CORE TECHNOLOGY VENTURES SERVICES

Hydrogen & Fuel Cell Companies and European Market Failure

College of Europe
April 2, 2009

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Agenda

1. Economics & Finance

- Investment and the Circular Flow of Income
- Investment & the Financial System

2. The European Fuel Cell Industry

- Global Players
- Global Technoogy Supply Chain
- The Structure of the European H2&FC Industry: Dominated by micro developers

3. Financing Early-Stage Technology

- The Long Road to Product
- Company Types and The Failure of Public Support Instruments

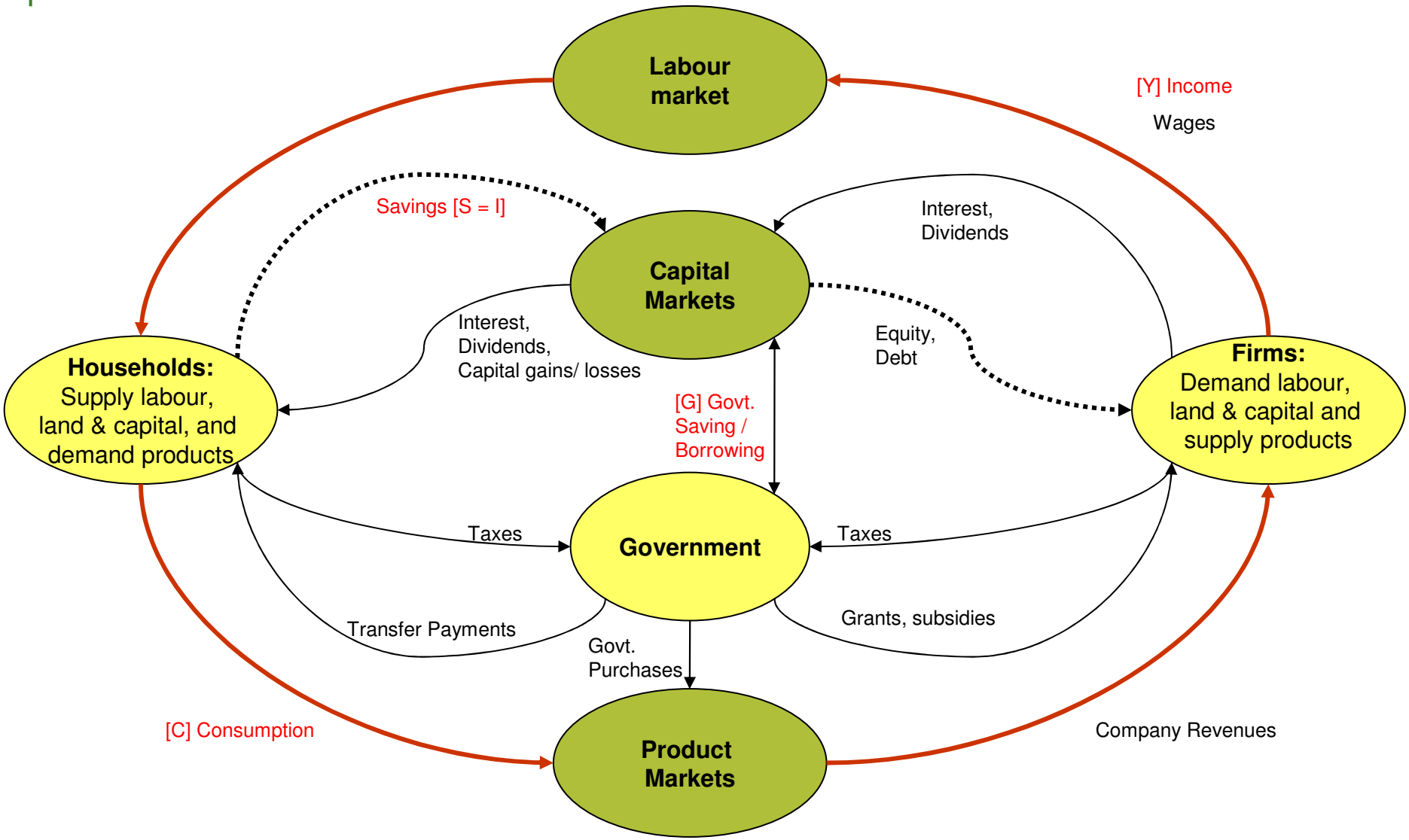
4. Early-Stage Companies & Investor Requirements

