A highly cited university patent: formalisation and localisation of its diffusion

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Introduction

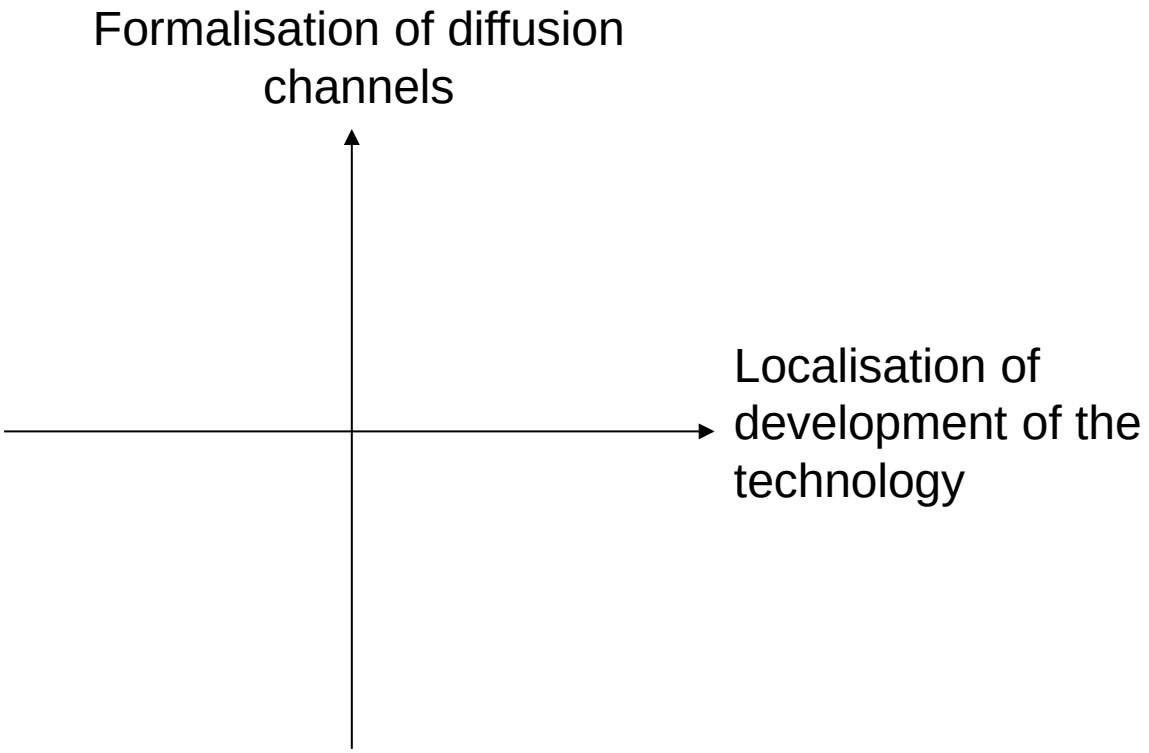
- Contribution of university patents to technological invention
- Many quantitative studies
- But can we give examples of important university patents? Need for case studies (Dopfer 2001, David, 1990; Geels, 2002; 2005; Barberá et al., 2011)
- Is the diffusion of the technology embodied by university patents geographic localised?
- Is this localisation related to the formalisation of its diffusion channels?

Objectives

- Produce a qualitative case studies (and hence an illustrative examples) of a highly cited university patent
- Theorise and find evidence on the relation between localisation and type of channels (formal and informal) in the diffusion of the technology embodied in university patent

Theoretical approach

- Contribution of university patents can be in any of these four quadrants



One case study

- Identification of a highly cited university patent
- Historic analysis through secondary sources
- 2 interviews with patent inventors (Current occupations: William E. Ayer Professor of Engineering, Faculty Director, Stanford Nanofabrication Facility; Director, National Nanotechnology Infraestructure Network - NNIN)
- 1 interview with an outstanding researcher in the same field: Director of the **institution (BSAC, a "triple helix" institute founded in 1986) where research embodied in the patent was conducted**, during late 80's. Long-term collaborator of one of the patent inventors (Program Manager for the MEMS Program at the Defense Advanced Research Projects Agency (DARPA)
- Illustrated with study of forward references

