QUADRUPLE INNOVATION HELIX AND S3: WHAT, HOW AND WHY

TOWARDS SMART, SUSTAINABLE AND INCLUSIVE GROWTH IN DEVELOPED DEMOCRACIES

INVITED LECTURE
STAKEHOLDER ENGAGEMENT AND RIS3 GOVERNANCE

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World Knowledge Economies and Societies in a New and Emerging Era: 21st-Century Drivers of Change

- Network Ubiquity
  - –More than a billion Internet users and three billion wireless subscribers, worldwide
- Open Standards
  - –Widely-adopted technical and transaction specifications
- New Business Designs
  - –Horizontally-integrated operations

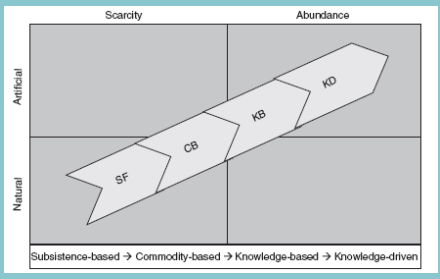
THE WORLD TODAY:

- *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-STRATEGIC, GEO-TECHNOLOGICAL, GEO-ECONOMIC AND GEO-POLITICAL (GEO-STEP) 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 ???*

FROM SOCIO-ECONOMIC BEING TO TECHNO-ECONOMIC BECOMING



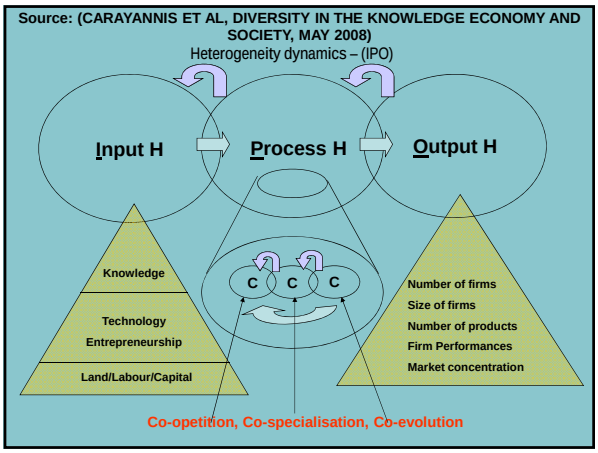
From natural (and/or artificial) scarcity to technology- and knowledge-enabled abundance (Adapted from Carayannis et al, Smart Development, MacMillan, 2005)

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.

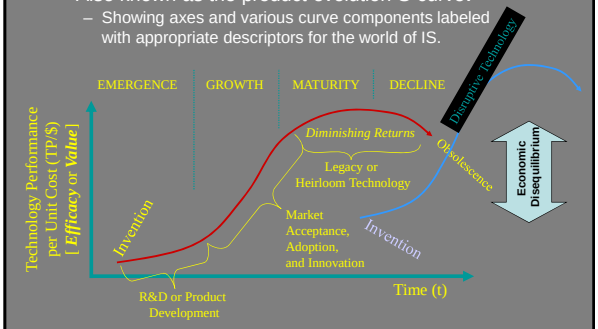
Joseph Schumpeter added *Technology and Entrepreneurship* as two more key input factors in the early 20th century

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.



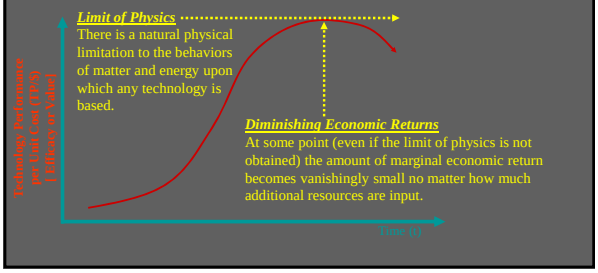
Business Technology Life Cycle

- Also known as the product evolution S-curve.
  - Showing axes and various curve components labeled with appropriate descriptors for the world of IS.



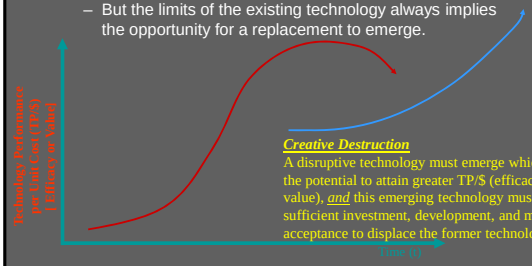
What Makes the Curve S-Shaped

- Every technology life cycle S-curve ***inevitably*** levels off at the top.
  - At which point, ***NO*** additional incremental gain can be derived from a system regardless of further resource availability.



