Capturing visions in Emerging Fields

Structuring the problematique and some first steps via the case of Asynchronous Logic

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Mapping the Dynamics of Emerging S&T

- Joint project funded via ANR and ESRC
- SPRU (UK) & LATTS (FR)
- Objective
  - to create a support system for capturing details of the dynamics of emerging S&T
  - To create a tool-set / technique-set that can cope with the diversity and heterogeneity of emerging S&T cases
  - Where the findings are USER-FRIENDLY

Key Questions

- How do epistemic communities come into being?
- What are the mechanisms underlying the process of community integration?
- How can the development of epistemic communities be effectively managed and influenced by public policy?
- How do the infrastructures that form and guide markets emerge? Are they constructed? What ware the mechanisms at play?

Method and tool question:

How can we create a system of finding insights into these questions and provide it in a usable way for policy makers (or those that provide intelligence for decision making)

Dynamics/Concepts

Generation, Integration and translation *(a.k.a.emergence, alignment & linkages, innovation)*

Crystallising agents *(a.k.a. emerging irreversibilities*)

Expectations of utility *(a.k.a. structuring expectations, normativities, visions)*

- ***Methods***
- Mapping cognitive networks: Global and overlay maps, co-citation or bibliographic coupling maps, coword maps
- Mapping social networks: co-authorship of papers at two levels of aggregation (1) individual, (2) organization.
- Mapping institutional developments: Interviews and application of field configuring Event theory)
- Methods for capturing expectations, visions and enacted normativities: interviews, qualitative case study approaches, interactive workshops and q-methodology.

