

HIGHER EDUCATION INSTITUTIONS EFFICACY AND HIGHER ORDER LEARNING: THEORIES, POLICIES AND PRACTICES

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Organisation and Management in Higher Education

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ABSTRACT

PLEASE FIND BELOW A BROAD THEMATIC OUTLINE OF ISSUES I WILL REFER TO:

THEORIES:

1. THEORIES OF ORGANIZATIONAL LEARNING – REVISITING PAST WISDOM TO DEVELOP EMERGING INSIGHTS
2. CLASSICAL THEORIES OF LEARNING AND COGNITION OVERVIEW
3. HIGHER ORDER LEARNING AND THE STRATEGIC MANAGEMENT OF TECHNOLOGICAL LEARNING

POLICIES:

4. PEOPLE, CULTURE AND TECHNOLOGY ISSUES – CROSS-CULTURAL AND TRANS-INSTITUTIONAL CHALLENGES AND OPPORTUNITIES
5. ROLES, WAYS AND MEANS TO COMBAT ORGANIZATIONAL INERTIA AND INSTITUTIONAL RIGIDITY IN HEIs AND PROMOTE CREATIVITY AND INNOVATION – AGILE DESIGN THINKING
6. FRACTAL RESEARCH, EDUCATION AND INNOVATION ECOSYSTEMS (FREIE) IN THE INDUSTRY 5.0 AND SOCIETY 5.0 CONTEXT

PRACTICES AND DISCUSSION THEMES:

7. USE CASES AND IMPLICATIONS FOR POLICY AND PRACTICE INCLUDING GOVERNMENT, UNIVERSITY, INDUSTRY AND CIVIL SOCIETY STAKEHOLDERS AS ENABLERS OF PERFORMANCE AND BRIDGES TO HIGHER LEVELS OF EFFICACY – A EUTOHA (EMERGING UNIFIED THEORY OF HELICAL ARCHITECTURES) (TRIPLE/QUADRUPLE/QUINTUPLE INNOVATION HELIX) VIEW (including open-ended questions for further discussion online and engendering of insights):
 1. THE DIGITAL UNIVERSITY 5.0 AND IMPLICATIONS FOR UNIVERSITY STAFF TRAINING AND DEVELOPMENT POLICIES AND PRACTICES
 2. THE STUDENT BODY IN HEIs AS ACTIVE STAKHOLDERS, CO-CREATORS AND CO-DESIGNERS OF DIGITAL LEARNING SOLUTIONS – A EUTOHA TOP-DOWN / BOTTOM-UP APPROACH
 3. THE VIRTUALIZATION OF HEIs – HOW COULD INCREASINGLY INTANGIBLE PEDAGOGY MAINTAIN TANGIBLE EFFICACY?
 4. DEVELOPING TOOLKITS FOR EFFICACIOUS LEARNING AND INNOVATION

Einstein on IMAGINATION....

“Imagination is more important than knowledge. Knowledge is limited. Imagination encircles the world”

Albert Einstein 1879 – 1955

THE WORLD TODAY:

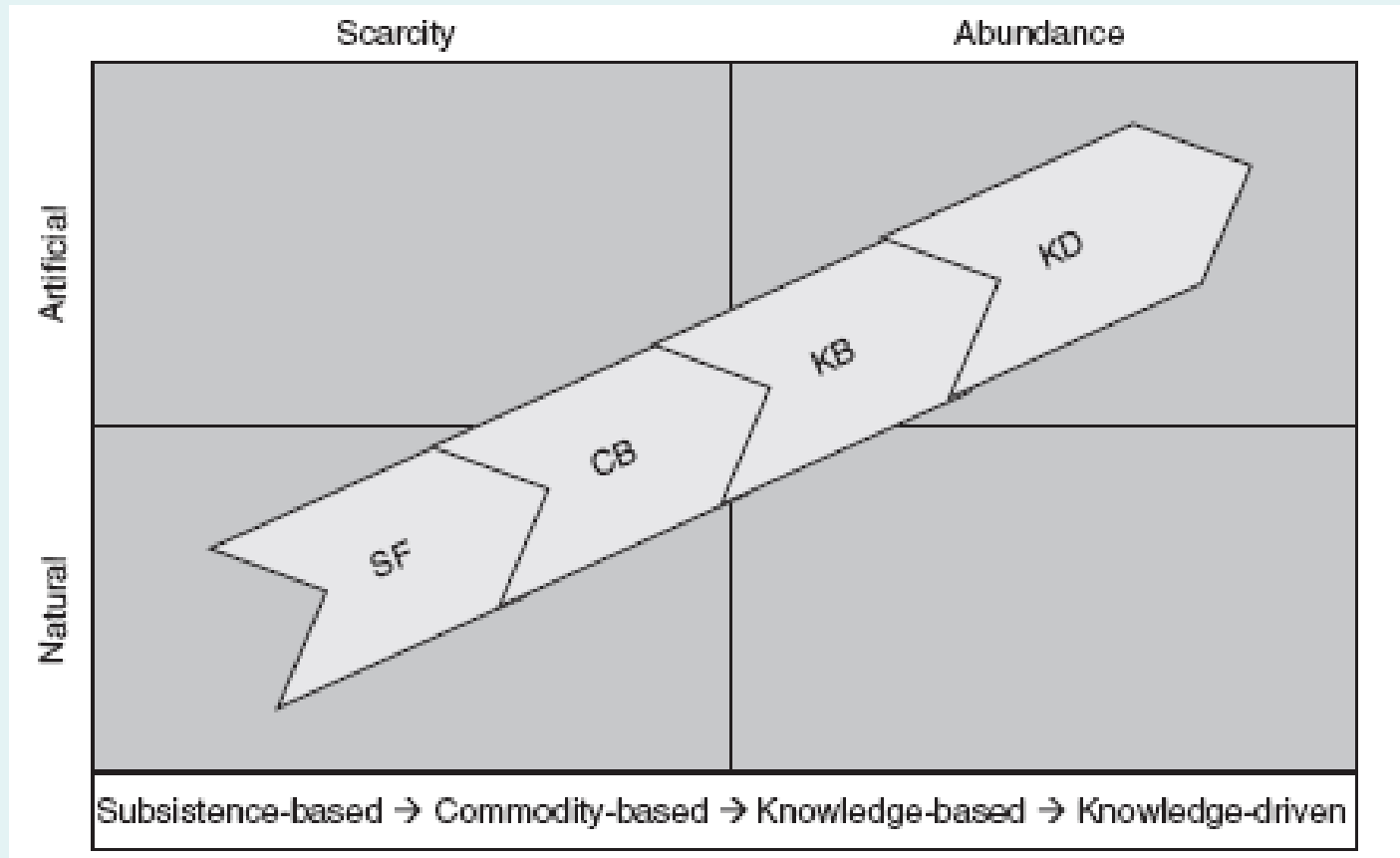
- A World of **Natural and Artificial** Scarcities
- **Geo-economic vs. Geo-political vs. Geo-technological Divides**
- **Multi-polarity vs. Oligo-polarity**
- A World of Divides (**SPECKD** – pronounced “specked”):
 - **Social**
 - **Political**
 - **Economic**
 - **Cultural**
 - **Knowledge**
 - **Digital**
- **Failed and Failing Developing and Developed States...**
- **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**
 - **WAR(S) OF CULTURES**
 - **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 2030)**
 - **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.

Effective efficiency

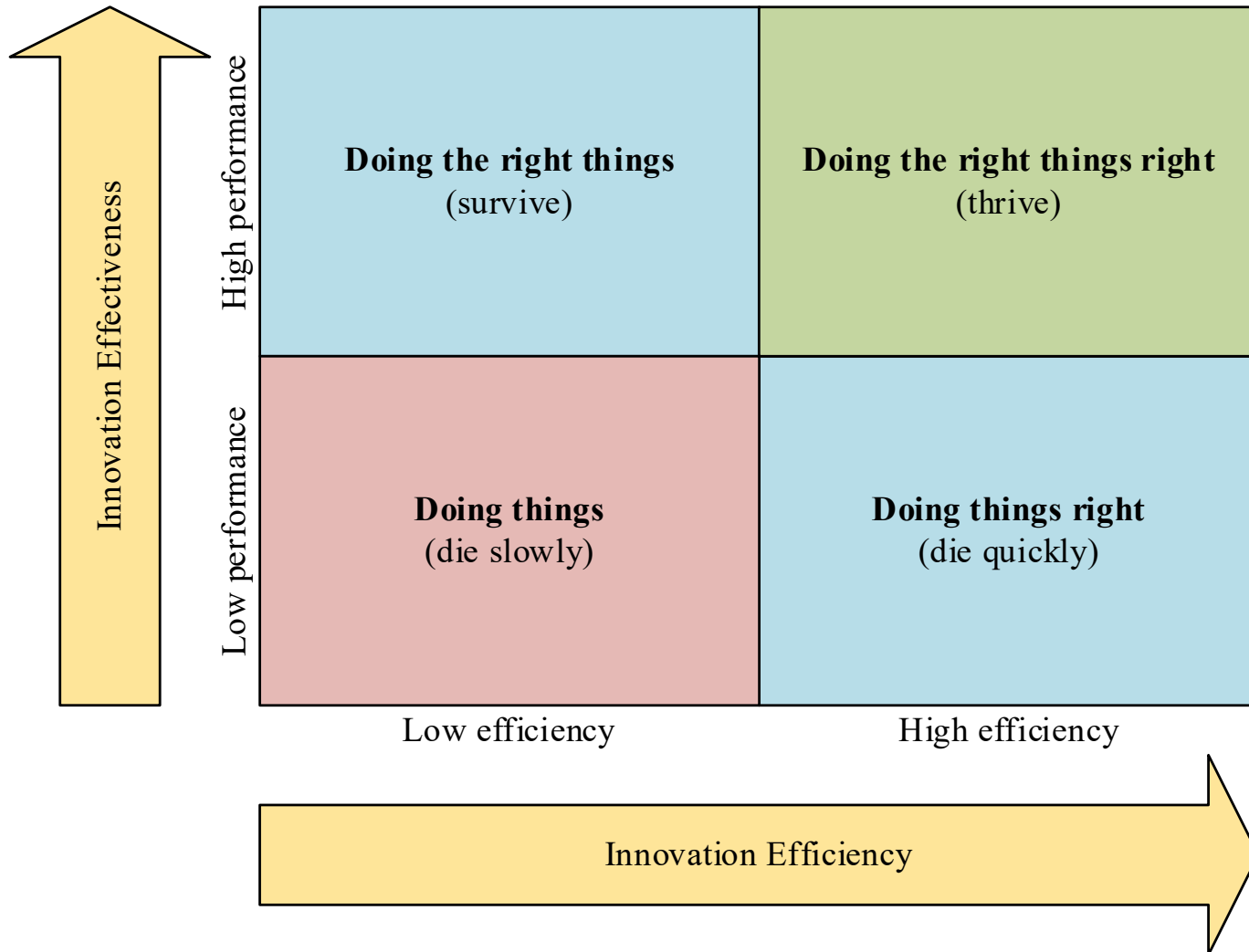
- Effectiveness vs Efficiency
 - Effectiveness is mostly related to strategy (i.e., doing the right things)
 - Efficiency is related to tactics (doing things right)
- Effective efficiency in innovation systems
 - Significant differences may be observed
 - Low performers may achieve high efficiency if inputs are relatively low compared to outputs (v.v.)



Gap analysis (1)

- Gap analysis between innovation efficiency and effectiveness in order to compare different ecosystems in a national/regional level
 - **Quadrant 1:** manage to meet performance targets efficiently
 - **Quadrant 2:** If high performance is not complemented with high efficiency, ecosystems may not attain the growth that they are capable of
 - **Quadrant 3:** too much attention is given on efficiency and short-term results
 - **Quadrant 4:** ineffective and inefficient ecosystems may lack a clear vision and strategy

Gap analysis (2)



