Mapping the meso space that enables technological change, productivity improvement and innovation in the manufacturing sector

Working paper commissioned by Future Industrial Production Technologies Chief Directorate of the dti

Research report for dti and stakeholders

Different phases; first phase to better understand the different concepts, approaches and to develop a framework to understand these changes for industry and institutions in a South African context. Research covered:

- Technology, cycles, disruption and discontinuities
- Innovation, incremental, disruptive, architectural & components
- Technological capability, absorptive capacity, innovation ecosystem
- Meso organisations, coordination and market failures, learning & adjustment, resilience
- South Africa's socio-technological capability, innovation measures, value add and key performance indicators

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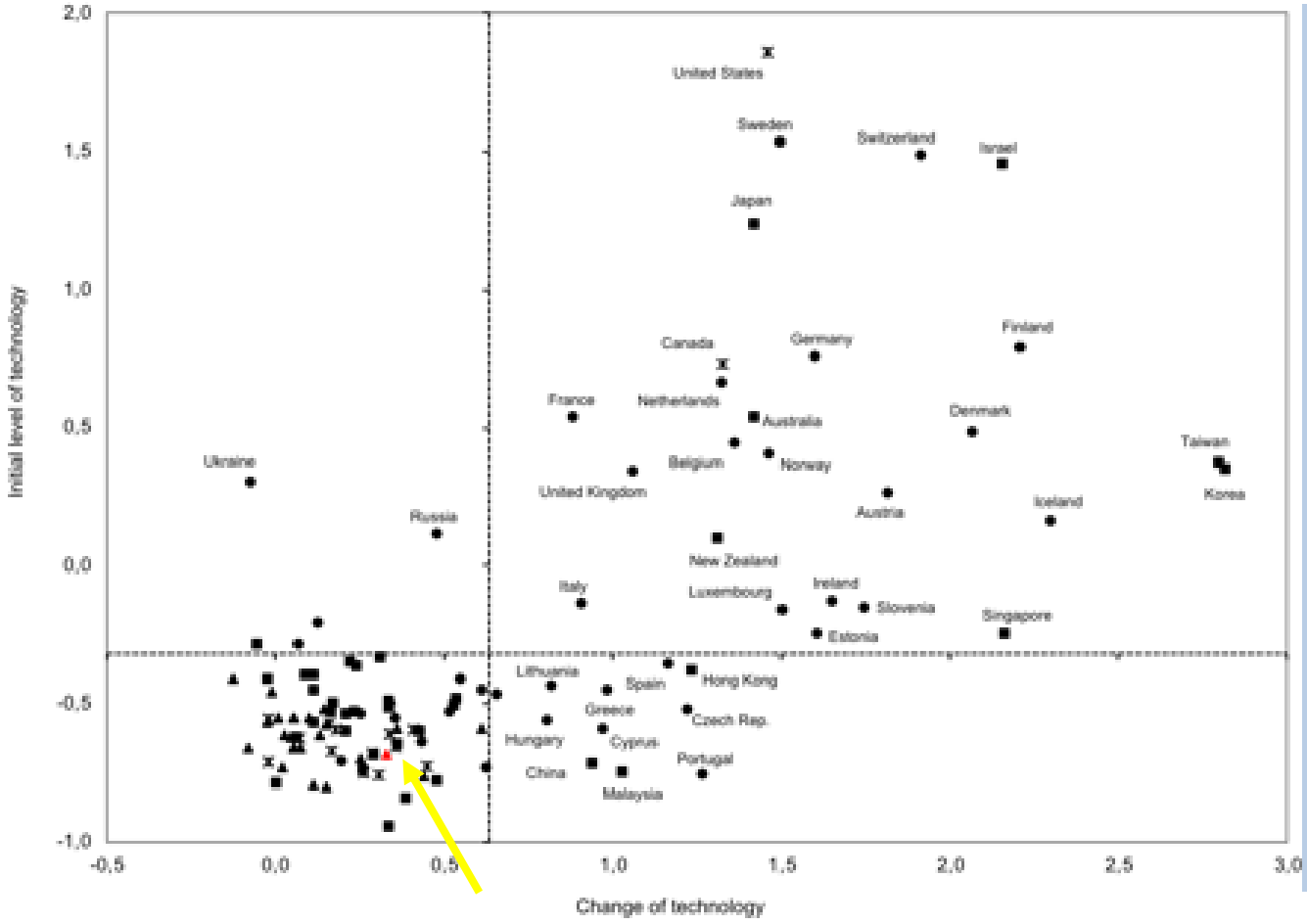
Technological capability