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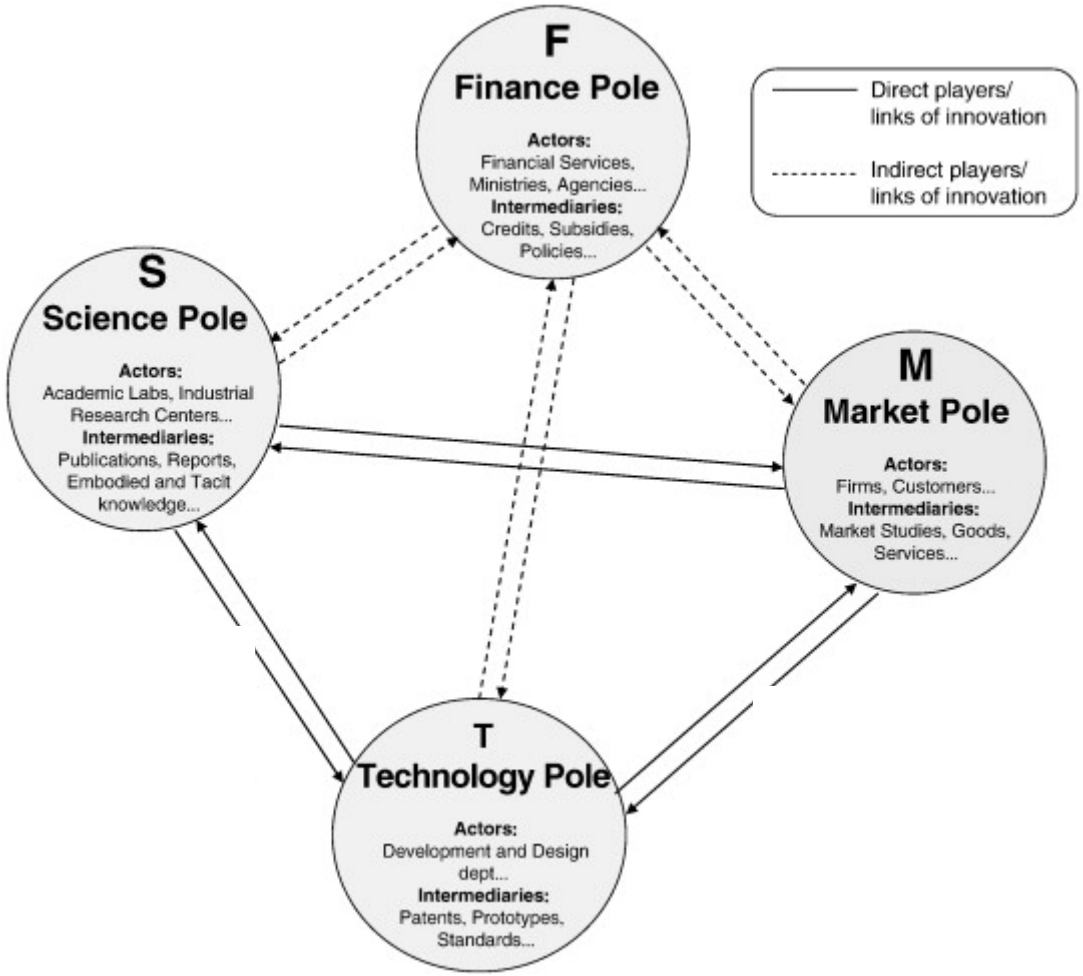
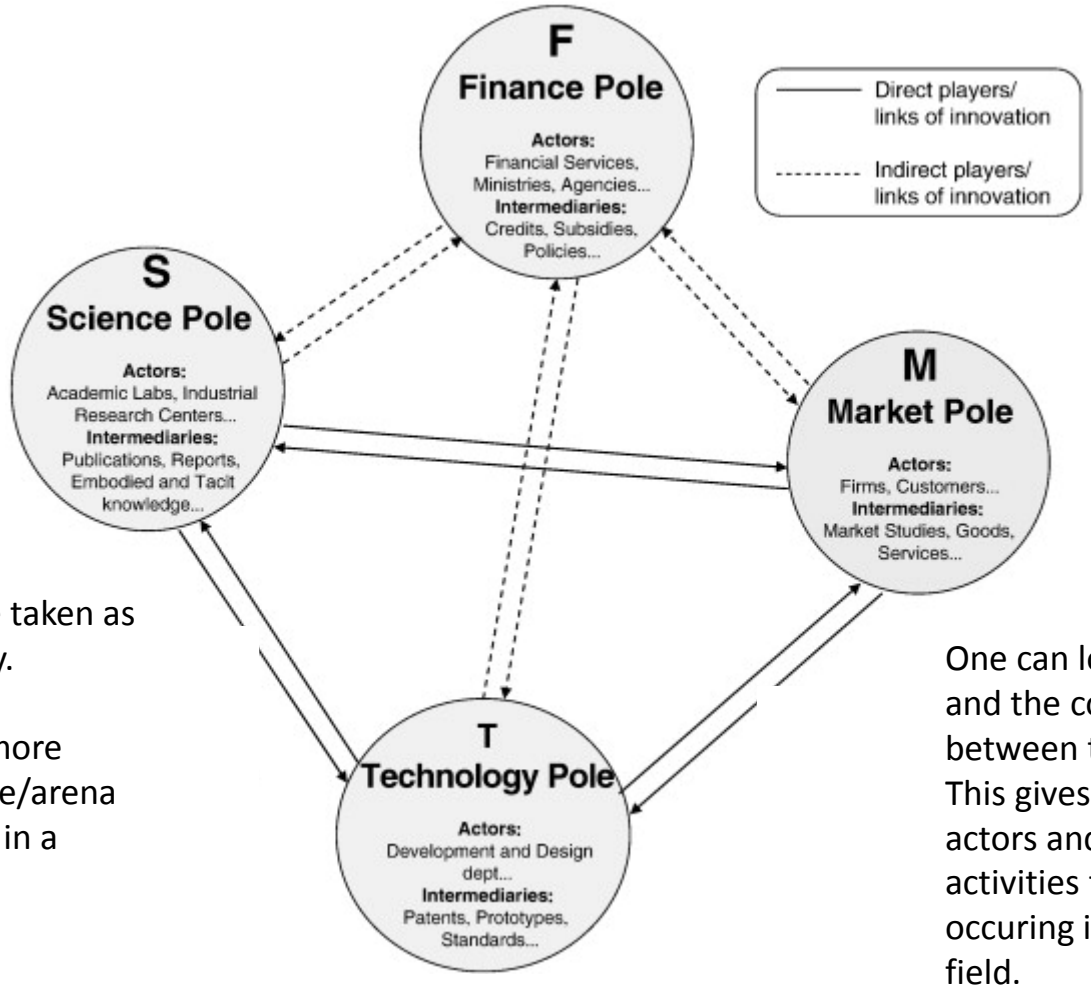
A key challenge which we will come back to this

Techno-economic network



Islam et al. After Callon

Techno-economic network



The Poles can be taken as arenas of activity.