- The Types & Roles of Early-Stage Financial Investors
- Investor Requirements: of the Business Model
- Investor Requirements: of the Management
- The Failure of Micro Companies: To appreciate ....

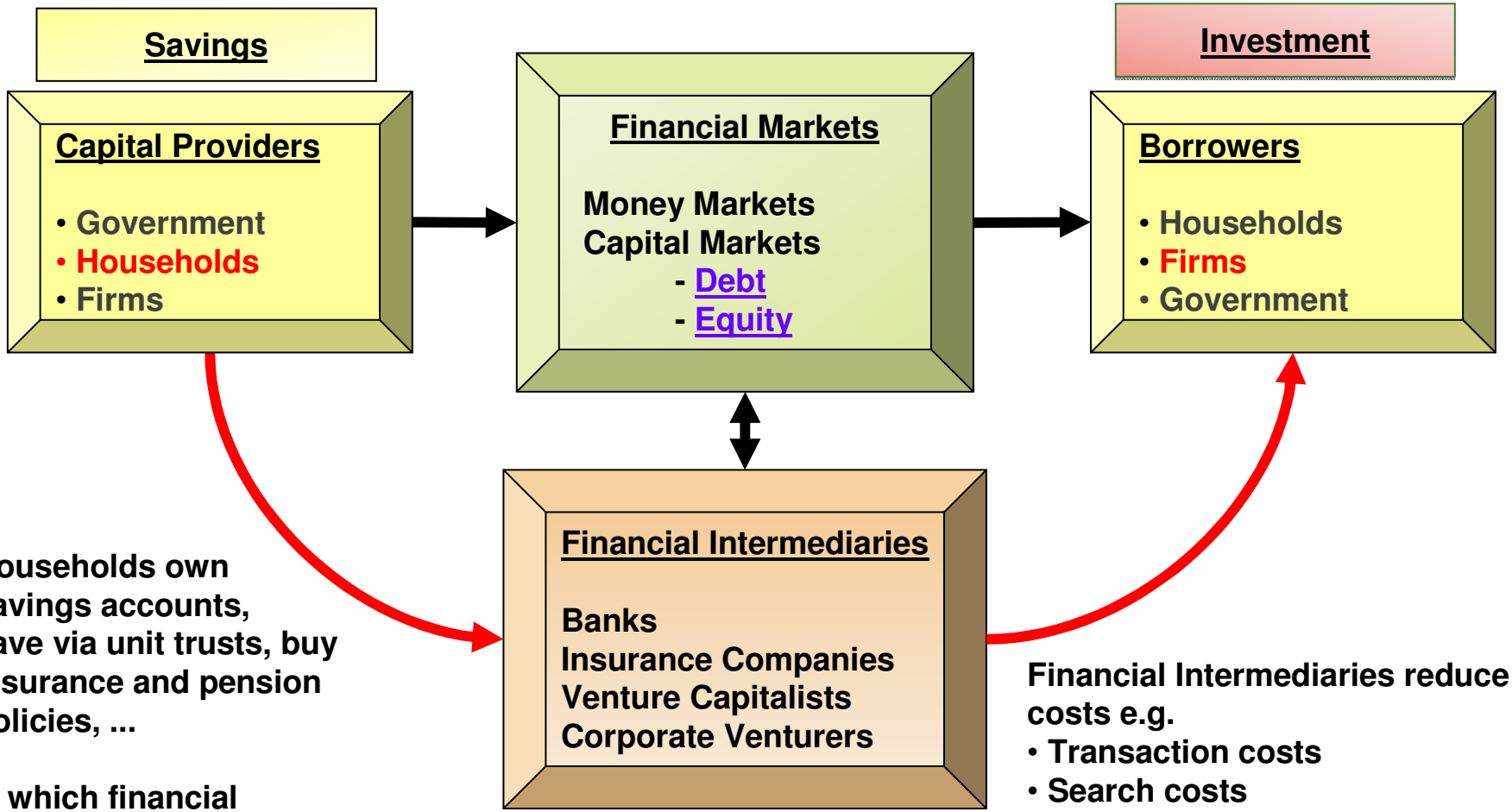
5. Concluding Remarks

