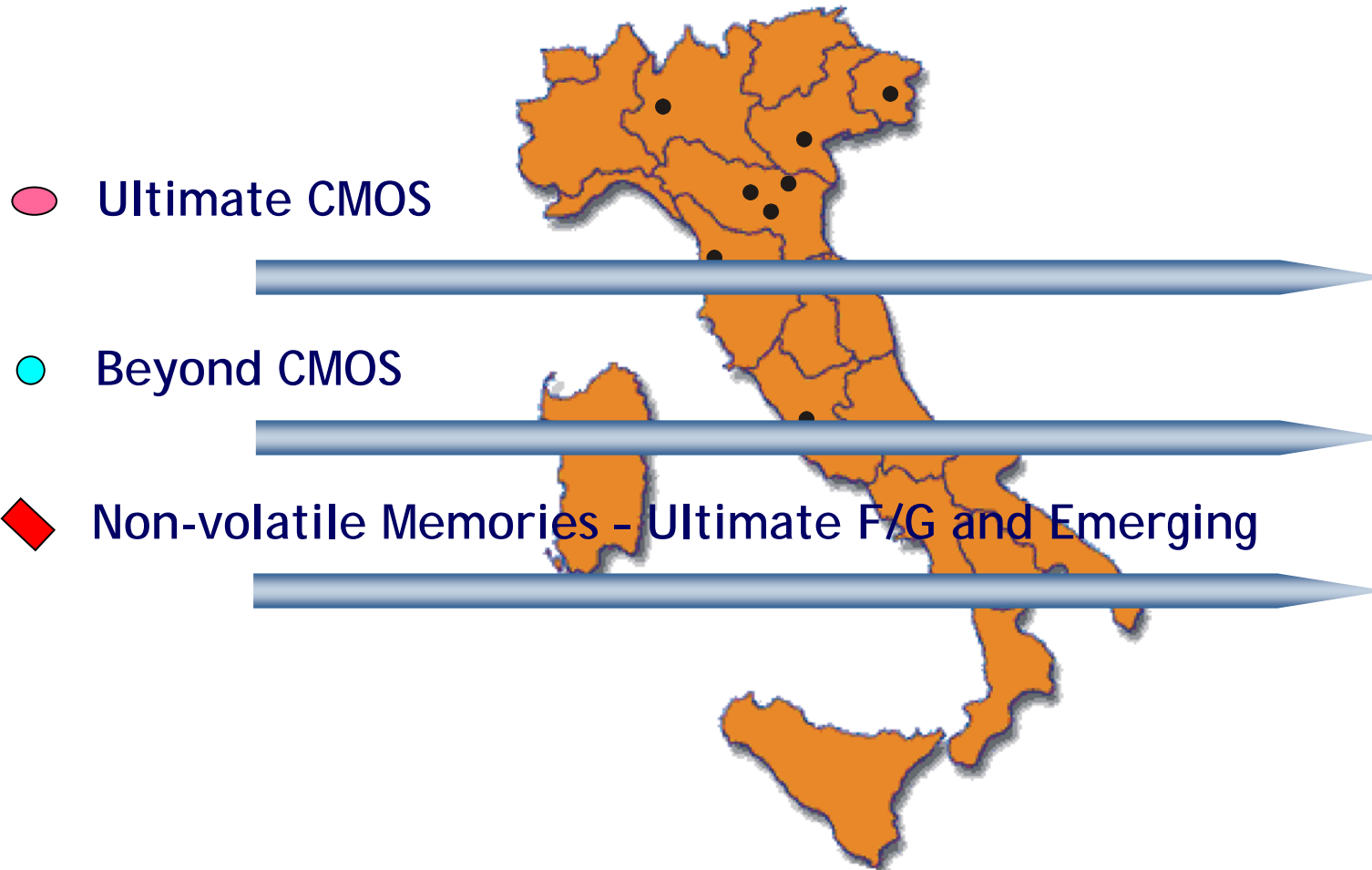


Programmi di ricerca del VII Framework

Andrea L. LACAITA

24 Novembre 2007

Research Lines

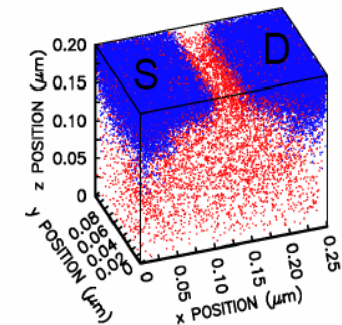
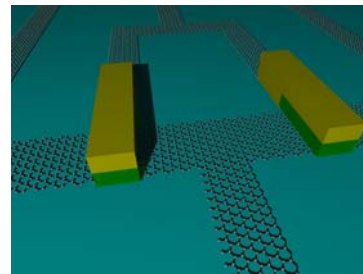
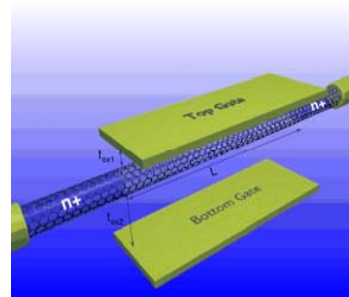
