Ε&Α, Καινοτομία και Πολυεθνικές

ΕΠΙΣΚΕΠΤΡΙΑ ΚΑΘΗΓΗΤΡΙΑ

ΜΑΡΙΝΑ ΠΑΠΑΝΑΣΤΑΣΙΟΥ

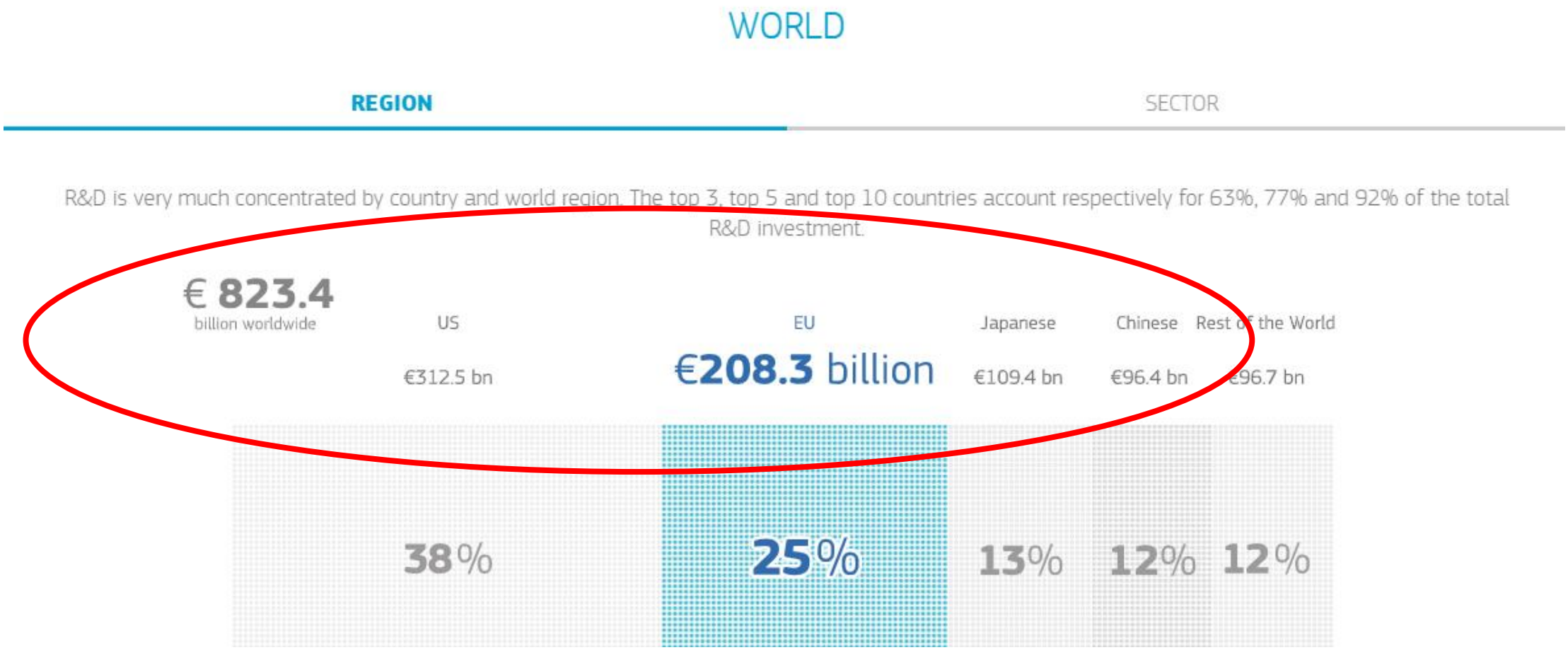
University of Leeds, UK

2 Νοεμβρίου 2020

Η δομή της διάλεξης

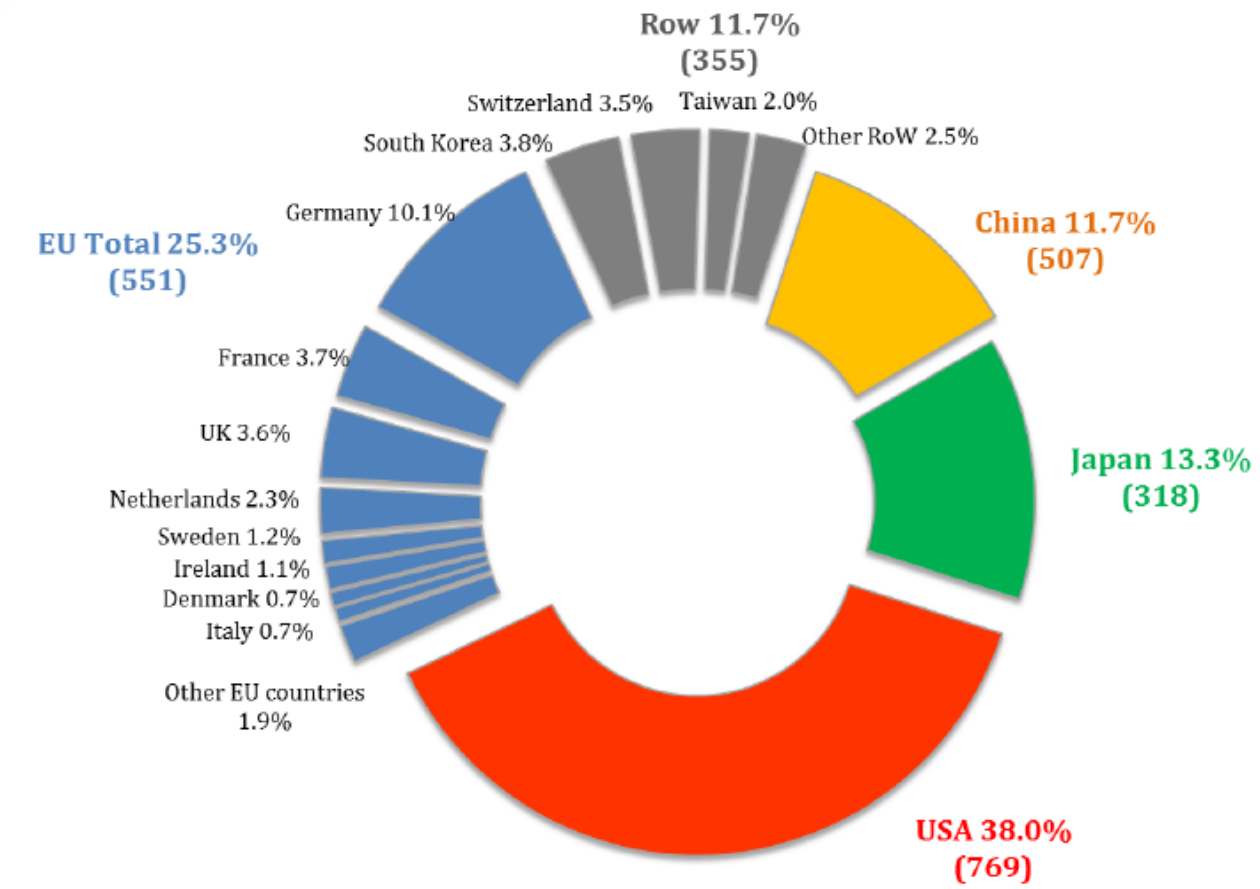
- **Τα δεδομένα**
- Επισκόπηση της βιβλιογραφίας
- A Case Study: Astra Zeneca in China
- R&D and the role of Asia
- Εθνικά συστήματα καινοτομίας
- **Συμπεράσματα**