- Is the distributed ability to make effective use of technological knowledge in efforts to assimilate, use, adapt and change existing technologies
  - It is easier to copy physical technologies than to develop the appropriate social technologies (institutions, networks, regulations, etc.)
  - Deliberate process of developing and modifying the appropriate social technologies and institutional arrangements
- There is a gap between the dti and DST in the innovation system.
  - DST mainly focused on formal organisations, not on organisations that solve problems, demonstrate technology, provide extension services, encourage competition, foster collaboration or promote upgrading

Global Technological Capability assessment

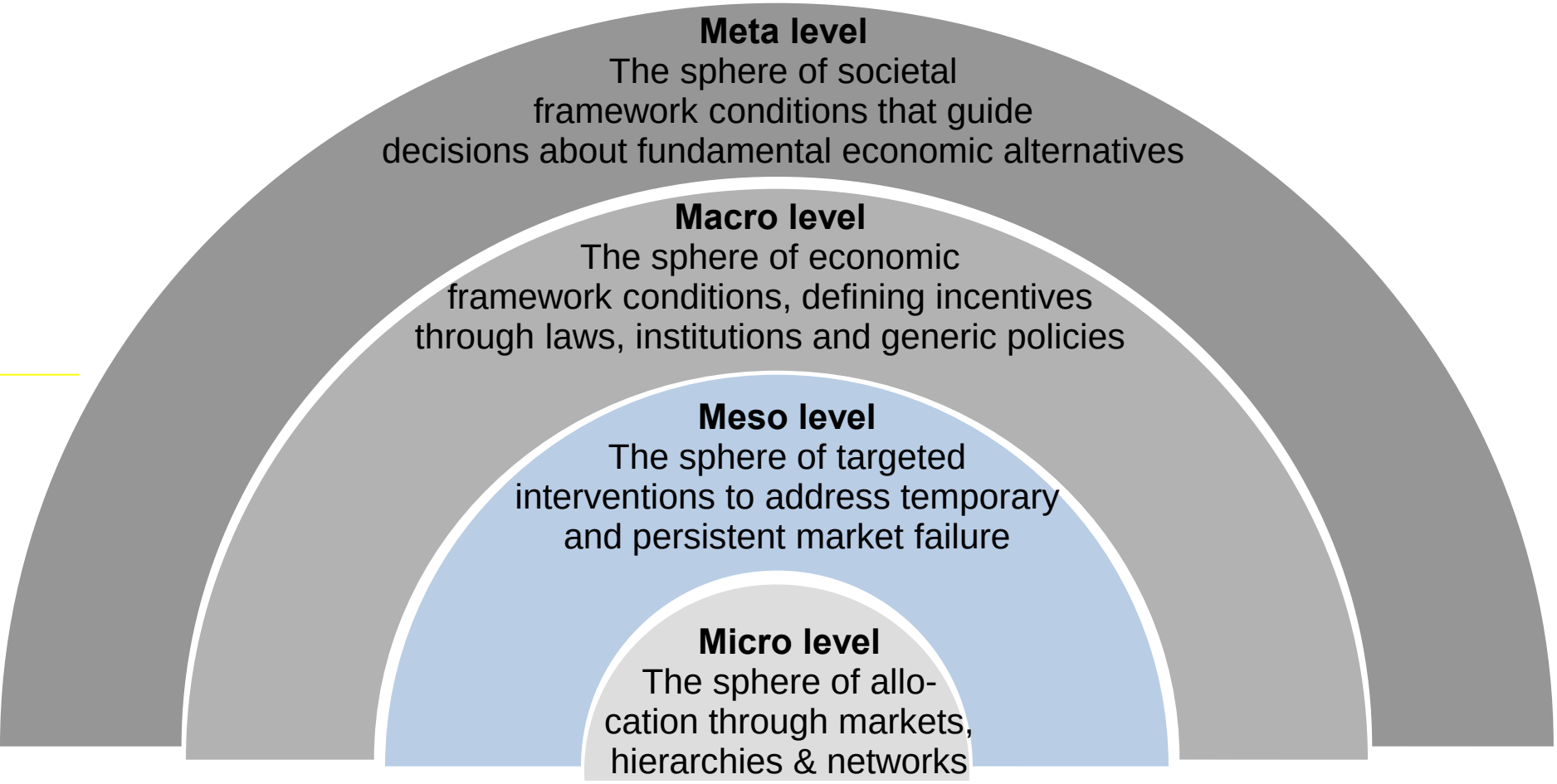


Indicators based on

- Quality of research system
- Patent applications
- R&D expenditure
- ICT infrastructure
- Skill level of the population (literacy)
- Quality of the governance system
- Corruption in public and private sector
- Efficiency of government

FAGERBERG, J. & SRHOLEC, M. 2017. Capabilities, economic development, sustainability. *Cambridge Journal of Economics,* Vol. 41 pp. 905-926.

The four levels of systemic competitiveness



Meso level, meso policy and meso space

Meso level	• Analytical level
Meso policy	• Targeted action of public and private actors – to address market failure – to strengthen the supporting environment for business – to shape structural change • Selective interventions (as opposed to macro policy = generic interventions)
Meso space	• Public and private organizations which are tasked with strengthening the competitiveness of businesses