Identification of a highly cited university patents

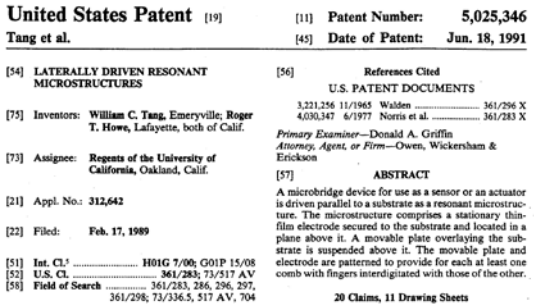
IPTS database

CITED_PUBLN	Type of literature	Cuenta de PUBLN_NR
WO9428139	PL	29
US5764190	PL	14
US5561054	PL	12
US5025346	PL	10
EP0601812	PL	10
US4618861	PL	9
US5799055	PL	9
US5177685	PL	9
US5770645	PL	8
US5262871	PL	8
US6737447	PL	8
GB2104391	PL	8
DE19544207	PL	8

Update: Espacenet 30/04/2013

Publication number	Applicant(s)	Citing documents
WO9428139	MASSACHUSETTS INST TECHNOLOGY [US]	74
US5764190	UNIV HONG KONG SCIENCE & TECHN [HK]	109
US5561054	UNIV MICHIGAN STATE [US]	33
US5025346	UNIV CALIFORNIA [US]	430
EP0601812	UNIV BRISTOL [GB]	12
US4618861	CORNELL RES FOUNDATION INC [US]	68
US5799055	UNIV NORTHWESTERN [US]	110
US5177685	MASSACHUSETTS INST TECHNOLOGY [US]	342
US5770645	UNIV DUKE [US]	88
US5262871	UNIV RUTGERS [US]	429
US6737447	UNIV AKRON [US]	37
GB2104391	UNIV EXETER [GB]	28
DE19544207	UNIV DRESDEN TECH [DE]	60

Focal patent: laterally driven resonant microstructures (Tang and Howe, 1989)



United States Patent [19]
Tang et al.

[11] Patent Number: 5,025,346
[45] Date of Patent: Jun. 18, 1991

[54] LATERALLY DRIVEN RESONANT MICROSTRUCTURES

[75] Inventors: William C. Tang, Emeryville; Roger T. Howe, Lafayette, both of Calif.

[73] Assignee: Regents of the University of California, Oakland, Calif.

[21] Appl. No.: 312,642

[22] Filed: Feb. 17, 1989

[51] Int. Cl.[5] H01G 7/00; G01P 15/08
[52] U.S. Cl. ..... 361/283; 73/517 AV
[58] Field of Search ..... 361/283, 286, 296, 297, 361/298; 73/336.5, 517 AV, 704

[56] References Cited
U.S. PATENT DOCUMENTS

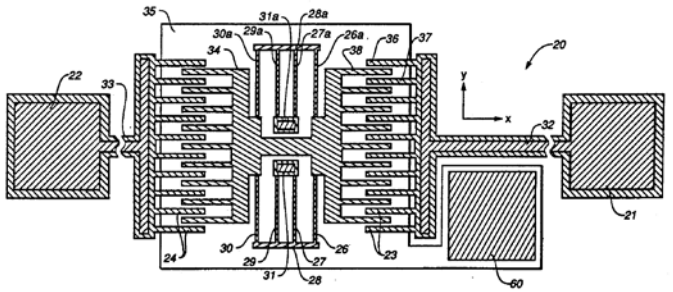
3,221,256 11/1965 Walden ..... 361/296 X
4,030,347 6/1977 Norris et al. ..... 361/283 X

Primary Examiner—Donald A. Griffin
Attorney, Agent, or Firm—Owen, Wickersham & Erickson

[57] ABSTRACT

A microbridge device for use as a sensor or an actuator is driven parallel to a substrate as a resonant microstructure. The microstructure comprises a stationary thin-film electrode secured to the substrate and located in a plane above it. A movable plate overlaying the substrate is suspended above it. The movable plate and electrode are patterned to provide for each at least one comb with fingers interdigitated with those of the other.