The regions/countries

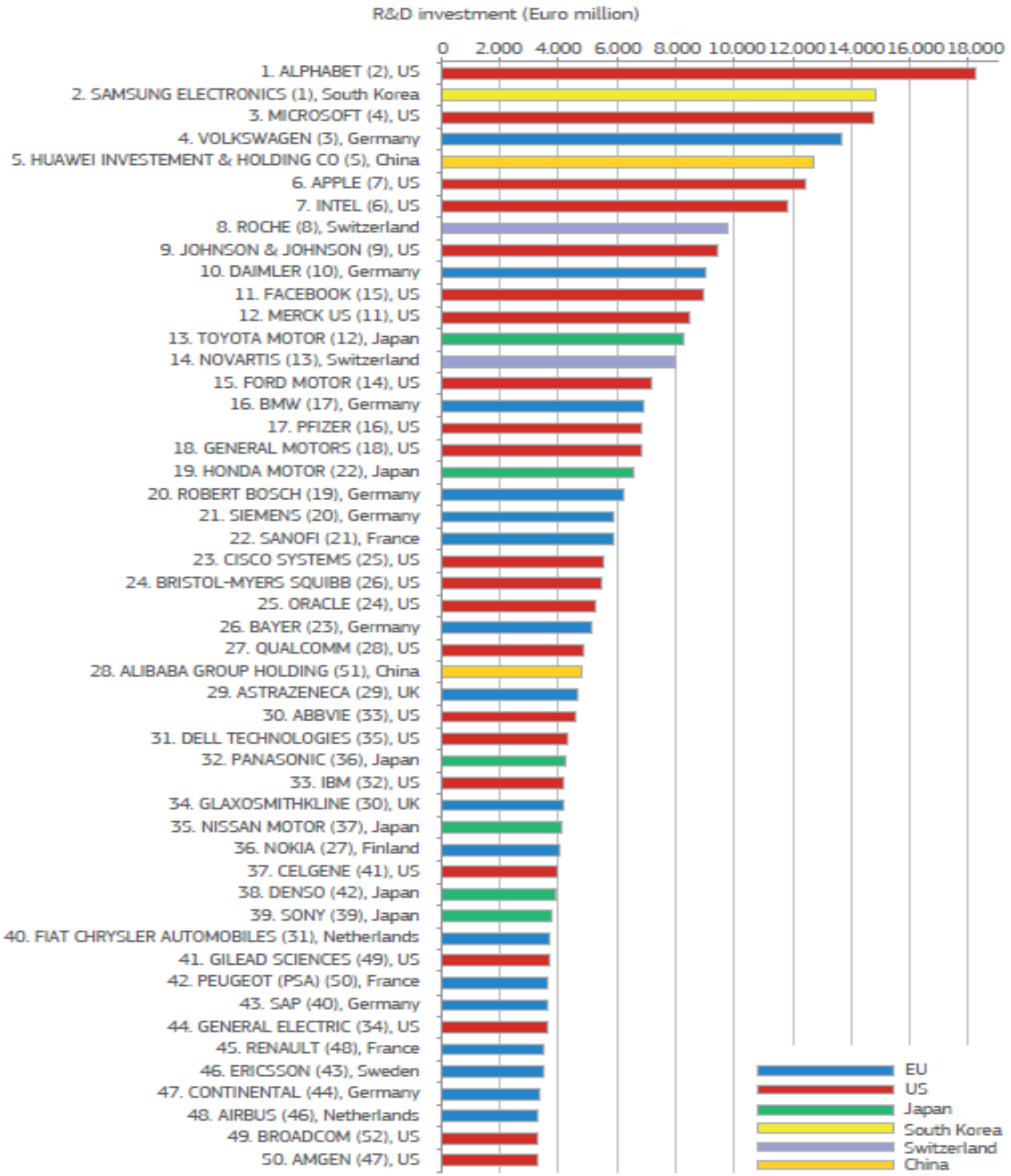


The companies geographical distribution

Figure 1.4 - R&D investment by the 2500 companies by main country/region (% of total €823.4bn).



Source: *The 2019 EU Industrial R&D Investment Scoreboard*, European Commission, JRC/DG RTD.



The global leaders

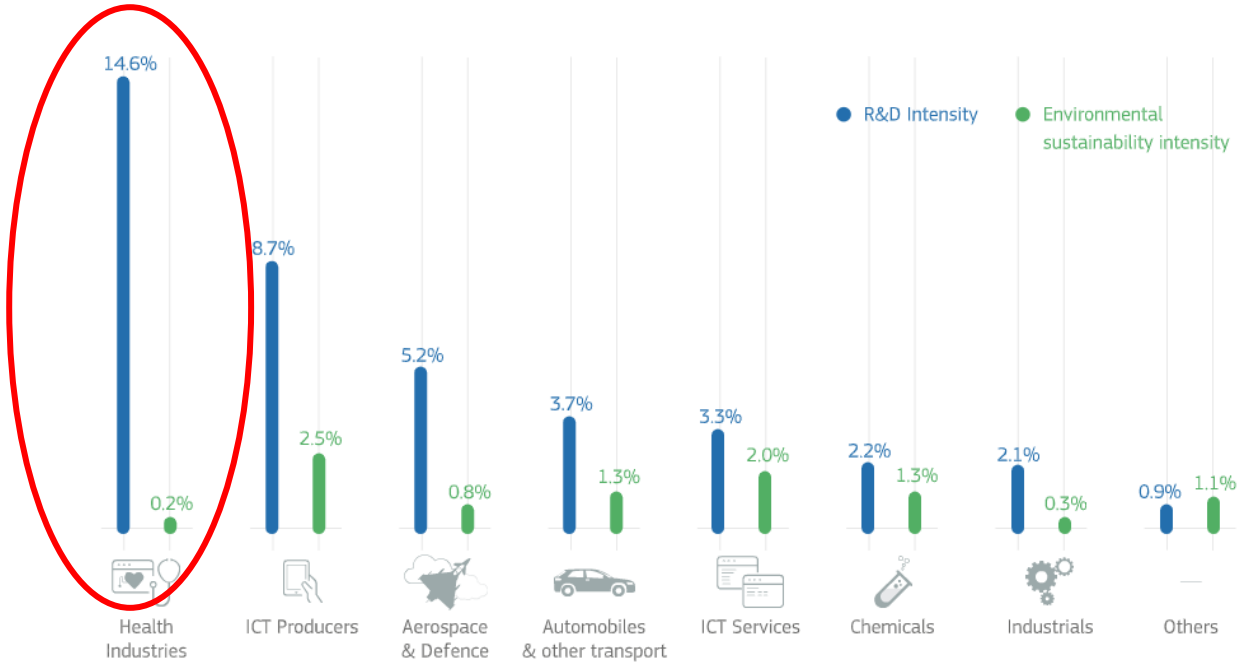
About R&D at Nestlé

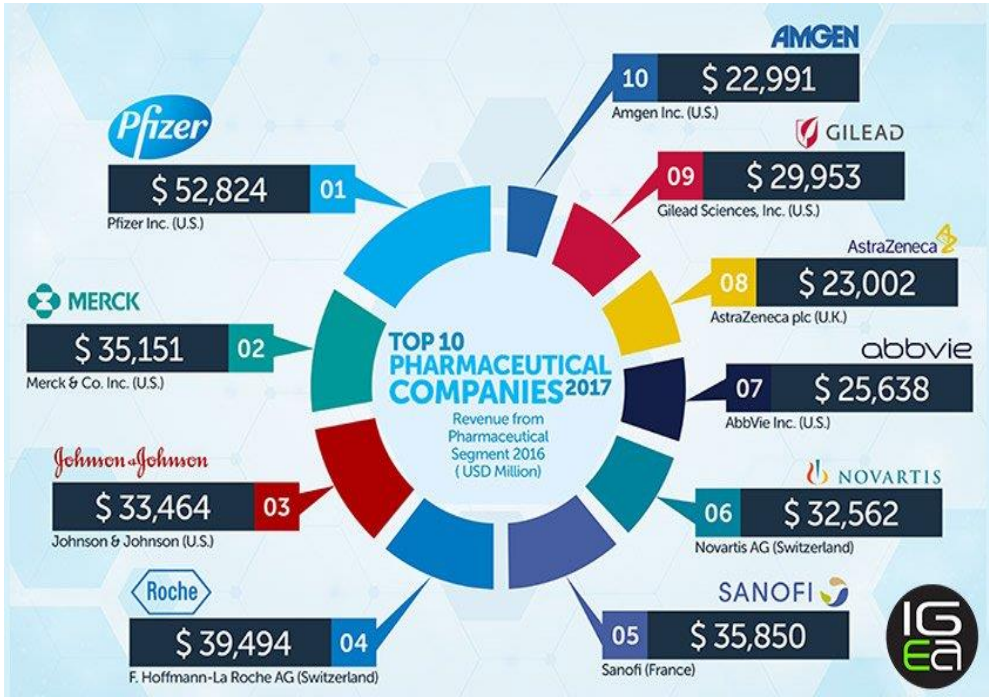
Source: https://www.nestle.com/media/pressreleases/allpressreleases/nestle-strengthens-research-capabilities-switzerland
https://www.youtube.com/watch?v=xgJDQmOWVsg
https://www.youtube.com/watch?v=rf1LG2s-_MY

The sectors

EU Survey

The EU Survey on Industrial R&D Investment Trend enquired companies on the amount of investments in environmental sustainability (not limited to R&D investments). The average R&D intensity (R&D over net sales) of all participants to the survey is 3.5%; the environmental sustainability intensity (investment in environmental sustainability over net sales) is 1.0%. Responding companies in Health Industries and Industrials sectors invest the smallest proportion of net sales in environmental sustainability.