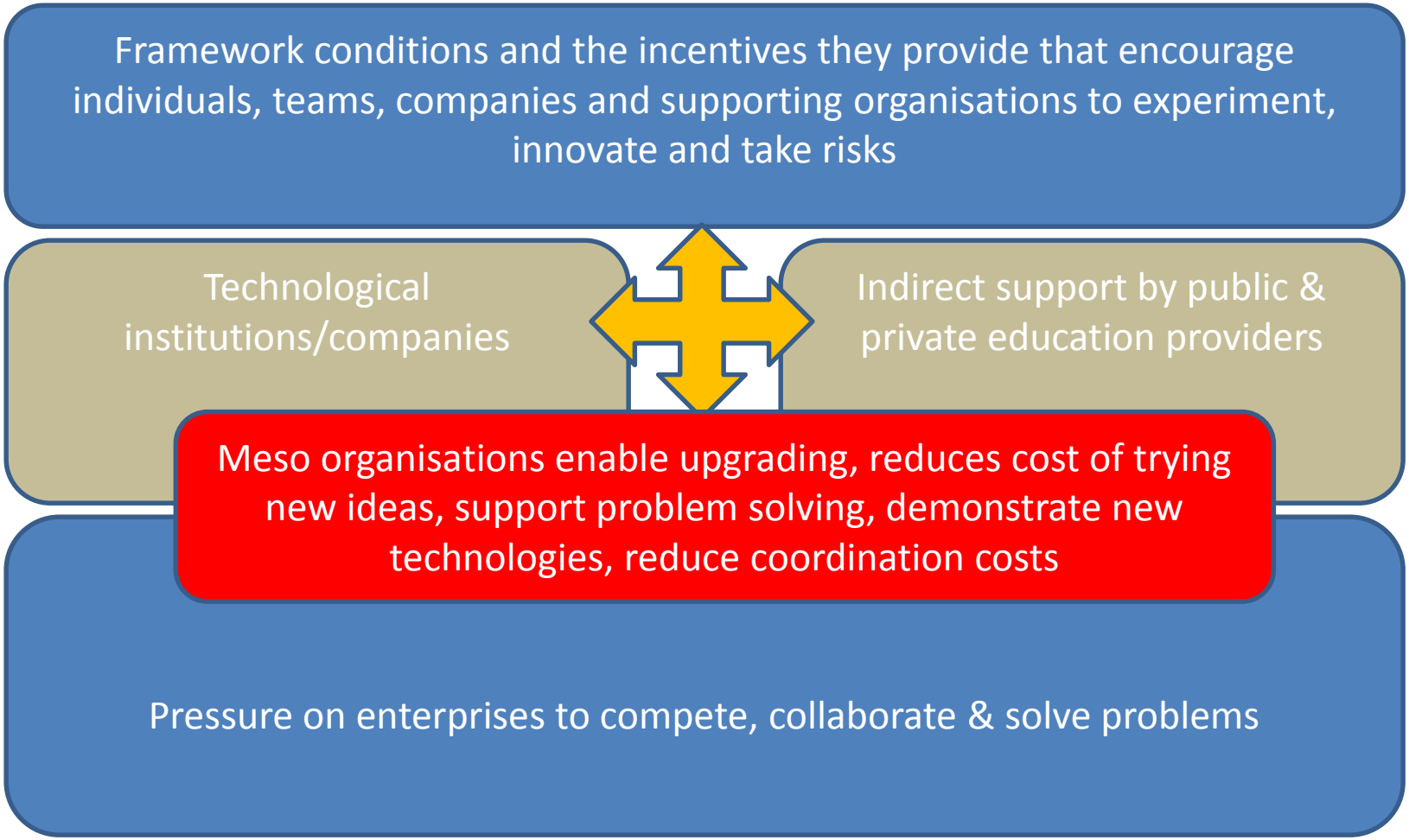
Meso organisations

- Are targeted interventions designed to address :
  - Patterns of underperformance in the economy or industries
  - Persistent or temporary market failures
  - To achieve structural adjustment
- It could be a program, or an organization
- It is not exclusively public sector funded
- In most cases transfers tacit or formal knowledge in the form of public or mixed goods

Economic development through technological change is hampered by

- Self-discovery externalities: learning between agents about what can be created here
- Coordination externalities: Often new activities require many simultaneous investments in infrastructure, capacity, resources and markets
- Missing public goods: Organizations, diversity of and quality of public goods
- Indivisibilities: High costs of new equipment, knowledge and scale of investment