Creative Destruction

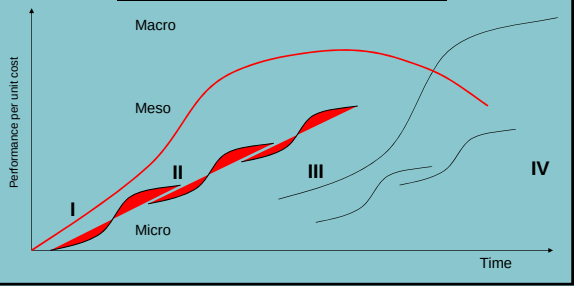
- There are profound implications of this limiting phenomenon to a technology-based market.
  - Market viability is only attained through economic enhancement of the emerging technology.
  - But the limits of the existing technology always implies the opportunity for a replacement to emerge.



Creative Destruction

A disruptive technology must emerge which has the potential to attain greater TP/$ (efficacy or value), *and* this emerging technology must gain sufficient investment, development, and market acceptance to displace the former technology.

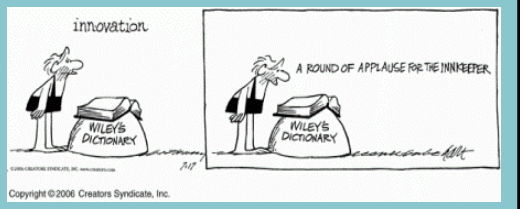
	CREATION	DESTRUCTION
CREATIVE	I: The beginning of the S-curve	II: The end of an S-curve
DESTRUCTIVE	III: The beginning of a new S-curve	IV: The end of a technological regime or business cycle



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



INNOVATION DEFINED

Innovation enhances the yield of resources via successful technology commercialization

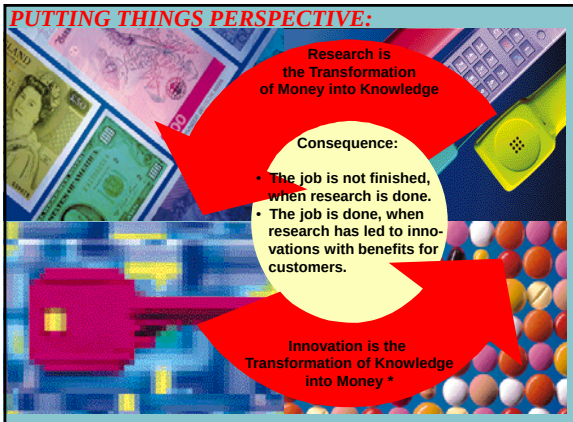
Innovation resides at the intersection of invention and insight, leading to the creation of social and economic value

•US National Innovation Initiative

Innovation is a socio-economic, socio-technical, and socio-political phenomenon

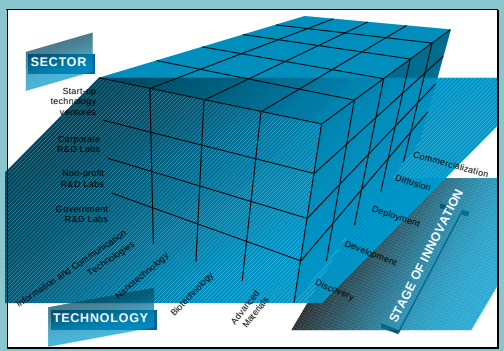
Delivering an Innovation Economy AND Society is the key structural challenge for new growth in gloCalized Europe and World Knowledge Economies and Societies.

PUTTING THINGS PERSPECTIVE:



** Bamelis, Bayer*

THE INNOVATION CUBE



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

Early Stage Innovations

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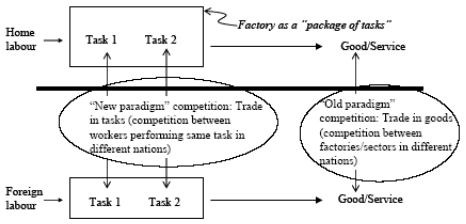
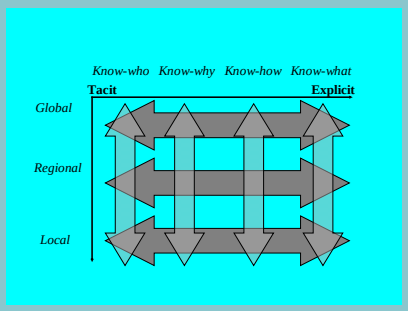
FROM TRADE IN GOODS TO TRADE IN TASKS: THE S3 CONTEXT

Figure 6 The first and second unbundling schematically.