Carayannis

STRATEGIC MANAGEMENT OF TECHNOLOGICAL LEARNING

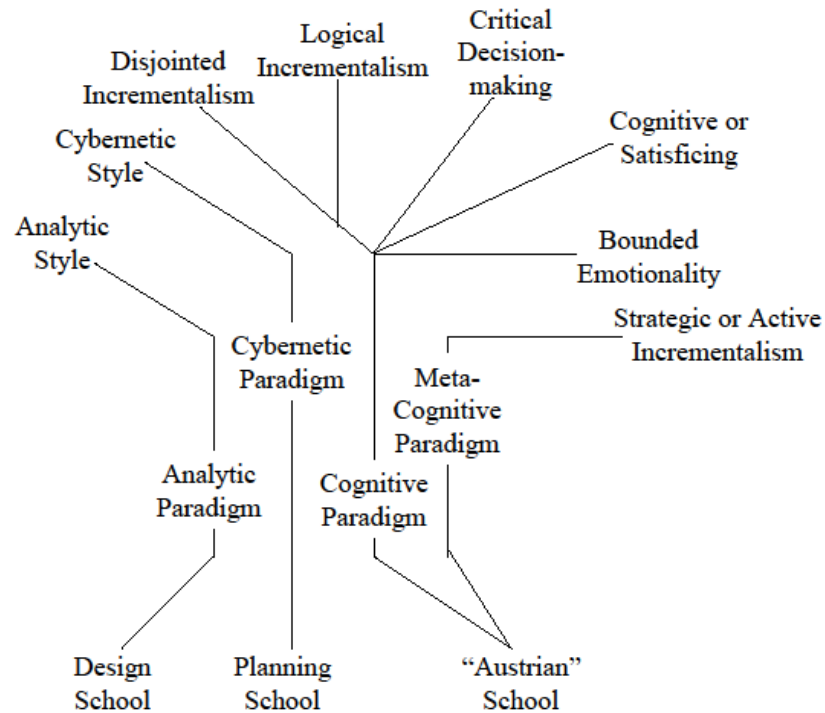


STRATEGIC MANAGEMENT of TECHNOLOGICAL LEARNING

By
Elias G. Carayannis

Series Editor Richard C. Dorf

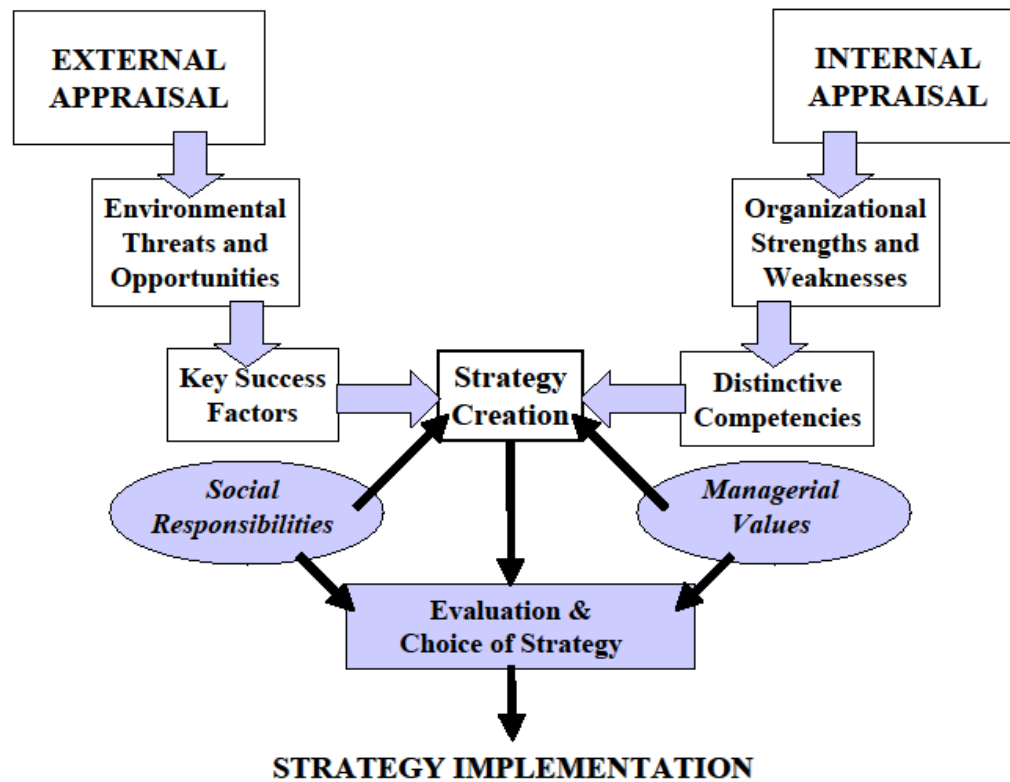
DECISION- & STRATEGY- MAKING SCHOOLS



Schools Of Strategic Thought

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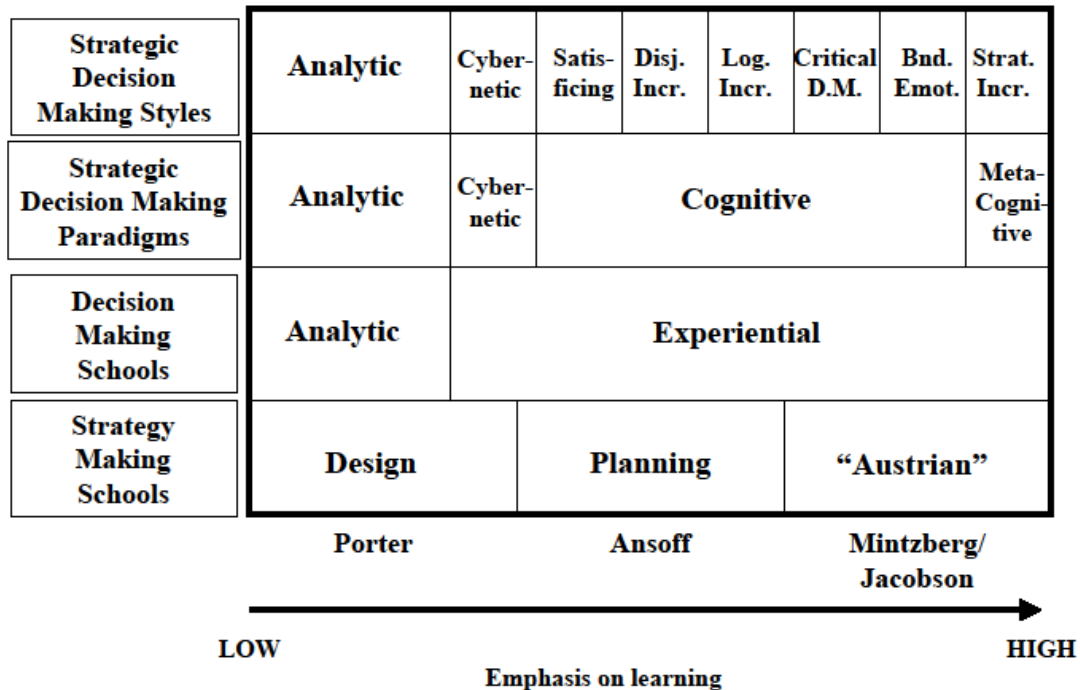
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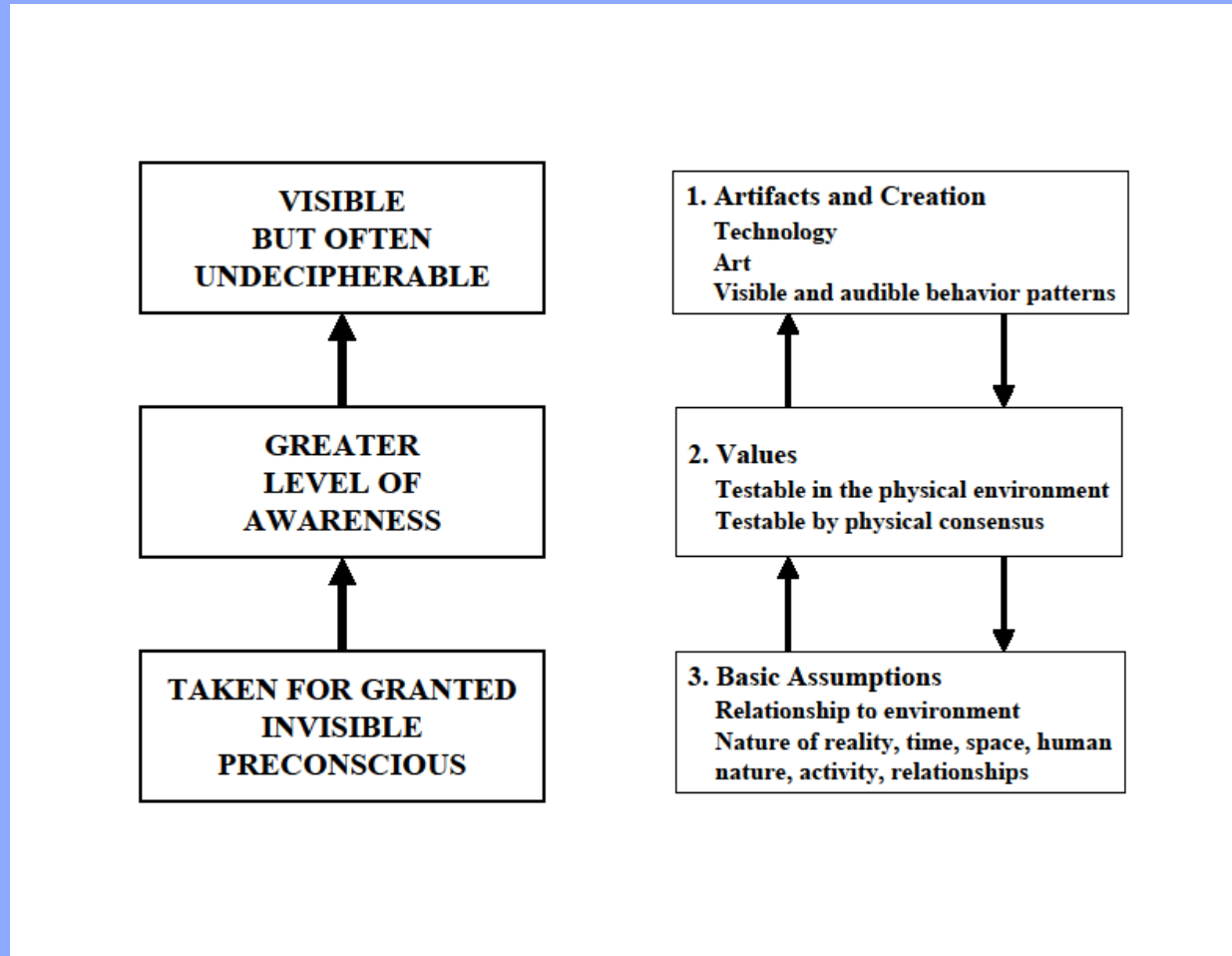
Schools Of Strategic Thought

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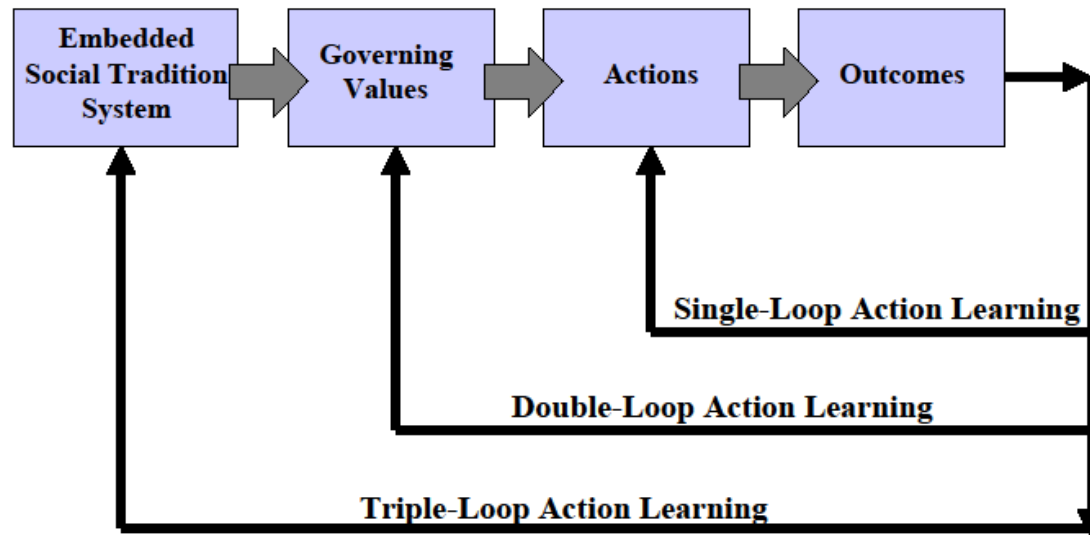


Culture As Medium for Learning



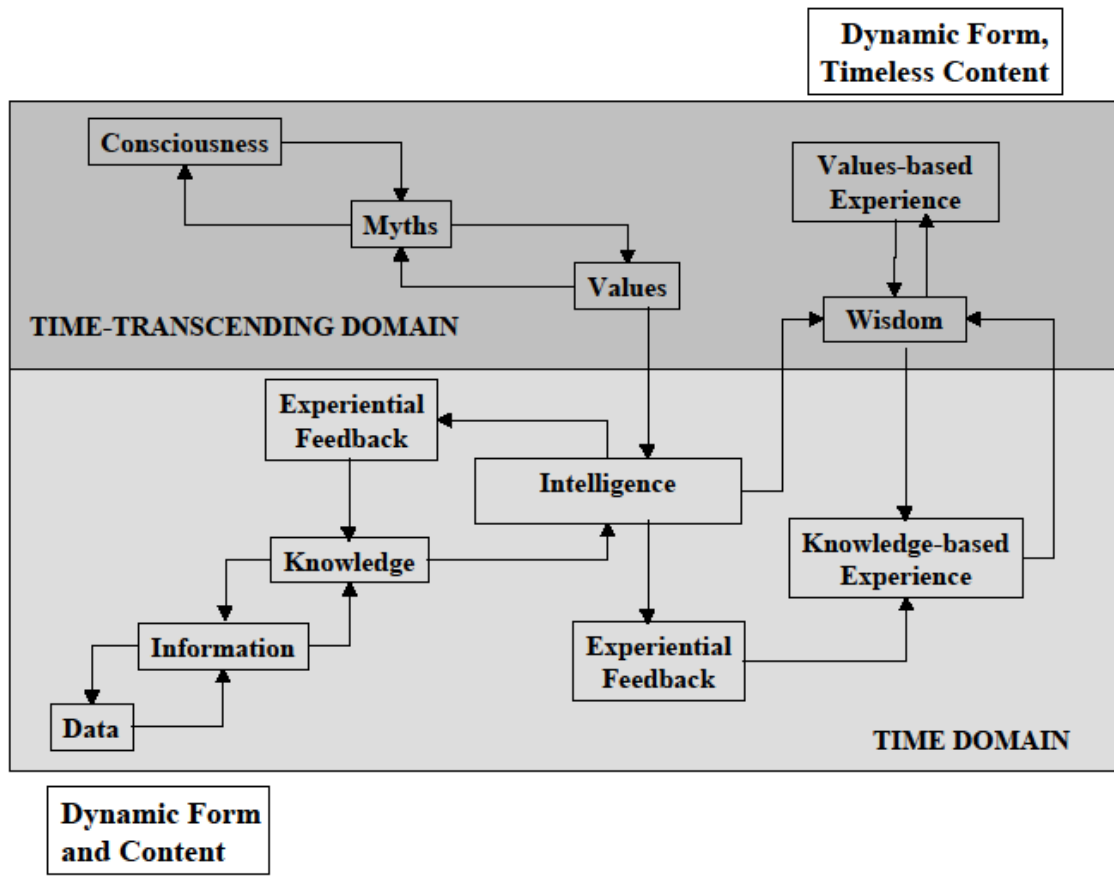
Learning: Autonomy & Responsibility

- Multiple-loop learning



Meta-cognitive Paradigm of Decision Making: Thinking about Thinking & Learning

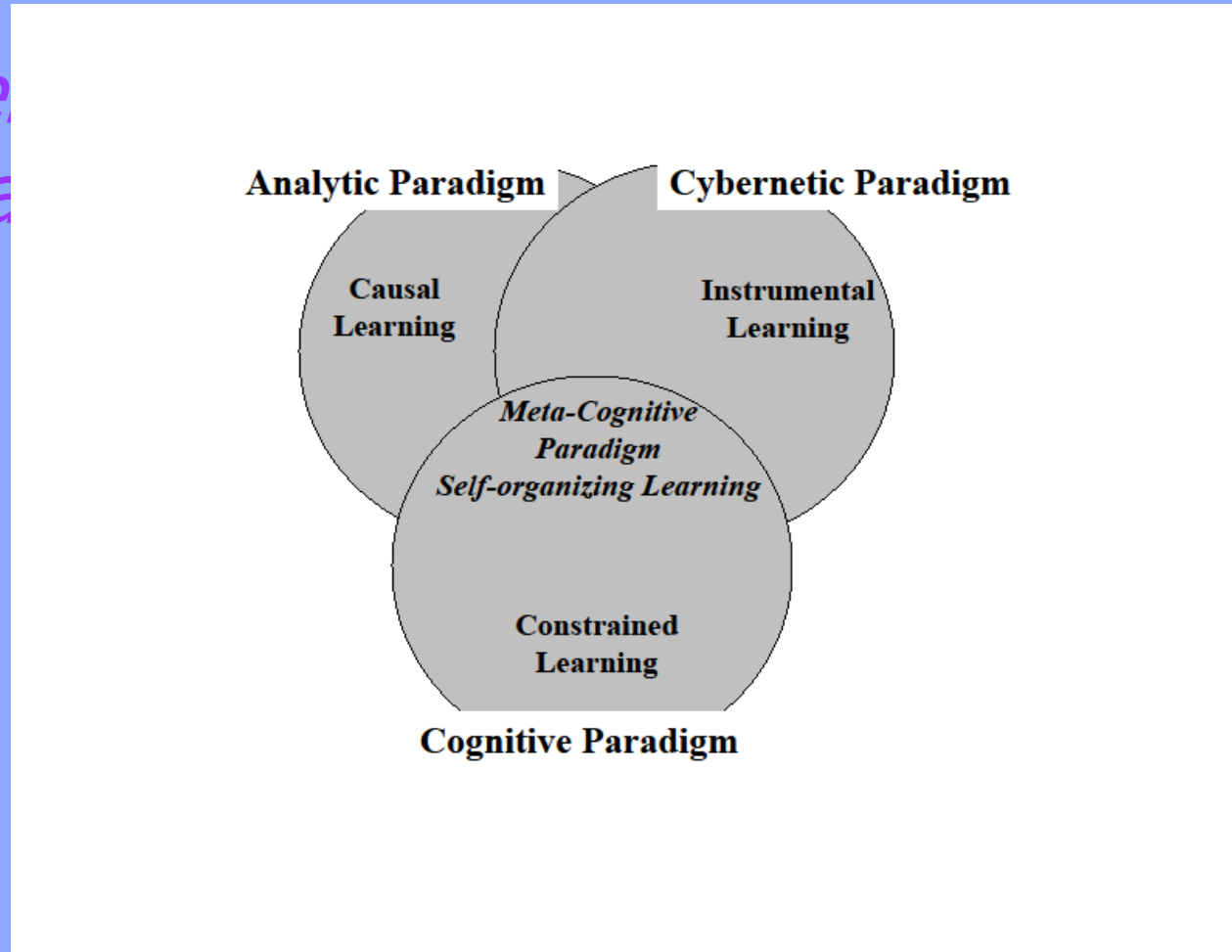
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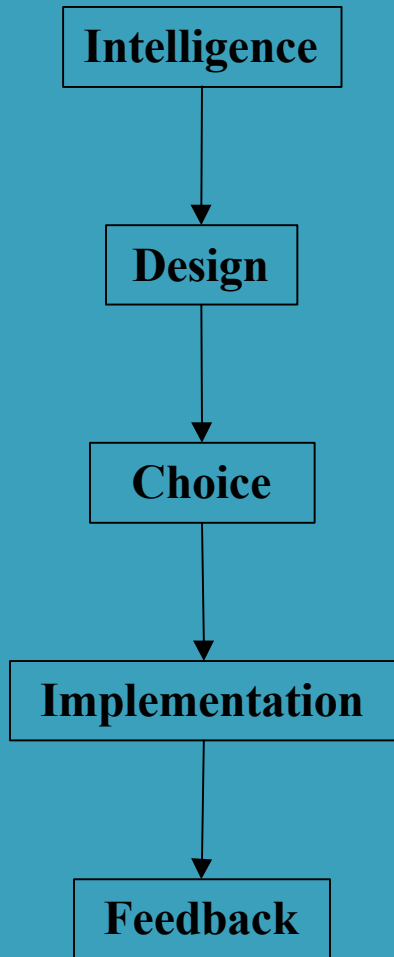
Meta-cognitive Paradigm of Decision Making: Thinking about Thinking & Learning