1. Economics & Finance

Circular Flow of Income: Expenditure (Y) = C + I + G



Investment & the Financial System



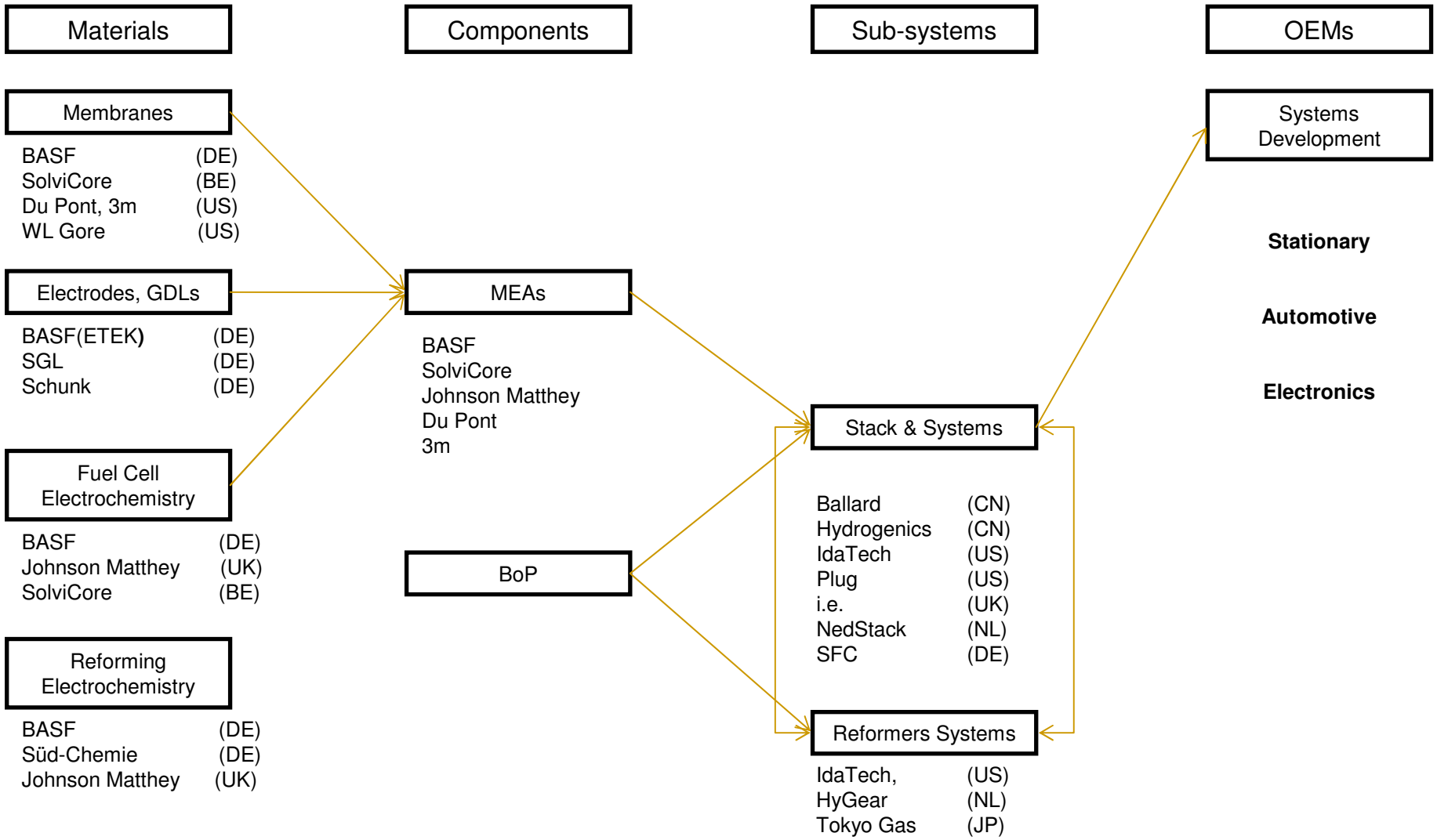
Households own savings accounts, save via unit trusts, buy insurance and pension policies, ...