SKARSE dimensions – place & content

SKARSE™: Strategic Knowledge Arbitrage and Serendipity



MODE 3 VS. MODE 1 AND MODE 2

- *The Mode 3 Knowledge Production Systems concept, extends, expands and complements the Mode 1 and Mode 2 Knowledge Production concepts by emphasizing the presence and imp act of higher order learning (learning, learning-to -learn and learning-to-learn how to learn)*

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MODE 3 KNOWLEDGE INTEGRATION (VS. MODE 1 AND MODE 2

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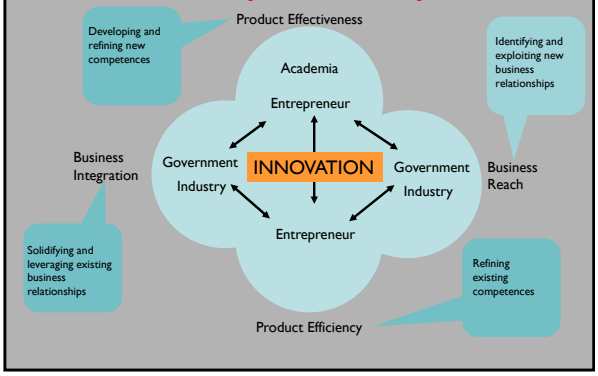
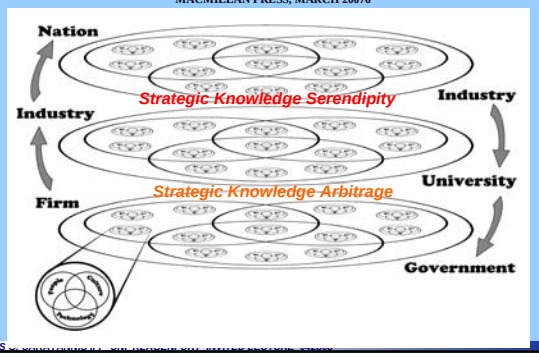
Mode 3: Co-evolution, Co-specialization, Co-opetition: 21st Century Innovation Ecosystem

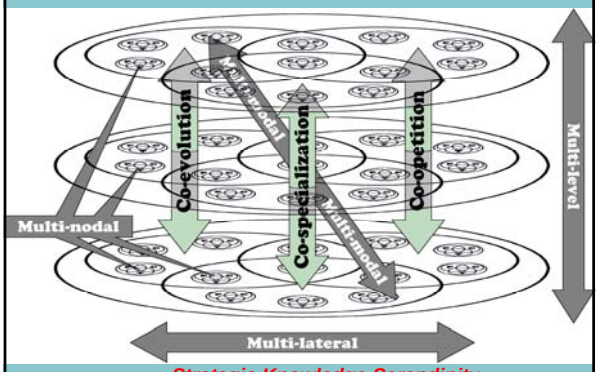


THE 21ST CENTURY FRACTAL INNOVATION ECOSYSTEM: A NEXUS OF INNOVATION NETWORKS AND KNOWLEDGE CLUSTERS

Source: CARAYANNIS ET AL, RE-DISCOVERING SCHUMPETER, MACMILLAN PRESS, MARCH 20076



Strategic Knowledge Arbitrage



Strategic Knowledge Serendipity

TRIPLE VS. QUADRUPLE & QUINTUPLE HELIXES

- *The Triple Helix focuses on top-down government, university and industry policies and practices whereas the Quadruple Helix focuses on BOTH top-down government, university and industry policies and practices as well as bottom-up and mid-level out civil society grass-roots initiatives and other actions that help better shape, fine-tune and make more effective and efficient the government, university and industry policies and practices.*
- *The Quintuple Helix adds to the Quadruple Helix the environmental dimension to ensure that said top-down, bottom-up and mid-level out policies, practices and initiatives are indeed as smart, sustainable and inclusive as possible and meet the triple bottom line (financial, social, and environmental) hurdles criterion.*

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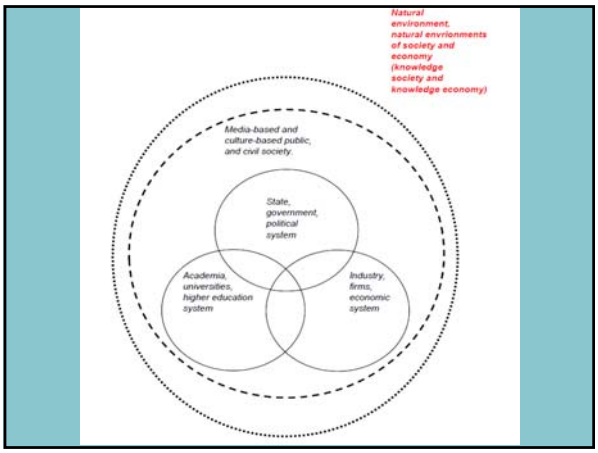