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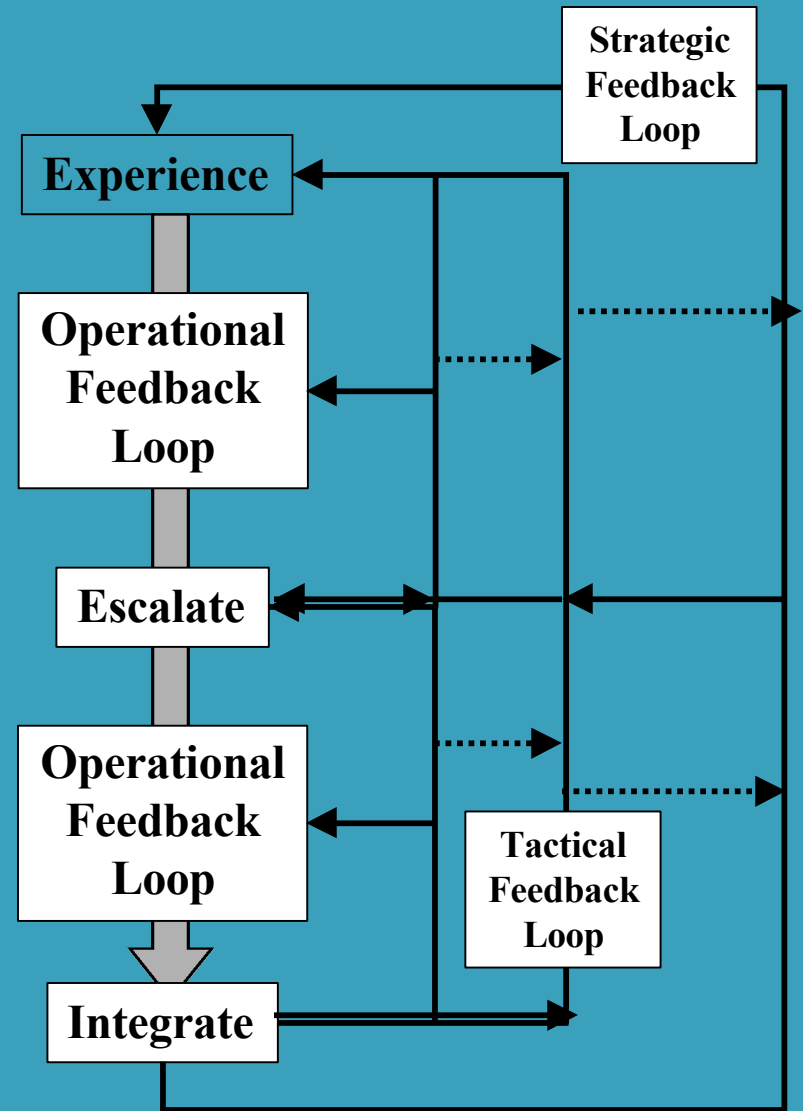
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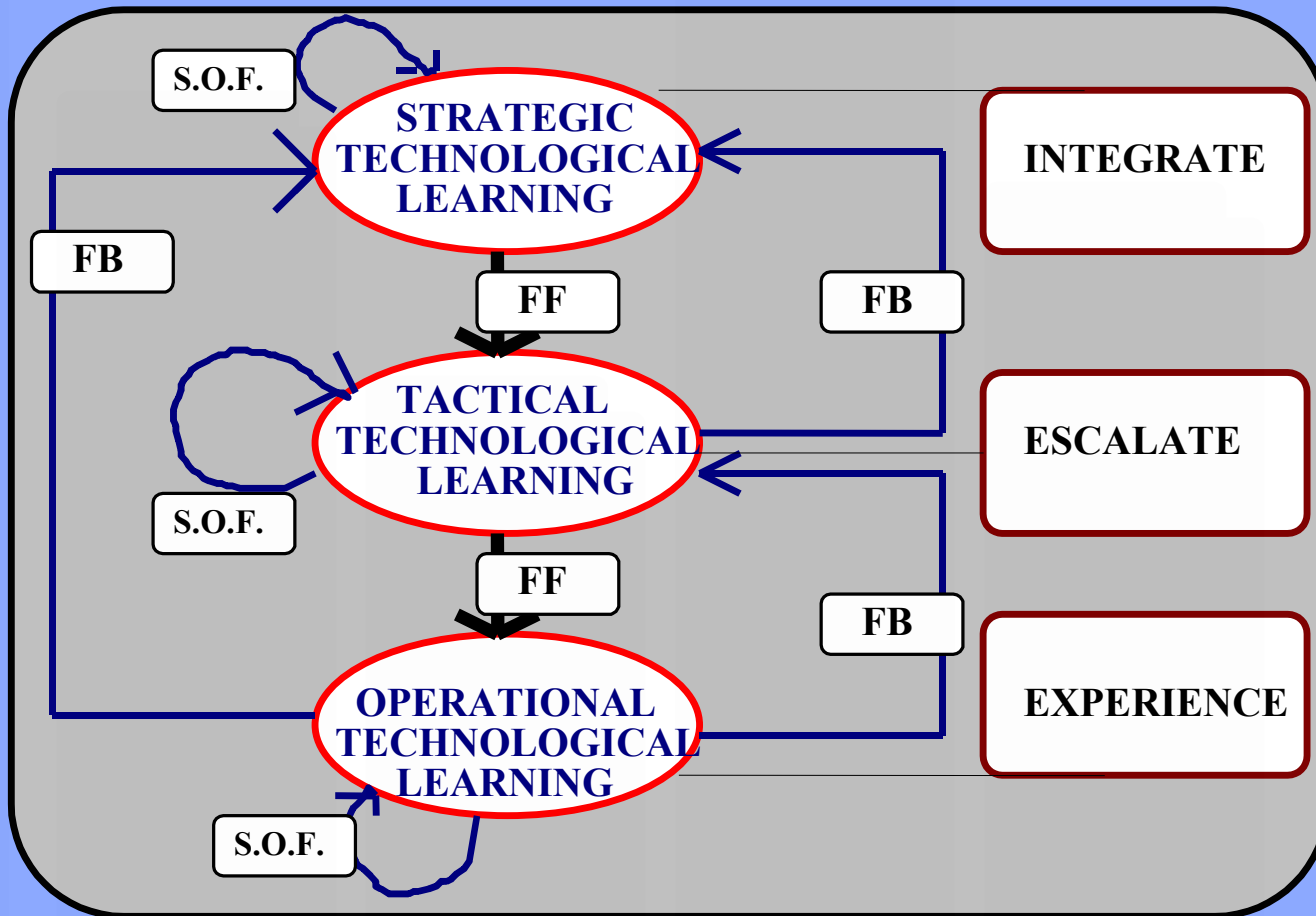
*SIMON'S SATISFICING
MODEL OF
DECISION MAKING*



*STRATEGIC INCREMENTALISM
MODEL OF STRATEGIC
DECISION MAKING*



A Triple-Layered Architecture Of Technological Learning: Strategic, Tactical, and Operational



Legend: S.O.F. = Self-Organizing Feedback, FB = Feedback Loop,
FF = Feedforward Loop
(adapted from Carayannis, 1994a, 1994b)

Learning: Autonomy & Responsibility

- Meta-processes of learning

TECHNOLOGICAL LEARNING PROCESSES:

Scanning, Diagnosis, Response

TECHNOLOGICAL LEARNING MODES:

ROBUSTNESS (Strategic Learning Level)

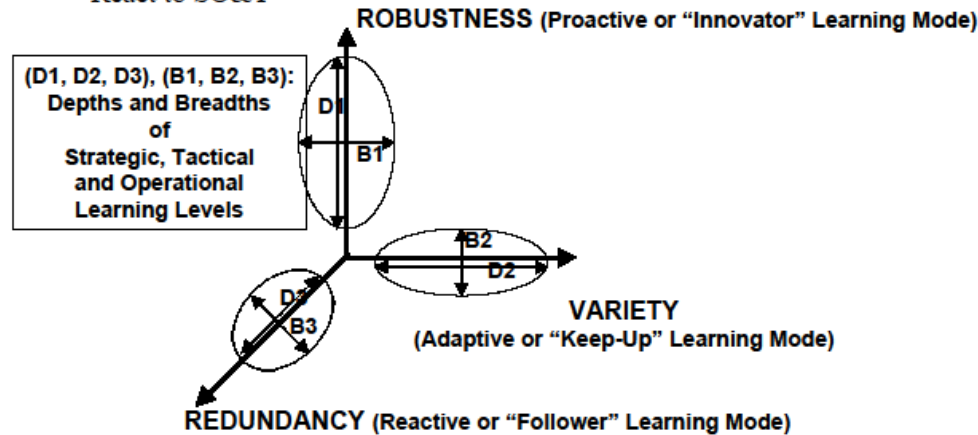
React to, foresee, and create strategic opportunities & threats (SO&T)

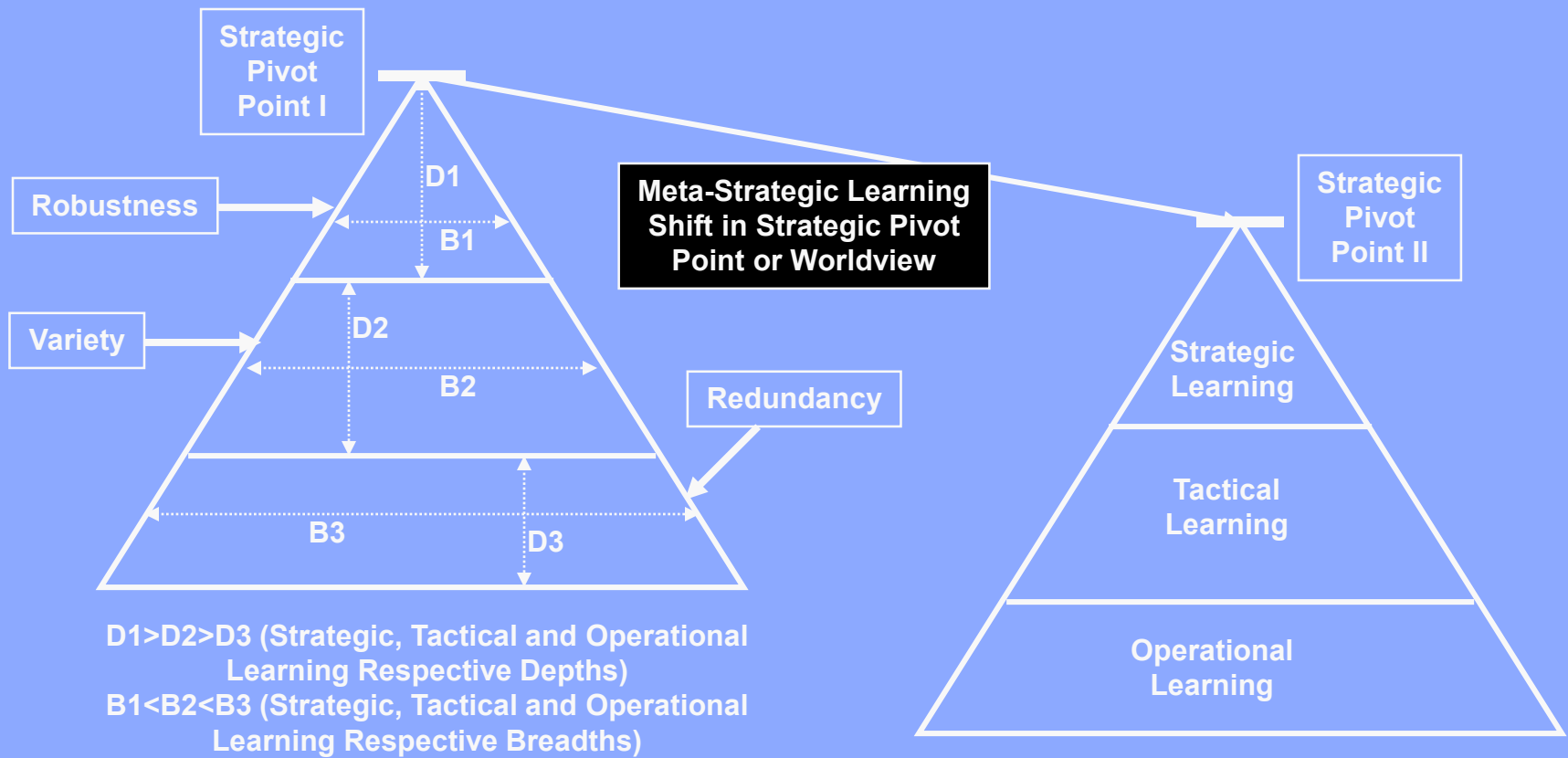
VARIETY (Tactical Learning Level)

React to and foresee SO&T

REDUNDANCY (Operational Learning Level)

React to SO&T

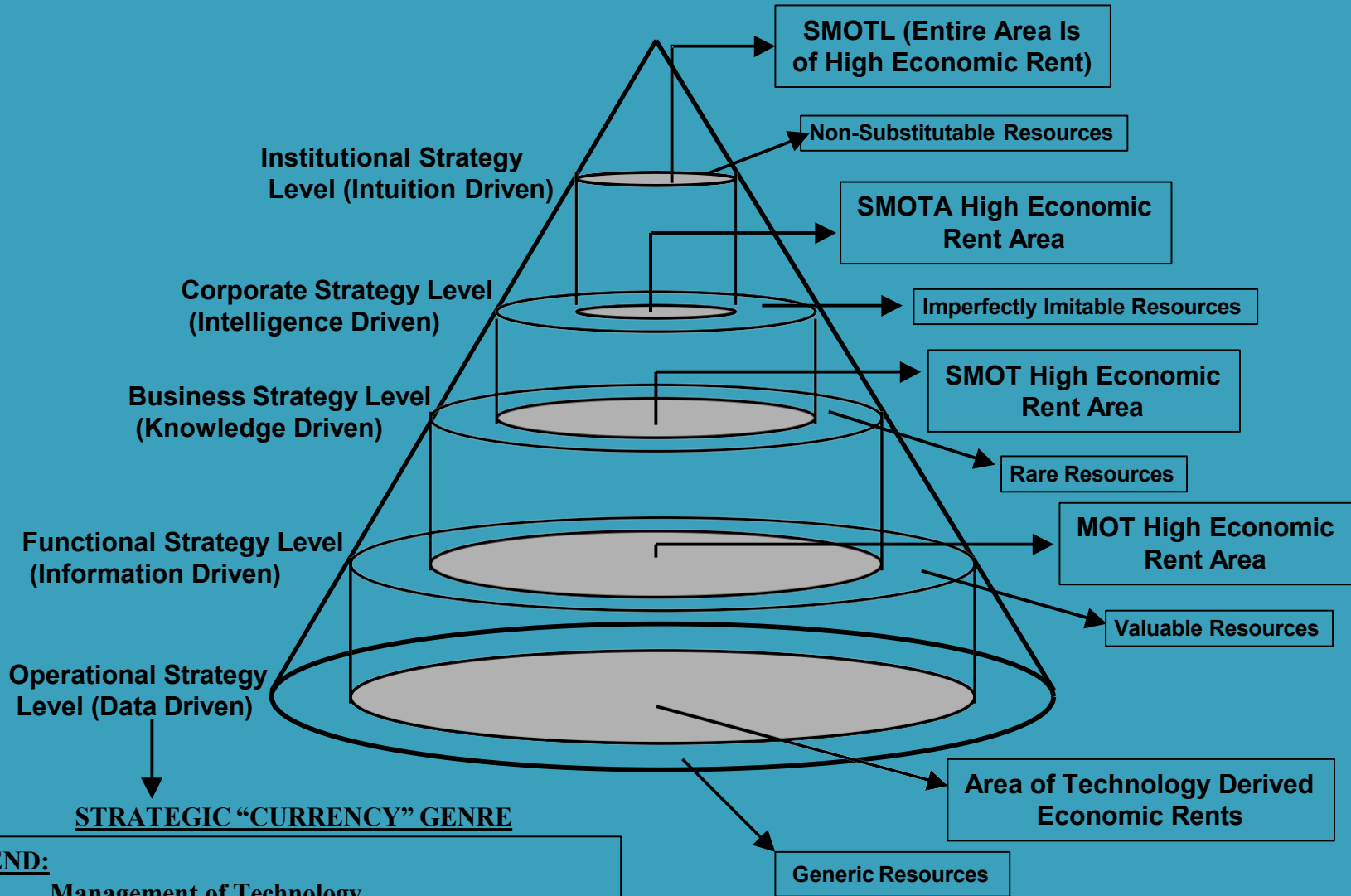




STRATEGIC PIVOT POINTS REPRESENT THE CURRENT PREVALENT BUSINESS/TECHNOLOGICAL WORLDVIEW

ROBUSTNESS, VARIETY, AND REDUNDANCY ARE THE FOCAL POINTS FOR THE RESPECTIVE LEARNING LEVEL

Adapted From: Carayannis, E., 1994d. *The Strategic Management of Technological Learning: Transnational Decision Making Frameworks and their Empirical Effectiveness*, Ph.D. Dissertation, School of Management, Rensselaer Polytechnic Institute



LEGEND:

- MOT:** Management of Technology
- SMOT:** Strategic Management of Technology
- SMOTA:** Strategic Management of Technology Assets
- SMOTL:** Strategic Management of Technological Learning

An Architecture of Concepts in Technological Learning

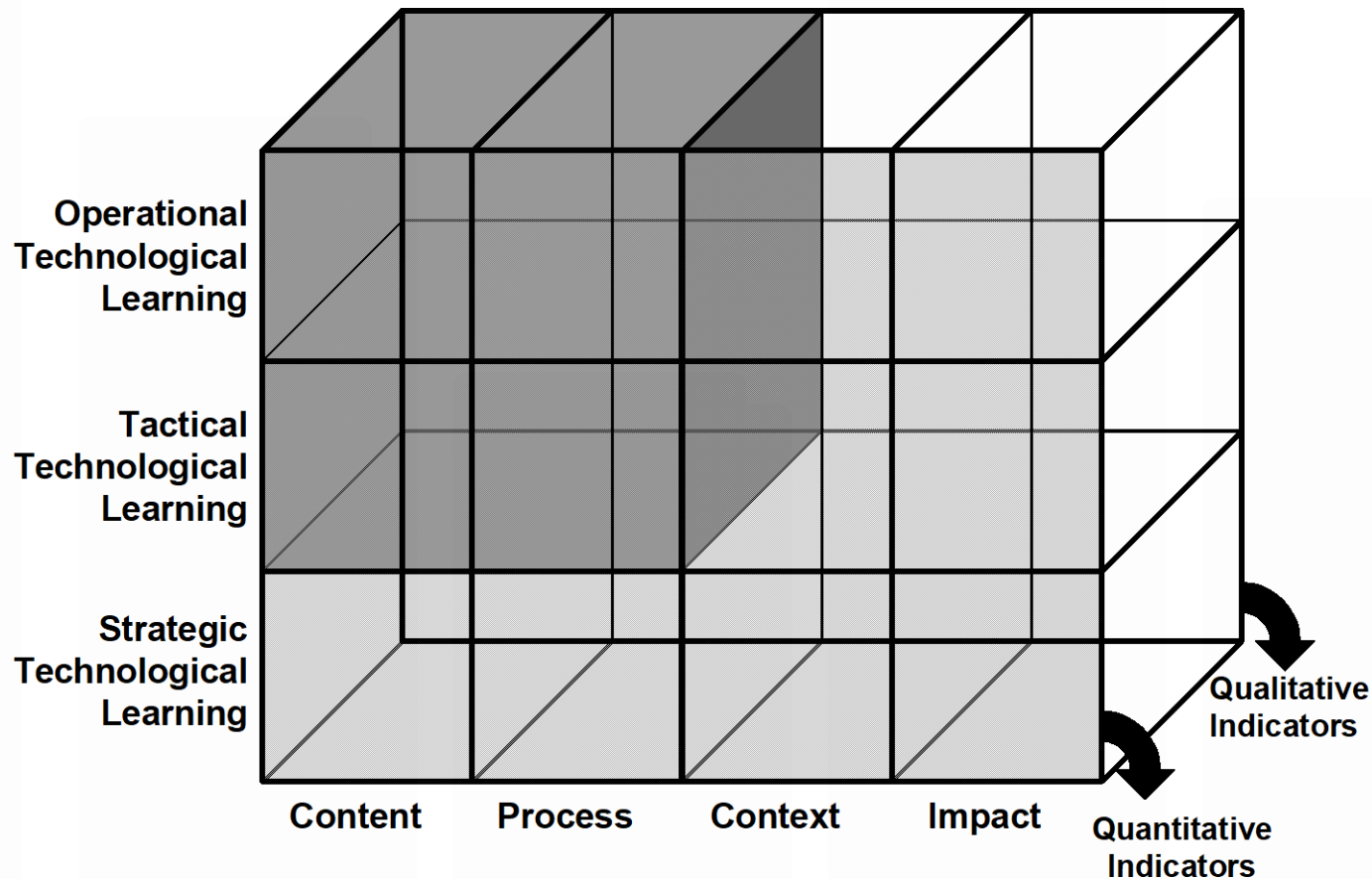


Figure Four
Basic Working Model Linking Firm Technological Learning
and
Market Performance

