



Articulating knowledge and institutional dynamics in Europe – an account of exploratory analysis (ERA Dynamics)

Stefan Kuhlmann, University of Twente

(and Peter van den Besselaar, Dietmar Braun, Jakob Edler, Luisa Henriques, Philippe Larédo, Terttu Luukkonen, Barend van der Meulen, Maria Nedeva, Daniel Pardo, Emanuela Reale, Duncan Thomas)

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Overview

- Assessing an emerging European research system – strategic needs
- The project ERA Dynamics (PRIME NoE)
 - Knowledge dynamics and institutional “configurations”
 - Chemistry case study
 - Conceptual and empirical work in progress

Assessing an emerging European research system – strategic needs

- In Europe, a supra-national (even post-national?) research system is emerging ("ERA")
- Need for improved strategic intelligence and indicators to understand the actual dynamics
- Work on needs, conceptualisation and feasibility of ERA-related assessment
- PRIME Network of Excellence (FP6) aims to develop long-term research and shared infrastructures on policies for research and innovation in the move towards ERA.
- PRIME works at the interface of academia-based exploration of new concepts and strategic intelligence for policy-making.
- Today's presentation is based on running experimental research work in progress targeted at policymaking, asking for your critical reaction!

Content matters – role of knowledge dynamics

Core hypothesis of PRIME NoE project

‘ERA-Dynamics’:

- Different dynamics *knowledge* production (KnowDyn)

correspond to

- different *institutional arrangements and policies* (InstArr)

= evolving ‘configurations’, borne by institutional change

Why ERA Dynamics ?

- Implications for an 'advanced' ERA: *different knowledge dynamics* appearing in different 'configurations' will evolve with different policy mixes:
 - ➔ **One size does not fit all!**
- Traditional EU subsidiarity policy model is too mechanic: In relevant (not all!) fields purely national policy approaches fall too short; also 'federal' policy approaches (like FP) don't suffice:
 - ➔ new mixed '**intra-European**' **institutional settings and policy approaches** and institutionalization patterns are likely to emerge.

Knowledge dynamics

‘Search regimes’ of knowledge production

with three main ‘aspects’ (Bonaccorsi 2006):

- **Growth** = capacity to survive and/or prosper within the same institutional and organisational setting. Indicators: publications, patents, exports
- **Convergence** = modalities of knowledge flows, and in particular opposing ‘individual’ vs. ‘distributed knowledge’ and the collaboration patterns
- **Complementarities** =
 - **Technical complementarities** = role of large shared infrastructures or equipment (critical infrastructures)
 - **Cognitive complementarities** = collaboration patterns (bilateral vs. multilateral e.g. networks and clusters); critical mass, competences to be assembled to develop a relevant ‘research production unit’
 - **Institutional complementarities** = heterogeneous collaboration for efficient productive settings (e.g. strong relationship between clinicians and biologists in biotechnology); frequency of industry-university collaborations