Actors that are more active in one pole/arena may be involved in a different arena.

One can look at each Pole and the connections between them over time. This gives an idea of the actors and (some) of the activities that are occuring in an emerging field.

Islam et al. After Callon

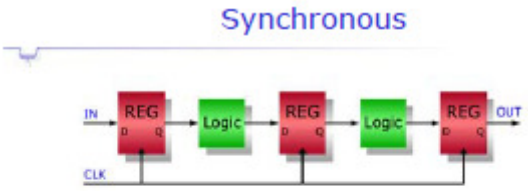
Visions an enacted normativities

Visions an enacted normativities

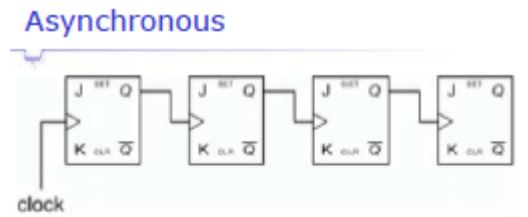
- The challenge is to capture visions and enacted normativities (the values and visions that are mobilised and shape the directions of an emerging field).
- Linked to specific actors and arenas.
- How do we capture these over time, and how do we capture them now?
- Let’s look at this challenge with a case vignette

Asynchronous Logic

- What is it?



- Simple design
- Global clock
- High power consumption



- No global clock
- Largely autonomous parts
- Different implementations
  - Bounded delay method
  - Delay insensitive method
  - Quasi delay insensitive method
  - Speed-independent method

- Technology for logic (computer processing) in a digital computation regime (based on switching 0/1 binary)
- Is part of the computer chip world
- Has potential advantages over the incumbent clocked based logic….heating, speed, security.
- Been around since the 1950s…I will come back to this

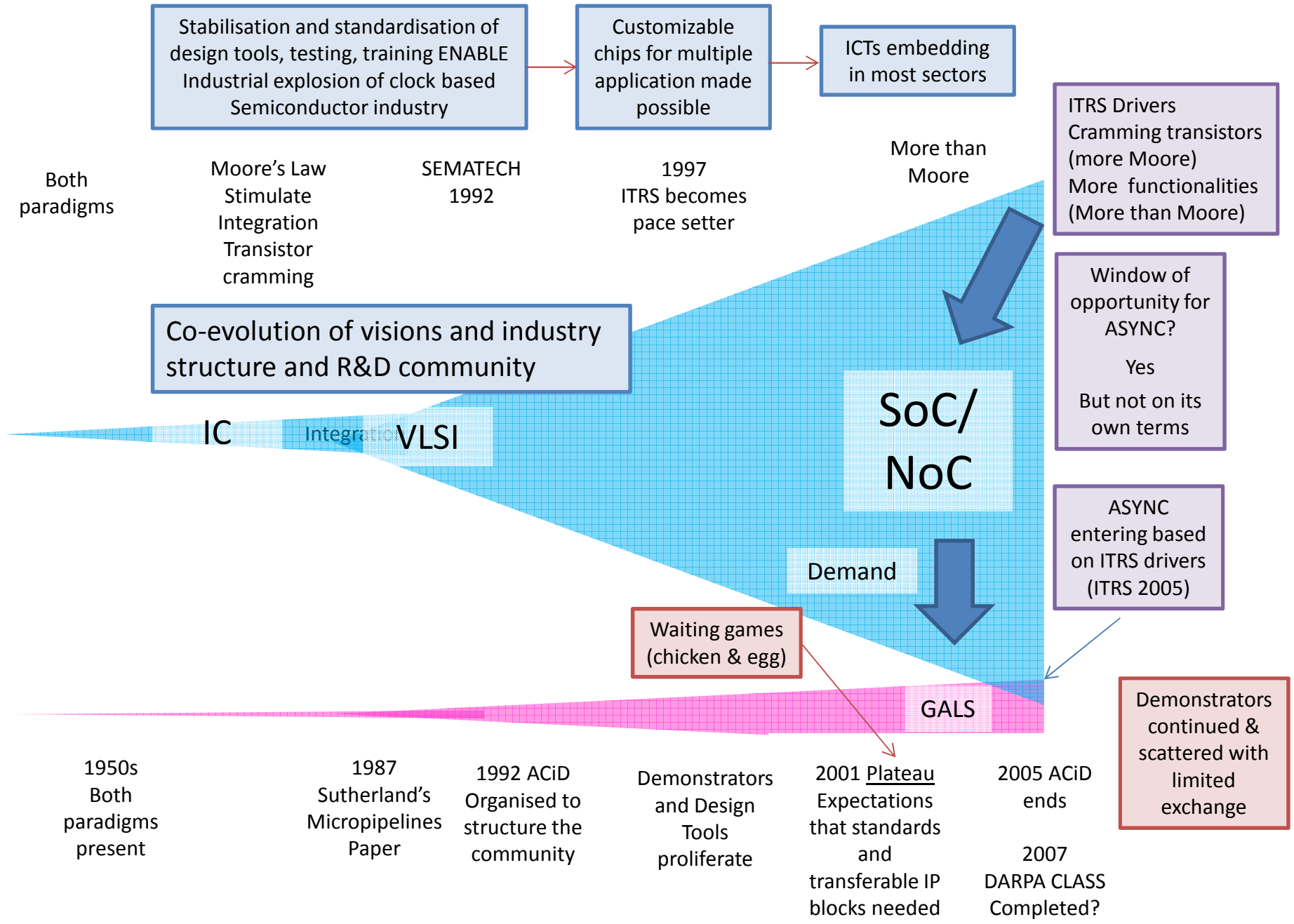
Can trace it chronologically through events