COVID- 19 and R&D

moderna

NIH National Institutes of Health
Turning Discovery Into Health

BIONTECH Pfizer FOSUN PHARMA

Johnson & Johnson

Beth Israel Lahey Health
Beth Israel Deaconess Medical Center

AstraZeneca

UNIVERSITY OF OXFORD

Zydus
dedicated to life

CUREVAC

NOVAVAX
Creating Tomorrow's Vaccines Today

МИНИСТЕРСТВО ЗДРАВООХРАНЕНИЯ РОССИЙСКОЙ ФЕДЕРАЦИИ

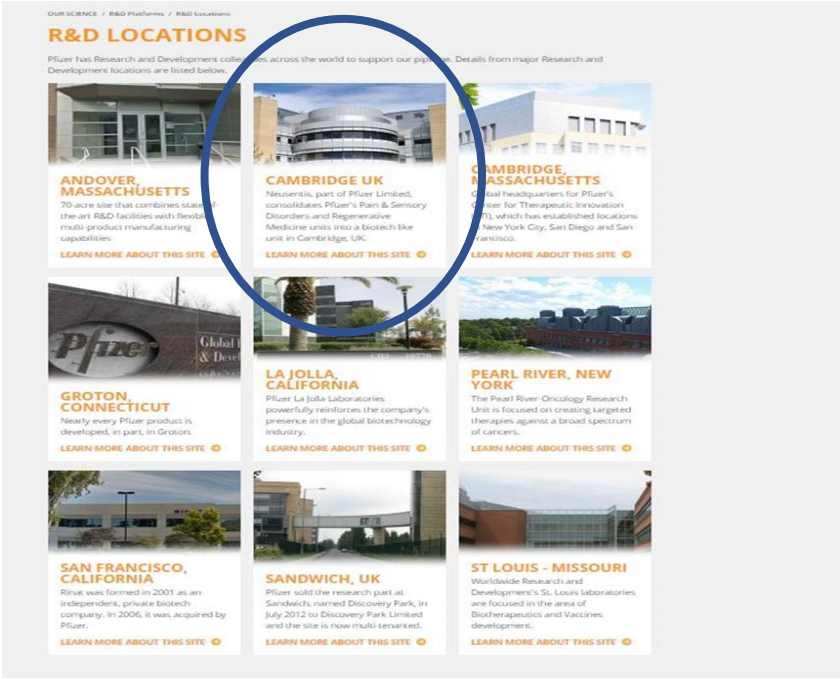
Imperial College London

MORNINGSIDE

Genexine

ZFSW
The Biologics Company

INSTITUTE OF MEDICAL BIOLOGY
CHINESE ACADEMY OF MEDICAL SCIENCES



Sanofi and Pfizer

Some key concepts and keywords

- Internalization
- Barriers to entry
- Ownership advantage
- Competitive advantage
- Organisational types of MNEs, roles of subsidiaries and HQs
- Centralization versus decentralization versus networking of R&D activity leading to internationalisation
- Breaking down R&D (basic research, applied research, development, adaptation)
- Roles of R&D laboratories

Some definitions: Dunning and Lundan, ch.11

- **Technological capacity e.g. R&D laboratories, scientists, research institutions**
- **Technology i.e. output of technological capacity e.g. new product, new organizational structures**
- Between technological capacity, which represents the stock of technology-producing assets (for example, R&D laboratories, higher educational institutions, scientists and engineers, information of all kinds, the accumulated experience of private and public institutions, and the knowledge of managers and administrative workers) and technology, that is, the output of technological capacity (for example, new product and process technologies, organisational improvements, more efficient inventory control techniques, new forms of transport and communication).
- **Human and physical technology assets**

- Between *human* and *physical* technological assets. The former include the stock of scientists and engineers, designers, managers, and so on, and the services flowin from them. The latter embrace buildings, plant and equipment, research laboratories, drawings, specifications, and so on, and capital goods which contain the output of technological capacity. A different, but related, distinction is between 'hard' and 'soft' technology. The former mainly represents all kinds of tangible innovatory assets, and the latter, drawings, blueprints, formulae, specifications, training manuals, technical skills, organisational management techniques, systems of quality control, inventory management, industrial relations procedures and so on.

- **Levels and stages--- know-how** (the knowledge of how to make the best use of the technology or technological capacity acquired) and
- **know- why** (understanding of the nature of the underlying materials, process and product technologies, which leads to a substantial adaptation, improvement and even replacement of existing materials, processes and products)
- Lall argues that developing countries go through various stages of technological development, where the first stage is the importation of **know-how** technology. This is followed by the application of the imported knowledge to the process of commercial innovation. The final stage of technological capability (which many countries do not reach), is the ability of countries and firms to undertake their own basic research **(know-why),** pushing back the frontiers of knowledge without regard to specific commercial applications.
- **Technology transfer** (the transfer of product or process technology within or between firms across national borders, but it could equally be between firms or other organisations in the same country).
- **Technology dissemination** (the diffusion of technology away from the organisation possessing it to other organisations, that is, externalising its ownership or use)
- **Technology absorption** (the institutional and other competences of an economy which acquires technology to utilise or adapt it to its advantage)

Overseas R&D laboratories

- Support Lab
- Locally Integrated Lab
- Internationally Interdependent Lab

A review of the literature: First Phase: 1970s – early 1980s

The first systematic attempts to understand decentralised R&D in MNEs appeared in the early 1970s.

First studies reflected the classic view of MNEs as largely innovating in the home country and merely adapting product and process technology in the host locations

A review of the literature: Second Phase: 1980s- early 2000s

Emergence of Overseas R&D laboratories typologies

This phase is characterized *inter alia* by an increasing perception of the diffusion of “home-base augmenting” and “asset–seeking” strategies as opposed to home-base exploiting and asset-exploiting R&D activities.

A review of the literature: Third Phase: post 2000

The third, post- 2000, phase is by and large characterized by the co-existence and partial convergence of complementary disciplines, including economic geography, international trade and industrial organization, and by the proliferation of empirical works.