KnowDyn | InstArr – examples from history

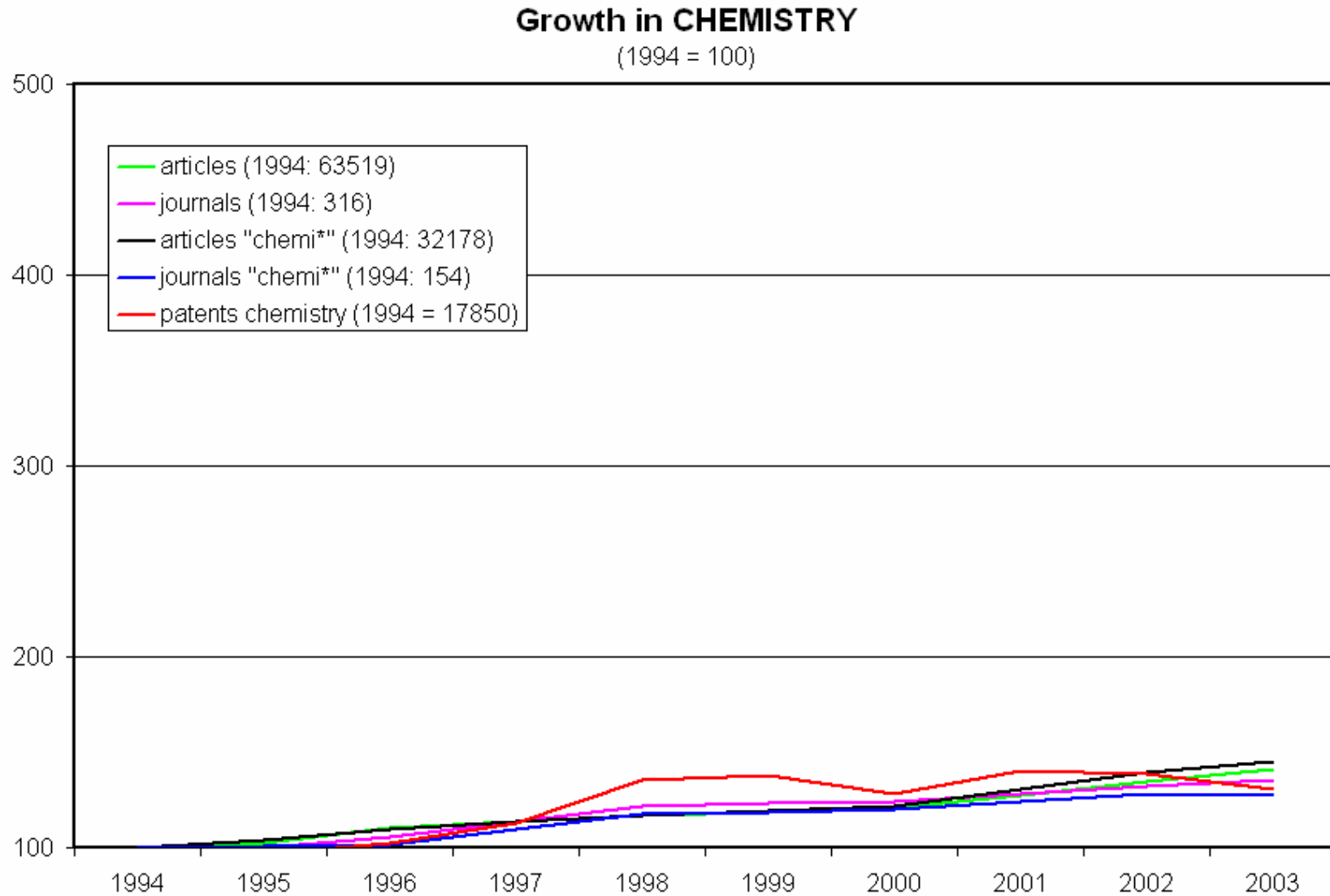
<i>Dominant science-led knowledge field</i>	Physics	Computer science / TI	Molecular biology
<i>Dynamics / crystallisation (Cognitive complementarities)</i>	Large objects or technical systems	Distributed PI (patent pools...)	Science bases / individual PI & transfer/licences
<i>Trajectory (degree of convergence)</i>	Early selection of a dominant design / cumulative improvements	Adoption of standards and design	Competition between paradigms
<i>Critical infrastructures (technical complementarities)</i>	Specific very large equipments	Generic infrastructures (broadband networks...)	No entry barrier
<i>Coordination mode (driving institutional complementarities)</i>	National large programmes (product oriented)	Technological programmes Strong industry-university relations	Networks & clusters (bottom-up)
<i>Main industrial actors</i>	National champions (specialising in “public” infrastructures/ services)	MNF (oriented toward mass markets) / specialised NTBF (B to B)	Start-up & venture capital (in early phases) (concentration around large established firms in wider diffusion)
<i>‘representative’ industries</i>	Nuclear energy, space, civil aeronautics, fixed numerical telecoms	Information technology, mobile communications	biotechnology

Source: Laredo, 2006

Chemistry: Knowledge dynamics and institutional setting

- Consolidated regime of chemistry as a discipline: low to medium growth, low diversity, low complementarity
- Institutional setting:
 - dominance of the laboratory based model in public research with established lasting hierarchy
 - key role of large firms turning multinational
 - long lasting I-U co-operations, bilateral
- Public national policies, delegated to 'agencies' (= 'operators') in a bottom-up peer review based model
- Limited European activities: strong industry association (CEFIC) for regulation; learned societies