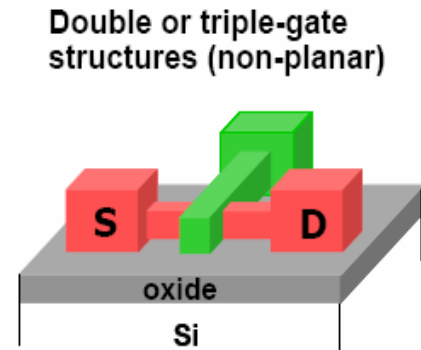
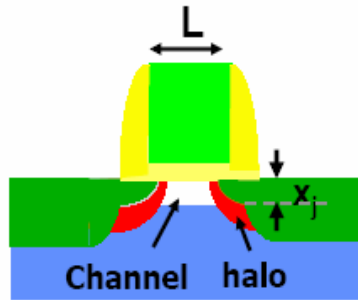


● Ultimate CMOS

● Beyond CMOS

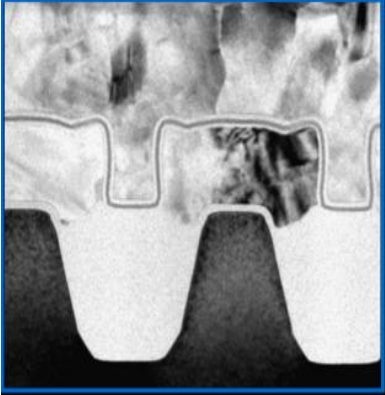

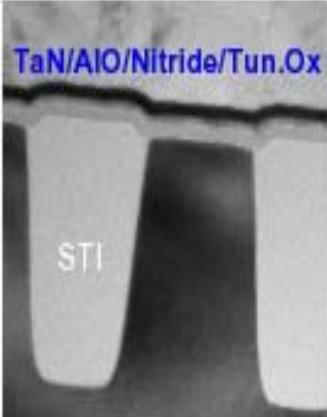
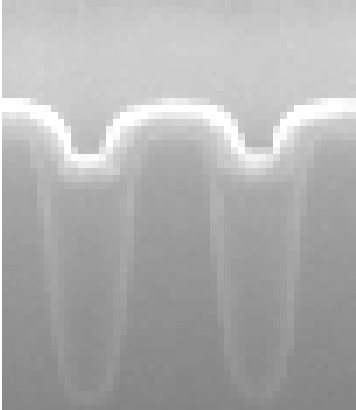
◆ Non-volatile Memories - Ultimate F/G and Emerging