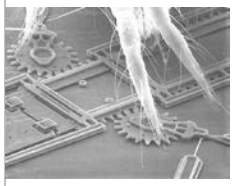
20 Claims, 11 Drawing Sheets

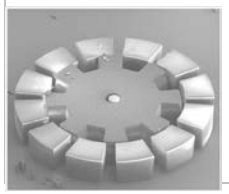


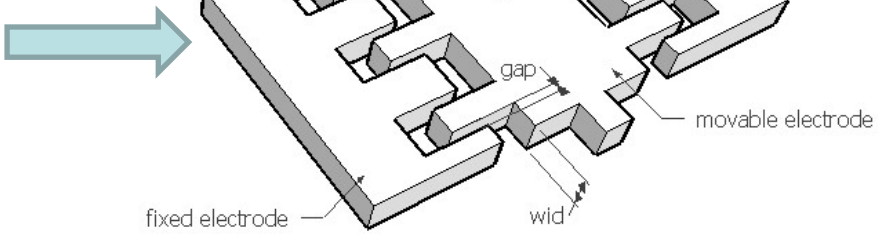
- A non-typical university technology (not chemistry, not pharmaceuticals)
- A patent crucial in the development of Microelectromechanical systems (MEMS): micro (in the micro-nano boundary) sensors and actuators
- Direct applications of the patent: Accelerometers (sensors for reporting vibrations in many engineering applications, from turbines to seismic activity; electronic applications)
- Indirect applications of the patent (paradigm shift): Micro-sensors for airbags

Focal patent: how it works

- Operational principle of MEMS: use of the electrostatic force at the micro/nano levels
- Main achievement on 1970s and 1980s: rotating engines at the nanolevel
- A revolution in MEMS technology: from rotating to linear ("was received with huge scepticism"): "a new linear/quasi-digital (and not rotative) kind of micro-sensor/micro-engine"