POLES	Research (knowledge production in Science and Technology)	Technology Development (demonstrators, prototype, working technological artifact)	Market Construction (The transformation of niche to mainstreanm) definition of standards, of use)	FINANCE
2000	ACiD-WG continues to grow in members and activities			Second turning point ACiD-WG
2002		Azuro Ltd created in Cambridge University		
2003		Silistix Ltd founded as a spin-off of the Manchester Amulet group.		
2005	There was a surge of interest in GALS and NoCs around 2005, but interest in asynchronous circuit design was on the wane (in Europe). ACiD-WG funding was halted (community continues to meet and exchange at IEEE ASYNC annual conference).			"I was sorry to learn that Philips had shut down Handshake Solutions a few years later; their DICY/TANGRAM/HASTE compiler and the systems and components that had been designed with it inspired the researchers involved in ACiD-WG over the years, and their technology also improved through the collaboration. Also, it was sad that Silistix didn't succeed with their CHAIN interconnect and closed down."
2005		DARPA CLASS project 2005-2007 lead by Boeing to (a) demonstrate commercial viability and (b) create a legacy of CAD design tools, provided a positive boost for async R&D in the US		
2006		It was clear to the participants of the DARPA-CLASS project that another 3 years would be needed to deliver results on the original "ambitious" project[2], but proposal for next round of funding was confounded by the coordinator of the project leaving, and no replacement available.		

But this new technology field is not occuring in a vacuum!

One can also look at the story of ASYNC from the perspective of chip manufacture

Where
COMPETING OPTIONS,
INCUMBENTS,
WINDOWS OF OPPORTUNITY FOR EMBEDMENT
are visible


Stabilisation and standardisation of design tools, testing, training ENABLE Industrial explosion of clock based Semiconductor industry
Customizable chips for multiple application made possible
ICTs embedding in most sectors
Both paradigms
Moore's Law Stimulate Integration Transistor cramming
SEMATECH 1992
1997 ITRS becomes pace setter
More than Moore
ITRS Drivers Cramming transistors (more Moore) More functionalities (More than Moore)
Co-evolution of visions and industry structure and R&D community
Window of opportunity for ASYNC?
Yes
But not on its own terms
IC
VLSI
SoC/ NoC
Demand
ASYNC entering based on ITRS drivers (ITRS 2005)
Waiting games (chicken & egg)
GALS
Demonstrators continued & scattered with limited exchange
1950s Both paradigms present
1987 Sutherland's Micropipelines Paper
1992 ACiD Organised to structure the community
Demonstrators and Design Tools proliferate
2001 Plateau Expectations that standards and transferable IP blocks needed
2005 ACiD ends
2007 DARPA CLASS Completed?

Chip manufacture doesn’t occur in a vacuum!!