... which financial intermediaries channel between lenders & borrowers

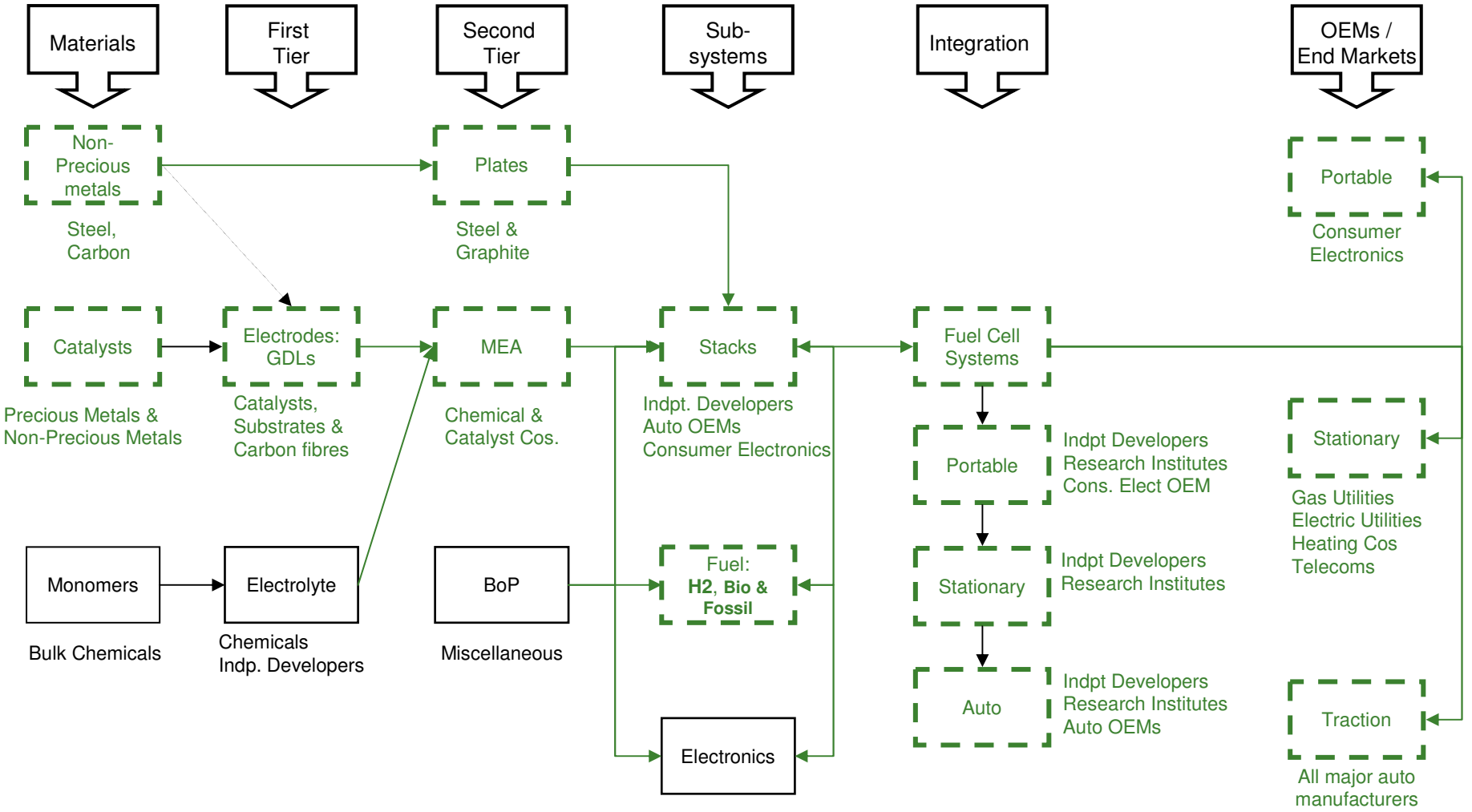
Financial Intermediaries reduce costs e.g.
- **Transaction costs**
- **Search costs**
- **Monitoring costs**
- **Technical due diligence**
- **Legal & other professional costs**