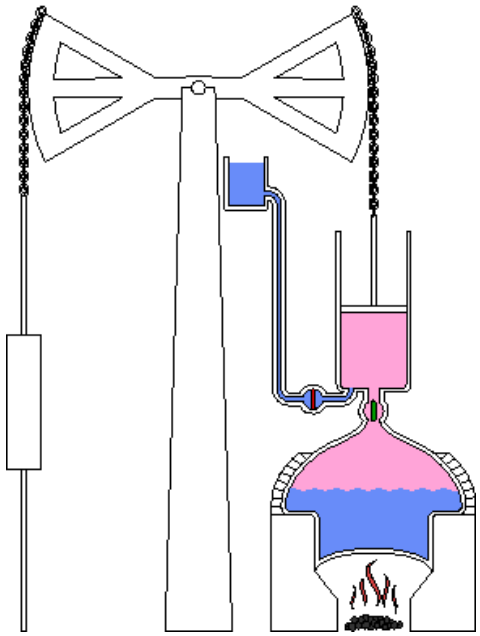






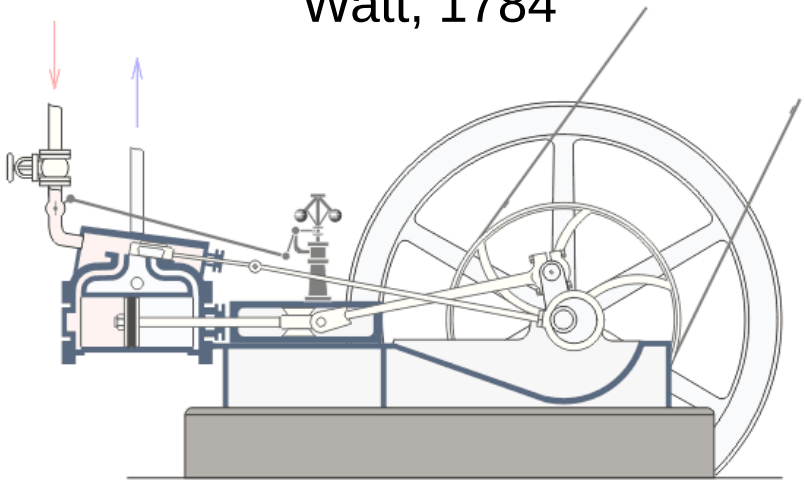
Focal patent: from rotation to linear movement in MEMS (anti-Watt)

Newcomen, 1712



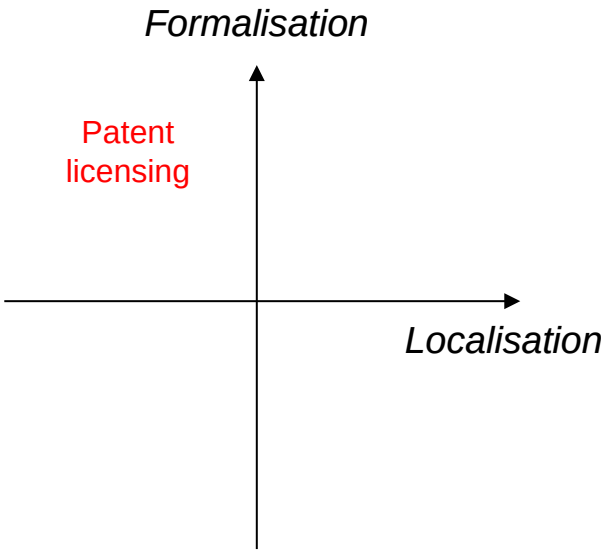
http://upload.wikimedia.org/wikipedia/commons/1/16/Newcomen_atmospheric_engine_animation.gif

Watt, 1784



http://en.wikipedia.org/wiki/File:Steam_engine_in_action.gif

Higher formalised channels, lower localisation (1)



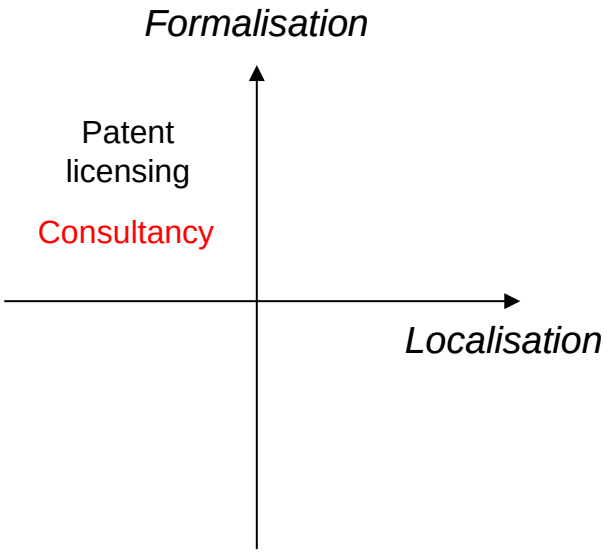
- BSAC guaranteed licensing priority for BSAC industrial members

"we waited and waited and waited - there was academic research, other patents referencing it - but no one was into production"

- Honeywell first licensed the patent in early 2000, for accelerometer application. Expired in 2007
- 4th citing inst. of focal patent