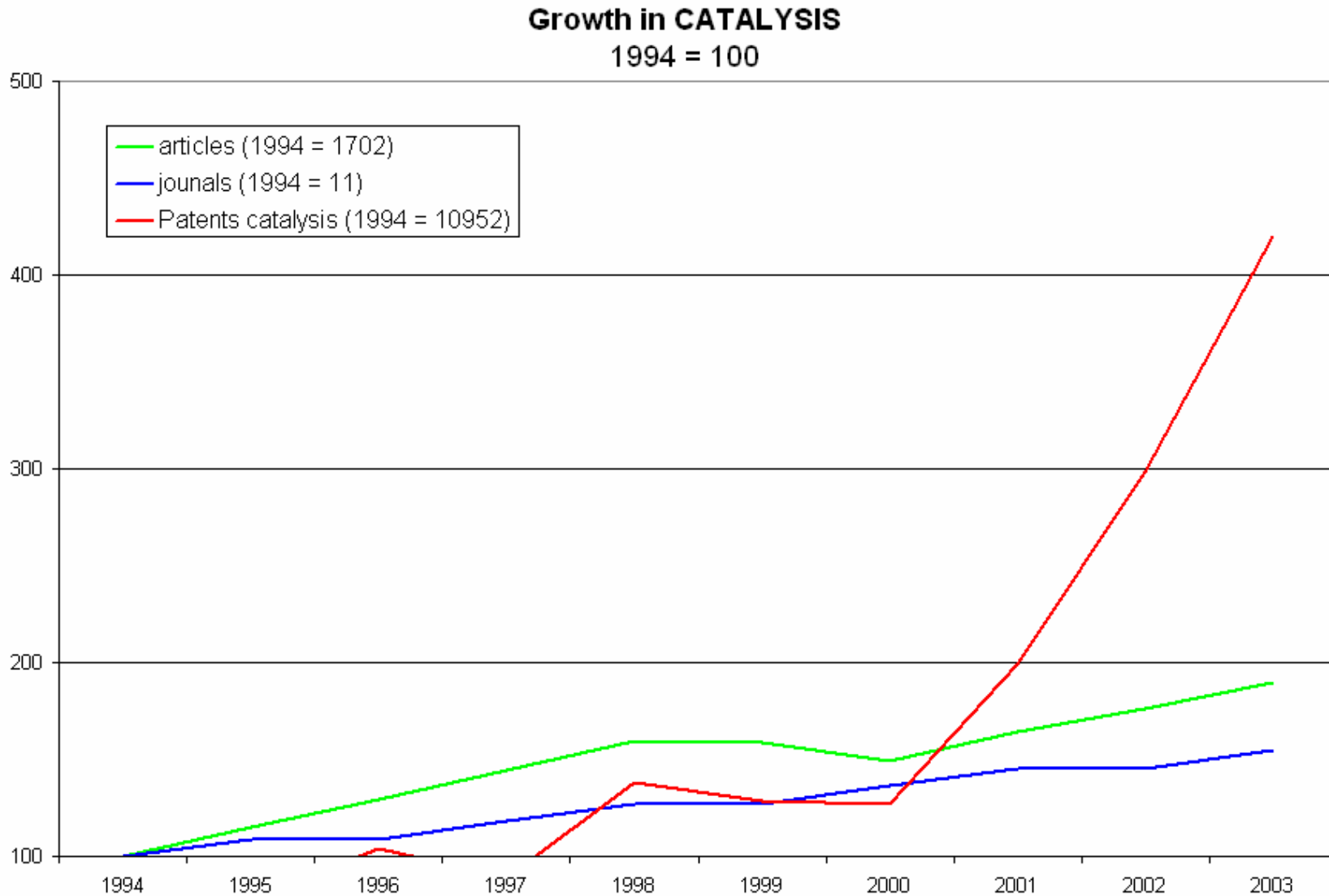
Chemistry: slow growth



Evolving configuration 'Catalysis'

- **Knowledge dynamics:** catalysis (and bio-catalysis) witness different dynamics
- **New institutional possibilities** at European level taken-up by actors in chemistry
- Combination drives to a **variety of views** with different consequences for intra-European policy initiatives

Catalysis grows twice as fast



Chemistry: One size does not fit all

- Europe is not the same for catalysis actors and chemistry actors
- **Chemistry** research actors continue to work with national support schemes, FP, and industry; new request for flexible post-national funding (beyond ERC)
- **Catalysis** research actors anticipate fully fledged European structure and “configuration” of its own covering academic and ‘targeted’ industrial dimensions
 - ERA Nets as a transition, disconnecting from their national origins?
- Can we consider these two futures as complementary? And if so what do they tell us about the need for intra-European instruments?