TRIPLE VS. QUADRUPLE & QUINTUPLE HELIXES

- *The social and natural considerations act as the "creative glue" for promoting smarter, more sustainable and more inclusive growth opportunities in the Knowledge Economy and Society for both developed and perhaps even more so for transitioning and emerging economies.*
- *In this latter case, civil society and environmental structures, infra-structures and institutions are often lacking or under-developed allowing for the cumulation of substantial negative externalities (such as pollution) and other transactional costs of growth (such as corruption) as well as impeding or even suppressing market, knowledge and network spill-over effects (positive externalities).*

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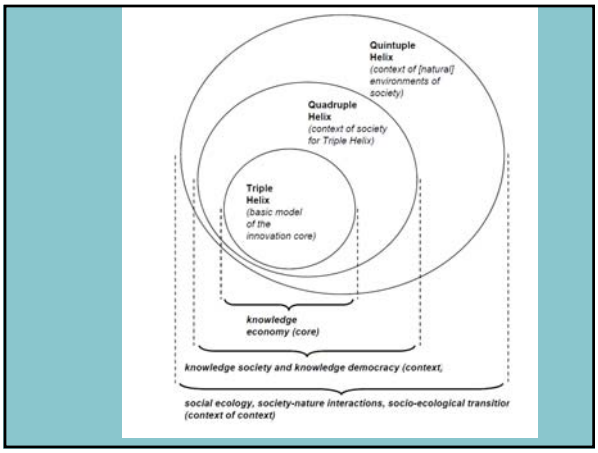

QUADRUPLE HELIX AND DEMOCRATIC CAPITALISM

- *Knowledge-based innovation may never be seen as a privilege of industrialized countries. This indeed would be a misleading approach. Knowledge-based innovations are just as valid for emerging economies and developing countries. In that sense, the Quadruple Helix and the Quintuple Helix are global und universal.*
- *The more appropriate question to ask would be what the specific implications and ramifications for knowledge-based innovation would be when applied in diverse political, economic, social, and technological contexts around the globe (Carayannis et al, 1998 to 2012) and how it concerns developed democracies versus emerging autocracies.*

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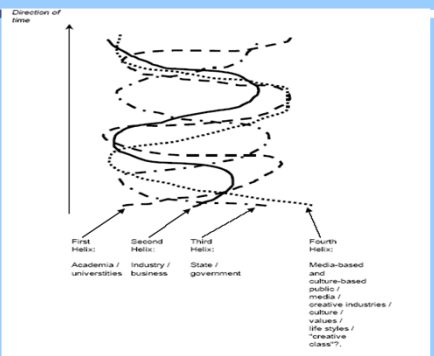
QUADRUPLE HELIX CONCEPT



Triple Helix: University-industry-government relations (helices).
Quadruple Helix: University-industry-government-"media and culture-based public" relations (helices).

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QUADRUPLE HELIX AND DEMOCRATIC CAPITALISM

- *In particular, the Quadruple and Quintuple Innovation Helix constructs may well serve to reveal and promote ways and means to help advance growth in a manner that is becoming increasing aligned with the progress of democracy instead of having growth advancing in defiance of and for the suppression of democratic institutions.*
- ***Over the medium to long term, our fundamental belief and premise is that true and transparent democracy constitutes a sine qua non for smart, sustainable and inclusive growth and this constitutes our main motivation and guide for our focus on ways and means that concepts such as the Quadruple and Quintuple Innovation Helix, can better serve architect a better tomorrow for the peoples of the world.***

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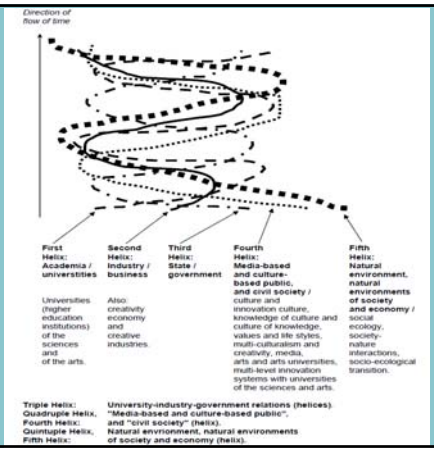
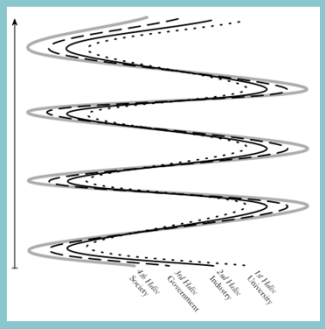