Mapping technological capability

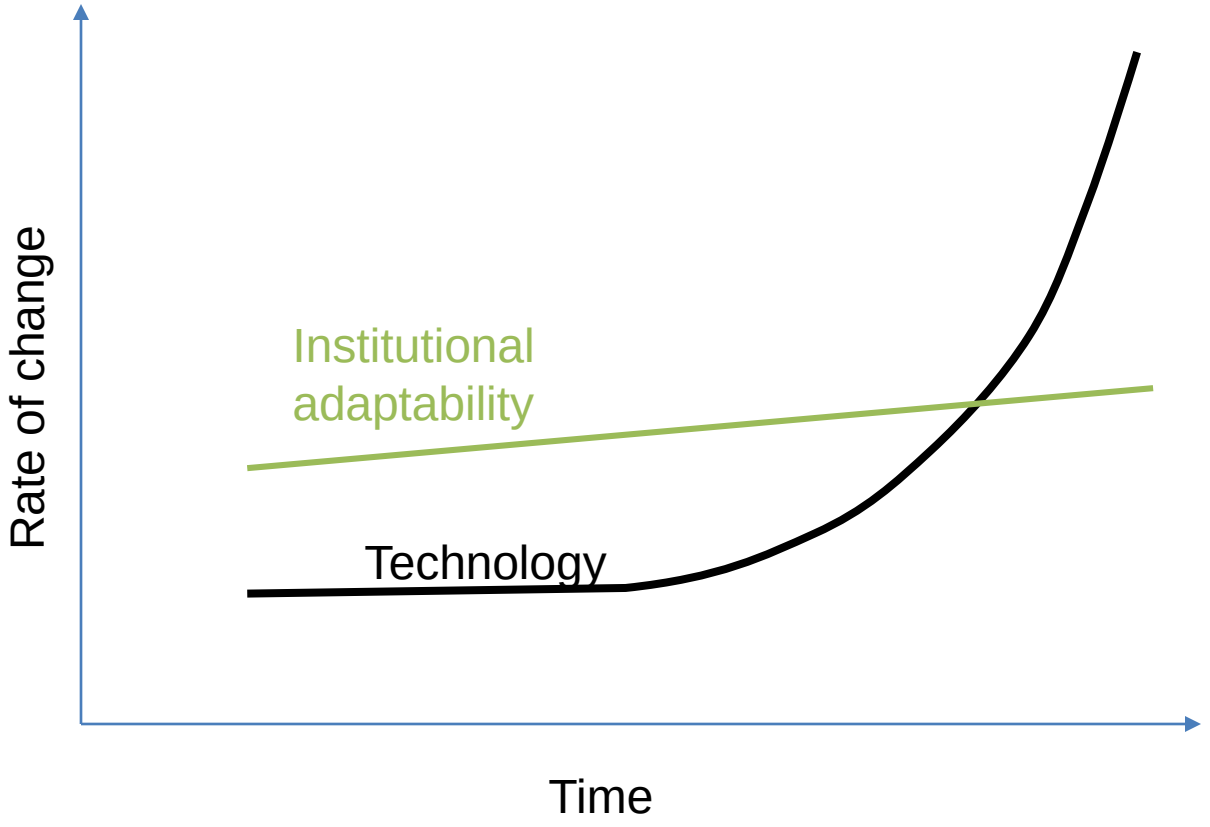


Important services provided by meso organisations

	Technology	Education and training	Finance	Infrastructure	Foreign trade	Entrepre-neurship	Business membership associations
Basic functions	**Measurement, standards, norms, quality assurance**	**Secondary and higher education in basic disciplines**	Credit, Investment capital	Basic infra-structure: roads, water, electricity, telephony	Basic foreign trade transactions	Awareness raising on potential of entrepreneur-ship	Elementary services Ad hoc lobby
Advanced functions	**Technology transfer**	**Vocational training in specialised disciplines**	Development banking Micro-finance Collateral banking	Reliable, efficient, high-quality infrastructure	Export financing Export credit insurance	Entrepre-neurship training, business skills training BDS market facilitation	Specialised services Business networking
Specialised functions	**Specialised R&D**	**Highly specialised, high-quality training courses**	Specialised, innovative financing Venture capital	Specialised, innovative infrastructure	Advice and support for market research, design, packaging, etc.	Business incubation, business acceleration	Comprehensiv e services Active role in locational policy

Meso organisations enable upgrading, reduces the cost of trying new ideas, support problem solving, demonstrate new technologies, reduce coordination costs

Technological change outpaces institutional capability



Where to start?

Identify initiatives that are:	Operational focus
Supply-driven	Transfer and commercialise technology from government research programmes to private enterprise, both high-tech and low-tech
Demand-driven	Diagnostic or problem driven transfer, plugging performance gaps
Network-based	Creating or strengthening bridging effects, inter-firm partnerships in promoting information flows, and the diffusion of technology (e.g. cluster projects)
Enable technological capability dialogue, adaptation and socio-technical infrastructure building	Working on a system-wide level to upgrade the technology diffusion capability of the national system of innovation within the context of global and regional economic and technological change and opportunities

Adapted from **OECD**. 1997. Diffusing technology to industry: government policies and programmes.