It is linked to uses of chips (and evolutions of chips) into applications, into markets and into society!!!

Computation and Smart tech

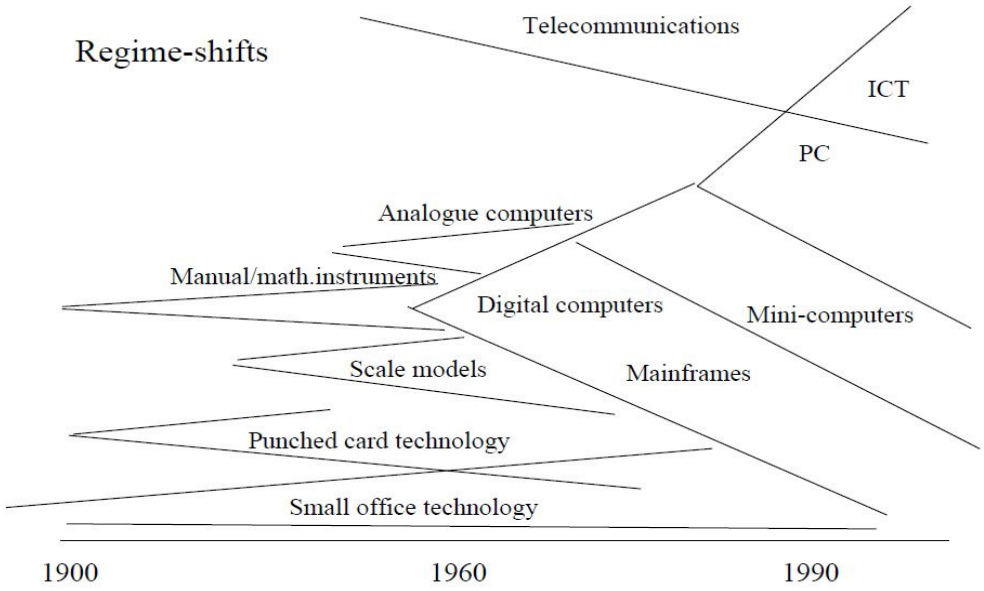


Figure 1: Paradigms in computing technology.
Source: Van den Ende and Kemp (1999)

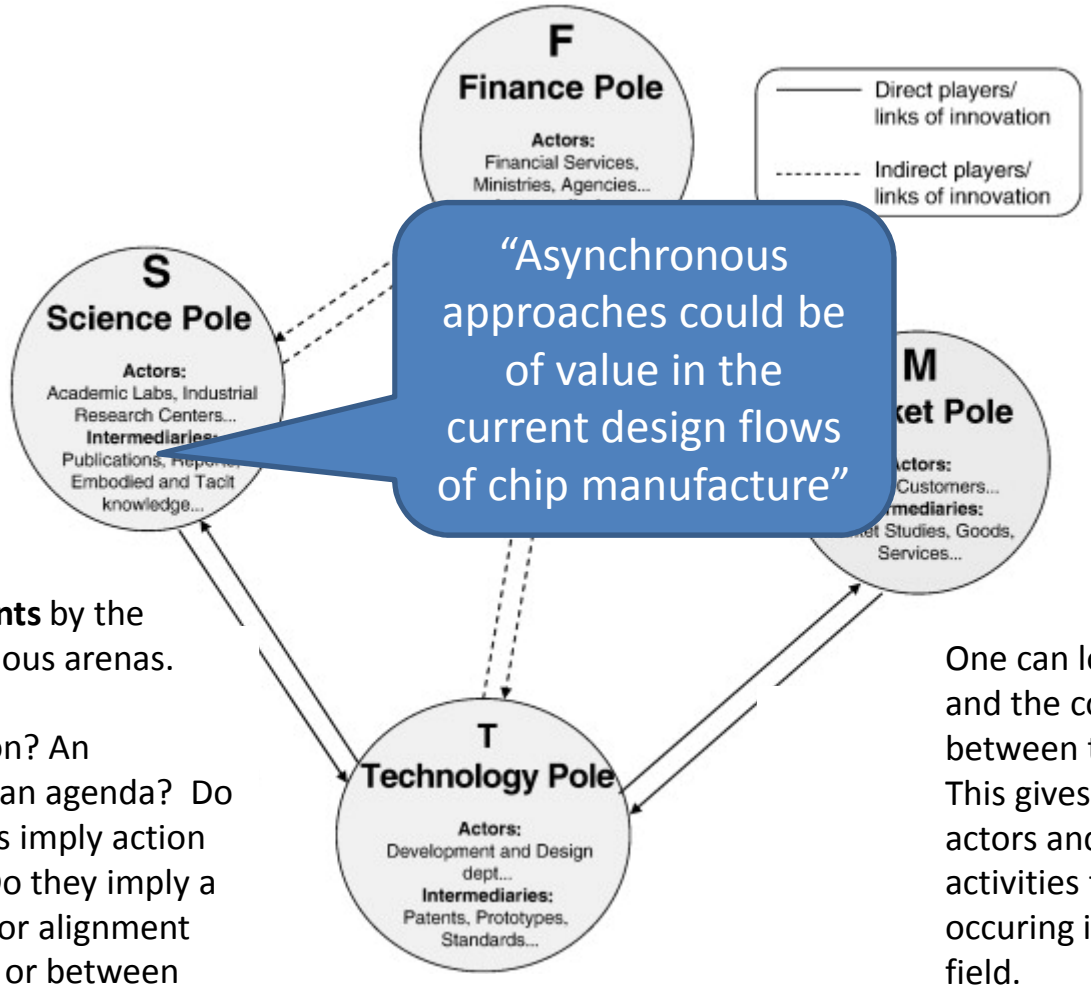
- They are not levels (as in the Transition Theory) but perspectives on technology options, industrial contexts, and of users (pull and push)
- They shape the visions and normativities of those in the asynchronous community and those they may link up wiht outside of the community