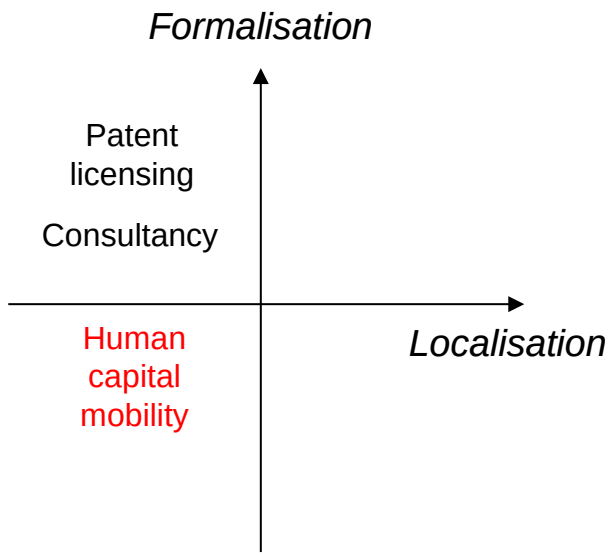
"at the peak, it was 2% of my income" (UC Berkeley Full Professor)

Higher formalised channels, lower localisation (2)



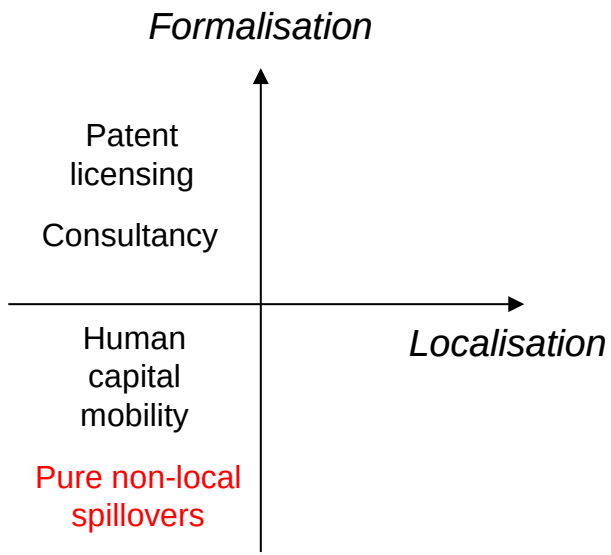
- Second inventor (late 80's): consultancy with Analog Devices
- Many self-cites to focal patent in later patents applied for by Analog Devices

Lower formalised channels, lower localisation (1)



- First inventor (1990-1997): Research Senior at Ford Research Laboratory in Dearborn, Michigan, and as the Sensor Research Manager at Ford
- Few self-cites compared to second inventor
- Both Ford and AD were industrial members of BSAC

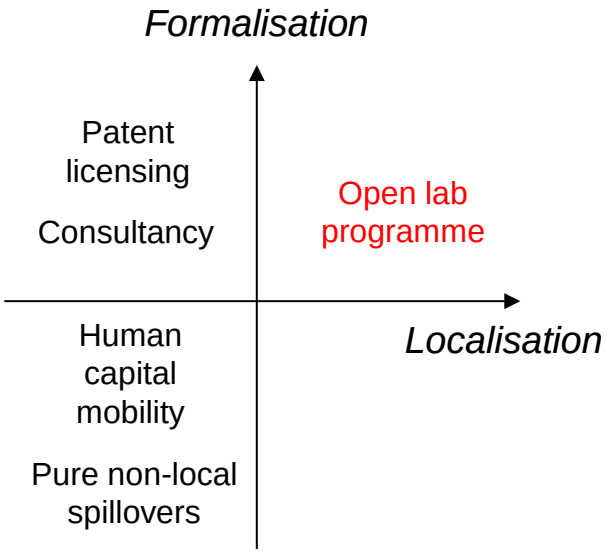
Lower formalised channels, lower localisation (2)



- Analog Devices, 1st citing institution of focal patent (more cites than the licensee – Honeywell)

Analog Devices introduced a revolutionary accelerometer in 1990, 1991 called the XL50 … And in fact, the way they made it was derived from my Ph.D. thesis