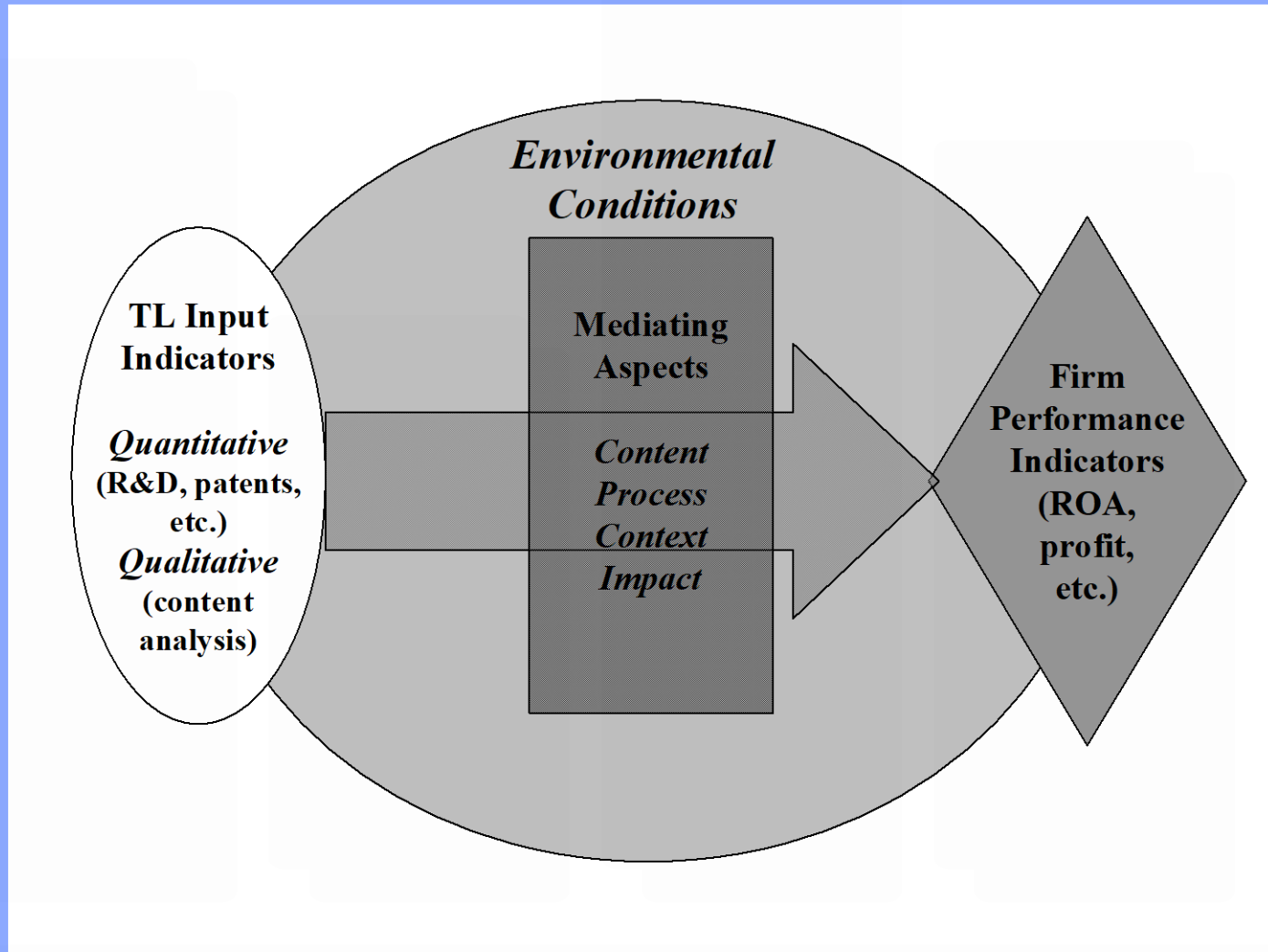


Table One

Framework for the Assessment of Learning

Aspect	Description	Dimensions
Learning content	Nature of the capability added or improved through learning	<ul style="list-style-type: none"> • Facts (Operational) • Rules, theories, models (Tactical) • Meta-rules (Strategic)
Learning process	Nature and effectiveness of the mechanism of learning	<ul style="list-style-type: none"> • Learning (learning new capabilities or improving existing capabilities) • Learning to learn (learning how to improve firm performance through learning) • Learning to learn-how-to-learn (learning how to redesign organizational paradigms to generate improved learning)
Learning context	Environmental conditions affecting and affected by learning content & process	<ul style="list-style-type: none"> • Focus (administrative versus technical) • Scope (individual, group, firm, industry) • Nature, including: • Timeframe (short, medium or long term) • Structure (formal to informal) • Tangibility (explicit to tacit) • Magnitude (radical to incremental) • Relation (competitive to cooperative) • Function (sociocultural change, socioeconomic change, etc.)
Learning impact	Nature and function of the change which results from learning in the technological operations and activities of the firm	<ul style="list-style-type: none"> • Instrumental change (Operational) • Innovative change (Tactical) • Creative change (Strategic)

Table Three
Indicators of Technological Learning

Indicator Type	Indicator Domains	Examples
Technical learning indicators	Indicators of R&D productivity	<ul style="list-style-type: none"> • R&D intensity or R&D spending/assets • Number of new patents per R&D spending • Number of new products per R&D spending
	Indicators of absorptive capacity	<ul style="list-style-type: none"> • R&D spending per employee • Ratio of R&D personnel to total employees • Licensing agreements signed • Formation of strategic alliances
Administrative learning indicators	Indicators of new approaches to innovation	<ul style="list-style-type: none"> • Introduction of new methods of managing innovation, such as alliances • Announcement of new R&D facilities & organization, e.g. movement of R&D closer to business units • Adoption of radical new forms of organizing innovation, such as concurrent engineering, global R&D
	Human capital development	<ul style="list-style-type: none"> • New training programs and initiatives, such as partnerships with universities • Changes in compensation practices, especially for technical/research personnel

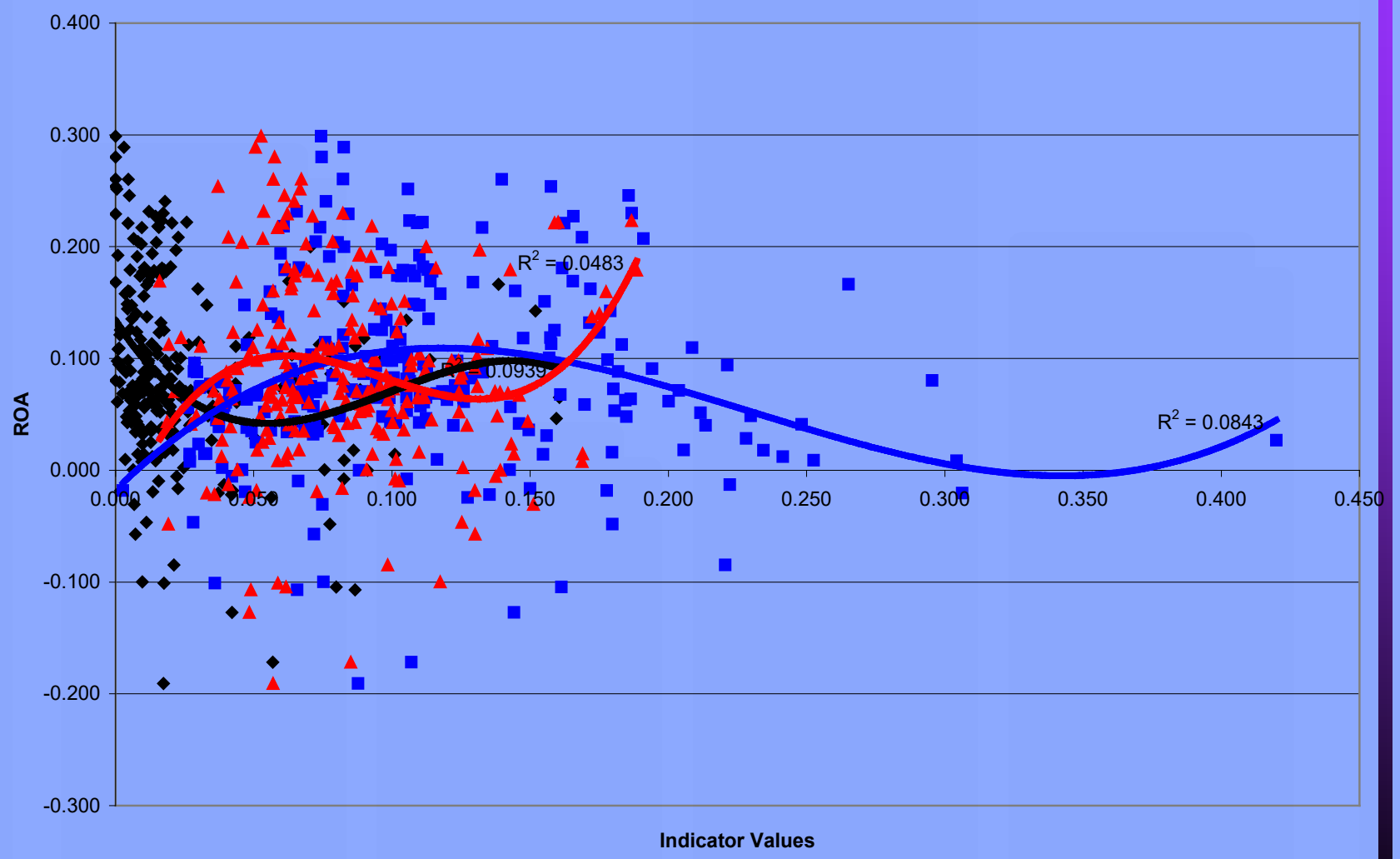
Table Four
Contrast between TL and HTL Activities

Technological Learning		Higher-order Technological Learning	
Technical learning	Administrative learning	Technical learning	Administrative learning
Change in the rate and volume of innovation	Changes in the organization of innovation activities	Change in the productivity and effectiveness of innovation	Introduction of new approaches to the management and organization of innovation

Table Five
Sample Terms Used as Indicators of Learning Activities

Research and Development Indicators	Research Development Patent Technology
Collaborative Research Indicators	Alliance Joint Venture License
Management of Technology Indicators	Acquisition Innovation Quality

Figure Five-A
Curve Fit for ROA versus Learning Indicators
at 1 Year Lag



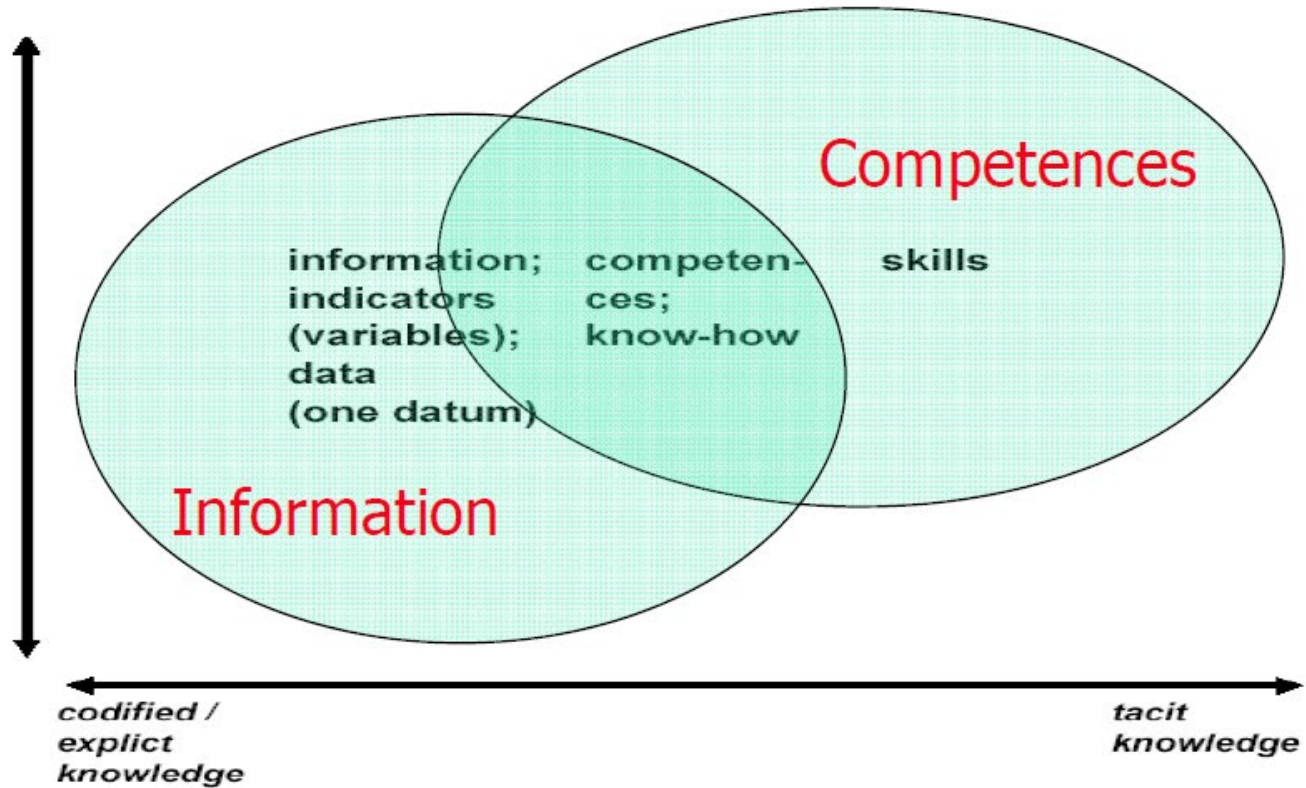
◆ Normalized Patents ■ Normalized R&D Spending ▲ TLL — Poly. (Normalized Patents) — Poly. (Normalized R&D Spending) — Poly. (TLL)

Further Research on TL

- TL & Catastrophe Theory
 - Static method for studying & modeling unstable discontinuous processes
 - Useful when dealing with the 5 pathologies of strategic decision-making
 - Uncertainty, complexity, ambiguity, uniqueness & value conflict
- TL & Chaos Theory
 - Strong affinity with strategic incrementalism, viewed as triple-layered feedback driven system
 - Trinity of war corresponding to operational, tactical & strategic learning
- Future research directions: towards a New Theory of the Growth of the Firm?
 - Knowledge generation, acquisition & renewal as source of competitive advantage
 - Motives for further research on the dynamics of creation & evolution of firm core competencies

Knowledge

*knowledge
in interaction
with observers/
users*



*knowledge
independent
of observers/
users*

Source: Author's own conceptualization (Campbell 2006).

Competences



- Different Axes of Competencies.



OECD (2014). Competency Framework.
Talent OECD. Learn, Perform, Succeed. Paris: OECD
(https://www.oecd.org/careers/competency_framework_en.pdf).

Competences

- Future Skills “Space of Action”.

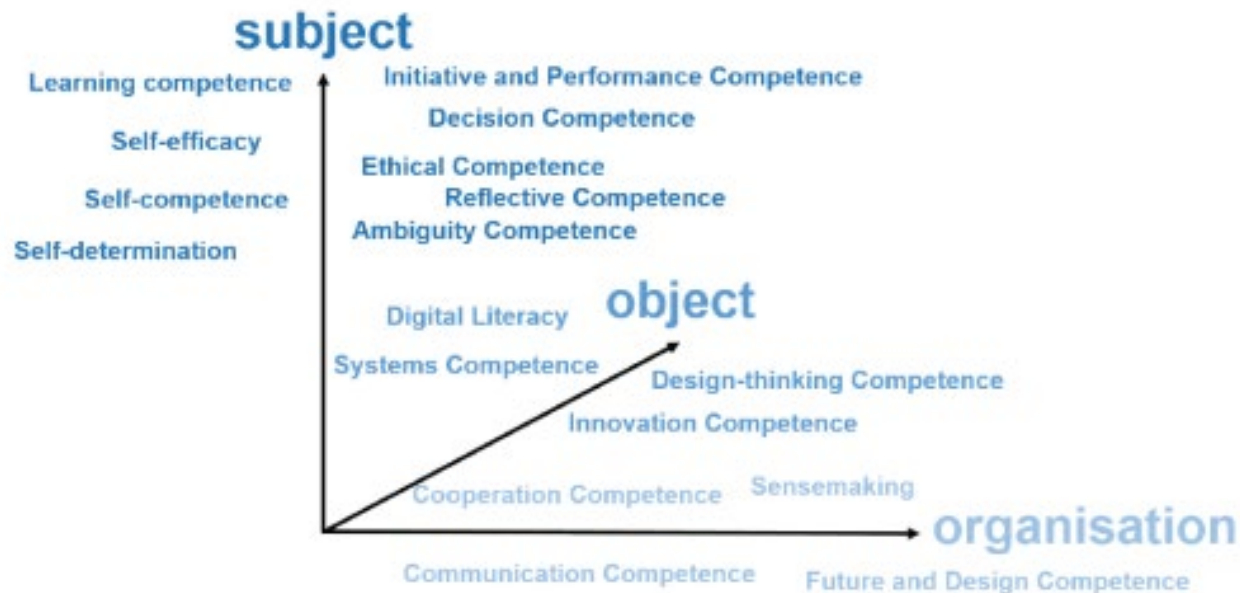


Fig. 13 Future Skills space of action

Ehlers, Ulf-Daniel (2020). Future Skills. The Future of Learning and Higher Education. Karlsruhe: Self-Published & Books on Demand (<https://nextskills.org/wp-content/uploads/2020/03/Future-Skills-The-Future-of-learning-and-higher-education.pdf>): page 57.