Quadruple Innovation Helix



Four Helices

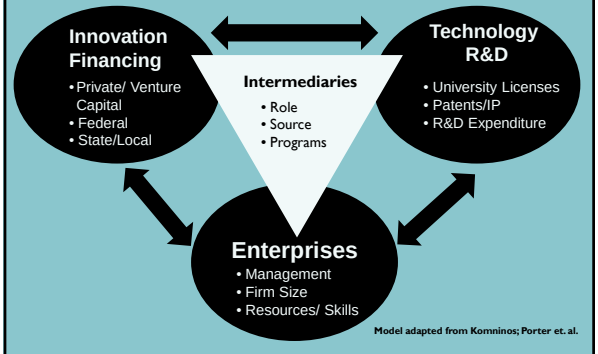
1st
- *Academia/Universities*

2nd
- *Industry/Business*

3rd
- *Government*

4th
- *Society/Culture*

Regional Innovation Network



Model adapted from Komninos; Porter et. al.

Research Overview

- Objective
  - Evaluate Mode 3/Quadruple Helix factors demonstrated by regional innovation networks
- Participants
  - Business Incubators in the State of Maryland
  - Technology Parks in Portugal
- Methods
  - Conducted semi-structured interviews during Q4 2009 and Q1 2010

Regional Innovation Network: Comparisons

Maryland	
Universities	56
R&D Spending	$14.3 billion
Incubators	15

Portugal	
Universities	39
R&D Spending	$2.1 billion
Science Parks	8

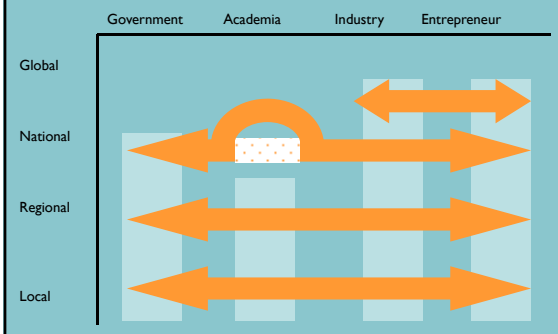
Mode 3: Regional Cultural Comparisons

Dimension	Maryland	Portugal
Entrepreneur	- Focus on product development - Well-educated (MBA/Ph.D.) - Often, 1st start-up - Focus on incremental steps	- Focus on going global - Well educated (MBA/Ph.D.) - Often, 1st start-up - Focus on incremental steps
Government	- Primary support programs offered at regional/local level	-Primary support programs offered at regional/local level
Academia	- Limited transfer of knowledge through TTO	- Transfer of knowledge is active via TTO
Industry	- Private financing at early stages - VC financing typically with Biotech	- Private financing at early stages - Corporate funding for spin-offs

Mode 3: Regional Innovation Network

Dimension	Business Objective	Network Resources	Culture	Goal
Entrepreneur	-Firm revenues -Firm profit	-Skills -Knowledge	-Focus -Incremental Approach -Learning style -Well educated (graduate degree)	Creating a going concern
Government	Economic development	-Support -Grants	-Motivated by political environment and role of public service	Economic showcase (Political clout)
Academia	Royalties	IP	-Motivated by research –grants and placement of publications	Power of knowledge success (Access to grant funds and best researchers)
Industry	ROI	Funds	-Private/Angel smaller risk profile -VC controlling (larger risk profile)	High "hit" rate (Attracts other investors and higher quality investments)

Mode 3: Knowledge Flow Networks



Mode 3: Knowledge Flow Networks

- 2- helices
  - Industry and entrepreneur are connected across all levels
  - These connections are at the knowledge level
- 3-helices
  - Industry, entrepreneur, and government are connected from local to national, but not globally
  - These connections are at the support and knowledge level
- 4-helices
  - Industry, entrepreneur, academia, and government are connected at the local/regional level, but not nationally and not globally
  - Theses connections operate across multiple levels

Mode 3: C3 Findings

- Academia and entrepreneurs tend to focus on the product dimensions (effectiveness and efficiencies)
- Government and industry tend to focus on the business dimensions (integration and reach)
- All work dynamically as part of the Ecosystem

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Triple Helix to Quadruple Helix: Modes 1, 2, & 3

	Government	Academia	Industry	Civil Society
Mode 1	•Loans •Transfer Technology	•Transfer Technology	•Partners •Customers •Financial	•Dyads w/o civil society
Mode 2	•Mode 1 + •Support Programs	•Mode 1 + •Support Programs	•Mode 1 + •Support Programs	•Triads w/ emerging civil society
Mode 3	•Mode 2 + •Connections /Network	•Mode 2 + •Connections/Network	•Mode 2 + •Connections/Network	•Quads with functional civil society