A Case Study: Astra Zeneca in China

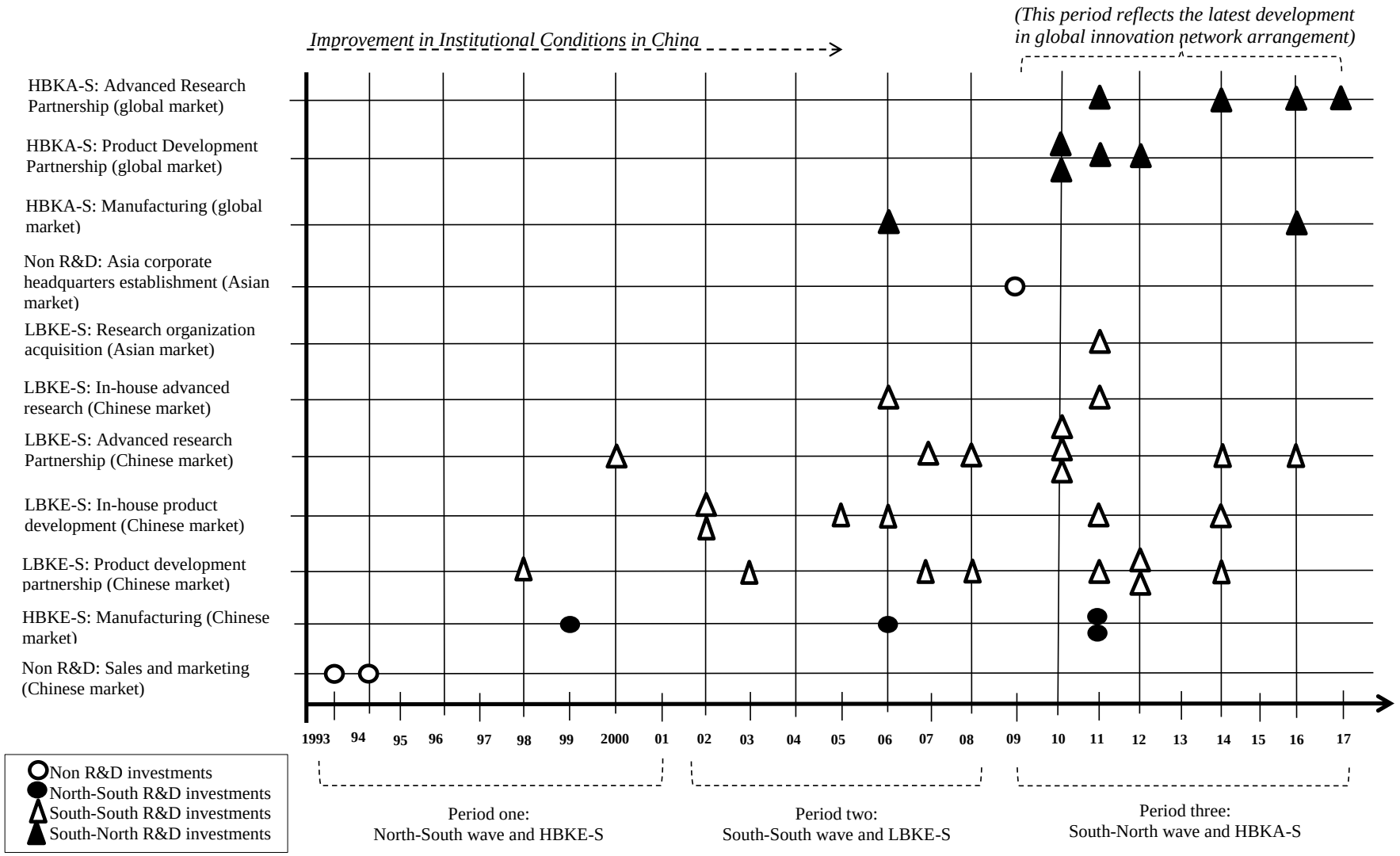


Figure 2. R&D activities of AZ China between 1993 and 2017

Third period of expansion in China (2009–2017)

- This period witnessed the most significant development in terms of localized and global innovation.
- It saw the strengthening of the Chinese government's policy and funding support for more advanced innovation activities.

Year	Means of innovation activity
2010	Partnership agreement with Peking University
2010	Partnership agreement with No. 1 Affiliated Hospital of Guangzhou Medical College
2010	Research collaboration with BioDuro Clinical Research
2011	Research collaboration with Chi-Med China
2012	Partnership agreement with WuXi AppTec, and support from AZ's US biotech subsidiary Medimmune
2012	Research collaboration with Ironwood Pharmaceuticals, Inc.
2014	Research collaboration with Shenzhen University Health Science Centre
2014	Partnership agreement with Tianjin Medical University
2016	Partnership agreement with WuXi AppTec
2017	Strategic joint venture (namely Dizal Pharmaceuticals) with Future Industry Investment Fund China

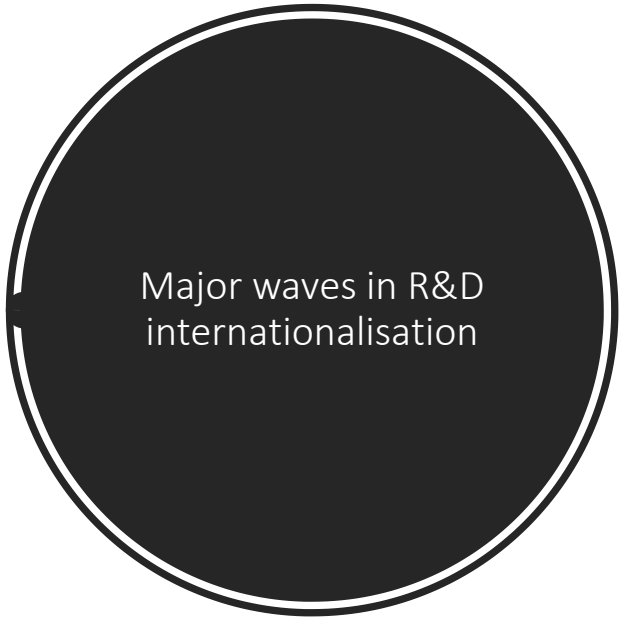


Table 1. Classification of the four major waves in MNE R&D internationalization

North: advanced economies (e.g. US, UK, Germany, Japan)
South: emerging economies (e.g. China, India, Brazil)

	Location	*R&D objectives*
Wave 1	North-North	Home-based knowledge augmentation in the North (HBKA-N)
Wave 2	North-South	Home-based knowledge exploitation in the South (HBKE-S)
Wave 3	South-South	Local-based knowledge exploration in the South (LBKE-S)
Wave 4	South-North	Home-based knowledge augmentation in the South (HBKA-S)

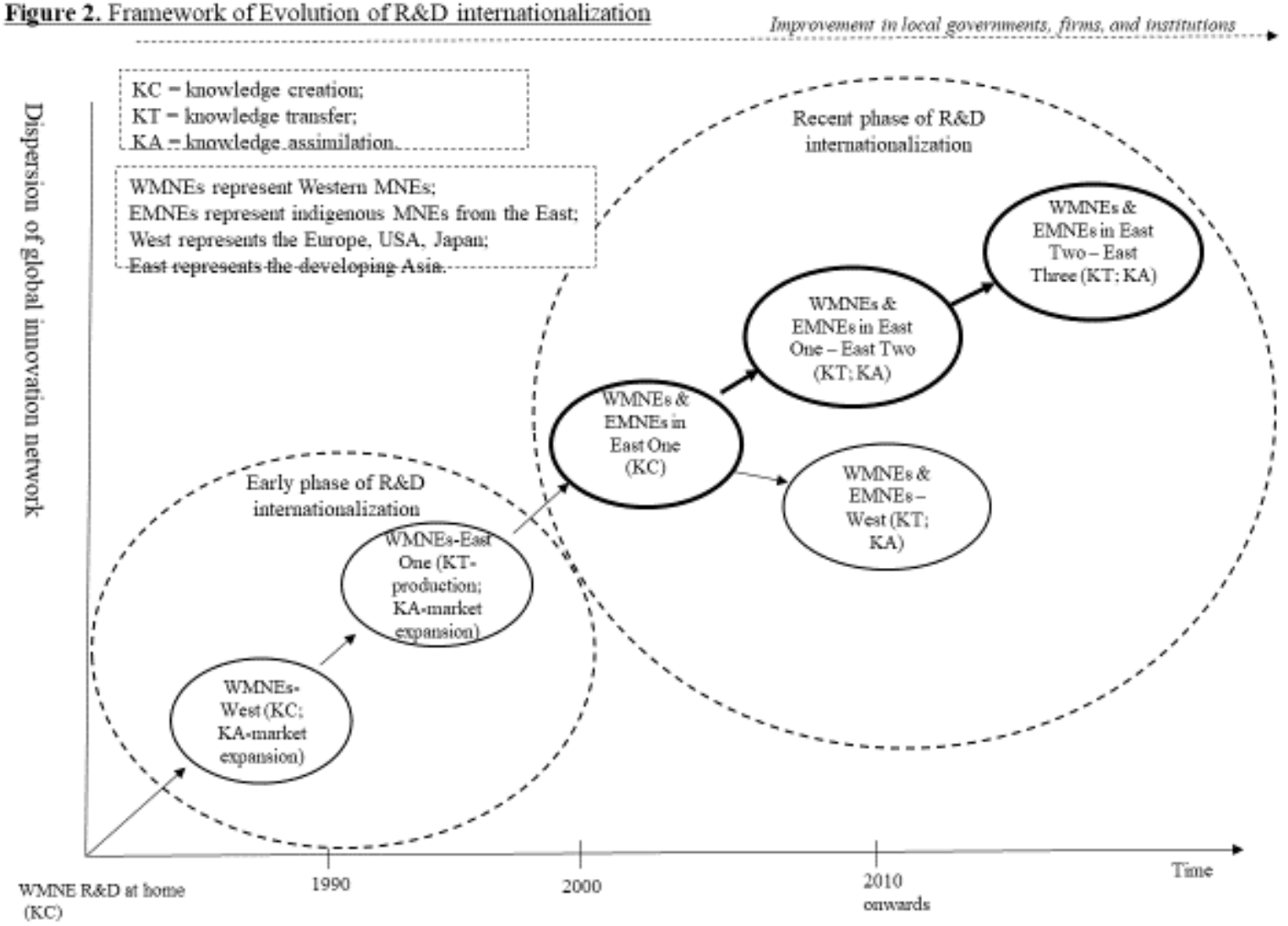
Heterogeneity of governments, indigenous firms, and institutions across East One