More Moore - Beyond CMOS



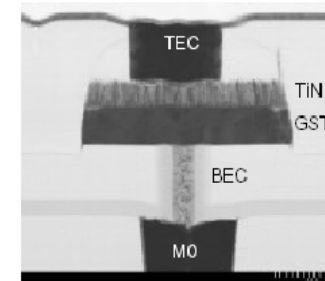
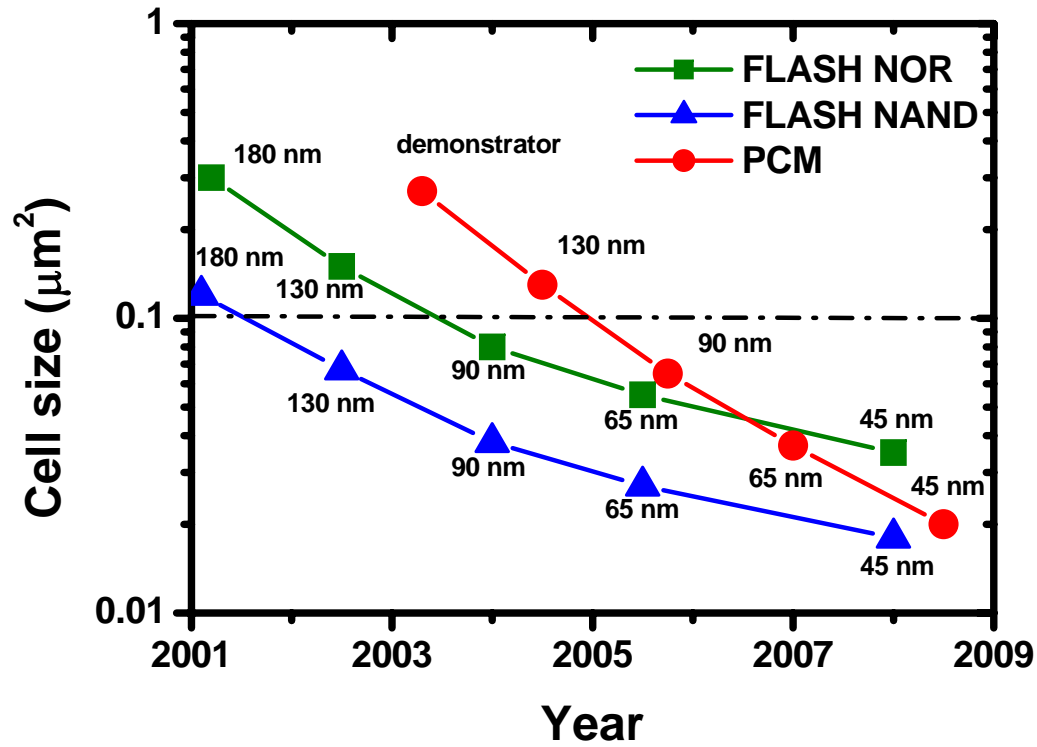
Flash cell evolution



Floating Gate not Self-aligned	Self-aligned Floating Gate	Planar Nitride	FIN-FET Nitride
 A cross-sectional SEM image showing a floating gate structure that is not self-aligned. The gate is wider than the underlying well, and the sidewalls are irregular.	 A cross-sectional SEM image showing a self-aligned floating gate structure. The gate is precisely aligned with the well edges, and the sidewalls are smoother.	 A cross-sectional SEM image of a planar nitride structure. The top layer is labeled "TaN/AlO/Nitride/Tun.Ox" and the underlying well is labeled "STI".	 A cross-sectional SEM image of a FIN-FET nitride structure, showing a thin nitride layer on top of a silicon fin.

Discrete-traps storage allows further scaling margins for the Flash cell but...

PCM roadmap





ICT - Call 1



- 10 proposals - 1 IP, 6 STREP, 1 NoE, 2 CA.
- 4 approved
- **Success rate 40% !!!**
- Funding 1,800 K€

Funded projects



Project name	Type	IUNET lead	IUNET (Mm)	Funding (k€)
NanoICT	CA	Pisa	12	82
GRAND	STREP	Bologna	70	496
NANOSIL	NoE	Udine	60	343
GOSSAMER	IP	Milano	148	962
			290	1883

- Over three years
- ~6,5k€ /Mm

Nano ICT (CA)



PARNERS

- Phantoms, CEA, EPFL, Techn. Res. Center Finland, IUNET, ICT, UPV, CNRS, Cambridge, Lund, Juelich, Jagiellonian Univ.

GOALS

- New switches and memory cells
- Local and chip level interconnects
- Radically new functionalities - NEMS and blocks from few nanometers down to atomic scale

IUNET

- Working groups - Theory and Modeling
- Focused Reports
- NanoICT computational HUB - Code repository

GRAND (STREP)



PARTNERS

- AMO, IUNET, CEA-LETI, Tyndall, Cambridge, STM France

GOAL

- Graphene applicability to novel switches and local interconnects at nanoscale (Beyond CMOS)

ISSUES

- Materials (SiC surface transformation, decomposition of thin SiC epitaxial layers, mechanical exfoliation and selective deposition...)
- Device fabrication (transistors, interconnects, high-k oxides..)
- Functionalization (edge states)

IUNET

- Electrical characterization (transport and noise properties)
- Modeling (1D transport, ballistic, phonons, MASTAR)
- Ab-initio calculations (band structure)

NANOSIL (NoE)



PARTNERS

- INPG, Warwick, RWTH, KTH, IUNET, Leuven, IMEC, CEA, STM-France, ISEN, UPS, AMO, Julich, Quimonda, Braunschweig, Demokritos, Stuttgart, Tyndall, Warszawska, Chalmers, EPFL, ETH, Synopsis, Glasgow, Liverpool, Newcastle.