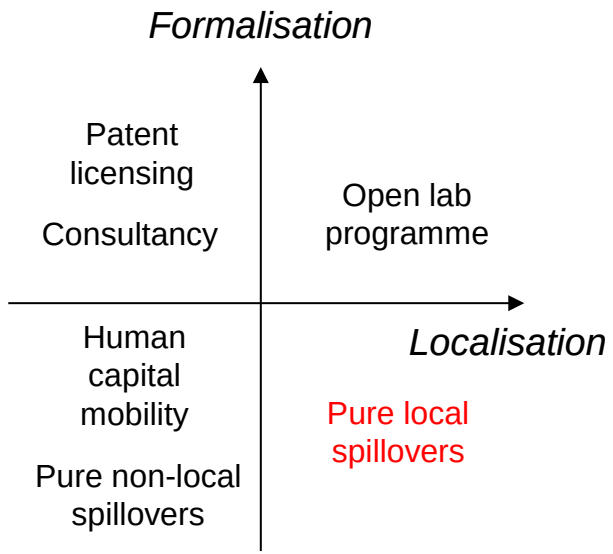
Higher formalised channels, higher localisation



- MEMS industry concentrated on the East Coast during 80' and 90's (including Analog Devices)
- During 90's Analog Devices provided fabrication technology for BSAC fabrication lab: "it was the next accelerator you had a very short path from idea to product"

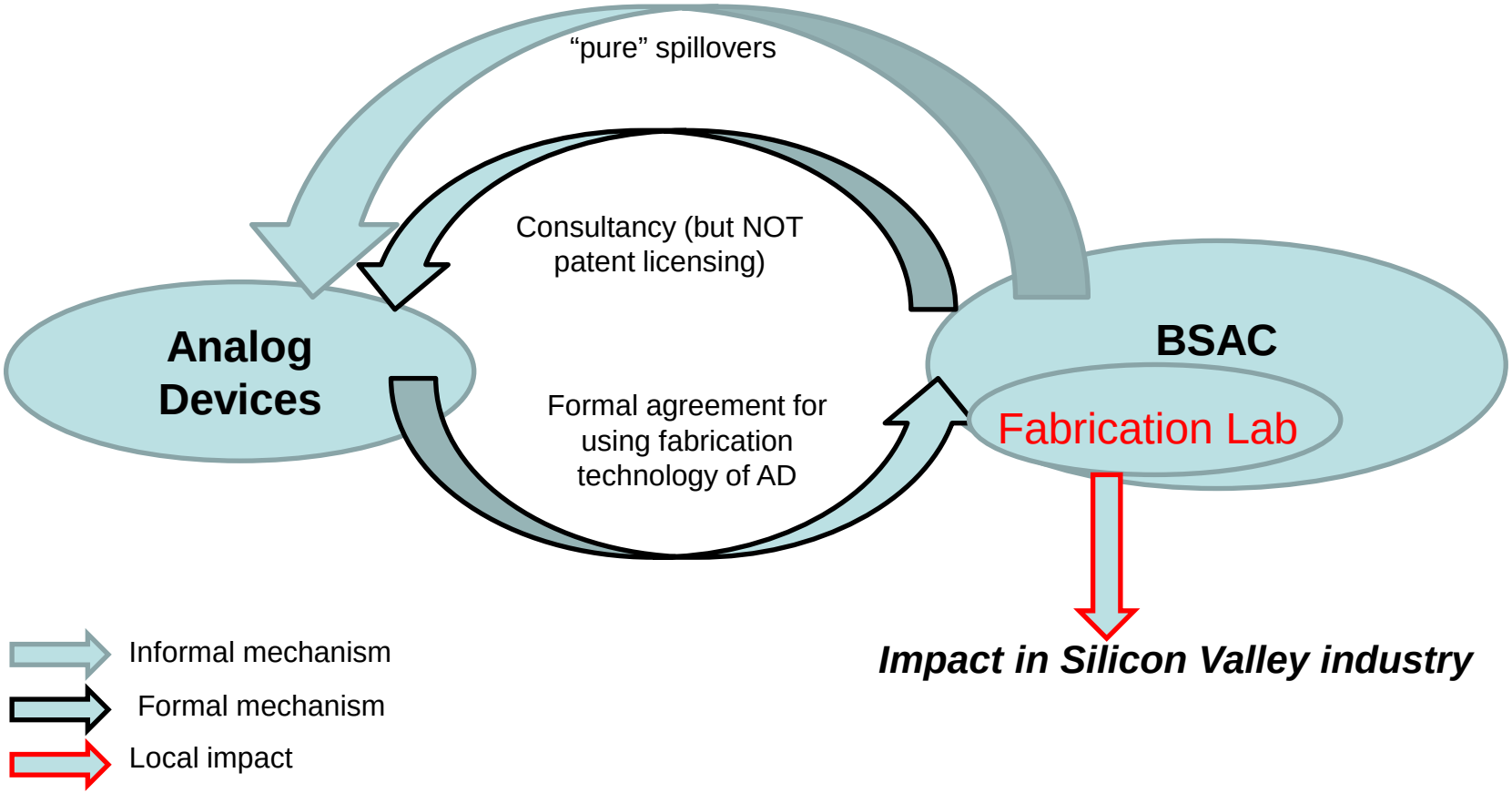
"In the Berkeley campus we had the micro lab and we had a program by which startups and companies could come and build prototypes in our lab… . Berkeley was the first place that had this open access for micro labs. So, the entrepreneurs started to work over there". Since 2000s, MEMS industry grew in Silicon Valley