KnowDyn | InstArr in wider context

Knowledge configurations are 'driven' by

- Specific characteristics of knowledge dynamics of different research and innovation themes
- Institutional arrangements
+ public policy initiatives and traditions
 - Regulation
 - Organisation of STI policy agency
 - Historical path dependency
 - Degree of Europeanisation
- Techno-industrial dynamics
 - market characteristics,
 - sectors
 - user behaviour and expectations
- 'Societal' concerns (sustainability, 'public goods')



Europeanisation

KnowDyn | InstArr – Lessons from Science Studies (1)

(adapted from working paper by T. Luukkonen & M. Nedeva, 2007)

- **R. Whitley (2000)**
 - ‘...differences and changes in scientific knowledges can be understood in terms of differences and changes in the system of their production and evaluation considered as types of work organisation termed intellectual fields.’ (Whitley, 2000, p. 33)
 - Fields differ in terms of ‘mutual dependence’ (functional, strategic) and ‘task uncertainty’ (technical, strategic)
- **T. Shinn (1999), 3 ‘principles’:**
 - First: Scientists’ tendency to selectively merge and integrate initially diverging facts, concepts, reasoning processes
 - Second: Science is characterised by a pattern of distributed labour (changing constellations)
 - Third: Opportunistic niching (Scientific institutions, and the orientation of research, never operated along a smooth continuum)

KnowDyn | InstArr – Lessons from Science Studies (2)

(adapted from working paper by T. Luukkonen & M. Nedeva, 2007)

- **‘Finalisation of science’ (Böhme, van den Daele, Hohlfeld, 1983)**
 - Pre-paradigmatic phase: Interfering with external goals
 - Paradigmatic phase: Just internal discourse
 - Post-paradigmatic phase: Application can refer to external goals
- **‘Pasteurs Quadrant’ of D. Stokes (1997)**
 - Pure basic research (Bohr)
 - Pure applied research (Edison)
 - Use-inspired basic research (Pasteur)

ERA-Dynamics approach (I)

- Europeanisation processes: the take-up and use of specific policy instruments (such as ERA-Nets, NoE, Technology platforms, ERC, etc.) are field and configuration dependent.
- Actors in evolving configurations use policy instruments (such as ERA-Net) in different ways; they aim to shape configurations to achieve “desirable” futures.

ERA-Dynamics approach (II)

- Different knowledge configurations develop different modes, measures, and patterns of co-ordination of actors and initiatives.
- Studying selected configurations in hindsight, we can identify co-ordination patterns
 - By level of aggregation (intra-organisational, regional, national, supra-national),
 - By role of inherited national institutional context for knowledge dynamics,
 - By role of vertical and horizontal “post-national”, “intra-European” levels of policy action, including the specific role of ERA-based policies
 - By policy ‘functions’ for institutional change.

ERA-Dynamics approach (III)