Three additional groups that must be mapped

Identify initiatives that are:	Operational focus
Private actors that provide public goods or mixed goods	Technology demonstration, training and the provision of technology modules in open-source formats
Intermediaries or facilitators in the system	Broker relationships between different meso organisations and other actors, e.g. NGOs that address certain problems in the education system.
International laws and compulsory standards	Rules, performance criteria or standards that put pressure on the economy to embrace new technology, new business arrangements, new process technologies.

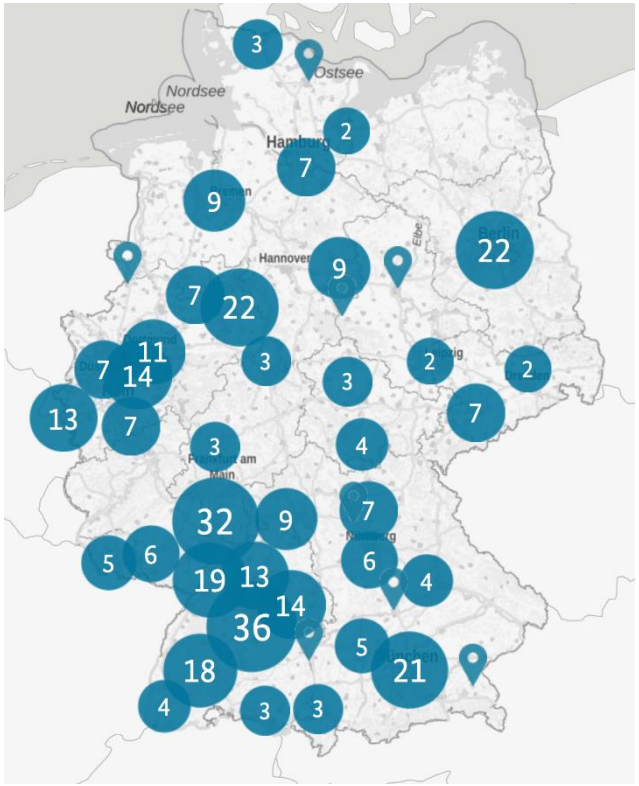
A typology for mapping the meso space

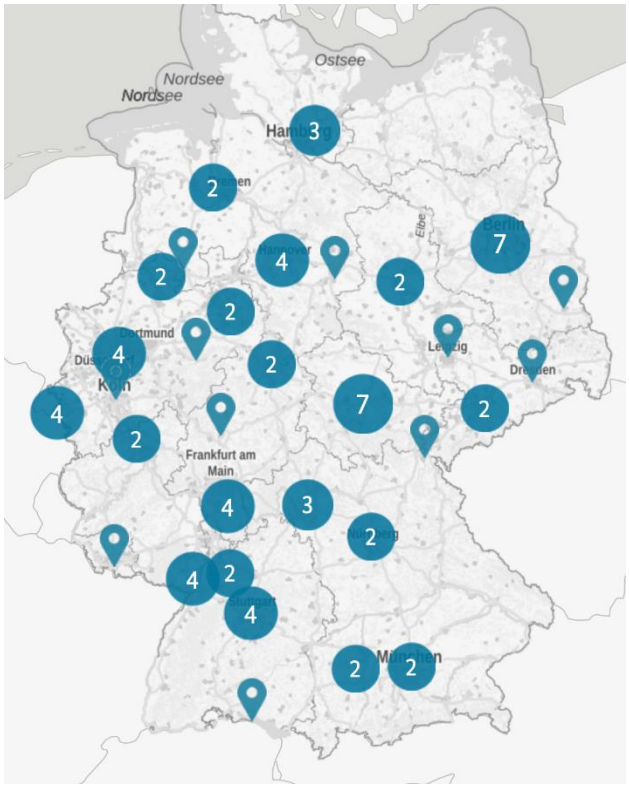
Goal	Programme or organisation type	Objectives
At the highest level, the meso functions improve the adoption and adaptation of specific technologies, business practices (such as particular standards or levels of certification) or new kinds of knowledge.	Technology or knowledge-domain specific	To diffuse specific technology or kind of knowledge to a wide range of firms and sectors
	Institution specific	Promoting technology transfer or dissemination from a specific institution such as a university or a research and development programme
	Sector specific	To diffuse technology or knowledge and practices to a particular industrial sector or sub-sector
	Demonstration	To demonstrate the practical implementation and adaptation of technologies
At the intermediary level, to improve the general technology reception or absorption capacity of enterprises	Technical assistance	To help enterprises to diagnose technology needs and solve problems
	Information networks	To make information exchange between enterprises and public knowledge bases easier, or to foster collaboration and information sharing
	Assistance for small-scale R&D projects and innovation processes	Build capacity for autonomous technology development and innovation within companies
At the level closest to firms, build the innovation, learning and technology-adaptation capability of enterprises	Participatory sector-wide technology roadmaps	Systemic exploration and planning for future strategic technology investments
	Promote the use of diagnostic tools and use cases	Help firms develop innovation-oriented management systems, and overcome adverse selection and information asymmetries
	Benchmarking	Transmit good practices and learning from elsewhere
	Academic programmes and or research and industry collaboration (university-industry collaboration)	Upgrade the knowledge base of the firm and leverage publicly funded infrastructure