Lower formalised channels, higher localisation

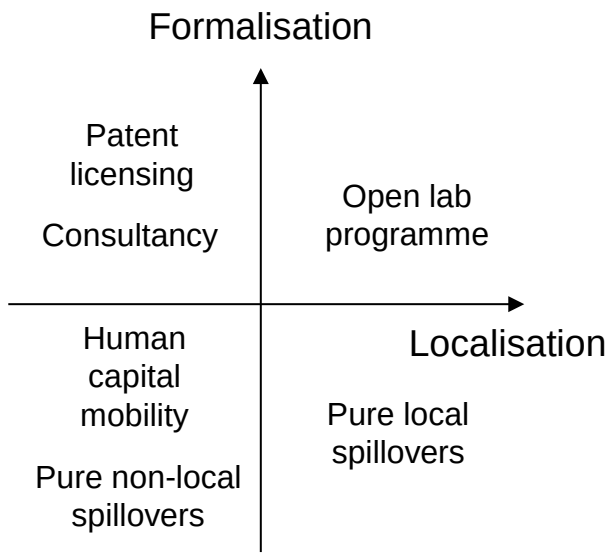


- Not acknowledged state-of-the-art of patents applied for by other firms in the region (many examiner citations added)

Complexity of local impact



Conclusions

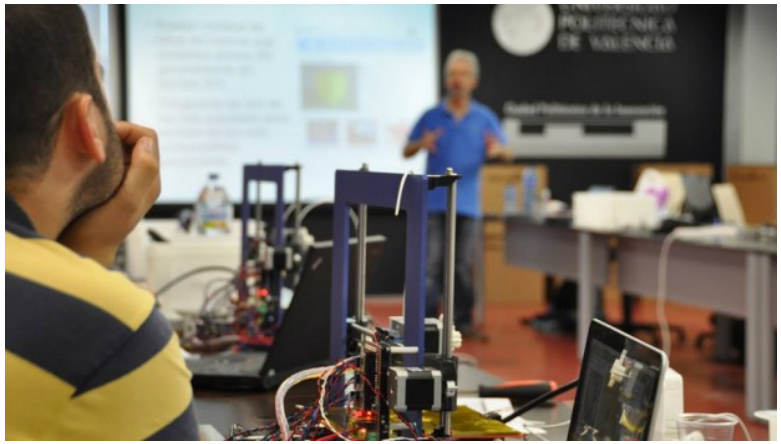


- A university patent with high technology impact overlaps with many diffusion channels
- Its license does not give an accurate idea of its value
- Sophisticated indicators of technology transfer should consider a split according to whether they are due to a patent
- Complexity of impact makes it difficult to plan the local contribution of university patents: our case shows that when the relationship of the industry is very close, the diversity of spillovers

Discussion & Limitations

- The importance of “open” fabrication labs for local impact: “FABLAB VLC”?