Heterogeneity of governments, indigenous firms, and institutions across East One			
	Governments (pro-innovation environment)	Indigenous firms (characteristics of local innovation)	Institutions (IPR legal protection; innovation expertise)
China	- Strong policy support - Effective NIS covering all key areas	- Highly concentrated in several key industries - Focus on both radical and incremental innovation - Extremely active learning from Western firms - Indigenous MNEs with strong R&D capability	- Weak IPR protection - Local-educated and repatriated expertise
India	- Strong policy support - Targeted NIS for priority industries	- Highly active across a few specific industries - Focus on frugal innovation - Active learning from Western firms - Indigenous MNEs with strong R&D capability	- Weak IPR protection - Local-educated ICT expertise
Singapore	- Strong policy support - Targeted NIS for priority industries	- Highly active across a few specific industries - Focus on incremental innovation - Extremely active learning from Western firms - Indigenous MNEs with strong R&D capability	- Strong IPR protection - Local-educated and immigrated expertise

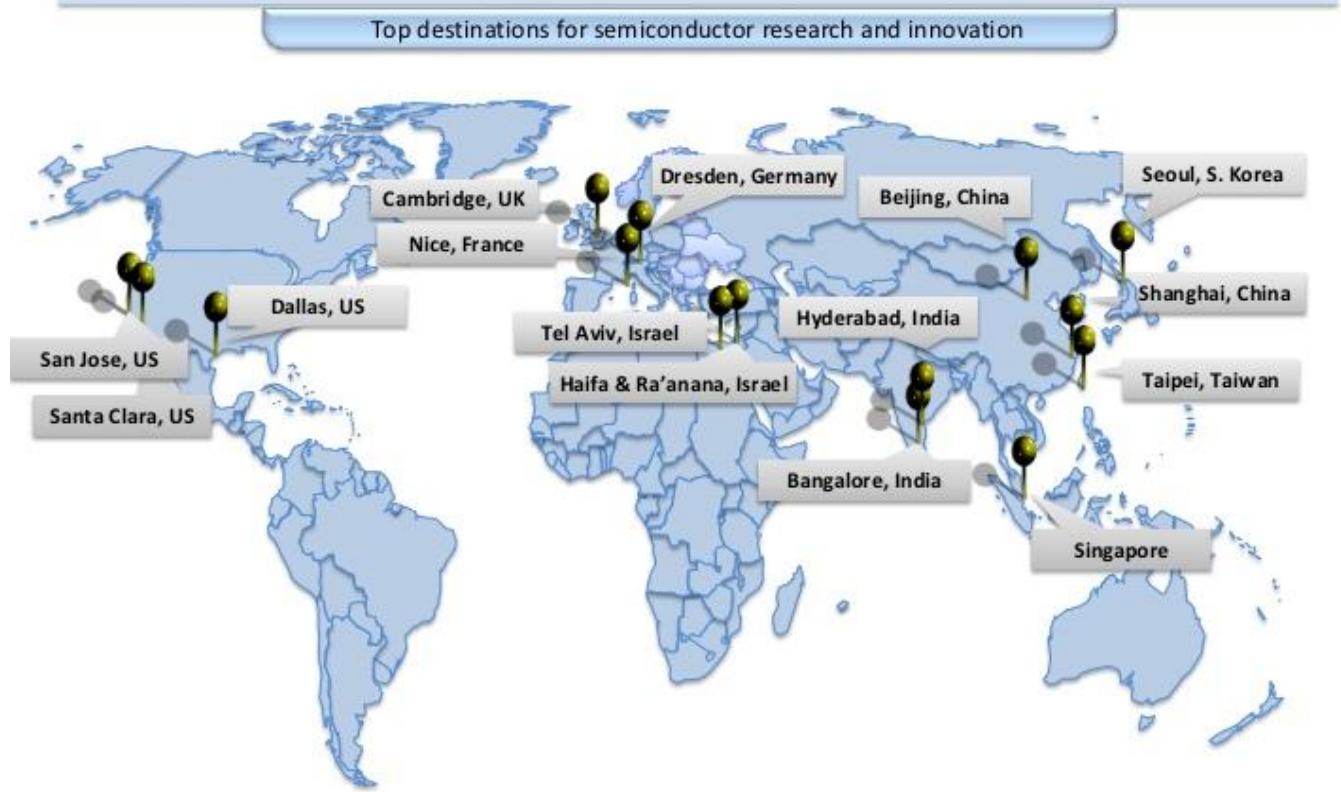
Heterogeneity of governments, indigenous firms, and institutions across East Two

Heterogeneity of governments, indigenous firms, and institutions across East Two			
	Governments (pro-innovation environment)	Indigenous firms (characteristics of local innovation)	Institutions (IPR legal protection; innovation expertise)
Malaysia	- Average policy support - Partially effective NIS for priority industries	- Limited innovation across key industries - Focus on incremental innovation - Limited learning from Western firms - No/limited indigenous MNEs	- Improving IPR protection - Local-educated expertise
Thailand	- Less effective policy support - Less effective NIS across all key areas	- Limited innovation across key industries - Limited focus on both radical and incremental innovation - Extremely limited learning from Western firms - No/limited indigenous MNEs	- Weak IPR protection - Local-educated expertise
Vietnam	- Less effective policy support - Less effective NIS across all key areas	- Limited innovation across key industries - Limited focus on both radical and incremental innovation - Extremely limited learning from Western firms - No/limited indigenous MNEs	- Weak IPR protection - Increase in repatriated expertise

Figure 2. Framework of Evolution of R&D internationalization



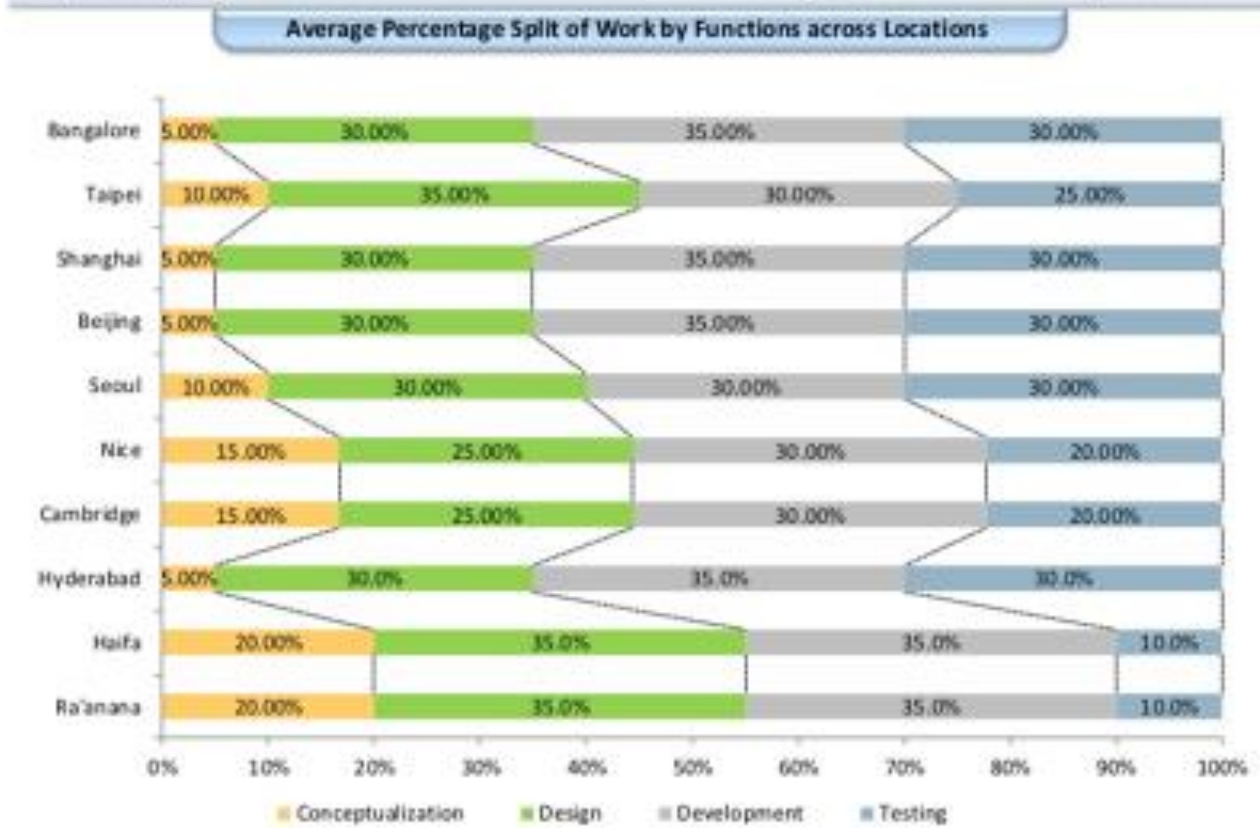
Asian and European cities emerged as the most suitable destinations for semiconductor related work



