balanced approach with a win-win-win mindset is key combining short-term with long-term considerations. People, culture and technology need to be organically aligned so that resources used lead into results obtained in as short-term a context as possible to establish credibility and gain cooperation and support from civil society.

b.. For that, top level champions are needed as well as a strategic leveraging of social networking structures and infra-structures. In the past, regions around the world - whether the Silicon Valley in California, or the Route 128 region in the Boston area or others - have been identified as success benchmarks for innovation and entrepreneurship - however, simply emulating those has not always led to successful results as people and culture are finicky and there are higher order inter-dependencies and complexities involved.

c.. Here are some ideas as to how to set up policies and frameworks to provide as conducive as possible conditions for the creation of an sustainable and competitive Entrepreneurship and Innovation Ecosystem:

c.1. Advocate the need for a non-political, institutionally and meritocratically established entity that would function as part of the government in Lithuania and all other EU countries and could be called "Ministry for Innovation and Entrepreneurship" but set up in a flexible manner to avoid becoming part of the problem.

c.2. Advocate the need for an "Ombudsman for Entrepreneurs and Innovators" with proper authority, visibility and resources to intervene and resolve barriers to Innovation and Entrerpeneurship (E&I) in Lithuania and across the EU (this is the institutional civil society role in support of E&I as part of the Quadruple Innovation Helix concept I have written about in 2009 (Carayannis, International Journal of Technology Management 2009) - government, university and industry working effectively with civil society to support and promote E&I)..

c.3. Advocate the need for high caliber volunteers among the Lithuanian Diaspora as mentors as well as potential risk capital investors and strategic partners - in this context, I would propose forming a "Global Lithuanian Diaspora Angel Investor Network" and "The Global Lithuanian Diaspora Bond Issue for Entrepreneurs & Innovators" and to have the funds managed by a professional entity that is subject to the Diaspora members in a transparent and efficient manner. The intent would be to allow for a pooling of resources so along with large scale donations, many small size but cumulatively substantial contributions could start being made on a streamlined and sustainable basis and always focused on supporting and promoting Entrepreneurship and Innovation initiatives and efforts (a working case of that can already be seen in Denmark where a micro-finance and micro-enterprise fund - "My C 4" - is already succeeding to pool thousands of investors with thousands of entrepreneurs leveraging social networking and clear vision and execution (www.mc4.org).

d.. Moreover, my descriptions of entrepeneurs and academics, based on 20 years of experience working with academics as well as entrepreneurs are as follows:

d.1. that entrepreneurs exhibit stongly the attributes of ***"obsessed maniacs" focused on realizing their vision and "clairvoyant oracles"*** seeing the opportunities and how to exploit them ahead of all others and being able to share that vision effectively with their key partners, investors and other early stakeholders (Carayannis, GWU Lectures, 2000-2010, Carayannis and Formica, Intellectual Venture Capitalists, Industry and Higher Education, 2008) - case in point is someone I met at the Innovation-driven Entrepreneurship conference in Vilnius this past week - Daniel Williamson and the venture "Connections" he is helping develop further (www.cnx.org).

d.2. that academics ideally should be "entrepreneurs of the mind in the business of growing people intellectually and spiritually" (Carayannis, Higher Education Manifesto, Industry and Higher Education, 2007) - case in point would be Prof. Dr. Asta Pundziene - the Vilnius Innovation-Driven Entrepreneurship conference chair and facilitator of a lot of "happy accidents" during this conference, that is knowledge exchanges and partnerships being spawned in the context of this event. Asta and her team truly represent a model of the academic "entrerpreneur of the mind" that I outline above.

d.3. Based on these descriptions, one should aim to inspire, empower and liberate the individual aspiring entrepreneurs (whether academic researchers and/or graduate students in science and engineering as well as

other fields) to dare to dream big and dream in scientific/technological as well as commercial terms and to dare to take the next huge step of forming a company and asking people to invest in their dreams.

d.4. One of the ways to do so would be to establish across all of Lithuania's universities inter-linked, complementary and reinforcing, cross-disciplinary graduate degrees focused on Entrepreneurship and Innovation with emphasis on practice and aiming to produce at their conclusion working prototypes in the related science and engineering fields of the participants (from medical devices to agricultural techniques to software programs) and provide support and guidance for proper follow through leading to the establishment of intellectual property rights (patents, trademarks, copyrights, trade secrets, etc) as well as the formation of companies to commercialize those prototypes. These companies should be supported by Advisory Boards as well as potential investors from both internal / domestic networks as well as the Lithuanian Diaspora including the ***Global Lithuanian Diaspora Angel Investor Network*** and others.

5. What are the key for the getting financing: cooperation or acting alone?

First of all innovation is a ***team effort*** so some type of cooperation (including co-opetition or collaborating with your competitors under the right sets of conditions) is a sine-qua-non.

a.. The first key challenge typically is to bridge / overcome the so-called "valley of death" hurdle - the lack of financing for early stage ventures to get to the next level of growth abd beyond a level of financing easily done with one's own resources.

b.. The comments I made above are part of the answer and also patient and persistent policies and strategies that will nurture the development of an innovation ecosystem and the re-engineering of the mindsets of potential entrepreneurs and investors so that they will work better together and become better risk takers and risk evaluators over time.

6. Could you compare USA and Europe practices in the innovation-adopting area. Why is USA the leader in that? Do you have any suggestions for the scientists who are potential innovators?

The US retains an apparently eroding lead (see ITIF Report on Innovation, 2010) thanks to earlier efforts starting with the Second World War, to promote E&I and also more E&I friendly fiscal policies as well as the presence of a more accessible and large enough market:

6.1. Fragmentation of markets, bureaucracy, lack of transparency, lack of the right mindsets, impeding fiscal and monetary policies, all these help to contribute to make things more difficult in Europe, however, there are many rays of hope in many regions across Europe, where clusters of innovative

companies and innovation networks across regions and industries have been emerging and the Baltic region can well be the next one on this trend...

6.2. Moreover, this trend can be further reinforced via a comprehensive and focused strategy to empower individual start-ups or spin-offs to be created in Lithuania with the intent and the underlying strategy to target and benchmark against competitors in the US and to plan and enact entry in the US from very early on. This strategy of "co-location" is described in a previous answer above.

7. Do incentive prizes help catalyze innovation? Why?

Incentive prizes always help trigger invention and catalyze innovation (such as the X Prize in the US among others) but they can not suffice to ensure both high quality as well as quantity innovation beyond isolated events ("happy accidents" again). For sure, they help focus people's minds and provide them with an opportunity to compete with each other and also attain an apparent achievable goal.

8. What is the importance of academic education as a pillar and driver of innovation ?

Academic education is key in order to provide the technical literacy and readiness to understand and leverage the messages nature is sending us and which we tend to realize through observing and learning from nature with an educated eye. In this regard, albeit there are cases of entrepreneurs who made it big with minimal education, education that is also tied organically with practice is a sine-qua-non for technology-driven innovation and entrepreneurship in particular.

9. What do you think, fundamental or applied science is more useful for the economy? Why?

This is a ***pseudo-dilemma*** in my opinion. Applied science stands on the shoulders of basic science but it takes longer for the fruits of basic science to manifest their value-adding potential so we need to plan for and support both basic and applied science but with appropriately long horizons in each case as both provide the knowledge foundation or "soil" in which the seeds of invention need to take roots so that the tree of innovation can grow and prosper.