GOAL

- More Moore (new channel materials, Schottky barrier contacts, gate stack materials)
- Beyond CMOS (1D nanowires, carbon electronics, tunnel/ionization MOSFETs) nanodevices by template self-assembly

IUNET

- Modeling: Schottky barrier, gate stack (high-k/metal gate), 1D nanowires, Tunnel/I MOSFETs

GOSSAMER (IP)



PARTNERS

- STM Italy, Active Technologies, Quimonda, ASM-I, CNR, Tyndall, IUNET, Freiberg, Fraunhofer, Braunschweig, Jordan Valley, ALMA

GOAL

- 8Gbit - 32nm TANOS demonstrators

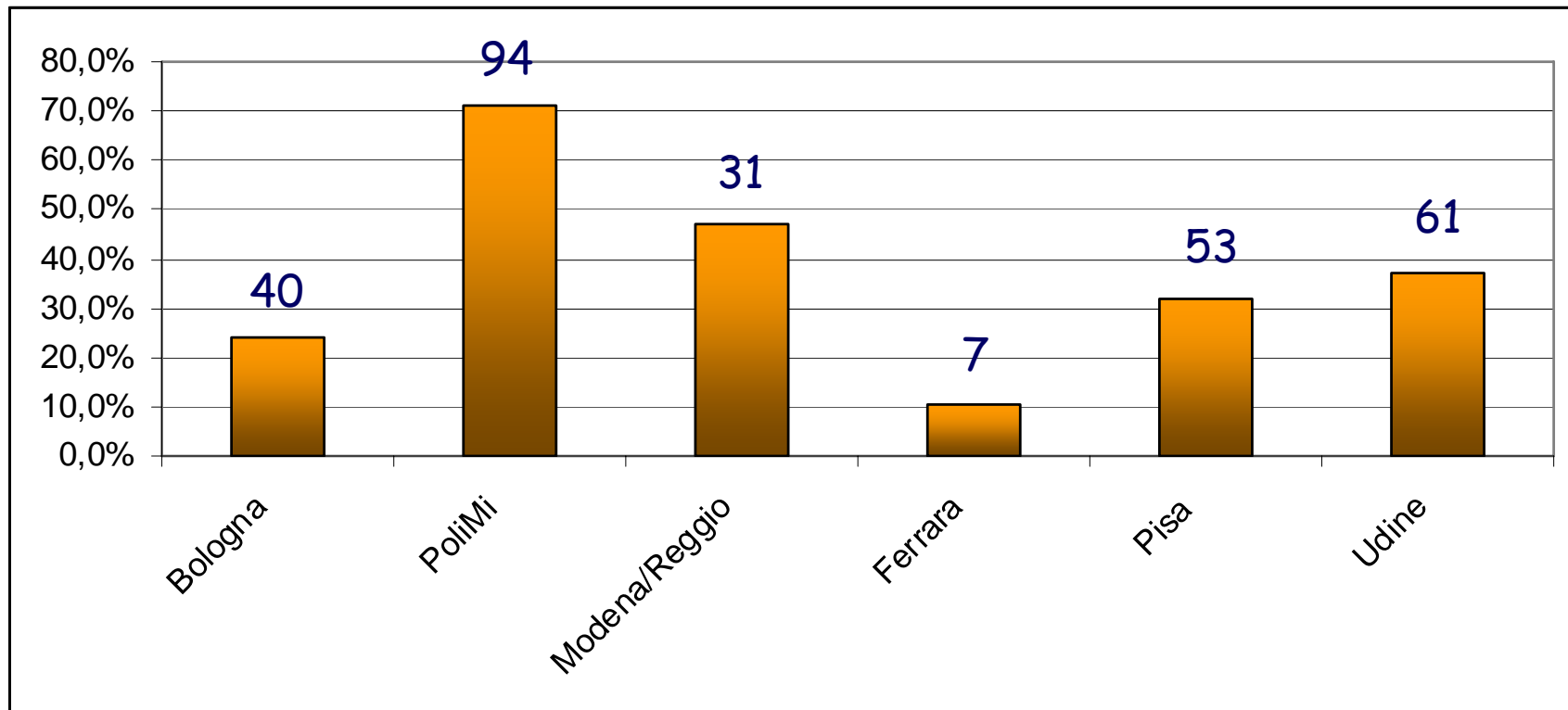
ISSUES

- Metal gate with high workfunction
- High-k blocking dielectric
- Optimization of nitrated layer (trap position, conduction)
- Asymmetric charge distribution P/E cycles