Source: Zinnov Database, Zinnov Research & Analysis

Semiconductor Research and Innovation: Source: https://www.slideshare.net/zinnov/semiconductor-hubs-for-research-innovation

Predominant activity in low cost locations in India & China is development & testing; in comparison, high cost locations like Israel & UK have a higher share of conceptualization



Source: Primary Interviews, Zinnov Research and Analysis

Semiconductor Research and Innovation: Source: https://www.slideshare.net/zinnov/semiconductor-hubs-for-research-innovation

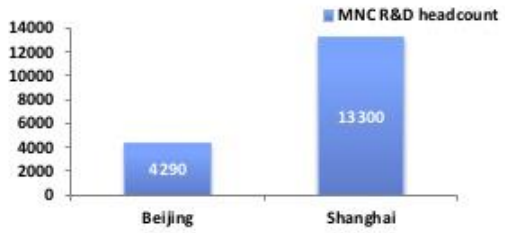
Beijing & Shanghai have a large Research & Development talent Pool across sectors which gives them a competitive advantage over other locations

Shanghai & Beijing

Shanghai & Beijing, China

- China is home to number of large semiconductor companies. Foreign companies dominate the landscape; a number of domestic firms have also gained in scale and glob al presence
- Besides being a strategic market location, Shanghai & Beijing have a large R&D talent Pool across sectors which gives it a competitive advantage over other locations
- China's government played a key role in promoting R&D investment in the region

Talent Pool & University ecosystem



- Beijing houses 70 graduate and post graduate colleges. Two of the Chinese National Universities are based out of Beijing
- Shanghai is a major center of higher education and research with ~30 colleges and universities. 6 of the country's prestigious universities are based out of Shanghai

Competitive landscape

- China has more than 600 companies in semiconductor vertical, including 472 IC design enterprises
- Foreign companies dominate the semiconductor industry; some of the domestic players have also grown significantly and established

Government initiatives & incentives

Financial incentives

- Companies incurring R&D expenses in the production of new technologies, products, or techniques may enjoy a **50 percent "super deduction"** over and above actual expense deduction
- Taxation laws for semiconductor manufacturing sector allow a **5 year tax holiday** involving full exemption from corporate income tax for first 5 years, starting when the business becomes profitable
- To promote the IC design industry, **state-owned research institutes were privatized** and also private companies were provided financial assistance to conduct R&D activities
- IC manufacturers are **exempt from paying import duties** and 17% VAT on IC production equipment and machinery. They are also granted easy customs clearance

Technology park/ R&D cluster

- China has more than **100 "high-technology parks"** scattered throughout the country. Relatively large and more concentrated clusters are emerging in Zhangjiang, Suzhou and Beijing

Semiconductor Research and Innovation: Source: https://www.slideshare.net/zinnov/semiconductor-hubs-for-research-innovation

The creation and support of the cluster in the Cambridge region "Silicon Fen" has led to the formulation of the well-established Semiconductor Industry in UK

Cambridge

Cambridge, UK

- Cambridge in East England has a healthy number of semiconductor design companies focused on device- and application-based markets
- Oxford, Southampton and Surrey in Southeast England are focused on application engineering and hardware design in the semiconductor ecosystem

University ecosystem

- Cambridge is the home to world famous '**University of Cambridge**' which has student population of about 18,000. It has produced 88 Noble prize winners
- The University is credited for the supply of competitive manpower that addresses the need of the semiconductor sector, which is highly knowledge-intensive
- Also of importance is Cambridge Universities' liberal attitude to IP rights which has allowed the 'spinning off' of companies from research

Competitive landscape

- The creation and support of the cluster in the Cambridge region "Silicon Fen" has led to the formulation of the well-established Semiconductor Industry in the UK
- A top semiconductor major focuses on development of DSP architectures and compilers and embedded software
- Another specializes in technologies, tools and design for mobile UI with engineering and design teams working on embedded mobile handset and server-side technologies

Government initiatives & incentives

Financial incentives

- R&D companies can claim a deduction on their taxable profits if they spend at least £10,000 annually on qualifying R&D activities
- While SMEs can claim 175%, large companies can claim 130% of qualifying expenditure