9.1. In this regard, the end of the cold war and the resulting shift in shorter term priorities for the US has to some considerable extent been very detrimental for the science enterprise in America and Vannevar Bush (President Roosevelt's Science Advisor who wrote a seminal report entitled "Science: The Endless Frontier" in 1946) would consider 1989 the beginning of the end of the "Endless Frontier" as we have come to know it.

9.2. Of course, the US society and economy have been showing capable to adapt and overcome any and all challenges cast upon them to date - and the jury is still out as to whether over the long run, more or less democratic regimes are more or less innovative (see also Joseph Needham's "The China Question").

10. What are your recommendations for the Lithuanian business and scientist community? We have a very big cooperation's lack between science and business.

As I mentioned above, ***a major shift in mindset from "tactical fragmentation" to "strategic integration"*** both within Lithuania and across government, university, industry and civil society as well as across the Baltic States, the EU and the world - and surely the US. More specifically, some initiatives that may need to engage both the Lithuanian society and government as well as the Lithuanian Diaspora (LD) are:

10.1. a strategicaly flexible, non-Political and supra-Governmental - civil service type - "Ministry for Innovation and Entrepreneurship" - led and staffed by independent experts (domestic and foreign) as well as members of the LD primarily and on a NON-career basis.

10.2. the formation of the Office of the Ombudsman for Entrepreneurs and Innovators (OOEI) again independent and supported by LD members and other non-political entities, foundations, etc.

10.3. the Global Lithuanian Angel Investor Network and the Global Lithuanian Diaspora Bonds for Entrepreneurs and Innovators Initiative to provide in a transparent and professionally managed manner, seed funding and risk capital for Lithuanian (primarily but not exclusively) high technology inventor-entrepreneurs and surrogate-entrepreneurs who are ready to develop the linchpins of the Lithuanian Knowledge Economy and Society over the next 10 years (let us call this initiative Lithuania 2020 to parallel the EU's Europe 2020 Plan and also to remind us of what was NOT accomplished with the Europe 2010 Lisbon Plan to help us learn and hopefully avoid repeating the same mistakes twice at the country or continent levels...

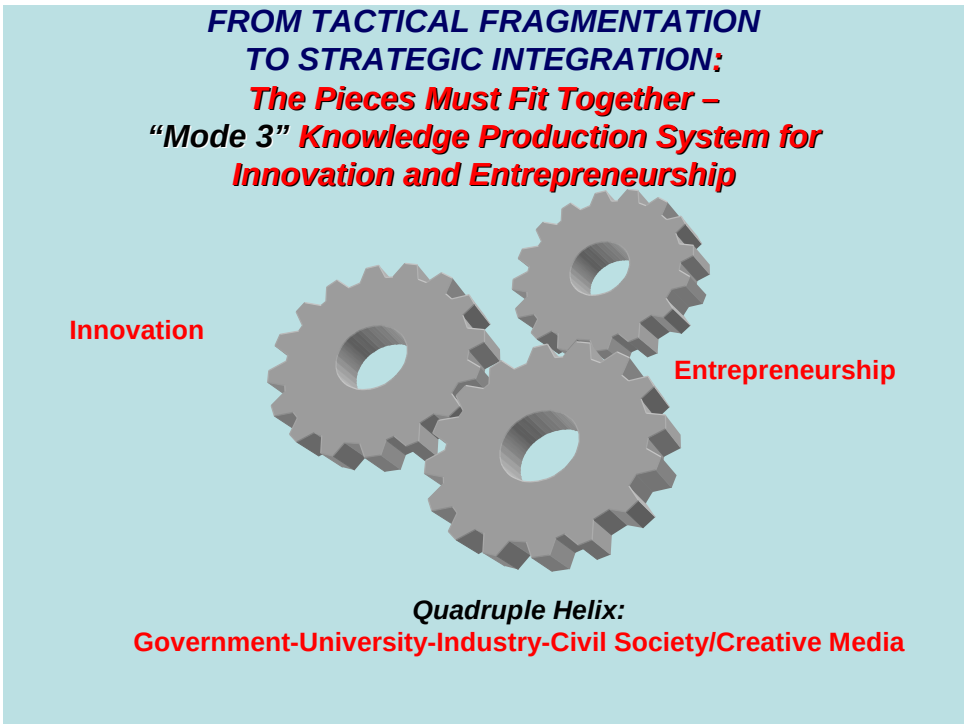
10.4. to establish across all of Lithuania's universities inter-linked, complementary and reinforcing, cross-disciplinary graduate degrees focused on Entrepreneurship and Innovation with emphasis on practice and aiming to produce at their conclusion working prototypes in the related science and engineering fields of the participants (from medical devices to agricultural techniques to software programs) and provide support and guidance for proper follow through leading to the establishment of intellectual property rights (patents, trademarks, copyrights, trade secrets, etc) as well as the formation of companies to commercialize those prototypes. These companies should be supported by Advisory Boards as well as potential investors from both internal / domestic networks as well as the Lithuanian Diaspora including the Global Lithuanian Diaspora Angel Investor Network and others.

III. EMPIRICAL IMPLEMENTATION AND CONCEPTUAL VALIDATION - HELLENIC-AMERICAN INNOVATION DIPLOMACY BRIDGES

Case Study

Achieving more with modern tools: how the use of innovation and business diplomacy helped offset limited resources and a stereotypically traditionally-branded economy

Facts:	The Greek Economy: i. Traditionally-branded ii. Low investment, technology and innovation visibility; low doing-business scores iii. Labor intensive iv. Low added-value product chain v. Strongly co-notated with natural/environmental assets (i.e. landscape, climate), non-tangible (i.e. cultural) goods
Environment:	The US
Mission:	To put the Greek economy 'within the radar' of American investors and the US business community, by attempting a country paradigm-shift: highlighting success stories, offsetting deficiencies and facilitating business deals.



State-of-play and incentives:

The stereotype is deeply anchored and needs little explanation: in the mind of the average American Greece is a country associated with its history and culture, the weather and the landscape and its famous Mediterranean diet[2]. Other than that the Greek economy has little to offer, let alone compete in the fields of innovation, state-of-the-art technologies, disruptive solutions, modern entrepreneurship and the like.

Every Greek economic actor, from the Trade Offices the Greek State maintains in the US, to the bilateral Chambers (i.e. the Greek-American Chamber of Commerce and similar entities), to the trade and business development agencies in Greece, to Greek companies seeking to do business in the US, all face this long-lived and largely misleading prejudice. But, to those who have first-hand knowledge or prefer to dig a little further beneath the surface, things do look different.

Despite the economic downturn there is a dynamic economic and innovation potential in today's Greece, which remains to large extends untapped. This potential can be ascribed to 3 main factors:

1. The native human capital: scientists and researchers, doctoral and post-doctoral candidates, graduates of world class universities and polytechnics, fellows in major institutes and research facilities, who return home and staff local academic institutions or start their own companies right out of their labs.

[2] In a very recent market analysis on US consumers attitude towards Greece and Greek products (*Kairos Consumers* for the Greek Exporters Association October 2010 -www.pse.gr/en), the test groups associated Greece with nothing but historical/cultural and geographical landmarks (i.e. Acropolis, ancient history, Pythagoras, islands, Athens etc) and food products (i.e. feta cheese, olives, yogurt etc). To the question "which 3 products would you label as 'made in Greece'" the responses further solidified the findings: ouzo, feta cheese, olive oil, grape leaves, yogurt etc. As one quoted answer perfectly epitomizes: "Olives, olive oil, feta cheese, yogurt; I can't think of any other products that is produced in Greece other than food".