Meta Competences

- Meta-competences as a component of a larger “meta competence framework”:
 - Reis (et al., 2020) emphasize the importance of entrepreneurial competences in connection with the success of policies, also of venture capital investments. This matters for digital ventures and associated breakthrough innovations. So, there is a need for “providing relevant knowledge for the policy-makers' strategy formulation processes”.



Meta Competences

- Meta-competences in relation to **business and technology**:
 - One interest here is to inquire, to which extent **meta-competences are important for the performance of managers** (Feng et al., 2008). For technological success, explicit references to meta-competences are being brought into play.
 - As Wadhwa and Rao (2000) indicate, **flexibility is sensitively crucial in managing high technology**, for example “involving a **dynamic control of structural, process and resource flexibility**”.



Meta Competences

- Meta-competences in relation to **business and technology** (continued):
 - Particular studies are being released, focusing on the **cross-road of digital competences and future teacher training in digital education** in higher education (for example, Rodriguez-Garcia et al., 2019).



Meta Competences

- Meta-competences in relation to **secondary and tertiary education**:
 - In a study about students of social work, the teaching of students was put also in relation to “**develop emotional self-regulation**” (Bogo et al., 2013).
 - The interest to support meta-competences among students in specialized classes in the secondary general school is sometimes based on the motivation **to connect skills-of-the-past with skills-of-the-future, and to combine hard skills with soft skills**. For that particularly, Furyaeva and Gudkova (2019) recommend a so-called “event-project format”, and this particularly in subjects with a focus on engineering and technology.



Meta Competences

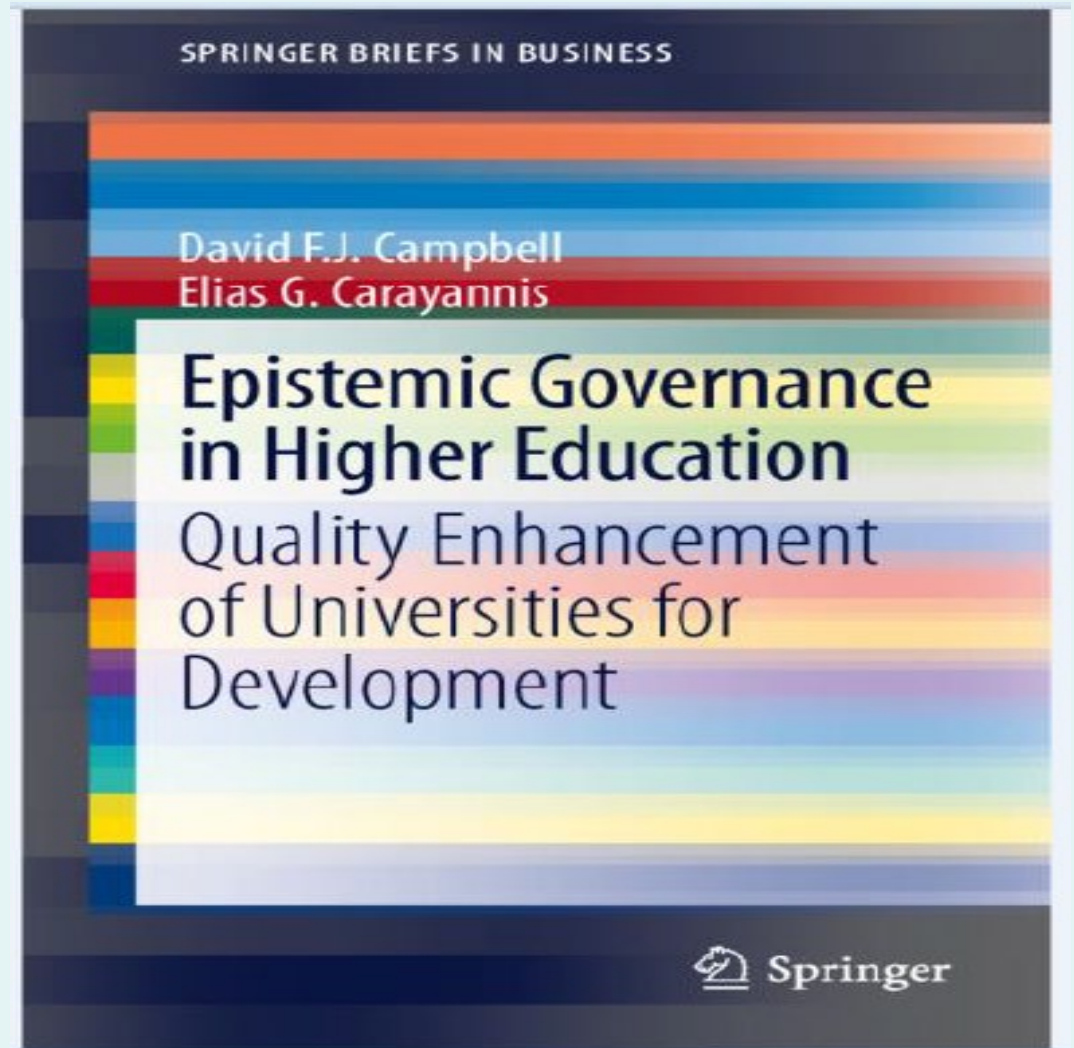
- Meta-competences in relation to **secondary and tertiary education** (continued):
 - The readiness of “**future teachers for lifelong learning**” associates with the ability to develop a meta-competence, and furthermore requiring that universities support conditions, so that students can develop “**meta-cognitive abilities**”. A study on this by Grebennikova et al. (2021) referred to 748 students participating in teacher education programs. Cognitive abilities do matter for the “future teachers' readiness” for a lifelong education.
 - “**Education 4.0**” emphasizes **the shift from a teaching to a learning perspective**, where a “**meta empirical competence and academic competence**” are to be brought together in a “**digital era**”, as it is being highlighted by Simon (2022). The so-called “T.A.LA goal setting life skills learning approach” was applied to learning processes in chemistry lessons.

**What is artificial is very clear.
What is intelligence – not so.**



“Hey, my sensors detect that you are
scanning my cards!”

Epistemic Governance (1)

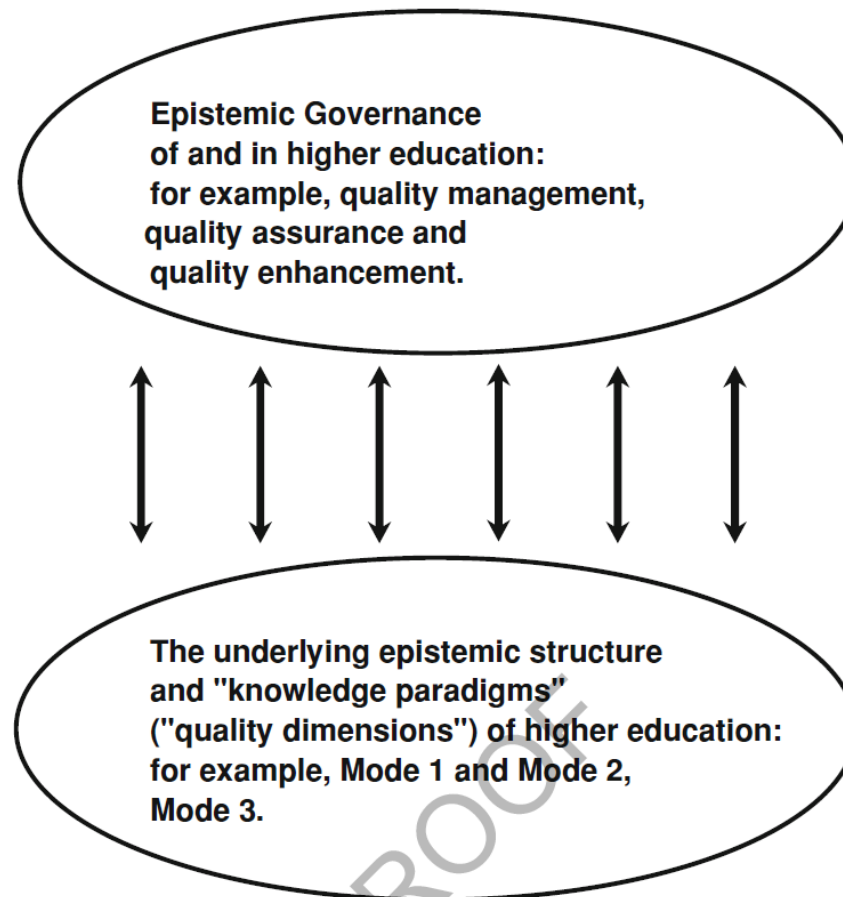


Epistemic Governance (2)

28

3 Governance: Governance of and in Higher Education

Fig. 3.2 “Epistemic governance” of and in higher education



Source: Authors' own conceptualization and visualization.

Epistemic Governance (3)

- General Definition of Epistemic Governance:
 - The “underlying understandings” (for example, types of research, types of innovation, quality culture, etc) must be explicitly addressed ...
 - ... by governance, policy, strategy, structures & processes (etc).

Interdisciplinarity, Transdisciplinarity: Basic Structure of the Disciplines

- **Disciplinary Structure (according to OECD):**
 - Natural Sciences;
 - Technical Sciences;
 - Human Medicine, Health Sciences;
 - Agricultural Sciences, Veterinary Medicine;
 - Social Sciences;
 - Humanities.

Interdisciplinarity, Transdisciplinarity: Basic Structure of the Disciplines

■ Disciplinary Structure (according to OECD):

- Natural Sciences;
- Technical Sciences;
- Human Medicine, Health Sciences;
- Agricultural Sciences, Veterinary Medicine;
- Social Sciences;
- Humanities.

■ Where is (where are):

- Mathematics;
- Life Sciences;
- Business Administration and Economics;
- Law;
- Psychology;
- Disciplines in the Arts?

Interdisciplinarity, Transdisciplinarity: Basic Structure of the Disciplines

■ Disciplinary Structure (according to OECD):

- Natural Sciences:
 - Mathematics;
 - Life Sciences (e.g., Biology).
- Technical Sciences;
- Human Medicine, Health Sciences:
 - Life Sciences.
 - Psychology.
- Agricultural Sciences, Veterinary Medicine:
 - Life Sciences.
- Social Sciences:
 - Mathematics (Statistics);
 - Business Administration and Economics;
 - Law;
 - Psychology.
- Humanities:
 - Psychology;
 - Discipline in the Arts.

Interdisciplinarity, Transdisciplinarity: Function of Disciplines

- What is the function of disciplines at universities (in higher education institutions)?
 - Allows for a **peer selection for peer review that represents the standard procedure for quality assessment** (quality control).
 - **Peers of the same discipline evaluate their colleagues (again of the same discipline).**
 - Serves as a reference for structuring units at a university (higher education institution).
 - **Provides a rationale for career advancement and promotion in academia** (see again peer review).



Conceptual Point of Departure (Research Question)

- “The competitiveness and superiority [... and advancedness and maturity ...] of a knowledge system is highly determined by its adaptive capacity to combine and integrate different knowledge and innovation modes via co-evolution, co-specialisation and co-opetition knowledge stock and flow dynamics” (Carayannis & Campbell, 2009, p. 201, 223)



Research

- Dimensions (subdimensions) of Research (also as being defined by the OECD):
 - **Basic Research** (ideal-typically, focuses on universities/higher education system, mainly public funding)
 - **Applied Research** (“Valley of Death”)
 - **Experimental Development** (ideal-typically, focuses on the economy, the business enterprise sector, mainly private funding)

Research

Literature Review: Wagner et al. 2011

- **Multidisciplinarity:**
 - Cooperation of disciplines.
- **Interdisciplinarity.**
 - Issue, topic, problem is too complex for only one discipline.
 - Which issues can be tackled by only one discipline?
- **Transdisciplinarity.**
 - Difference to interdisciplinarity is not so much in the “what” of knowledge, but the “how” of knowledge production;
 - Cooperation of academic research communities with communities of practitioners for the process of knowledge production;
 - It has implications for the research design (to go beyond a purely academic research sphere);
 - For example, radically new knowledge from the interaction of scientific and artistic research.

Interdisciplinarity, Transdisciplinarity: Questions

- When new (interdisciplinary, transdisciplinary) knowledge becomes more mature within a university (higher education context), **does this new knowledge then convert, over time, into the formation of a new discipline?**

Interdisciplinarity, Transdisciplinarity: Questions

- What do you say to the following statement?
- “Persons” (individual researchers) only have a disciplinary competence, and only “teams” can be interdisciplinary or transdisciplinary competent.

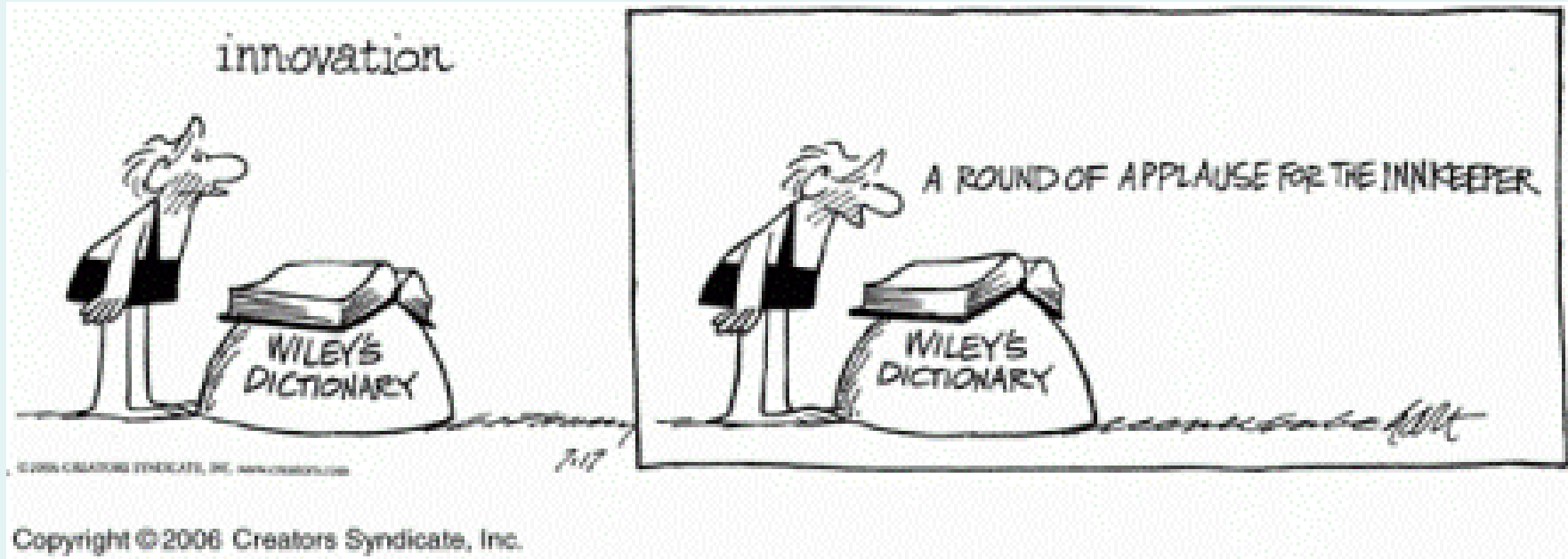
Interdisciplinarity, Transdisciplinarity: Questions

- Should a university (higher education institution) want to promote
 - **(a) an interdisciplinary/transdisciplinary organizational development (process development) and**
 - **(b) an interdisciplinary/transdisciplinary governance:**
 - **What does this mean?**
 - **Open Discussion.**

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

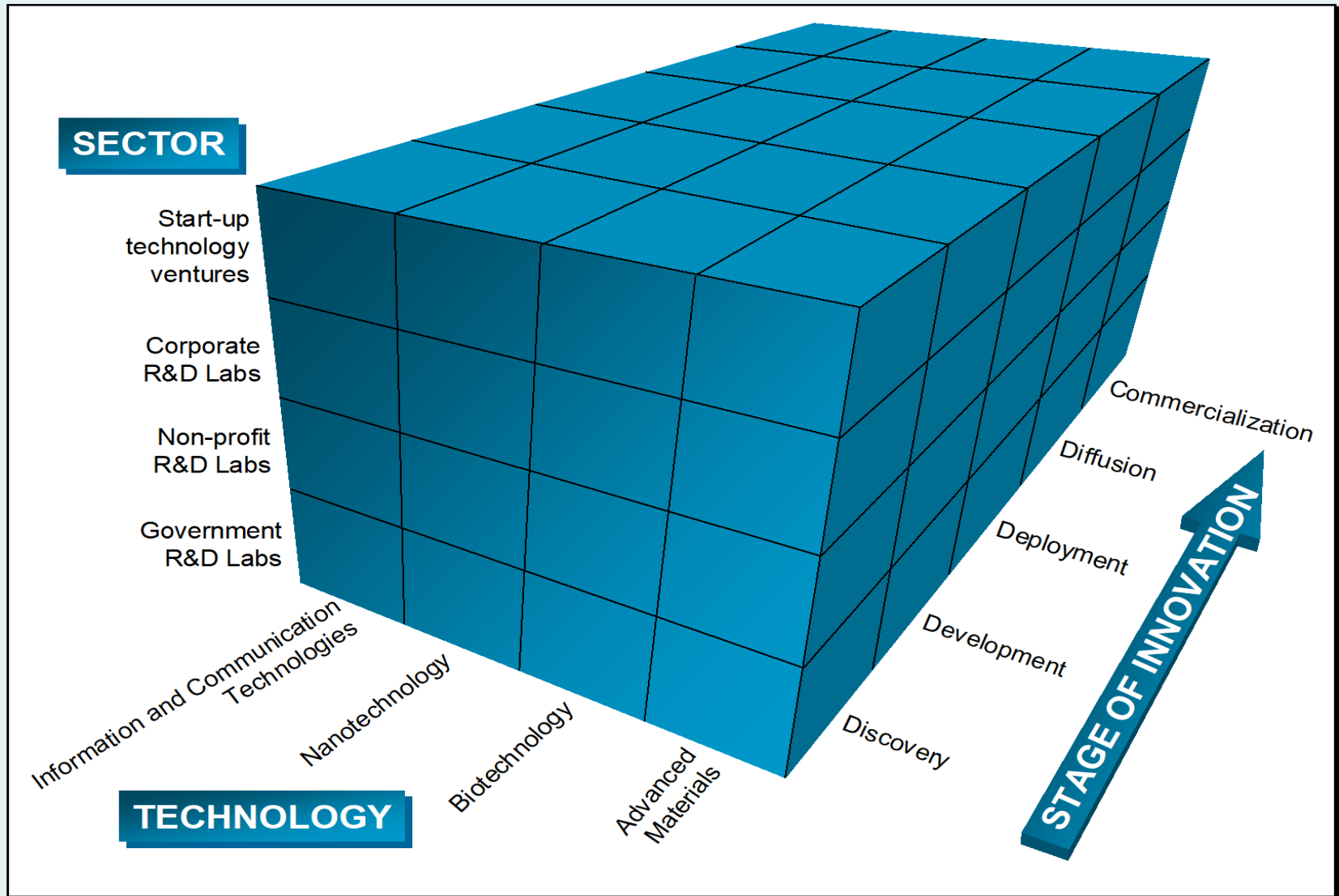


INNOVATION DEFINED

- *Innovation resides at the intersection of invention and insight, leading to the creation of social and economic value*
- *US National Innovation Initiative*



THE INNOVATION CUBE



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



Innovation

- Analytical, conceptual challenge: Could (at least in some cases) one and the same innovation process (or one and the same set of phenomena) be interpreted according to linear and non-linear innovation models?
- Innovation policies in the twentieth and twenty-first centuries:
 - Does the “political system” (the “state”) increasingly govern society and the economy through innovation policies or by policies moving through the innovation system?
 - Do innovation policies replace (partially) economic policies?
 - Does the “volume” (amount) of innovation policies reflect the maturity (“advancedness”, progress) of policy-making of states?