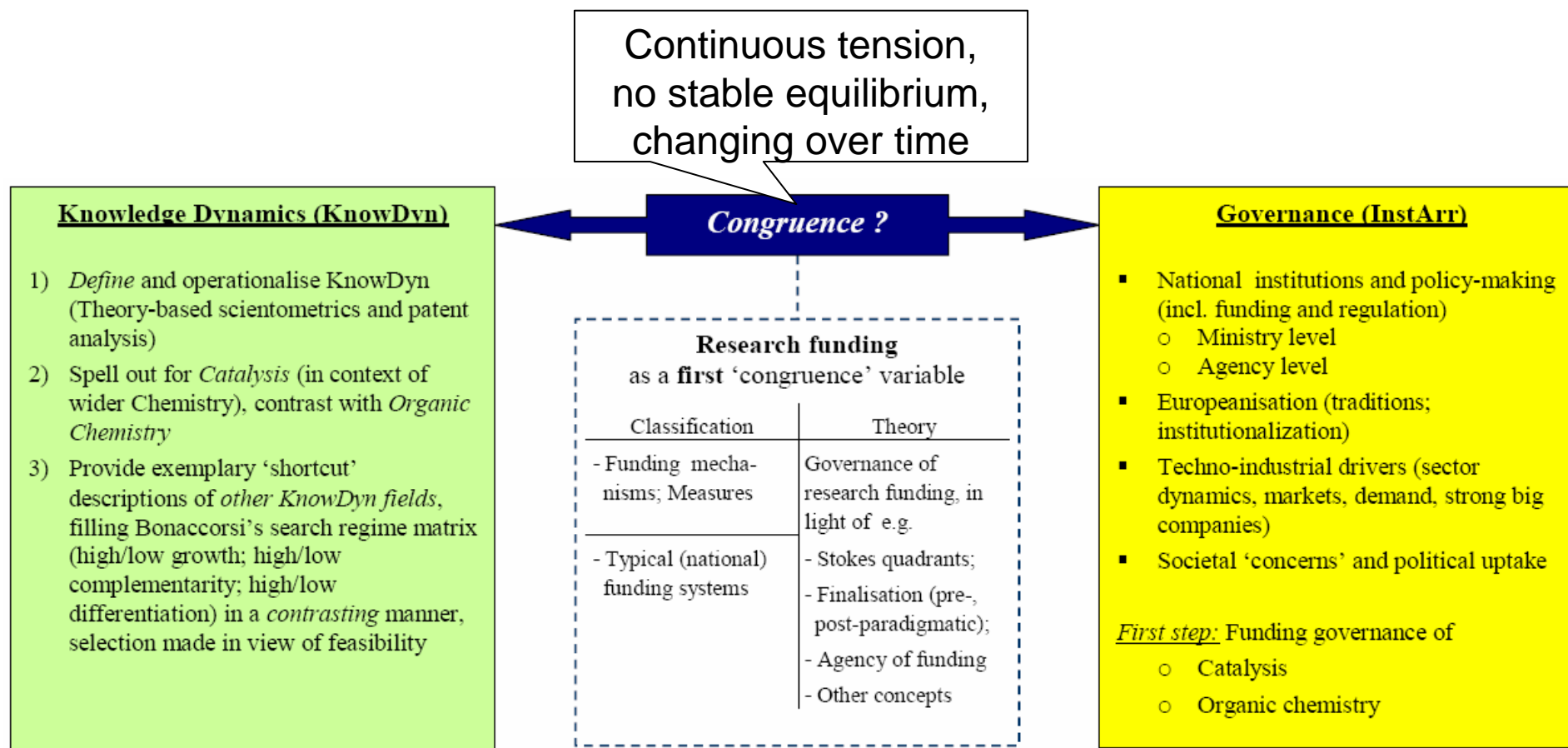
Linking KnowDyn | InstArr: Policy 'functions'

	<i>Policy 'functions' for institutional change</i>			
<i>Knowledge dynamics</i>	Coordination	Integration	Competition	Non-related
Growth				
Convergence / diversity				
Complementarities				

ERA-Dynamics approach (IV)

- Identifying a **stylised set of configurations** would allow to work in a prescriptive manner:
 - Pin-point institutional gaps,
 - Delineate co-ordination mismatch,
 - Develop options for institutional development and policy making through foresight
 - Helping to define “intra-European” policy needs.

ERA Dynamics – becoming ‘modest’



Operationalising KnowDyn | InstArr

- KnowDyn: scientometric and technometric empirical analyses in selected fields
 - Chemistry / Catalysis
 - Nanoscience and technology
 - Genetic modification of plants
 - ‘Water management’ ?
 - ... ?
- InstArr: Focus on ‘funding arrangements’
- KnowDyn | InstArr – Integrated ‘functional’ analyses of selected configurations and countries (incl. EU level) aiming at stylised models

InstArr: Focus on ‘Funding Arrangements’

Dominant funding relationship	Number of funding bodies	Number of research units	Dominant funding modes	Funding Arrangement
Patronage	One	Few or multiple	Generic	1.National “system”
	Many	Multiple	Generic	1.Territorial fragmented
Authority	One	Few	Targeted	1.Nationalised arrangement
	Many	Multiple	Targeted	1.Functionally fragmented
Market	Many	Multiple	Contract	1.Real market
	One	Multiple	Contract	1.Monopsony
	Many	One /Few	Contract/ collaborative	1.Monopoly / Cartel
Network	Many	Multiple	Heterogeneous	1.Network
			Collaborative	1.Formal network

ERA-Dynamics project

see: <http://www.prime-noe.org>