2. The entrepreneurial spirit: Greeks have been archetypical for their adjustability and innovative thinking throughout history, having not only survived but flourished in unfriendly terrains and uncharted markets. A recent example illustrating this spirit is the unprecedented penetration Greek companies have accomplished in Southeast Europe in the early '90s, in a very volatile political, business and investment environment right after the collapse of the former Soviet 'block'. Today, in some countries in the Western Balkans Greek FDI stock ranks first among foreign investors, outpacing economic giants like Germany, Great Britain and the US.

3. Smart thinking –inventive academics and business pioneers had to virtually bypass a systemic defect in the Greek R&D framework: the decoupling of basic from applied research, leading to a correlated decoupling of innovation from industry and markets[3]. Applied research was practically transferred away from the Universities, where mainly basic research is conducted, to Research Centers and Tech Parks, where commercializing technology and creating tech-driven startups is by far more uncomplicated.

How well Greece scores in winning competitive EU funding is an indicator of both the existence and the impact of the above mentioned factors, when combined and applied in a proper manner and in a highly antagonistic environment. The following table highlights the performance of Greek 'players' compared to other member states in winning competitive EU funding in Information and Communication (ICT), one of the most innovative and competitive sectors[4].

European Union
FP7 --ICT Programs
Calls for Proposals 1-5 (Dec. 2006 through Oct. 2009)
Percentage (%) of final funding allocated per member state

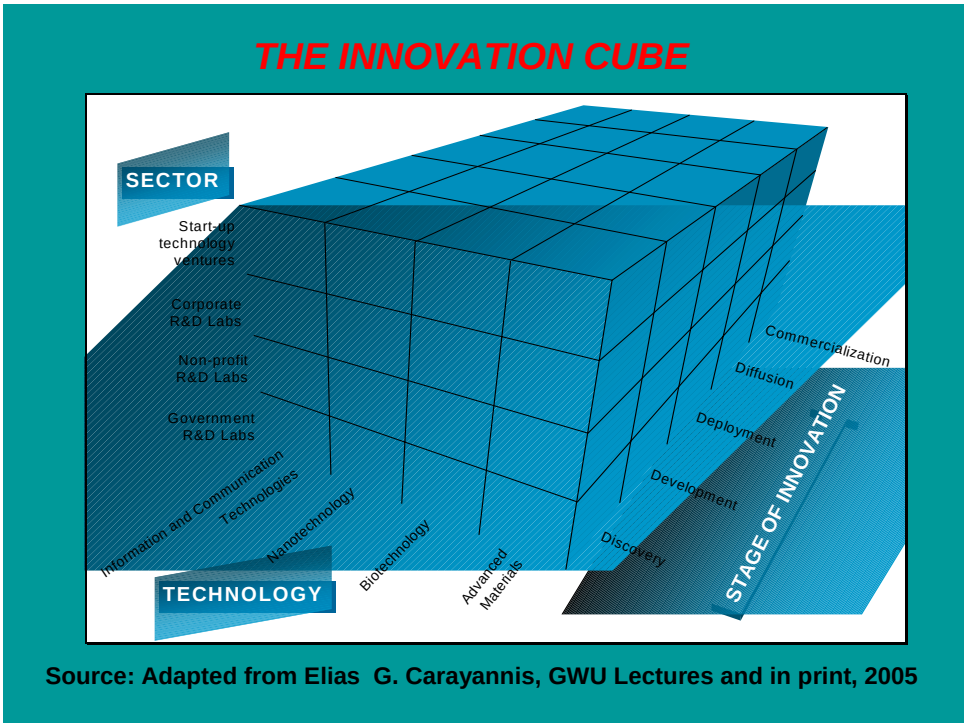
Country	1st call *12/2006-5/2007*	2nd call *6/2007-10/2007*	3rd call *12/2007-4/2008*	4th call *11/2008-4/2009*	5th call *7/2009-10/2009*	Total Average/Rank
Greece	4,79	4,64	2,73	4,46	4,20	4,16 (3)
Austria	4,18	2,83	5,30	3,72	3,46	3,89 (4)
Belgium	4,88	5,36	3,21	6,11	4,65	4,84 (2)
Denmark	1,22	1,36	0,39	1,65	1,23	1,17 (8)
Finland	3,30	3,84	0,97	1,81	2,35	2,45 (6)
Ireland	1,38	1,24	0,75	1,19	4,37	1,78 (7)

[3] *Article 16* of the *Greek Constitution*, which regulates *Education, Art and Science*, especially the correlation of provisions "Art and science, research and teaching shall be free and their development and promotion shall be an obligation of the State" (*§1*), "Education constitutes a basic mission for the State and shall aim at the moral, intellectual, professional and physical training of Greeks" (*§2*) and "Education at university level shall be provided exclusively by institutions which are fully self-governed public law legal persons. These institutions shall operate under the supervision of the State (…)" (*§5*) of this Article, have been widely and consistently (mis)interpreted as practically forbidding any kind of commercial implications (let alone exploitation) of academic research.
This idealization (one is tempted to say sanctification) of academic research impeded the transformation of research to tangible novel goods and procedures, despite the fact that a number of targeted laws have been enacted to revert that distortion. Paragraph 3A of law 2741/1999 (further amended in 2000 by law 2843) clearly states that "The outcomes of research and the knowledge created in research centers, educational institutions, companies or other entities in Greece and abroad can be economically exploited in various ways, including:
a. Direct commercial use by producing and trading goods or services from the very knowledge-producing institution. In case the entity is an academic institution, those activities can be undertaken by the companies managing the institution's property"
b. Out-licensing the commercialization from the knowledge-creating institution to a third-party entity or company, under a concession agreement defining the economic terms.
c. Founding a targeted subsidiary corporation or participating in a third-party company to commercialize the knowledge produced.
d. Technology companies where the economically-exploitable knowledge-creating individuals (scientists, technologists and researchers) engage in entrepreneurial activity; the institution where the knowledge was created can participate in these companies in any desirable form as can third parties (individuals or legal persons).
e. A combination of any of the above mentioned forms and other ways.

[4] The mix of counties is arbitrary, chiefly by virtue of comparable size with Greece yet also reputation and significance in the R&D and innovation field. Data provided by *Directorate of International S&T Cooperation, European Union Division* of the Greek *General Secretariat of Research&Technology* (www.gsrt.gr) and the Greek national contact points for EU ICT programs.

Netherlands	6,37	5,04	6,39	6,82	4,53	5,83 (1)
Sweden	4,08	5,11	2,49	3,57	3,59	3,76 (5)

Ranking 3rd and almost on par with Belgium, ahead of globally recognized R&D and innovation 'role-models' Sweden and Finland and also the equally advanced Nordic economy, Denmark, in front of the reputed international FDI 'magnet' Ireland and dynamic Austria is a very positive sign for the Greek innovative ICT sector.
As a further qualitative indicator, in the 1st call (12/2006-5/2007) for example 35,8% of all the submitted proposal (total: 1836) had a participating Greek entity and 85 of the total 318 successful (=funded) proposals (or 26,7%) had a Greek participation. Furthermore, 20 out of total 135 of the submitted proposals under Greek coordination were approved, a remarkable 14,8% success rate.