Innovation

Model of linear innovation modes:

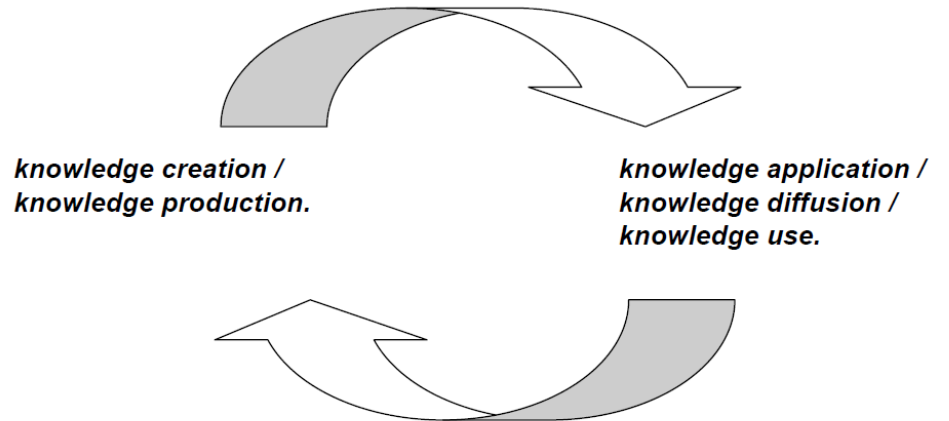


Source:
Carayannis & Campbell
(2009)

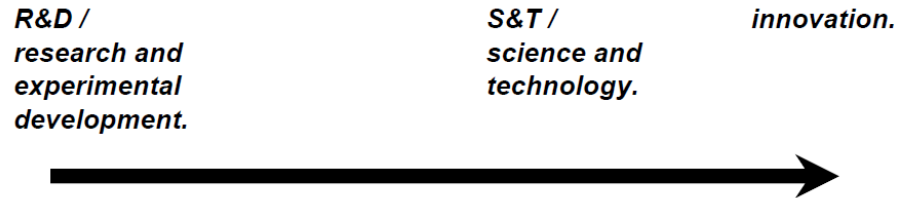
Comment: Vannevar Bush ("Science: The Endless Frontier", 1945) never explicitly mentioned the concept/word "innovation".

Innovation

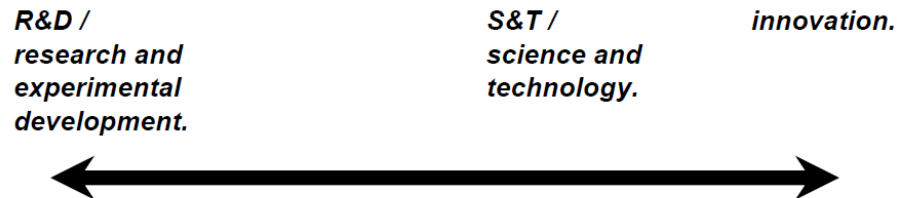
Figure 1: Conceptualization of (a possible) relationship of knowledge and innovation.



Linear model of innovation (one-way direction):



Non-linear model of innovation (two-way direction):



Source:
Carayannis & Campbell
(2010)

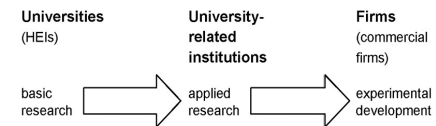
Source: Authors' own conceptualization.

About “non-linear innovation modes

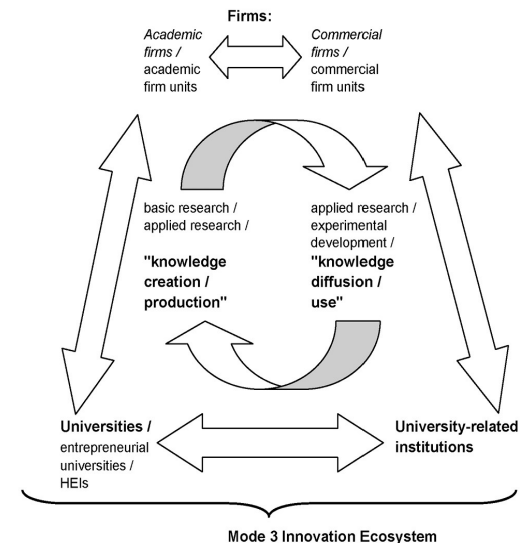
- Basic assumptions about a “**Linear model of innovation**” go like this: *basic research generates applied research of intermediary organisations (university-related institutions)*
- Next, “...firms pick up, and transform applied research to experimental development, which is then being introduced as commercial market applications”.
- The concept of “**Non-linear models of innovation**”, introduces a new relationship between basic research, applied research and experimental development.
- Thus universities or Higher Education Institutions (HEIs) in general, **university-related institutions and firms join together in variable networks and platforms for creating innovation networks and knowledge clusters, where** universities, university-related institutions and firms engage in a parallel process, performing simultaneously basic, applied research and experimental development.
- Mode 3 Innovations Ecosystem is thus about a model for a simultaneous coupling of “**non-linear innovation modes**” (see Figure 6).

Figure 6 Linear and non-linear innovation modes linking together universities with commercial and academic firms (firm units)

Model of linear innovation modes:



Model of non-linear innovation modes:



Source: Authors' own conceptualisation

The 'Mode 3' Systems Approach for knowledge creation, diffusion and use

- *'Mode 3' is a multi-lateral, multi-nodal, multi-modal, and multi-level systems approach to the conceptualisation, design, and management of real and virtual, 'knowledge-stock' and 'knowledge-flow', modalities that catalyse, accelerate, and support the creation, diffusion, sharing, absorption, and use of co-specialised knowledge assets.*
- *'Mode 3' is based on a system-theoretic perspective of socio-economic, political, technological, and cultural trends and conditions that shape the co-evolution of knowledge with the "knowledge-based and knowledge-driven, gloCal economy and society".*

Elias G. Carayannis, David F.J. Campbell, 'Mode 3' and 'Quadruple Helix': toward a 21st century fractal innovation ecosystem , Int. J. Technology Management, Vol. 46, Nos. 3/4, 2009 p. 201

Innovation

Source:
Etzkowitz & Leydesdorff
(2000)

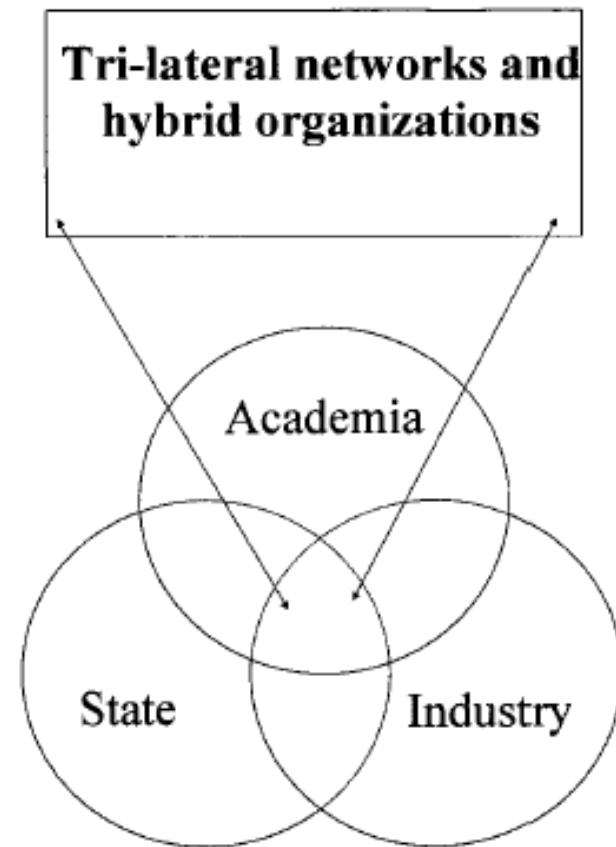


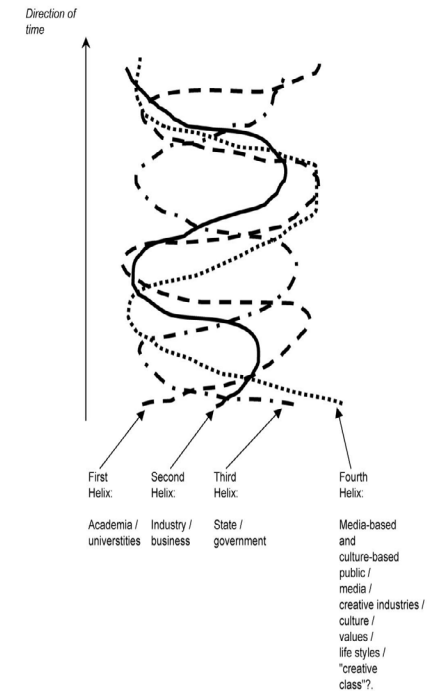
Fig. 3. The Triple Helix Model of University-Industry-Government Relations.

The Quadruple Helix Innovation Model

- The 'Triple Helix' model of knowledge, developed by Etzkowitz and Leydesdorff (2000) stresses three 'helices' that intertwine and by this **generate a national innovation system: academia/universities, industry, and state/government**.
- The Triple Helix model focuses on "university-industry-government relations" and networks, placing a particular emphasis on "tri-lateral networks and hybrid organisations", where those helices overlap.
- In extension of the Triple Helix model Carayannis and Campbell suggest a 'Quadruple Helix' model (see Figure 2).
- Quadruple Helix, in this context, means to add to the above stated helices a 'fourth helix' that is identified as the "media-based and culture-based public".
- This **fourth helix** associates with 'media', 'creative industries', 'culture', 'values', 'life styles', 'art', and perhaps also the notion of the 'creative class' (a term, coined by Florida, 2004).

Elias G. Carayannis, David F.J. Campbell, 'Mode 3' and 'Quadruple Helix': toward a 21st century fractal innovation ecosystem, *Int. J. Technology Management*, Vol. 46, Nos. 3/4, 2009 p. 201

Figure 2 The conceptualisation of the 'Quadruple Helix'

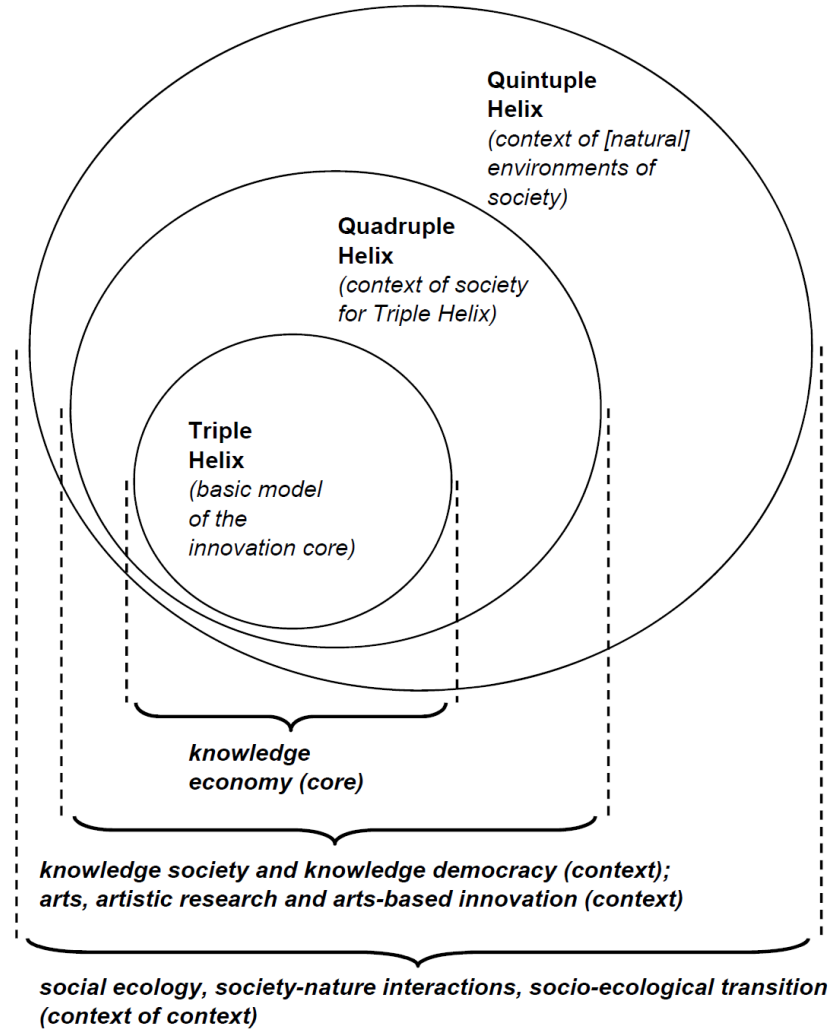


Triple Helix: University-industry-government relations (helices).
Quadruple Helix: University-industry-government-"media and culture-based public" relations (helices).

Source: Authors' own conceptualisation based on Etzkowitz and Leydesdorff (2000, p.112)

The Quadruple and Quintuple Helix innovation systems in relation to society, economy, democracy, and social ecology.

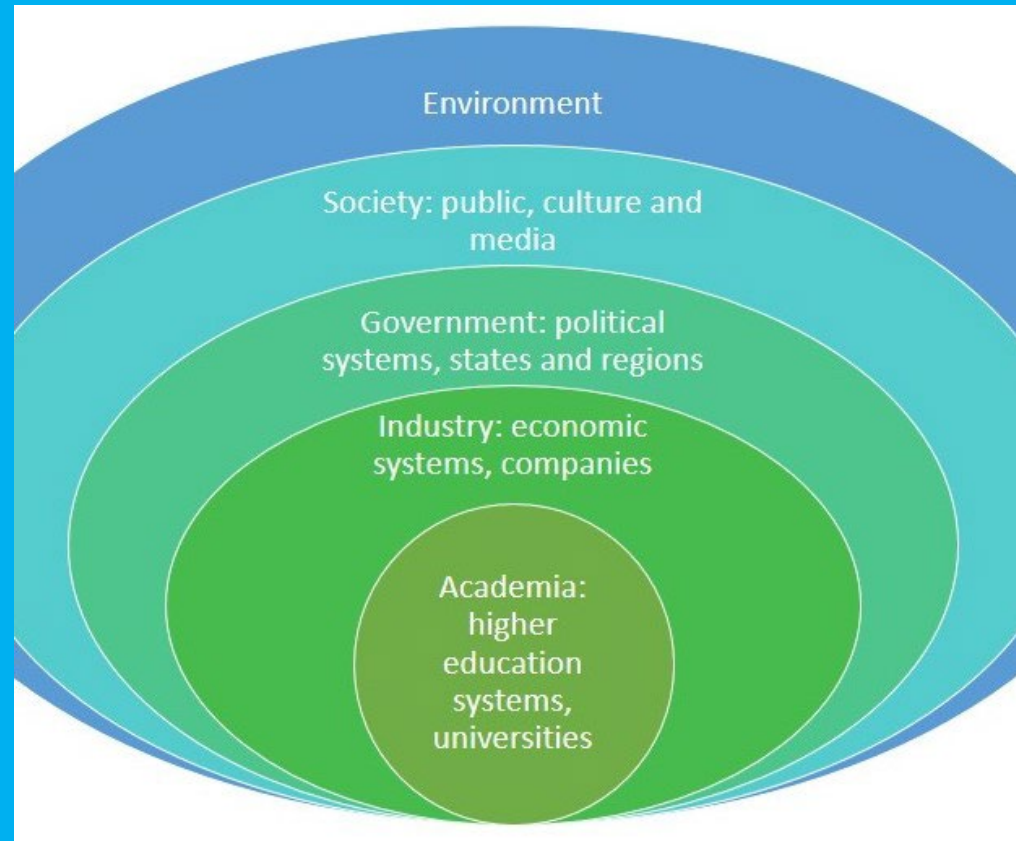
Innovation



Source:
Carayannis & Campbell
(2010, 2014)

Source: Authors' own conceptualization based on Carayannis, Barth and Campbell (2012, p. 4) and Carayannis and Campbell (2013).