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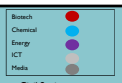
Triple Helix to Quadruple Helix: Industry Map



	Government	Academia	Industry	Civil Society
Mode 1				
Mode 2				
Mode 3				

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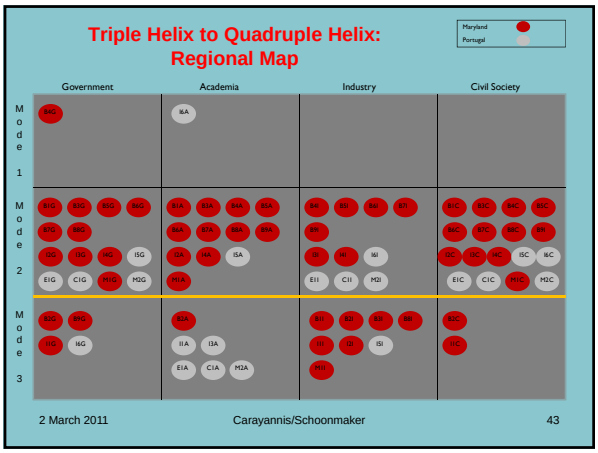
Triple Helix to Quadruple Helix:
Regional Map
Maryland
Portugal
Government
Academia
Industry
Civil Society
Mode 1
Mode 2
Mode 3
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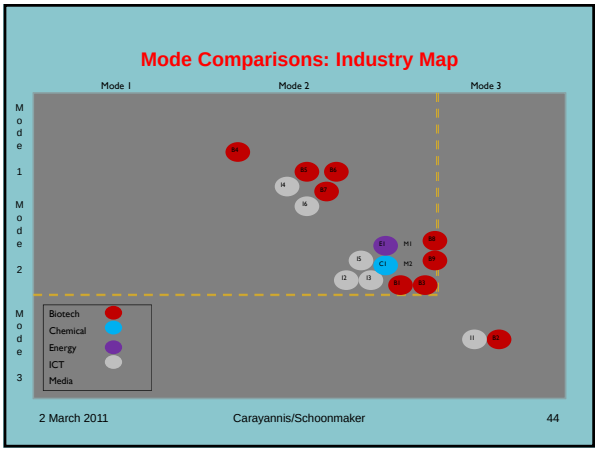
Mode Comparisons: Industry Map
Mode 1
Mode 2
Mode 3
Biotech
Chemical
Energy
ICT
Media
2 March 2011
Carayannis/Schoonmaker
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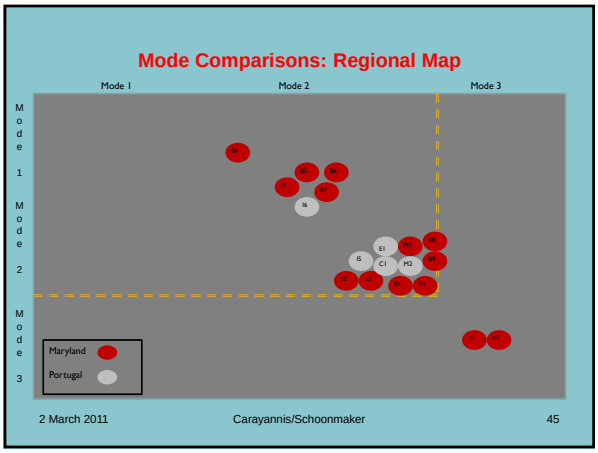
Mode Comparisons: Regional Map
Mode 1
Mode 2
Mode 3
Maryland
Portugal
2 March 2011
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Triple Helix to Quadruple Helix

	Government	Academia	Industry	Civil Society
R&D	•Gov't IP •Gov't customer w/IP	•Academia IP •Informal IP	•Partners •Customers	•2-3 actor connections
Funding	•Grants •Loans	•Grants •Loans	•Private •Angel •VC	•2-3 actor connections
Support	•Gov't Incubator	•Science Park	•Private Incubator	•2-3 actor connections

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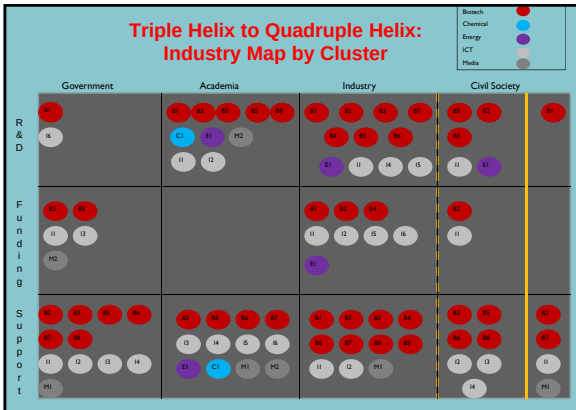
Triple Helix to Quadruple Helix: Industry Map by Cluster