IUNET

- Modelling of cell electrical behaviour
- Cell/Array characterization and modeling
- Multibit storage

Staff allocation



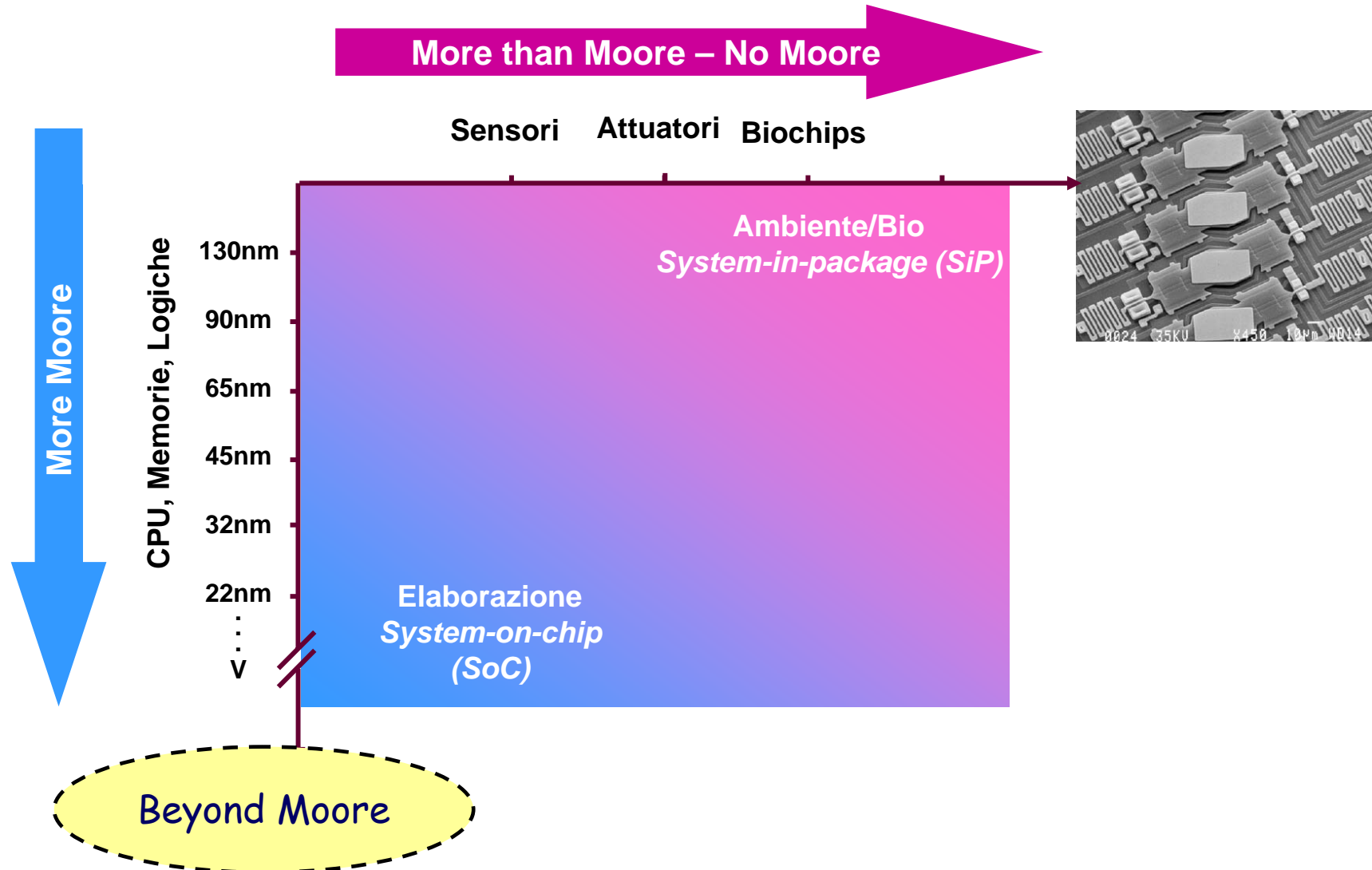
Opportunità/Prospettive



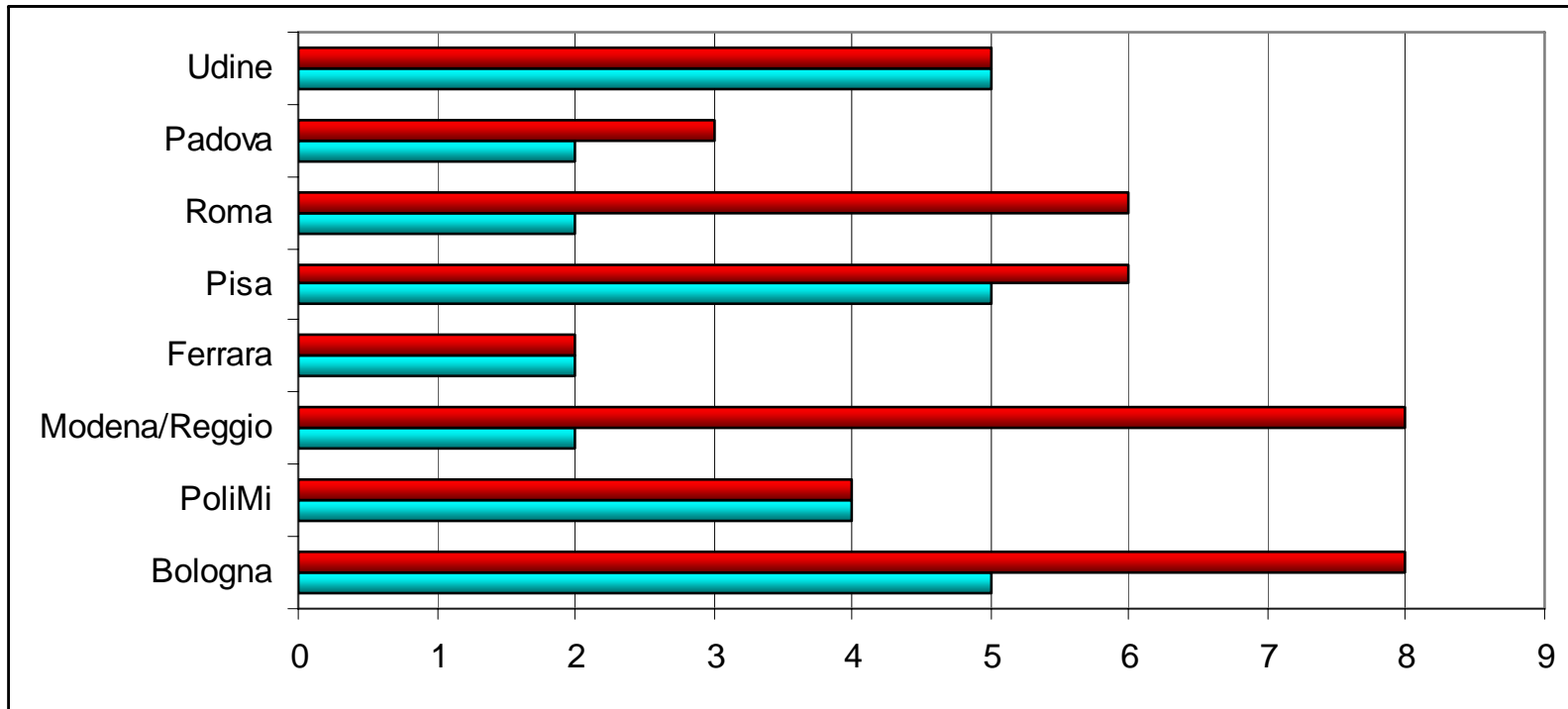
- 55 Partners
- Promotion, networking
- Industrial links

	Total Proposals received	Retained Proposals	SuccessRate
All	85	20	24%
IPs	13	4	31%
STREPs	61	10	16%
NoEs	2	1	50%
CSA	9	5	56%

Diversificazione



Staff / Interests



Conclusioni



- Call I - Grande successo
- Accompagnare l'Italia nella JTI
- Governare la crescita
 - ▶ Aggregazioni di competenza nelle sedi sui temi di ricerca del consorzio
 - ▶ Incrementare le collaborazioni intra-sede
 - ▶ Consolidare il rapporto con i player del settore
 - ▶ Investimenti in comunicazione

Forging Ahead !