Source: Adapted from Elias G. Carayannis, GWU Lectures and in print, 2005

Strategic goal:
Promoting Greek economic interests in the US by facilitating business and strategic partnerships of mutual benefit for both economies is a fundamental part of the role the Greek Economic&Commercial Office (ECO) in Washington, DC is expected to play. Through its deep knowledge of the modern Greek reality and its network and day-to-day operation in the US, the ECO Washington has a very precise picture of: **i.** the largely untapped potential of contemporary Greek entrepreneurship; **ii.** the existing discrepancy between this potential and the stereotypical misleading perception of the Greek economy urbi et orbi; **iii.** the chances, seen both as challenges and opportunities present in the US for an enhanced presence of Greek state-of-the art businesses.
This condition presented the ECO Washington with a 'double bet': to facilitate bilateral doing-business by attempting to change the prevalent anachronistic image of the Greek economy among US business people and investors, while at the same

time offsetting long lasting/systemic deficiencies and scarce human and financial resources.
In less than 2 years, stretching from early March 2008 to late October 2010, the ECO of the Greek Embassy organized, co-organized, hosted or co-hosted 7 major, innovation and modern entrepreneurship related projects/events revolving around Greek businesses, mainly startups and R&D Centers as well as attractive investment opportunities in today's Greece. Those where:

DIARY of PROJECTS/EVENTS ***In chronological order***	
Date	**Description of action**
4-6 March 2008	Washington International Renewable Energy Conference and Trade Show (WIREC) –Greek high-level delegation and business pavilion
27-29 March 2008	US Roadshow of National Research Center "Demokritos" and 6 of its cutting-edge spinoff companies
1-3 October 2008	2008 National Universities Startup Conference of the National Center for Entrepreneurial Tech Transfer (NCET2)
20 November 2008	Targeted VIP Luncheon with Greece's Secretary General of Telecommunications –Greece's Fiber to the Home (FTTH) deployment scheme
12-15 May 2009	Biotech/Life Sciences Business and Research Center Mission –Boston, MA and Washington, DC metro area
29 September 2009	Webinar "Investing in Innovation in Greece", dedicated to the Greek innovation and tech transfer ecosystem
25 October 2010	Webinar "Innovation in Nutrition -The case of Greece in a US and Global Perspective"

In order to offset limited human resources and financial means, the ECO made extensive use of a mix of tools, including:

A. Technology

For example, by organizing online events (web conferences), which do not require the physical presence of either the panelists/presenters or the audience and have limited or no associated costs compared to real-life fora (i.e. venue and equipment rentals, travel and accommodation expenses, catering needs etc)
Furthermore the ECO used exclusively electronic correspondence to promote the implemented projects, eliminating the advertisement cost, and reduced material printouts to the absolute essential, preserving the environment.

B. Strategic partnerships/Networking

The ECO teamed up with top-of-the-line entities both in Greece and the US, in order to enhance the visibility of its projects and complement its limited budget, when/where necessary.
On the Greek side the ECO partnered or cooperated with

NAME	DISCRIPTION/FUNCTION	TYPE
National Center for Scientific Research (NCSR) "Demokritos" www.demokritos.gr/	Research Center and Laboratories (8 Institutes, including Nuclear Physics& Technology, Microelectronics, Material Sciences and ICT)	Public
PRAXI/Help-Forward Network www.help-forward.gr/	Tech-transfer&commercialization entity focusing on SMEs and Research Centers	Quasi-public with initial private funding
HBio www.hbio.gr/	Biotech/Life Sciences cluster (17 member companies in May 2009)	Private
Hellenic Technology Custers Initiative "Corallia" www.corallia.org/	A super-cluster with special focus in nano/microelectronics and embedded microsystems	Private
TANEO www.taneo.gr/	The sole Greek Fund of Funds	Private with initial public funding
Hellenic American Chamber of Commerce (AmCham)	Fully independent, not-for-profit business and economic development entity	Private

www.amcham.gr/		

to name some of the most prominent.
In the US, the approach was multi-level and multi-focal. The ECO reached out to and worked with (inter alia):

LEVEL	ENTITY	TYPE
US Federal Government US Administration	-Department of Commerce -Department of Energy -Department of Health and Human Services -International Trade Agency/DOC -Invest In America/DOC	Public
Economic Development Agencies (state, regional and local level)	-Greater Washington Board of Trade/Greater Washington Initiative -Choose Maryland/Maryland Department of Business&Economic Development -Yes Virginia/Virginia Economic Development -Montgomery County Department of Economic Development -Fairfax County Economic Development Authority -Rockville Economic Development Inc.	
Academia	-Johns Hopkins University -George Washington University -University of Maryland -George Mason University	
Institutions and Research Centers	-National Science Foundation -National Academies of Science -National Association for the Advancement of Science	
Think tanks	-Center for Strategic&International Studies	
Trade Centers/Business Networks	-World Trade Center Institute-Baltimore -Johns Hopkins Biotech Network -Hellenic Bioscientific Association in the US	
Technology Catalysts	-Northern Virginia Technology Council -TechCouncil of Maryland -Maryland Technology Development Corporation -Virginia Biotechnology Association	
Tech Transfer Specialists	National Tech Transfer Center –NTTC; National Council of Entrepreneurial Tech Transfer –NCET2	
Umbrella Organizations and Associations	-Biotechnology Industry Organization-BIO, --Pharmaceuticals Researcher Manufacturers of America –PhRMA -AdvaMed	
Funds and Venture Capital Associations	-Angel Capital Association –ACA -Mid Atlantic Venture Association –MAVA	

In 2008 and 2009 the Greek Embassy/the ECO where also registered members of NVTC and WTCI-Baltimore.

C. Sponsorships

The ECO Washington made also extensive use of sponsorships, in an effort to counterbalance its limited resources. Microsoft, through the company's Innovation Center in Athens, was the technology sponsor of the 2010 webinar "Innovation in Nutrition –The case of Greece in a US and Global perspective", offering pro bono both the online conference tool (MS Office Live Meeting) and the necessary

technical support. Likewise, the 2009 webinar "Investing in Innovation in Greece" was hosted and entirely carried by NCET2, one of the ECO's closest and most valuable partners in Washington.
On the same track, the May 2009 matchmaking Reception at the Embassy of Greece in honor of the visiting Greek Biotech/Life Sciences delegation was made possible through in-kind contributions of various importers and distributors of Greek products, from DC Metro and N. York[5].
It should also be noted that, reversely, the Embassy of Greece was the official Embassy sponsor of NCET2's 2008 University Startups Conference in DC, following a proposal by the ECO Washington underlining the visibility and the added value of this event, which was endorsed by the Greek administration in Athens allocating the necessary funds.

Comprehensive project description:
1. The Economic and Commercial Office **instigated** initially and later **coordinated** the **Greek high-level political representation** and the **business delegation** at the **Washington International Renewable Energy Conference** and **Trade Show** (*WIREC*), the world's largest and most significant RE convention for 2008.
Some 133 countries participated in WIREC, with more than 80 Ministers and hundreds of executives of the world's most significant energy, alternative energy and environmental protection technology companies.
The ECO also supported the Greek Trade Show Pavilion, featuring the Greek Center for Renewable Energy Sources (CRES), PPC Renewables S.A. along with the leading experts in renewable projects and investment incentives of Invest in Greece Agency.
2. The ECO Washington organized the **first ever US road-show of Greek high-tech spin-off companies and their overarching Research Center "Demokritos"** (March 27-29, 2008).
Greece's renowned National Center for Scientific Research (NCSR) "Demokritos" and 6 of its most advanced spinoffs crossed the Atlantic to visit the wider DC Metro Area, to showcase their technologies and enter into potential deals with US companies and investors.
Two of the visiting spin-offs originated from the *Renewable Energy* sector:
⇨ **Advent Technologies** (http://www.adventech.gr/), a leader in fuel cell and photovoltaic technologies, with special focus on polymers and electrode membranes for fuel cell systems,
⇨ **Advanced Industrial Technologies** (http://www.aitech.gr/), a top-notch industrial innovator utilizing electromagnetic thermal conditioning for more efficient energy generation;
another two from the field of *Biotechnology/Genetics*:
⇨ **Biogenomica** (http://www.biogenomica.gr/), a highly specialized service provider of advanced molecular and genetic testing (i.e. disease predisposition analysis, genotyping, early cancer prognosis etc),
⇨ **DendriGen** (http://www.regulon.org/dendrigenroot/index/index.html), a developer of patented platform technologies for a more targeted and efficient delivery of existing drugs based on dendritic and dendronized liposomes;
one spin-off from the *IT* sector:

[5] The ECO made use of in-kind contributions also in a number of other, non innovation/modern entrepreneurship related events it implemented, offering in return on-site promotional opportunities to the sponsors and, of course, the high visibility of the Embassy

➪ **i-Sieve Technologies** (www.i-sieve.com/), an innovator and leading provider of advanced customized electronic sentiment analysis, information extraction and comprehensive content filtering/management systems;
and *Nanotechnology*:
➪ **Hellenic Nanotechnologies**, engaging nanomaterials and nanofluidics in high efficiency energy and renewable energy applications (enhanced heat transfer, high performance solar cells, hydrogen storage nanoparticles etc).
NCSR "Demokritos" was represented by its Director and Chairman of the Board Dr. Niarchos.
The program of the road-show, put together by the Office for Economic&Commercial Affairs, included:

- Three **Showcase/Networking events** of NCSR and its spin-offs, attended by representatives of US companies, investors (mainly early-stage/angels) and senior academics and researchers:
  - ➥in Falls Church, VA, together with the *Fairfax County Economic Development Authority* and the *Northern Virginia Technology Council* (NVTC), targeting primarily Northern Virginia companies in IT and RES
  - ➥at the *Center for Advance Research in Biotechnology* (CARB) of the *University of Maryland,* in Rockville, MD, together with the *Montgomery County Department of Economic Development*, focusing on Biotechnology and genetics
  - ➥at the *Emerging Technology Center* (ETC), in Baltimore, MD, together with the *Maryland Department of Business & Economic Development* (MDBED); there the Greek spin-offs engaged in a fascinating interaction on research and applicable innovations with comparable US startups, members of the ETC;
- A closed Luncheon Program in DC, co-hosted with the *Greater Washington Board of Trade* (GWBoT) and the *Greater Washington Initiative* (GWI), for bankers, angel investors and VCs; and
- A well-attended Reception at the Embassy of Greece (with over 200 businessmen, investors, government, state and local officials, academics and scientists from the Washington Metro attending), to honor the Delegation and the local partners of the Economic&Commercial Office of the Embassy who contributed in organizing the road-show.

3. The Embassy of Greece and the ECO Washington sponsored the 2008 National University Startups Conference of the National Council of Entrepreneurial Tech-Transfer –NCET2 (October 1-3, 2008).
This conference series of NCET2 is dedicated exclusively to the creation and funding of globally-competitive, venture-backable university startups. It brings together Universities and their spin-offs with early-stage investors, VCs, US government funding program officers, Fortune 500 tech scouts etc, while also incorporating the international aspect, through the participation of Science&Technology attaches of selected Embassies.
The Embassy of Greece was the official Embassy host and major sponsor of the 2008 conference[6]. The opening reception, held at the Embassy of Greece on the eve of the conference as the tradition dictated, was attended by over 200 guests including conference participants, federal and local government officials, academics, members of the regional and national research and business community etc.

[6] The 2009 Conference was sponsored by the Embassy of the UK; in fact the impact of the 2009 Conference was viewed as so positive, that the UK Embassy decided to also sponsor the 2010 Conference (1-3 December 2010, Washington, DC)

A member of the ECO's staff portrayed the Greek innovation and commercialization ecosystem in the introductory remarks of the international panel, held on the 2nd conference day, featuring Greece, France, Sweden, Great Britain, the Netherlands and the EU as a whole. Subsequently, he also moderated the discussion among the participating countries.
The Economic&Commercial Office mobilized 6 leading Greek experts, from the fields of innovation, tech-transfer, University startups creation and funding, who participated in the Conference representing Greece:
✓ The President and COB of NCSR "Demokritos" Dr. Niarchos;
✓ The Head of the only dedicated tech-transfer and SME supporting entity PRAXI-Help Forward Network, Dr. Tsakalos;
✓ The CEO of the Greek New Economy Development Fund (Fund of Funds) "TANEO" Dr. Charitakis;
✓ The Executive Director of the Hellenic-American Business Council Mr. Lamnidis;
✓ The President and CEO of the innovation fund "GloCal Network Corporation", Prof. Seferis; and
✓ The Director of the Greek business incubator "i4G Euroconsultants" Mr. Prokopiou.

Ahead of the Conference (October 1st) the ECO joined forces with *GloCal Network Corporation* in co-organizing a business round-table, making the most out of the presence of the numerous Greek, American and international business, funding and tech-transfer experts in Washington. The well attended colloquium was sponsored by the US National Science Foundation (NSF) and the Greek New Economy Development Fund (TANEO) and highlighted both the existing and potential Greek-US synergies in R&D and business cooperation along with investments opportunities.

4. The ECO Washington organized a closed targeted Working Luncheon at the Embassy of Greece in November 2008, hosting the Secretary General of Telecommunications of Greece Mr. Anastasopoulos.
As part of its national telecommunication strategy, fully aligned with EU directives, Greece is in the process of tendering a large-scale project of deploying a high-speed, broadband fiber optic network (Fiber to the Home -FTTH) to span over 2 million households in more than 50 major Greek cities. The project is running as PPT (Public-Private Partnership), under a 30-year concession scheme.
The Secretary General presented the plan to a significant group of American participants, primarily VCs/corporate VCs, representatives of large investment banks and private equity firms as well as executives of US telecom companies, aiming to create awareness in the US for the project and all the attractive business opportunities it unfolds for US investors and the telecom industry.

5 The ECO Washington organized the 1st ever sectoral roadshow of Greek biotechnology/life sciences businesses and research centers to the US, in May 2009, together with PRAXI-Help Forward Network in Athens. Eight state-of-the-art companies and 2 top research institutes visited the wider Boston, MA, area (May 12-13) and the DC Metro area (May 14-15), to showcase their technologies, their R&D and business models and enter into business and scientific meetings with respective US companies and institutions.
The 8 Greek companies were:
⇨ **Anavex** (www.anavex.com/), a biopharmaceutical company engaging in drug discovery/development primarily in treating cancer and neurological diseases (proprietary SigmaCeptorTM discovery platform);

➪ **Biomedcode** (www.biomedcode.com/), a contract research organization providing full preclinical drug evaluation services to the pharmaceutical industry using a unique collection of proprietary mouse models of human inflammatory diseases;
➪ **Bionature** (www.bionature.com.cy/), a biopharmaceuticals company, specializing in oncology, human aging, neuroprotection, chronic inflammations, pharmacogenomics etc;
➪ **Biovista** (http://www.biovista.com/), a company with a broad portfolio, from identifying drugs suitable for repositioning into new therapeutic areas to providing biotech companies with early profiling and risk mitigation plans etc;
➪ **CBL Patras** (http://www.cblpatras.gr/) is a global peptide manufacturing technology company industry with novel chemistries in key areas of solid phase peptide and organic synthesis and a premier supplier in the peptide industry;
➪ **Cambridge Biomagnetics** (http://www.cambridge-biomagnetics.com/) develops innovative magnetic encoding technologies and fully integrated "lab-on-a-chip" portable devices for clinical diagnostics, drug discovery, proteomics, genomics etc;
➪ **Embio** (http://www.embiodiagnostics.com/), is a world leader in cell-based biosensors, based on proprietary cellular biosensor technology of portable, point-of-care diagnostic devices for mass screening of chemical and biochemical compounds; and
➪ **Medicon** (www.mediconsa.com/), a leading developer of a wide range of molecular diagnostics reagents in clinical chemistry, hematology, immunochemistry etc; Point-of-Care test systems; laboratory automation; software solutions etc.

and the two research institutes were:
➪ the **Biomedical Sciences Research Center "Alexander Fleming"** (http://www.fleming.gr/), internationally acclaimed for its cutting-edge biomedical research, currently receiving competitive funding from Greek, European and US organizations and the industry, specializing in immunology, molecular biology and genetics molecular oncology, developmental biology and microbiology-virology; and
➪ the **Biotech Research Foundation** of the **Academy of Athens** (http://www.bioacademy.gr/), an Institute focusing on biomedical and clinical research, with excellence in experimental surgery, immunology and transplantation, preventive medicine, neuroscience and also psychiatry.