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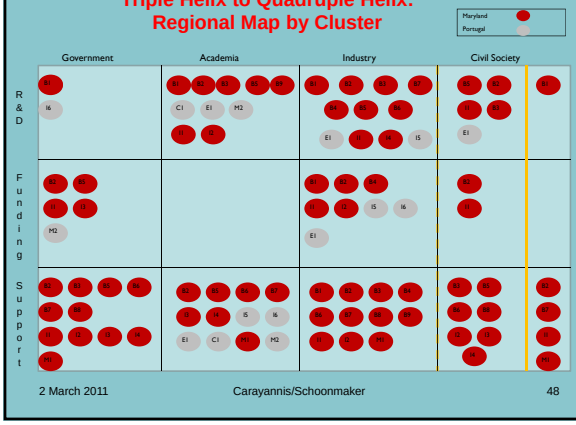
Triple Helix to Quadruple Helix: Regional Map by Cluster



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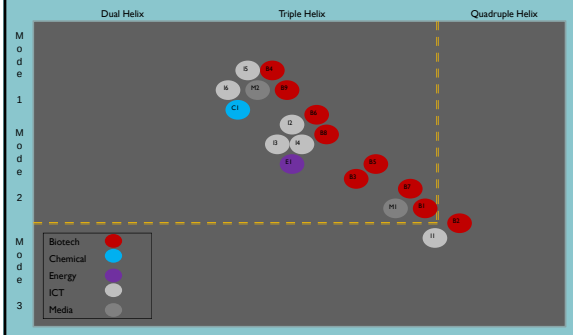
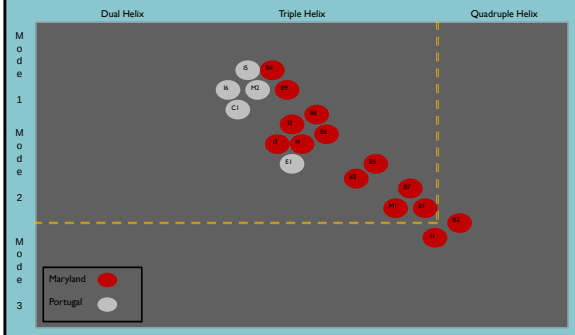
Mode Comparisons: Industry Map



Mode Comparisons: Regional Map



Empirical Evidence

- **Networks with largest number of nodes and density represent 70% of all connections in regional innovation networks. Pharmaceutical and ICT industries are examples. (Christ)**
- **Positive and significant correlation between universities and regional technology innovation. (Florida)**
- **Mode 3 regression analysis demonstrated strong prediction (~80%) for payroll, salary, and revenues (Carayannis & Schoonmaker)**

Best Practices Summary

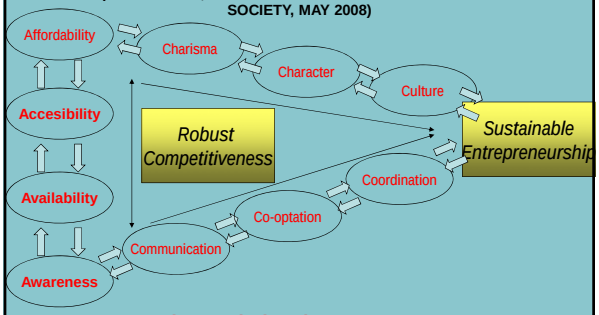
- Elements of cluster/network configure depending on industry
- Infrastructure support is a common need and supports early growth stages
- Full networks, such as those exhibited in HLS, exhibit the most industry concentration and network connectivity

Key Findings

- Civil Society
  - Virtual extension of all actors
- Industries
  - Biotech and ICT are industries that are beginning to demonstrate 'Mode 3" and the 'Quadruple Helix'
- Regions
  - Maryland is leading the regional progression towards M3/4H
  - Portugal is operating on the frontier of M3/4H
- Companies
  - M3/4H Best in Class companies are able to leverage all 4 actors
  - Highly networked, globally to locally, typically 2nd start-up

Entrepreneurial Critical Success And Failure Factors

Source: (CARAYANNIS, DIVERSITY IN THE KNOWLEDGE ECONOMY AND SOCIETY, MAY 2008)