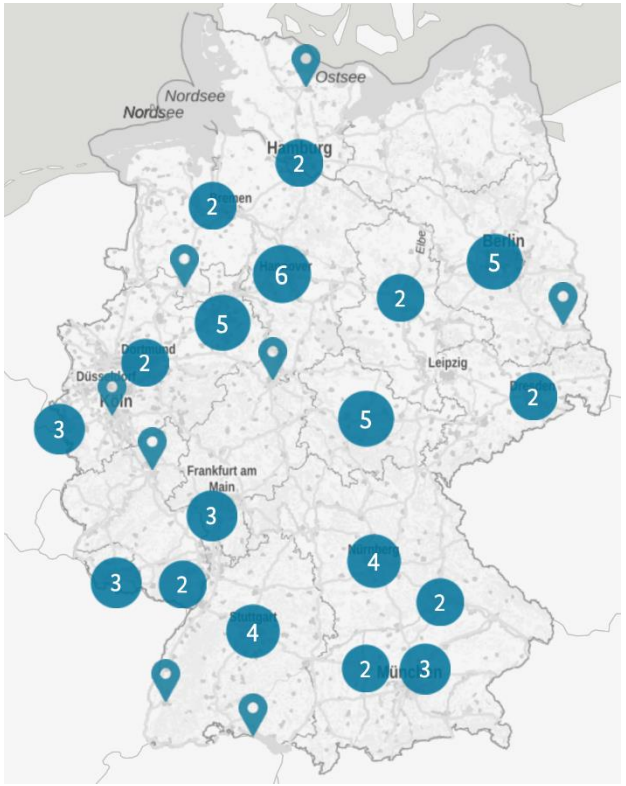
Adapted from **OECD**. 1997. Diffusing technology to industry: government policies and programmes.

Example: Mapping Industrie 4.0 meso organisations in Germany

Demonstration centres	Testing centres	Advice and info







These are not to be confused with research centres

Recommendations

1. Use the existing network of meso organizations to go beyond a directory
    1. **Make it easy** to find scarce equipment, problem solvers, specialized facilities, demonstrators, advisors
    2. Assist some of the technical facilities to become more **business-centric** or **accessible**
    3. Support the development of South African use-case studies of not only product or process technologies, but how meso organisations can help, how business models changed, etc.
2. Leverage existing meso programmes by providing incentives to encourage technology dissemination, networking and strengthening technological capability
3. Strengthen the dynamics and feedback systems between different meso organisations, the private sector and public decision makers
4. Build meso-level institutional capability to detect technological threats or acceleration of technological change.
    1. In some areas technological change observatories should be established
    2. Create rapid response mechanisms to foster collaboration around urgent threats

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