Two major match-making events were organized by the ECOs of Washington, DC and New York City, respectively in the US capital, under the auspices of the Greek Embassy, and in Boston, under the auspices of the local General Consulate of Greece. The two events were attended combined by over 200 US business people, investors, senior researchers and academics. Consequently, the visiting companies and research centers entered over 100 B2B meetings with interested US parties. One business deal was signed as a result of the matchmaking event in DC, between a visiting Greek drug development company and a Maryland-based US pharma company.
Both the Embassy of Greece in Washington, DC and the General Consulate in Boston organized receptions, to honor the visiting delegation and at the same time provide them with an additional networking opportunity with hundreds of attending business people, executives, researchers and investors.
Apart from the dedicated business functions and the B2B meetings, the 2 ECOs in Boston and Washington, DC respectively put together an extensive program of onsite visits for the Greek delegation. In Boston the program included:

i. A visit at the **Center for Drug Discovery of Northeastern University**, where the delegation was welcomed by its Director, who introduced them to Center's main areas of research and where then given a tour in the facilities.
ii. A visit with the **Massachusetts Biotechnology Council** (MBC); there the Director of Economic Development portrayed the Council's activities, the remarkable growth of the Biotech/Life Sciences sector in the wider Boston area, as well as the full array of supporting and incubating services the Council's strategic partners in the area can provide for a soft US landing of interested foreign companies.
iii. Onsite visits at the **Institutes of Biomedical Research of Novartis** (Boston, MA location) and the famous **joint MIT-Harvard Broad Institute** (Cambridge, MA) where they were welcomed and briefed by institute executives and toured the facilities.
In the Washington, DC metro area, the Greek business people and scientists visited:
i. The **National Institutes of Health** (NIH-Bethesda location), where they were briefed by the Russia&Eurasia and the SBIR/STTR Program Officers on the international collaborations of NIH and the funding opportunities available for pioneering Greek small businesses through partnering with the primary fund receiving US companies.
ii. The **Shady Grove Innovation Center** of Montgomery County, MD. The Shady Grove incubator is targeting primarily startups and high-tech businesses, offering a wide range of competitive services to hosted companies, including clever soft-landing solutions for foreign enterprises (inter alia also virtual presence services). Those services have attracted already numerous companies from the UK, France, the Netherlands, Israel etc. The visit was assessed as very valuable by all the Greek delegates.
iii. The world renowned **J. Craig Venter Institute** in Rockville, MD. The Head of the Synthetic Biology&Bioenergy Group and an Officer from the Genome Sequencing Team briefed the Greek delegates on the various internal Groups and areas of research and the most recent scientific breakthroughs of the Institute.
Finally, the Greek delegation had a joint dinner with the members of Spanish biotechnology/biosciences mission visiting the DC metro area concurrently, organized by the Johns Hopkins University Biotech Network, where interesting scientific and business synergies were established.

6. The ECO Washington co-organized an online webinar dedicated to Innovation in Greece on September 29, 2009, together with NCET2 and the US Department of Commerce/International Trade Administration (US DoC/ITA) as part of their webinar series "International Innovation". The webinars aim to display the innovation ecosystems of leading technology countries around the world and to create win-win synergies with US academics, senior researchers, tech transfer/commercialization experts as well as investors[7]. The one co-organized by the ECO was titled "Investing in innovation in Greece" and moderated by one of the US DoC/ITA leading strategists in international investments of US capital.
Five leading experts on the Greek side depicted the national innovation ecosystem in depth: the structure of the Greek academic and R&D system; the challenge of bridging basic with applied research and the specifics of commercializing innovation; the legal framework and the practical issues of 'starting up' and 'spinning out'; the

[7] note: similar webinars had already been held for Brazil, Sweden, Denmark, Italy, UK and France, to follow after Greece were the Netherlands, China, India and Russia

creation and the protection of IP; the strategic and comparative advantages of Greece-based R&D in a geographical/regional perspective; the national long-term strategy in R&D and innovation etc, while at the same time highlighting not only success stories but also identifying business opportunities. It is in this respect that the panelists included:
Dr. Niarchos, President and COB of the National Research Center "Demokritos", one of the nation's most successful institutions in spinning out high-tech companies;
Dr. Tsakalos, the Coordinator (Head) of "PRAXI", the only 100% tech-transfer and commercialization dedicated quasi-public entity of the country;
Dr. Zachariades, Director of the Science and Tech Park of Crete, a very dynamic incubator and business facilitator with a significant record of both tenant and graduated companies;
Dr. Strouboulis, Head of the Department of Innovation and Business Development of the Biomedical Sciences Research Center "Alexander Fleming" and leading the institutes' spin-off mechanism; and also
Dr. Chris Velissaris, VP and CFO of the "Glocal Venture Capital Fund" (GVCF), a joint Greek-American fund investing in innovative Greek companies.
In the Q&A session that followed, the participating experts answered to questions of the online audience, in an a broad array of fields: the opportunities of enhancing the cooperation between leading Greek and US universities and research centers, the issues and challenges disconcerting the Greek tech-transfer and commercialization landscape, the Greek-US exchange in senior researchers, the current co-funding opportunities in research and development etc.
According to the series organizers, the impact of the webinar on the Greek innovation ecosystem had an overall positive impact to the online participants and endured the comparison to similar webinars dedicated to technologically advanced countries like France, Sweden, the UK etc. It has also to be noted, that it was also the first ever such online venture held in the US, to showcase to the American public advanced R&D, innovation and modern entrepreneurship 'made in Greece'.