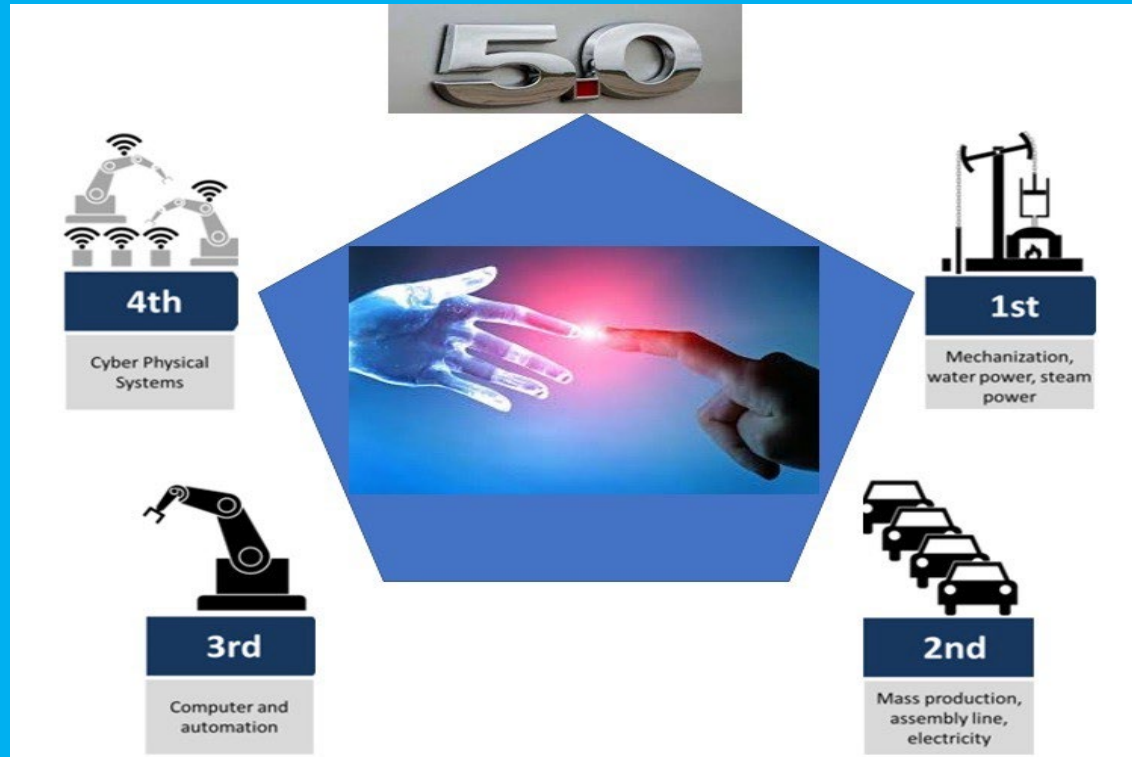
***Quadruple and
Quintuple
Innovation
Helix Models
(Q2IH Models)***





INDUSTRY 5.0

Techno-Centric AND Human-Centric



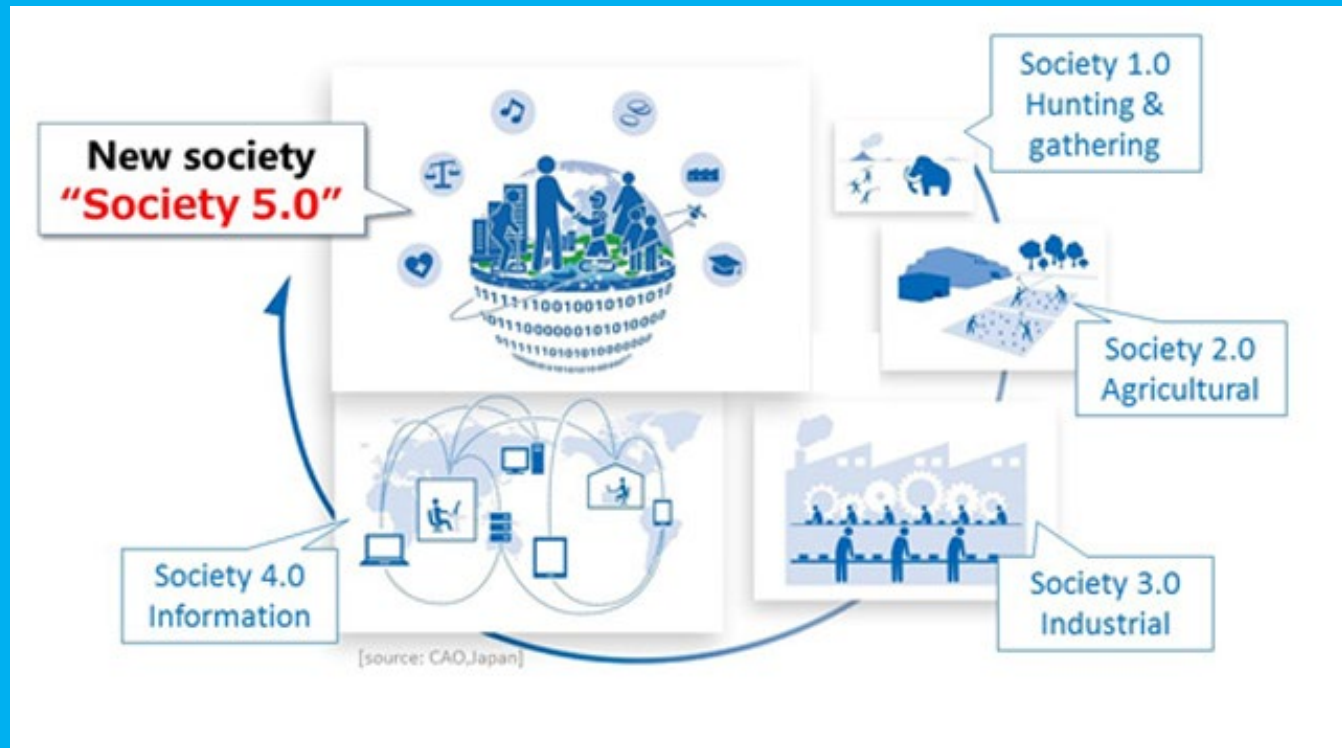
SOCIETY 5.0

Society 5.0 'aims to put human beings at the centre of innovation, taking advantage of the impact of technology and the results of industry 4.0 with the deepening of technological integration in improving quality of life, social responsibility and sustainability'



SOCIETY 5.0

FROM TECHNO-CENTRIC TO HUMAN-CENTRIC



ADAPTED FROM SLOVENIA TIMES, NOVEMBER 2019

Towards Universities 5.0 Digital, Institutional and Cultural Transformation

Today, universities are expected to fulfil manifold and increasingly challenging roles. Finding balance between participation in solving global issues and their local contexts is one of the challenges.

If universities wish to actively contribute to sustainability they need to go beyond their traditional functions of education, research and community outreach and to integrate social innovation in their core and new missions (Bayuno et al., 2020)

'In particular, universities are called upon to consider themselves as ***open systems*** in relation to their environment and actively seek the engagement of stakeholders, including municipalities, industry, civil society or development agencies' Dentoni and Bitzer (2014, p. 3).



Towards Universities 5.0: Digital, Cultural and Institutional Transformation

Change in values, attitudes, motivations and especially **LEADERSHIP STYLES AND PERSPECTIVES** which would also help transform and be enabled by a transformation of academic culture – for instance:

Embracing trans- and interdisciplinarity in research and education.

Promoting cross-sector and multi-actor collaboration.

Focusing more on social well-being and the quality of life.

Delivering tailor-made solutions through social/digital innovation.

***Universities need to “practice what they preach”
and actively engage with different stakeholders!!!***



TRANSFORMATION

INNOVATIVE ^ HIGH RISK

NEW AMERICAN UNIVERSITY

LAND GRANT UNIVERSITIES

LEADING EDGE INNOVATIVE UNIVERSITIES

AMERICAN RESEARCH UNIVERSITIES

SMALL SCALE <

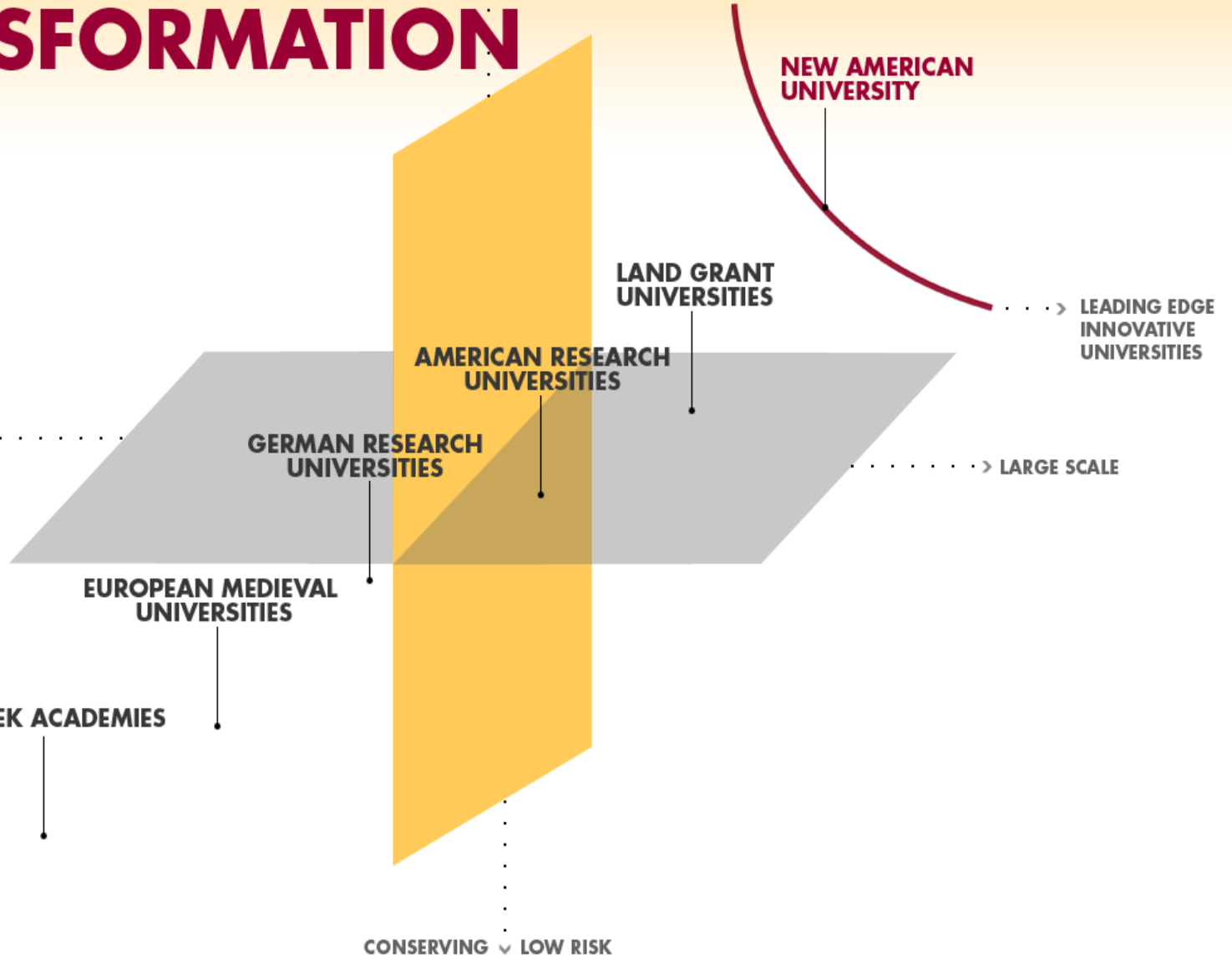
GERMAN RESEARCH UNIVERSITIES

. > LARGE SCALE

EUROPEAN MEDIEVAL UNIVERSITIES

GREEK ACADEMIES

CONSERVING v LOW RISK



FREIE

Fractal Research, Education and Innovation Ecosystem

CONTEXT MATTERS:

Institutional, socio-economic, regulatory/legal, socio-technical, socio-political and and cultural

HORIZON MATTERS:

A 5-10 year part of a longer term horizon - short-termism is a substantial risk-factor in policy-making and thus I would like to think generationally in educational matters - for instance, in a "University of Vienna 2050" vision roadmap

POLICY MATTERS:

The EU Education Policy 2030-2050 Agenda context, meaning we are thinking on a longer term basis than 5-10 years and on a regional / continental level than a specific university only albeit we do start at the university level as a pilot case and the first 5-10 years as the pilot implementation phase horizon

FREIE

*Based on these concepts, I would architect a university as **a flexible, open-learning, open-knowledge and open-innovation ecosystem** that would consist of a network of mutually complementary and reinforcing, **Trans-disciplinary Research, Education and Innovation Centers (TREICs)**.*

*Each Center would have as its **Charter DNA the Quadruple** (and even Quintuple to encompass the Environmental/Green Imperative) **Innovation Helix Philosophy** and the **Mode 3 Knowledge Production System Competence** and thus they would be organically intertwined with other Government, University, Industry and Civil Society entities locally as well as regionally and globally.*

*Moreover, I would consider each Center and the University itself as nodes (C-nodes and U-nodes) of a **Fractal** (self-similar and self-organizing via higher order learning processes) Glocal (Global/Local) **Research, Education and Innovation Ecosystem (FREIE)** whose “blood” would be knowledge and its circulation would take place via the pro-active and strategic socio-technologically and/or socio-economically targeted initiatives as well as intentionally triggering “happy accidents” of strategic knowledge serendipity and arbitrage value.*

FREIE

Each Center and the University per se would also be considered and leveraged as "Innovation Diplomacy Ambassadors" locally, regionally and globally and this means a cross-cutting and cross-leveraging set of visions, missions, strategies and tactics involving not only the Ministry of Education but also the Ministries of Economy, Development and Innovation and Entrepreneurship as well as the EU Innovation Commission.

Since each Center and University in the 21st Century University Model I outlined above would have to be as well as act as an autonomous, essentially self-managing and self-financing on a substantial basis (I would propose a modified Fraunhofer research funding model to fit specific contexts and priorities and with a dynamically adaptive configuration) but also organically and strategically integrated with other Center- and University-nodes part of FREIE.

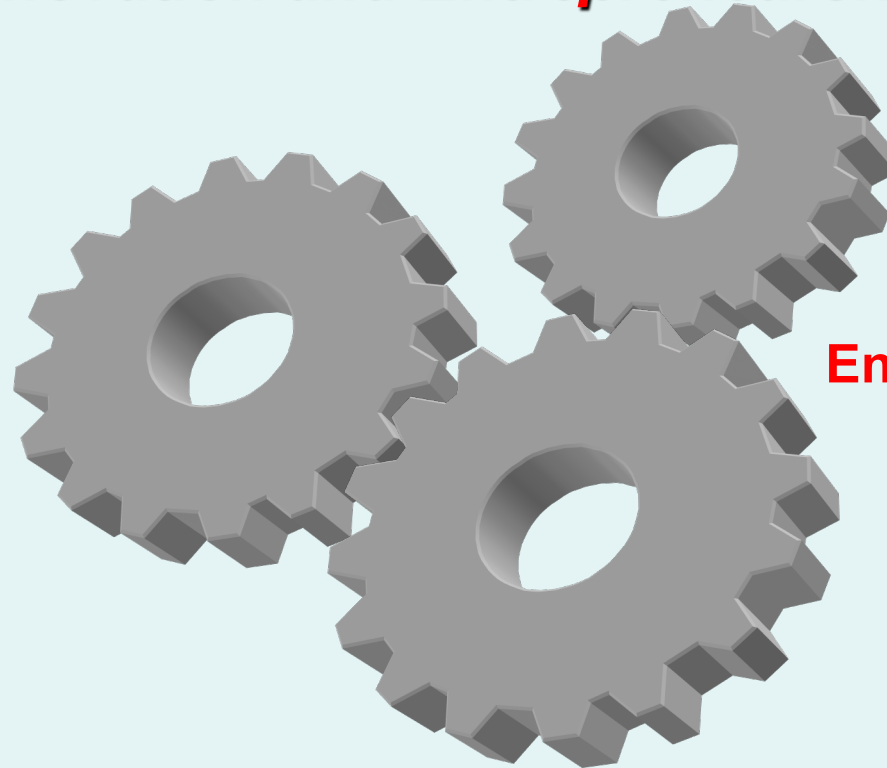
FREIE

I would envision as complementary and reinforcing devices of the knowledge production competence as well as the self-financing of FREIE a local/global, real.virtual network of Start-up Incubators, Science and Technology Parks and Technology Transfer Offices attached to each University-node and even Center-node as needed and warranted by size and significance of activities (see Carayannis at al, Glocal, Real/Virtual Incubator Networks, 2005).