Technology park/ R&D cluster

"Silicon Fen" Cambridge, UK

1970s

Early Years

Cambridge Science Park set up in 1970

Large number of high-technology spin-

1980-90s

Growth & Innovation

Cluster produces more patents per capita than the UK average

Cluster grows rapidly with the emergence of computer services firms and

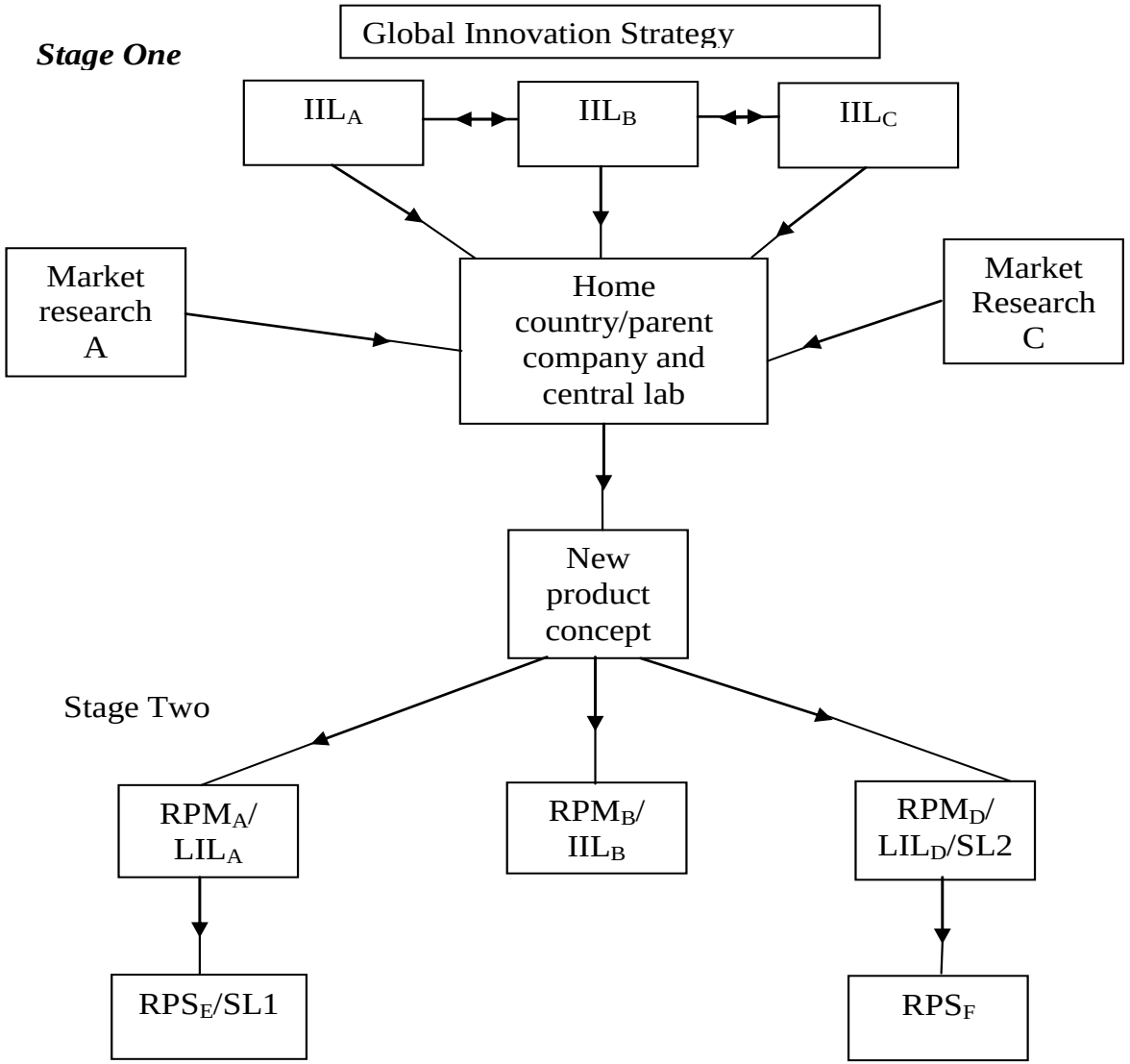
1990-Present Day

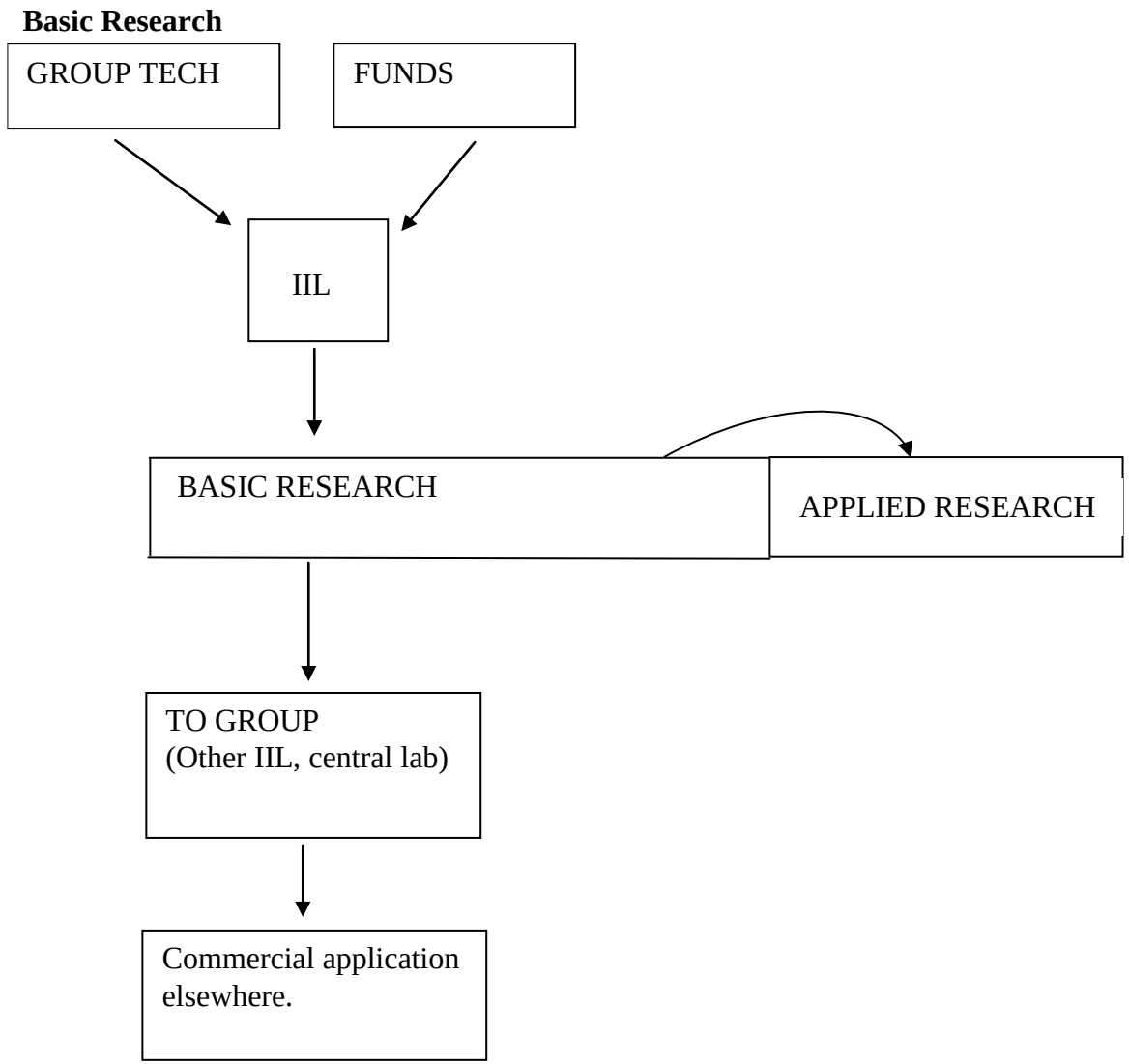
Established Ecosystem

250 active start-ups are directly linked to the Cambridge University

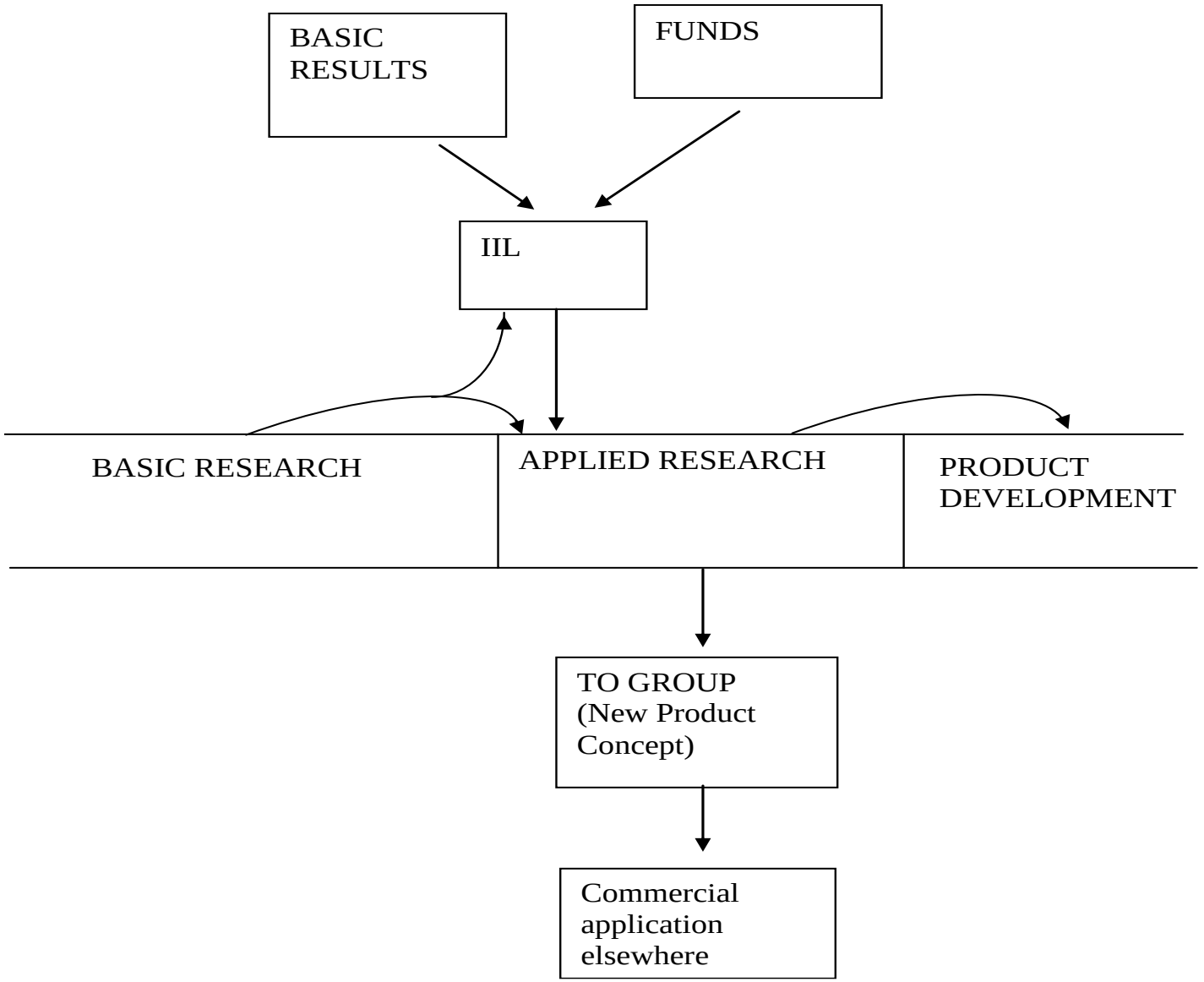
Factors that helped establish the semiconductor ecosystem

- Proximity to University
- Collaboration with University and other R&D organizations
- Easy access to