7. Building upon the experience of the 2009 webinar, on October 25, 2010 the Washington ECO organized an **online discussion** titled "**Innovation in Nutrition – The case of Greece in a US and Global Perspective**". This webinar marked-the 1st ever autonomously organized, exclusively web-based, innovation and business centered conference hosted by a Greek government entity in an international context.
The panel lineup included:
-*Dr. Helmut Traitler*, a chemist by training, former Vice President of *Nestlé's* Global Innovation Partnerships (ret.) and current smart-food entrepreneur;
-*Dr. Elsa Giakoumaki*, a food biotechnologist and R&D executive of *Creta Farms Greece*, a food innovator par excellence in the Greek meat products industry;
-*Mr. Chuck Fletcher*, CEO of *Creta Farms USA, LLC*, the most successful Greek-US joint-venture in the field of delicatessen meat products and charcuterie.
-*Dr. Demetrios Kouretas*, *Prof. of Biochemistry and Biotechnology* at the University of Thessaly, Greece and one of the most active Greek *innovative nutrition entrepreneurs* (*K-Meditura spinoff*);
-*Mr. Nikos Nicolaou*, Sales&Operations Manager of *Olympus Diary Products USA*, a major Greek diary producer/exporter and currently the sole exporter of Greece-made yogurt to the American market;

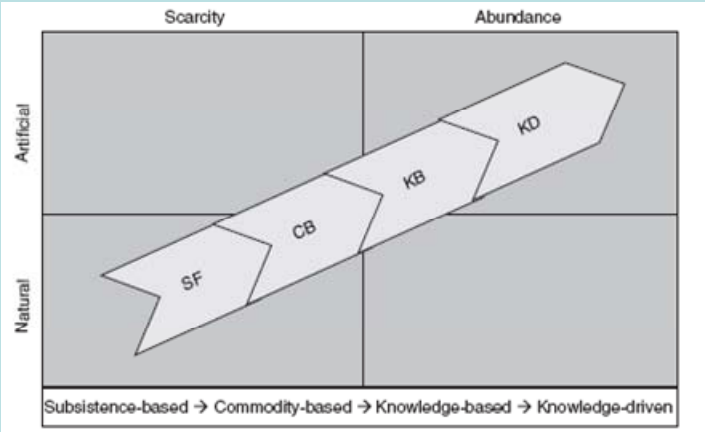
-*Mr. Stefanos Kirkagaslis*, Agricultural Engineer, Quality Design Manager and member of the R&D team of *Yiotis S.A.*, a leading Greek food company specialing in early-life nutrition and diabetic products.
The web conference was moderated by *Dr. Elias G. Carayannis*, Professor of Science, Technology, Innovation&Entrepreneurship at George Washington University (Washington, DC).
The discussion first focused on Greece, where research and development of new products conjuncts with the local dietary traditions to allow for the country's food sector to still thrive in a battered economic environment; then it shifted to the US and global markets, where innovation is a pivotal factor in the food and nutrition industry, with dynamic and extrovert Greek companies competing successfully and innovative Greek nutrition products enjoying an enhanced presence in the past few years.
Following their presentations, the panelists engaged in a lively dialogue, with the floor opening to Q&A for the online audience. The ultimate goal was to advance from the initial depiction of the current state-of-play, to exploring win-win synergies among Greek, US and Global key industry players and further to identifying attractive business and investment opportunities.
The webinar was co-organized by PRAXI/Help-Forward Network, the 'one-stop shop' of Greek tech transfer&commercialization and member of the Enterprise Europe Network – Hellas; and sponsored by Microsoft Corporation and the company's Innovation Center in Athens, who provided pro bono the Office Live Meeting platform to materialize and also the technical expertise to support the webinar.

Projects/Events:
➢2 International Conferences
-WIREC
-NCET2
➢2 Roadshows
-Demokritos
-HBio
➢2 Webinars
-Investing in Innovation in Greece
-Innovation in Nutrition
➢VIP/Working Luncheon
-FTTH/Secretary General of Telecoms of Greece
Total: 7 projects/events

IV. IN CONCLUSION: LESSONS LEARNED FOR POLICY AND PRACTICE AND RECOMMENDATIONS FOR THE ROAD AHEAD

The challenge and opportunity is to engage on a large enough scale to ***both upgrade existing SMEs and catalyze the formation of new ones*** with an expectation to both survive and prosper as well as grow (Greece should aim at being the cradle of the next Google or Amgen in the next 10-15 years as the nature and dynamics of the underlying technologies demand resources that are now well-within the grasp of Greek researchers and potential or current entrepreneurs) - the real challenge is ***to convert the past failures of courage and imagination into future successes*** and to learn to convert counter-productive cynicism into empowering dreams grounded into reality. To identify and outline clearly and convcincingly to all Greek citizens (including those in the ***Diaspora*** – and especially ***Diaspora Innovation Networks and Knowledge Clusters*** – namely, communities of interest and practice including diaspora members as well as other innovation ecosystem stakeholders) as potential partners and mentors of domestic current and aspiring entrepreneurs - especially younger ones) a vision for the future and a strategy for change that is comprehensive, feasible and convincing - enough so to overcome the "cynicism premium" that politics in Greece - and not only - has to pay to atone for prior failures of ***ommission and commission***. In short, we believe that the E&I area is one of the key pillars on which ***a strategy for change that people can believe in and they clearly need to have*** can be architected upon to bridge the divides currently stifling sustainable development, innovation and entrepreneurship and undermining democracy and sovereignty per se (see Table and Figure on Divides).

FROM SOCIO-ECONOMIC BEING TO TECHNO-ECONOMIC BECOMING



From natural (and/or artificial) scarcity to technology- and knowledge-enabled abundance
(Adapted from Carayannis et al, Smart Development, MacMillan, 2005)

Specific areas of focus should be clean/green technologies, environmental remediation/recovery solutions, eco-tourism and other higher value (lower cost/benefit ratios) tourism solutions, transportation / connectivity solutions, nano-biomedical therapies, advanced materials for civilian and other uses, organic farming to feed the world, generic medicines to heal the world, e-learning solutions to educate the world (many of these should be set up as regionally-centered, EU-supported initiatives focused on CSEE, ECA and MENA as well as the Greek domestic market).

Some more examples and thoughts of where and how E&I interventions might be targeted are listed below:

a. Entrepreneurship as a solution for the way ahead - ***grow the pie not just re-distribute it***

b. ***Environment and Energy*** as key sectors for entrepeneurial initiative - ***destroy the monopolies and bring on democratic capitalism (see Carayannis and Kaloudis, 2009)***

c. ***New technologies*** as platforms for flexible and high value-added manufacturing - ***use intangibles to build valuable tangibles as they are the course of viable, long-term prosperity (not services in a globalized, slave-labor-cost-driven economy) - nano/bio-tech and next-gen ICT from our universities and R&D centers like Demokritos*** needs to

be fed into new companies in strategically designed and located clusters inter-networked with high speed info-structures.

d. ***Eco-tourism*** building on environmental remediation and safeguarding and Green Energy Schemes as drivers of entrepreneurial initiative - ***Greece is the saudi arabia of renewable energy and should be a major green energy exporter*** (think of ***an intelligent grid of power generating units with multiple types of energy sources*** - air, sun, waves, geothermal, waterfall, etc. - inter-connected across Greece) - ***every house should be a power source***

e. ***Generic medicines*** and ***organic foodstuff*** not only for Greece but also parts of the world (like Africa) where they are dearly needed (and GMOs cause harm) - this could again leverage Greek know-how with UNIDO/WB/EBRD/EIB funding schemes and become a major and targeted (and also protected) export driver - ***from natural scarcity to artificial abundance - feed and heal the world and do so in a profitable manner***

f. ***Trans-disciplinary university pilot programs*** where students from engineering, medicine, business and social sciences are brought together into practice-focused, apprentice groups to support existing firms and help create new ones in a network of inter-networked incubators across universities, R&D centers, and other locations of private sector firms and feed the experiences and lessons learned back into curriculum renewal and design - ***renew and re-invent your knowledge infra-structure in terms of both content, processes, and practices in an era of converging disciplines and diverging specializations - that could be a (if not the) major competitive advantage differentiator at a national level - let us move beyond the current pathetic regime of turf fights and mediocrity enhancement (by the way, faculty should be allowed to have companies - in the open not as now as part of the grey market - and profit from them and involve their students - another dimension of democratic capitalism providing real opportunities to really most - if not all - people).***

These are examples of architecting and implementing the ***QUADRUPLE INNOVATION HELIX*** concept (government, university, industry, and civil society all actively and effectively collaborating) and the ***MODE 3*** knowledge production system (see Carayannis and Campell, 2009). This is happening in many north and western European countries today and we need to engage in Greece as well.