I would like to envision an EU-wide FREIE emerging over the next ten years and becoming fully fledged by 2030 to encompass with effective organic links and bilateral as well as flexible, multi-lateral, multi-modal and multi-nodal strategic partnerships (the FREIE Architectural Blueprint (FREIE AB) and an evolution / complementary successor to prior pilots)

**FROM TACTICAL FRAGMENTATION
TO STRATEGIC INTEGRATION:
The Pieces Must Fit Together –
“Mode 3” Knowledge Production System for
Innovation and Entrepreneurship**

Innovation



Entrepreneurship

**Quadruple / Quintuple Helix:
Government-University-Industry-
Civil Society/Creative Media-Natural Environment**



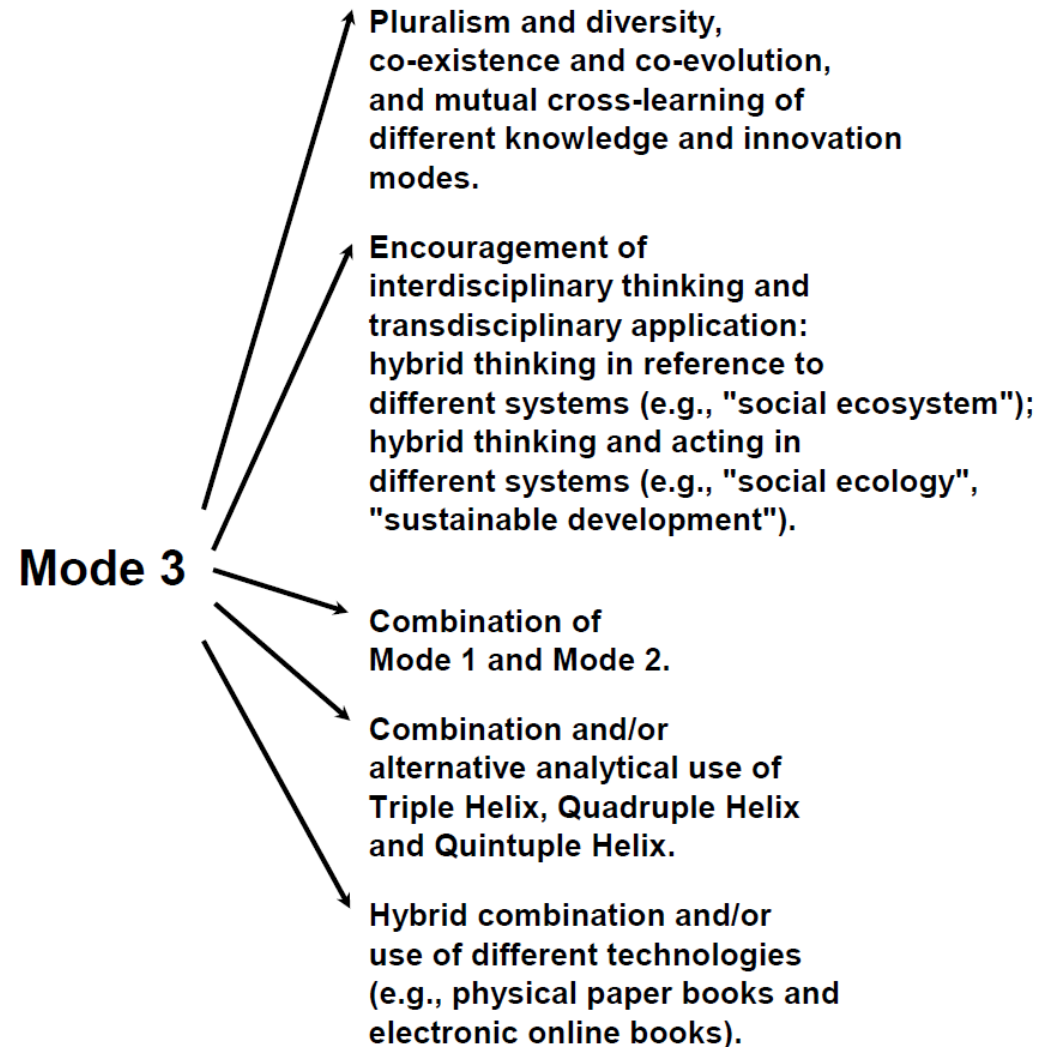
Conclusion

- “Mode 3”, “Quadruple Helix”, “Quintuple Helix” emphasize:
 - **Co-existence, co-evolution and co-learning (cross-learning) of different knowledge paradigms (research, innovation, etc.);**
 - **Basic Research in the Context of Application;**
 - Heterogeneity, diversity and creativity (CKEs);
 - Creative knowledge = new knowledge?
 - A **“Democracy of Knowledge”** (“knowledge swings”)?
 - Interdisciplinary and trans-disciplinary combinations (recombinations) of **“research in the sciences” and “artistic research”**.

Figure 2: Key features and propositions of Mode 3.



Conclusion

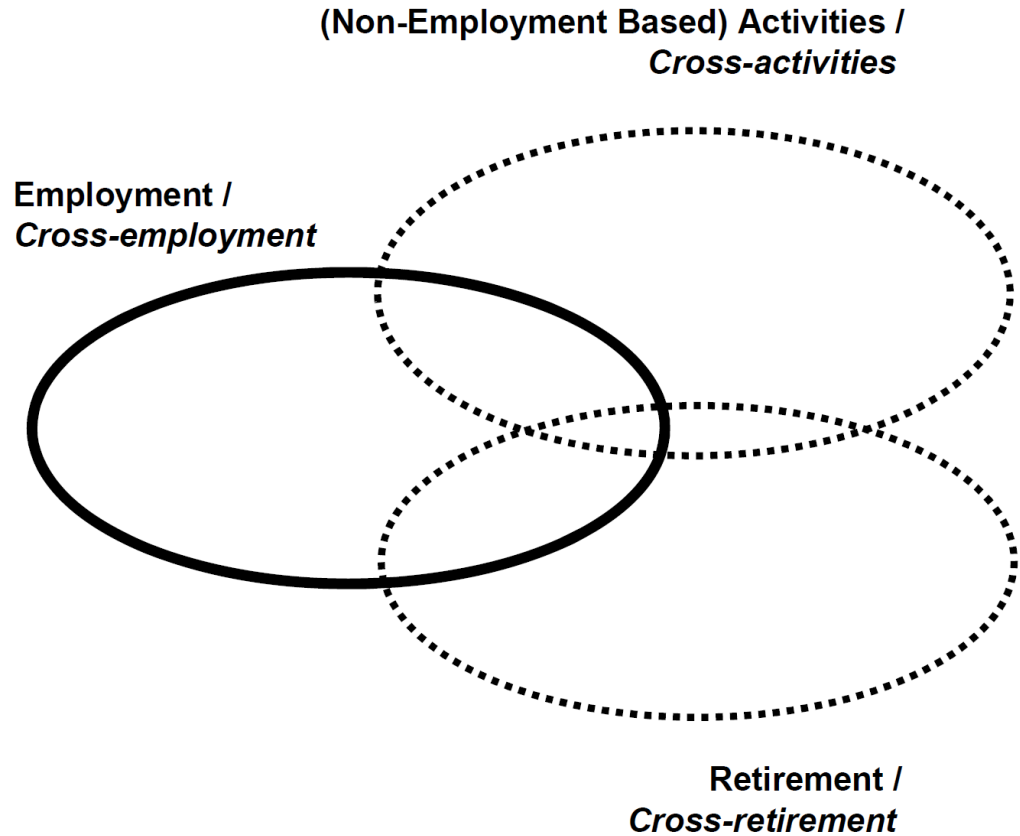


Source:
Carayannis & Campbell
(2010)

Source: Authors' own conceptualization.

The hybrid overlapping of employment and cross-employment with activities and retirement.

Conclusion



Source:
Campbell
(2014)

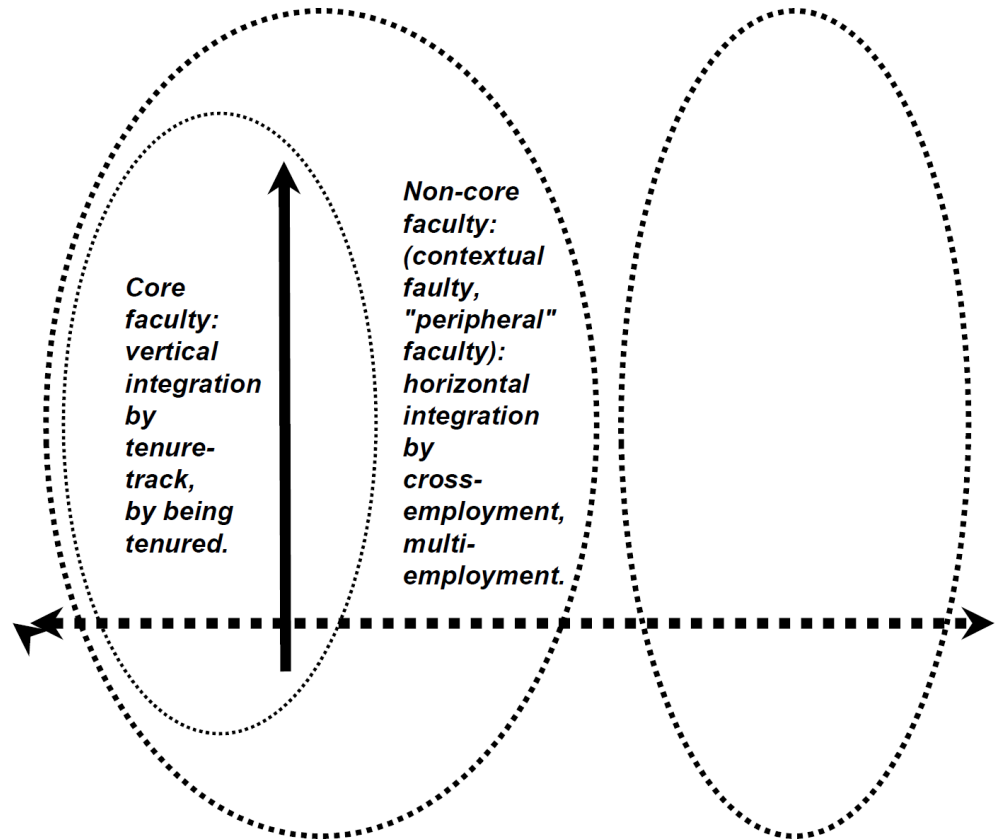
Source: Author's own conceptualization.

Conclusion

Vertical integration by tenure-track and horizontal integration by cross-employment (multi-employment): only within higher education or within and outside of higher education.

Higher Education System,
Higher Education
Institutions (HEIs)

Non-Higher Education
Systems (external to
Higher Education)

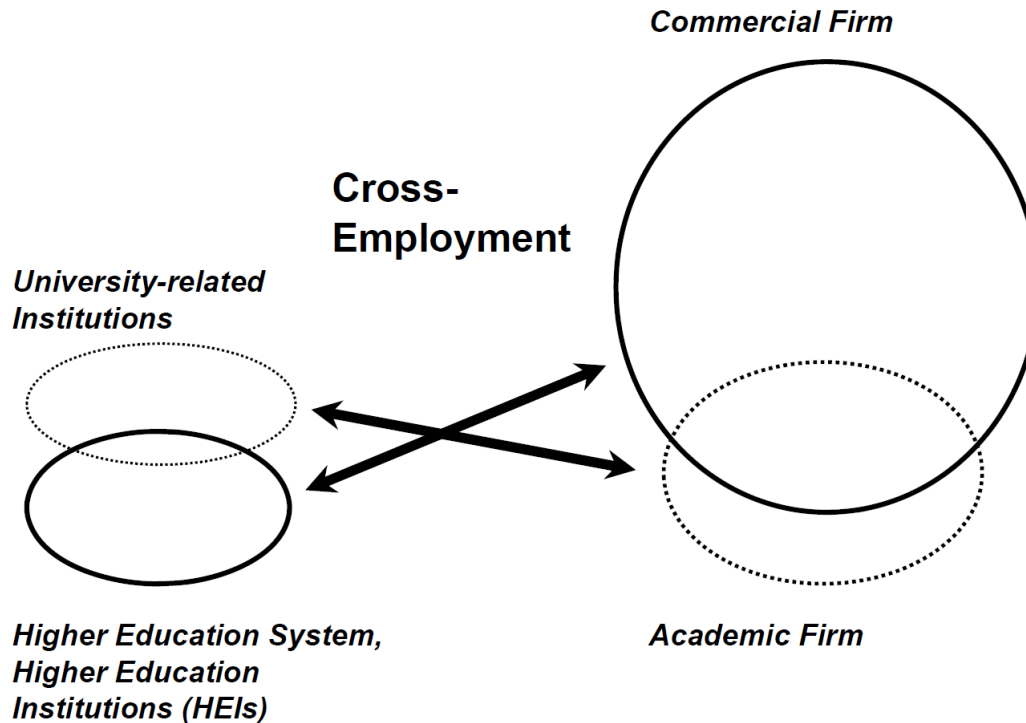


Source:
Campbell
(2014)

Source: Author's own conceptualization based on Campbell and Carayannis (2013, p. 68).

Conclusion

Possible network linkages of cross-employment between higher education and other organizations (sectors).



Source:
Campbell
(2014)

Source: Author's own conceptualization based on Campbell and Carayannis (2013, p. 29).



Conclusion

■ Discussion Points:

- What are implications for strategy, policy and governance (development)?
- What are the implications for universities (HEIs, “Mode 3 Universities”) and possible “academic firms”?
- What are the implications for basic research or for “basic research in the context of application”?
- How does “cross-employment” change careers (within and outside academia)?
- What are possible (better) designs for non-linear innovation (what can be here the role of “fractals”)?
- What are “innovation eco-systems”?

Ending Thoughts...

- *'Until philosophers are kings, or the kings and princes of this world have the spirit and power of philosophy,... cities will never have rest from their evils - no, nor the human race as I believe...'*

[Plato, *The Republic*, Vol. 5, p. 492]

- *'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]

She – she !!! 😊





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Aris Kaloudis
and Åge Mariussen

Diversity in the Knowledge Economy and Society

Heterogeneity, Innovation and Entrepreneurship

Series editors: Elias G. Carayannis and Aris Kaloudis

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Creative Destruction
Evolving into “Mode 3”

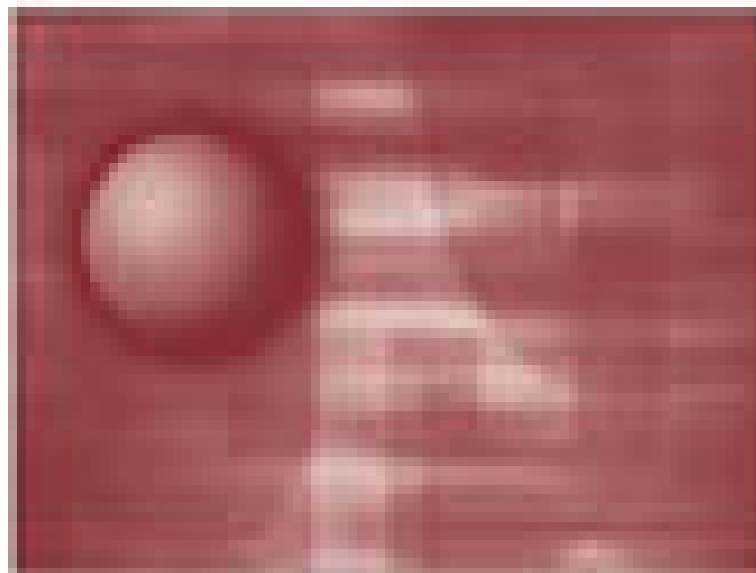
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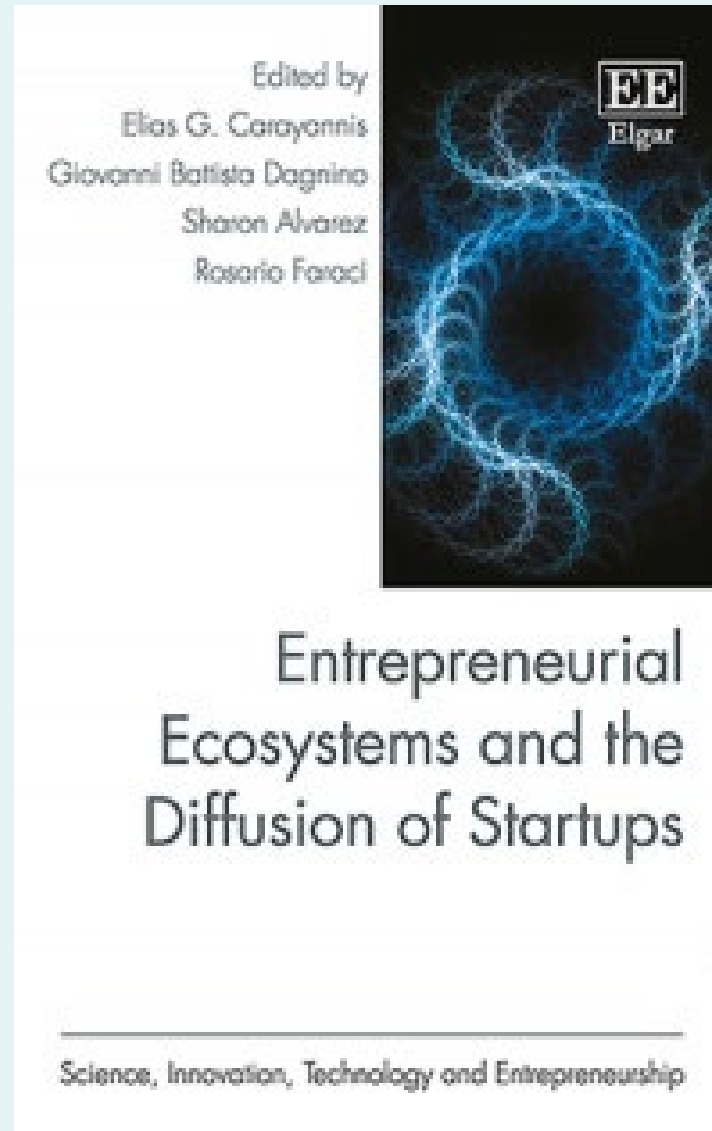
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