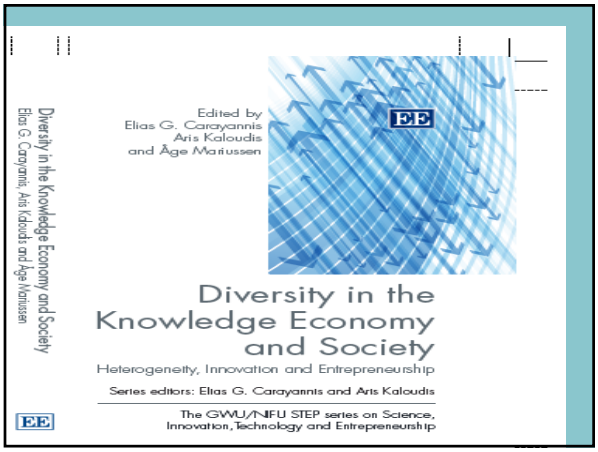


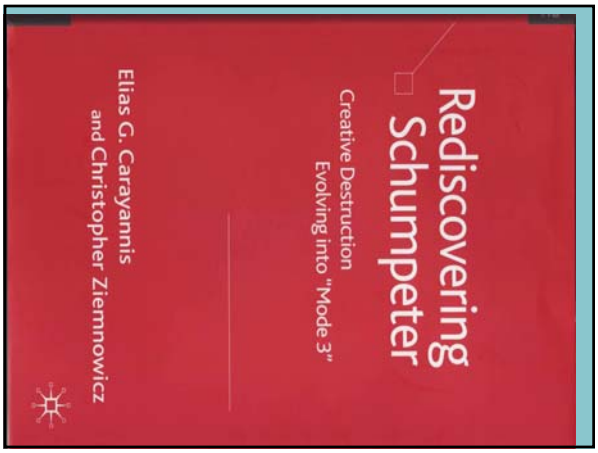
–Gestation Period and PATIENCE are KEY Factors…

–Co-location and a Global / Local View are KEY Factors…

In Conclusion…
21ST CENTURY INNOVATION ECOSYSTEM

- *A 21st Century Innovation Ecosystem is a **multi-level, multi-modal, multi-nodal and multi-agent system of systems.***
- *The constituent systems consist of **innovation meta-networks** (networks of innovation networks and knowledge clusters) and **knowledge meta-clusters** (clusters of innovation networks and knowledge clusters) as building blocks and organized in a self-referential or chaotic fractal (Gleick, 1987) knowledge and innovation architecture (Carayannis, 2001), which in turn constitute agglomerations of human, social, intellectual and financial capital **stocks and flows** as well as cultural and technological artifacts and modalities, continually co-evolving, co-specializing, and co-opeting.*
- ***Sustainable Entrepreneurship and Robust Competitiveness can only exist in a Democratic Society and Polity balancing openness and participation with creativity and innovation…***



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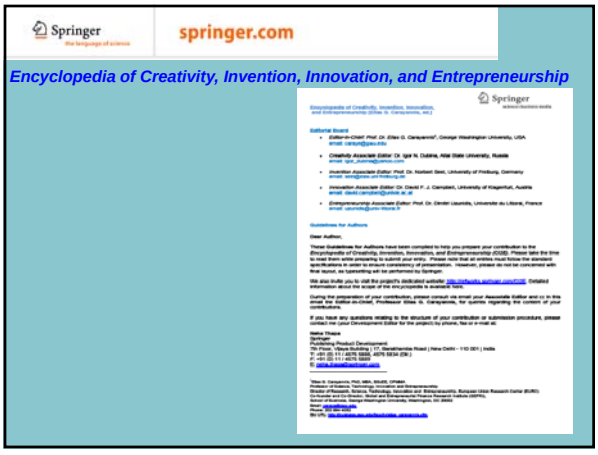
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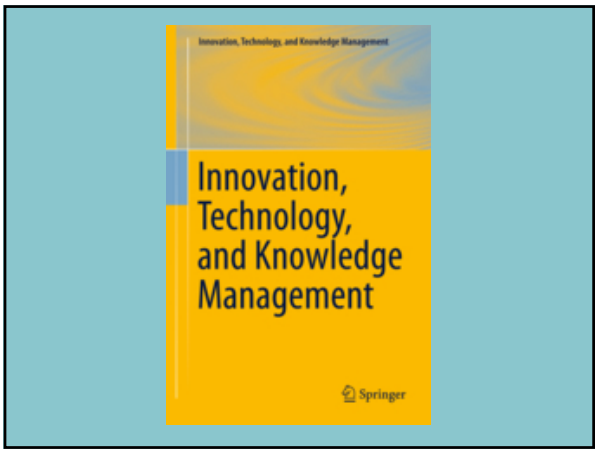
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