In closing, we wish to note that people are ***interested in solutions that they can relate to and trust in to make things better for them individually and socially*** and in a viable manner. Hellas (aka Greece) remains the land of Alexander and Ulysses and by extension, Hellenes within Hellas may choose to embrace defeat and decline or re-discover the voices, dreams, innovation, entrepreneurship and competence of Alexander, Ulysses and their comrades at arms and re-invent and re-architect modern Hellas and its socio-economic and socio-political ecosystems, locally, regionally and globally.

Innovation Diplomacy may be considered as part of a number of other potential initiatives that could help engender a more appropriate climate and environment for sustainable entrepreneurship and robust competitiveness (Carayannis, IJIRD, 2008). For instance, we recommend a number of potential actions that may be taken up by all components of the Quadruple Innovation Helix from within Greece as well as the Hellenic Diaspora around the world, namely government, university, industry and civil society.

RECOMMENDATION 1. Set up **a "Tiger Team"** at the National level composed of public and private sector, expert academics and practitioners (from Government, University, Industry and Civil Society - see Quadruple Helix of Innovation concept -

Carayannis et al, IJTM, 2009) from within Greece as well as the Hellenic Diaspora and the EU (other countries) to identify best and worst practices for / against innovative, creative, and entrepreneurial mindsets and behaviors in the public and private sector in Greece with authority to name and shame as well as reward from the highest level.

RECOMMENDATION 2. Identify, organize and engage agents of and for transformative change (**Entrepreneurship and Innovation Champions**) pivoting around innovative and entrepreneurial behavior across public and private sector entities in Greece and create the Hellenic Social Network for Innovative and Enterpreneurial Change.

RECOMMENDATION 3. Take stock and identify best and worst practices and critical success and failure factors and compile lessons learned from diverse public and private sector entities within Greece as well as the ROW including KPIs concerning innovative and entrepreneurial actions and behaviors - publich results on a portal - I propose we call it the **Hellenic Innovation Portal for Entrepreneurial Reform (HIPER)** and enable / leverage around the HIPER platform Social Networking Technologies to poll on an ongoing basis the Quadruple Helix (Carayannis et al, 2009) stakeholders as to challenges, opportunitties and choices going forward.

RECOMMENDATION 4. Using HIPER as a convergence/organizing device, establish the **Hellenic Entrepreneurship and Innovation Social Network (HEISN)** to develop Entrepreneurship and Innovation communities of interest and practice (within Greece as well as the ROW and especially the Hellenic Diaspora) to trigger, catalyze and accelerate entrepreneurial and innovative action and initiative (including the concept of high tech spin-off formation in Greece and co-location in multiple markets from the very beginning - local start-ups with a global view - this is something I am engage in actually doing currently).

RECOMMENDATION 5. **Hellenic Innovation Diplomacy Initiative (HIDI)**, is a special case of ***Innovation Diplomacy*** focused on Greece in this case but this methodology and approach outlined further in the cases-in-point from recent practice, can well serve as prototype and best practice for similar economic development efforts with a socio-political dimension across the globe.

RECOMMENDATION 6. Recognize the need for a ***non-political, institutionally and meritocratically established*** entity that would function as part of the government in Greece and could be called **"Ministry for Innovation and Entrepreneurship"** but set up in a flexible manner to avoid becoming part of the problem.

RECOMMENDATION 7. Recognize the need for and set up an "**Ombudsman for Entrepreneurs and Innovators**" with proper authority, visibility and resources to intervene and resolve barriers to E&I in Greece (this is the institutional civil society role in support of E&I as part of the Quadruple Innovation Helix we also discussed).

RECOMMENDATION 8. Recognize the need **for high caliber volunteers for the Global Hellenic Diaspora Entrepreneurship and Innovation Ecosystem (GHDEIE) as well as sponsors / donors . mentors** - in this context, we propose **"The Global Hellenic Diaspora Bond Issue for E&I"** and ***to have the funds managed by a professional entity that is subject to the Diaspora members in a transparent and efficient manner.*** The intent would be to allow for a pooling of resources so along with large scale donations, many small size but cumulatively substantial contributions could start being made on a streamlined and sustainable basis and always focused on supporting and promoting Entrepreneurship and Innovation initiatives and efforts.

We believe that these ideas would serve as strategic complements of the **National System for Innovation and Entrepreneurship** that needs to be urgently developed and matured in Greece to allow for sustainable growth initiatives that over time become self-perpetuating and scale up organically with decreasing need for public intervention and funds.

Innovation Diplomacy: The Road Ahead

- ***SHAPING MINDS AND BUILDING LEADERSHIP CAPACITY: THE ROLE OF UNIVERSITIES IN BREEDING WORLDCLASS ENTREPRENEURS ACROSS THE DISCIPLINES AS INNOVATION DIPLOMATS – WHAT, HOW, WHY, WHEN, WHO***
- ***R&D, ENTREPRENEURSHIP AND INNOVATION CHALLENGES AND OPPORTUNITIES***
- ***STRATEGIES TO ESTABLISH AND EXPAND S&T PARKS & INCUBATORS AS KEY ELEMENTS OF GLOCAL INNOVATION NETWORKS AND KNOWLEDGE CLUSTERS INFRA-STRUCTURE –***
  - ***High Tech Associations, Technopoleis, Innovation Zones, Poles and Networks and Knowledge Clusters***
  - ***INNOVATION BOTTLENECKS AND FAILURES OF COURAGE AND IMAGINATION***
  - ***CRITICAL SUCCESS AND FAILURE FACTORS AND LESSONS LEARNED***

TABLE ON DIVIDES

INNOVATION DIPLOMACY IN ACTION
TYPOLOGY OF MODALITIES:

➢In person (physical) vs. Virtual

In person	Virtual
WIREC	Webinar "Investing in Innovation in Greece"
Demokritos Roadshow	Webinar "Innovation in Nutrition"
NCET2 Conference	
Targeted Working Luncheon	
Biotech/Life Sciences Roadshow	

➢Across the board vs. Sectoral

Across the Board	Sectoral
Demokritos Roadshow *(Research in general + energy, biotech, IT and Nanotech Materials)*	WIREC *(Renewable Energy, Environmental Applications etc)*
NCET2 Conference *(Innovation, University spinoffs, commercialization/tech transfer, funding etc)*	Targeted Working Luncheon *(Telecoms/Fiber Optics)*
Webinar "Investing in Innovation in Greece" *(the Greek R&D Ecosystem, Tech-Transfer& Commercialization, challenges and opportunities etc)*	Webinar "Innovation in Nutrition – The case of Greece in a US and Global Perspective" *(Nutrition, R&D/Innovation in Nutrition, smart foods etc)*
	Biotech/Life Sciences Roadshow *(specialized R&D in Biotech/Life Sciences, biotech companies)*

➢International vs. Bilateral

International	Bilateral
WIREC	Demokritos Roadshow
NCET2 Conference	Targeted Working Luncheon
Webinar "Investing in Innovation in Greece"	Biotech/Life Sciences Roadshow
Webinar "Innovation in Nutrition"	

➢Autonomously organized vs. Co-organized/Sponsored/Supported

Autonomously Organized	Co-organized/Sponsored/Supported
Demokritos Roadshow	WIREC
Targeted Working Luncheon	NCET2 Conference
Biotech/Life Sciences Roadshow	Webinar "Investing in Innovation in Greece"
Webinar "Innovation in Nutrition"	

FIGURE ON DIVIDES