So how do we develop a system of capturing enacted normativities (inc. Visions)?

- Sociology of expectations and vision assessment give us insights into the location of expectations and visions (various arenas) and their shaping role (at different levels of aggregation)
- The role of foresight and roadmaps can also help.
- BUT!
- It is a challenge to trace normativities/visions historically
- Also how do we capture them today (in real-time)

This is a major challenge for us which we are tackling now. Here are some of our entrance points

Modality of statements to capture visions in texts and to trace “enacted normativities”



Look at **statements** by the actors in the various arenas.

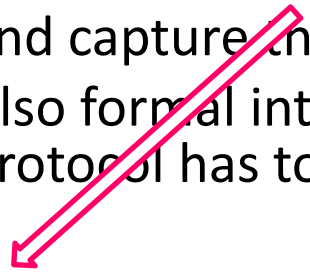
Is it a broad vision? An expectation? Or an agenda? Do these statements imply action wihtin a pole? Do they imply a connection and/or alignment outside the pole or between poles).

One can look at each Pole and the connections between them over time. This gives an idea of the actors and (some) of the activities that are occuring in an emerging field.

See Robinson, Ruivenkamp and Rip 2007 Journal of Scientometrics for an approach to this.

Enter a key arena where values, normativities and visions are expressed!

- In the ASYNC case, there is an annual conference linked to IEEE on ASYNC which through our case research it is a visible arena in the science and technology poles where visions are articulated.
  - One can go to these meetings (though you need a protocol)
  - One can do insertion (become a welcome visitor in the world and capture the visioning and values)
  - Also formal interviews with actors (standard practice – but protocol has to be clear to capture these traces of normativities)



- See insertion in the nanoworld Chapter by Rip and Robinson in the forthcoming book (edited by Neelke Doorn, Ibo van de Poel and Daan Schurrbiers)

Run structured interactions with actors and collectively explore

Two ways

- Create an open-ended discussion about the status of the field, its history and directions within a key arena in the field (we have done this in May 2012)

- Create a system of collectively exploring and positioning (perhaps ranking) normativies, values, visions. For this one can imagine Q-methodology.

Wrapping Up

- This presentation has more or less outlined the challenge and our first steps.
- We have deep case research already in topics like Async…but traces of enacted normativities historically and in real-time are difficult to capture.
- One can apply mutiple methods.
  - Statements in texts,
  - Moving in and around the arenas of normativity/vision articulation,
  - feeding our analysis back into the community for reactions and modification
- These can help in tracing them
- Our challenge is to do this systematically, and turn the results into a usable format for decision makers…..but that the next episode.