No se podrá acceder al FabLab sin haber reservado horario. Sólo podrán acceder al uso directo de las máquinas quienes se hayan formado previamente en los cursos cortos de iniciación por máquina que es lo que le acredita para poder utilizar las máquinas. El resto de personas contratarán los servicios añadidos del técnico asignado como suplemento.



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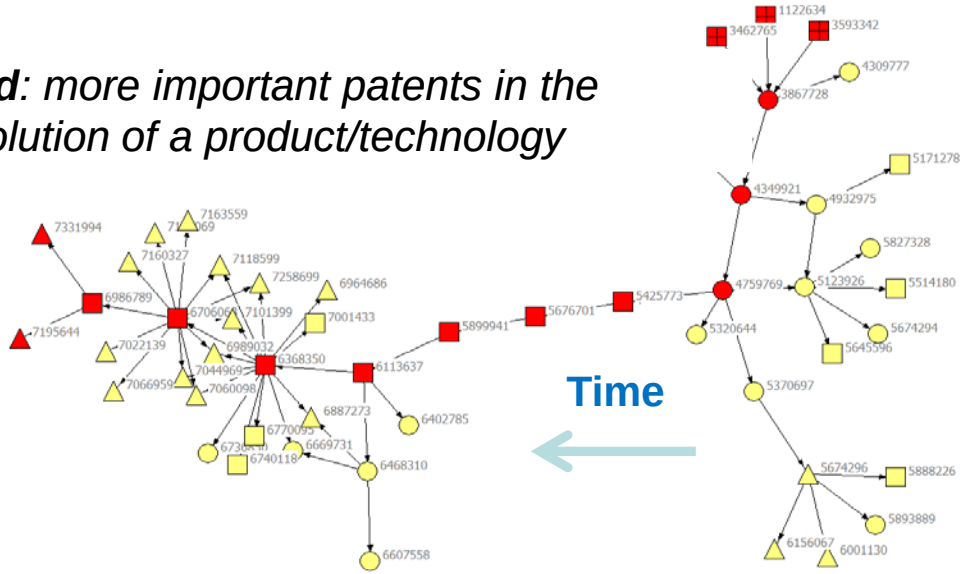
“Creado por un grupo de profesionales dedicados (sic) en el MIT, el Fab Lab es un lugar donde las se hacen realidad. Utilizando una pequeña cantidad de máquinas, cualquier persona con cualquier nivel de experiencia puede crear cualquier cosa.”

- Limitations: one case study (“selecting on the dependent variable”)

Future research

- Ongoing empirical work: localized10 experts in the field active in BSAC during late 80's for future interviews
- Application of a recent patent analysis technique to the early years of MEMS and the BSAC role as patent assignee and BSAC researchers role as patent inventors

***Red**: more important patents in the evolution of a product/technology*



***Yellow**: dead-ends where technology cannot advance*

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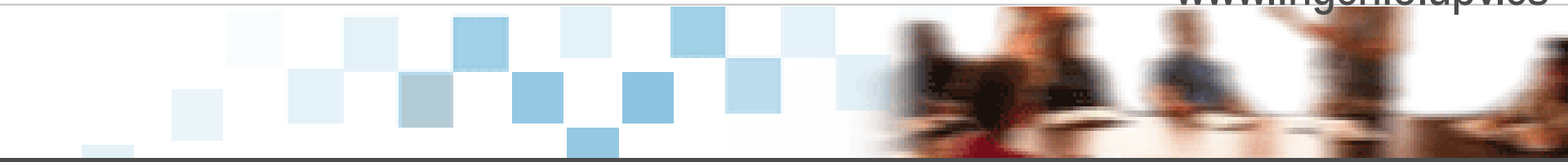

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