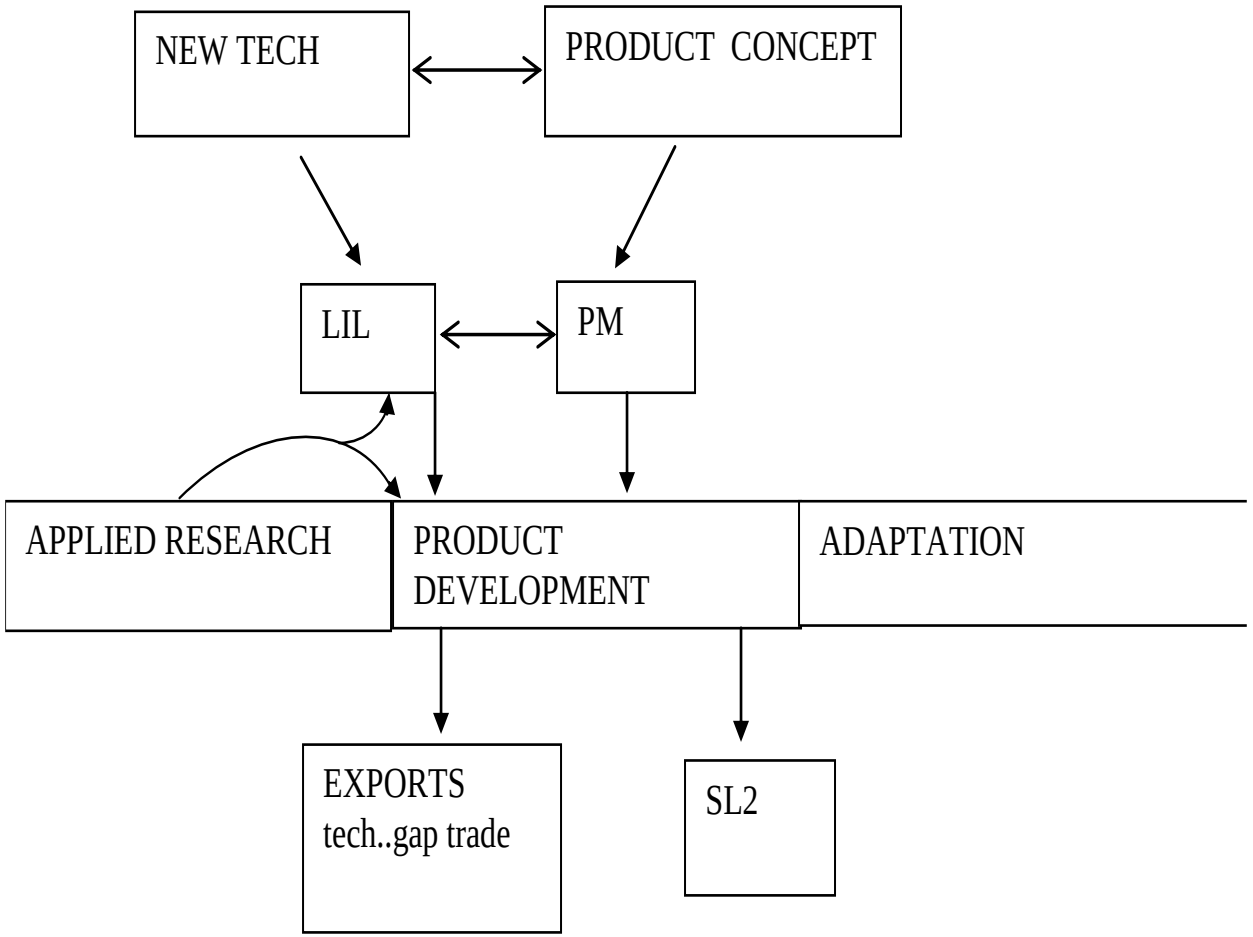

Stage One
Global Innovation Strategy
IIL$_A$
IIL$_B$
IIL$_C$
Market research A
Home country/parent company and central lab
Market Research C
New product concept
Stage Two
RPM$_A$/ LIL$_A$
RPM$_B$/ IIL$_B$
RPM$_D$/ LIL$_D$/SL2
RPS$_E$/SL1
RPS$_F$


Basic Research
GROUP TECH
FUNDS
IIL
BASIC RESEARCH
APPLIED RESEARCH
TO GROUP
(Other IIL, central lab)
Commercial application
elsewhere.

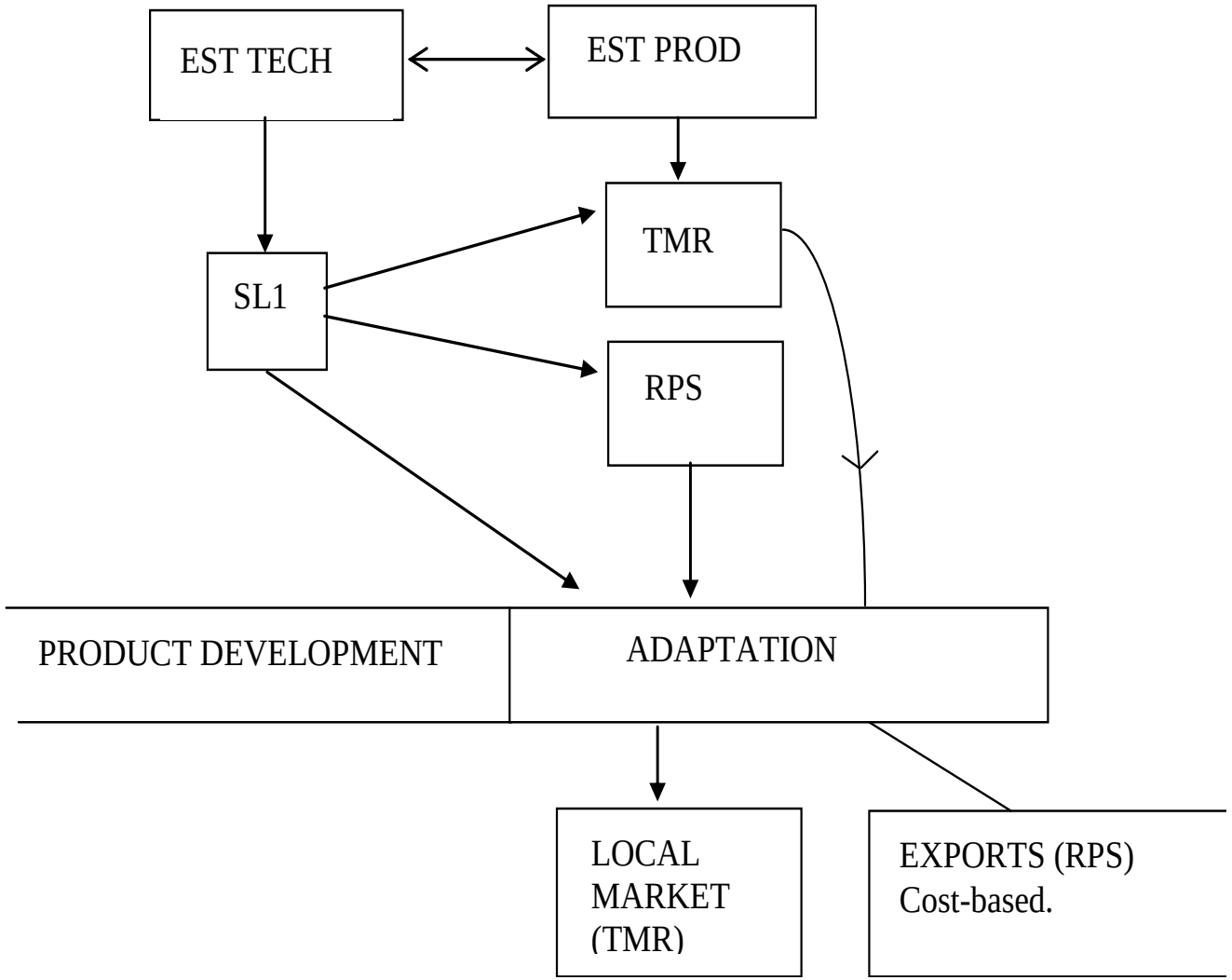
Applied Research



Product Development



Adaptation


EST TECH
EST PROD
TMR
SL1
RPS
PRODUCT DEVELOPMENT
ADAPTATION
LOCAL MARKET (TMR)
EXPORTS (RPS) Cost-based.

Συμπεράσματα

- Καθοριστικός ο ρόλος των Πολυεθνικών στην παγκόσμια καινοτομική δραστηριότητα
- Διαφορετικοί τύποι εργαστηρίων Ε&Α
- Παγκόσμια στρατηγική καινοτομίας
- Εθνικά συστήματα καινοτομίας