2. The European Fuel Cell Industry

PEMFC Global Industry Supply Chain (non-exhaustive)



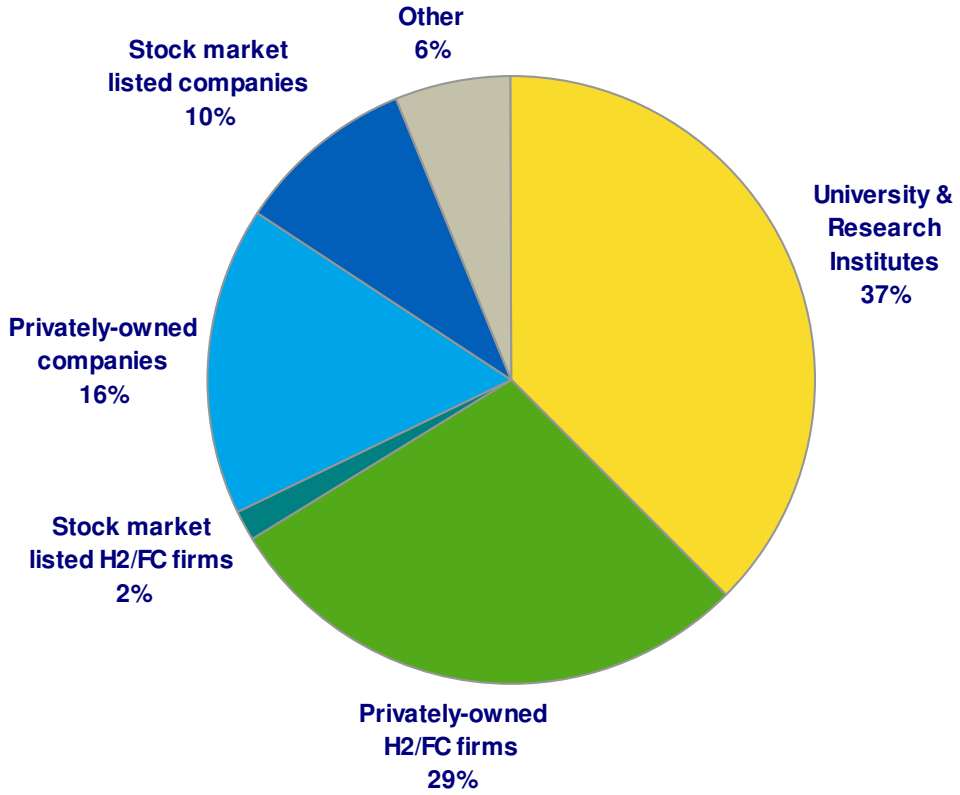
Global Technology Supply Chain



Structure of the European H2&FC Industry*:

Dominated by innovative Independent and Academic organisations

Provisional Data from Roads2HyCom Project*



Nomenclature

- **"University & Research Institutes"**
  Institutions developing H2&FC technologies,
  e.g. Frauenhof, ECN
- **"H2&FC Firms"**
  'Micro-firms', predominantly focused on the development of H2&FC technologies,
  e.g. CFCL, Nedstack, P21
- **"Companies"**
  Well-capitalised, economically successful corporates, whose existence is not dependent on the success of H2&FC
  e.g. Daimler, SGL Carbon, Schunk
- **"Other"**
  Service companies
  e.g. consultants

Organisational Form	Potentially Available Financial Instruments
Stock market listed (Corporate) company	Debt , Equity, Grants & Subsidies, Tax breaks, Retained Profits
Privately owned (Corporate) company	Debt, Grants , Subsidies, Tax breaks, Retained Profits
Stock market listed (Micro) firm	Debt, Equity, Grants & Subsidies, Tax breaks
Privately owned (Micro) firm	Venture Capital, Private Sources
University, Research Institute	R&D Grants, Industry sponsorship

**Source Roads2HyCom*
281 respondents gave details of "organisational form"

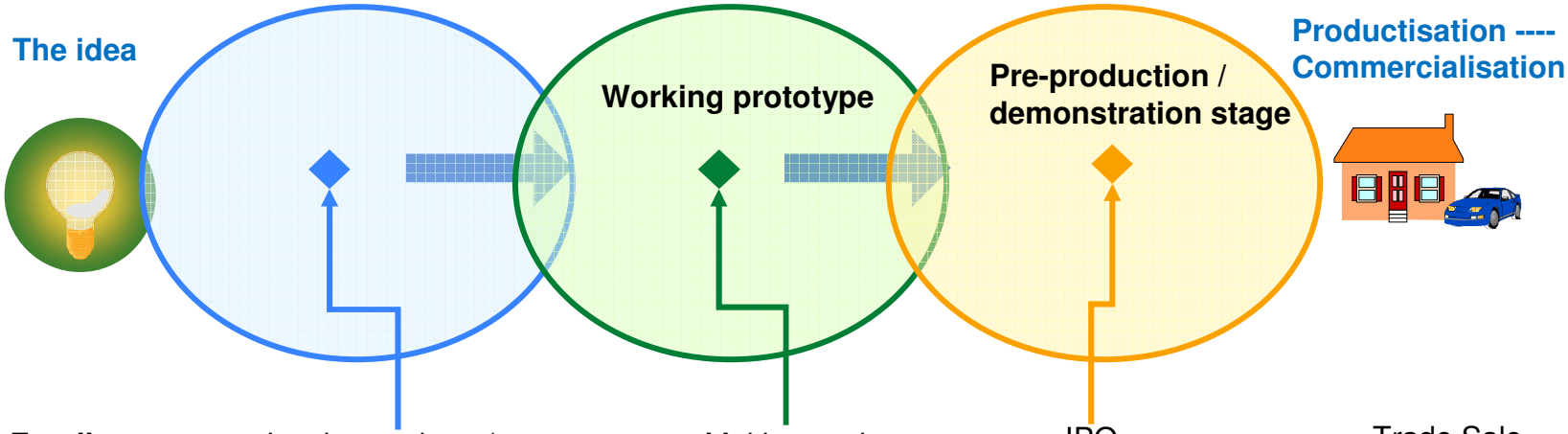
•Roads2HyCom is an EU supported consortium charged with describing & analysing the European H2&FC industry

3. Financing Early-Stage Technology

The Long Road to Product

Company journey

1 or 2 individuals (sweat equity)	Form venture (or new unit) (Friends & family)	Bring in first outsider (Angel or seed)	Recruit specialists (Venture Capital)	Grow operational staff (IPO, revenues)	30+ employees (Profit)

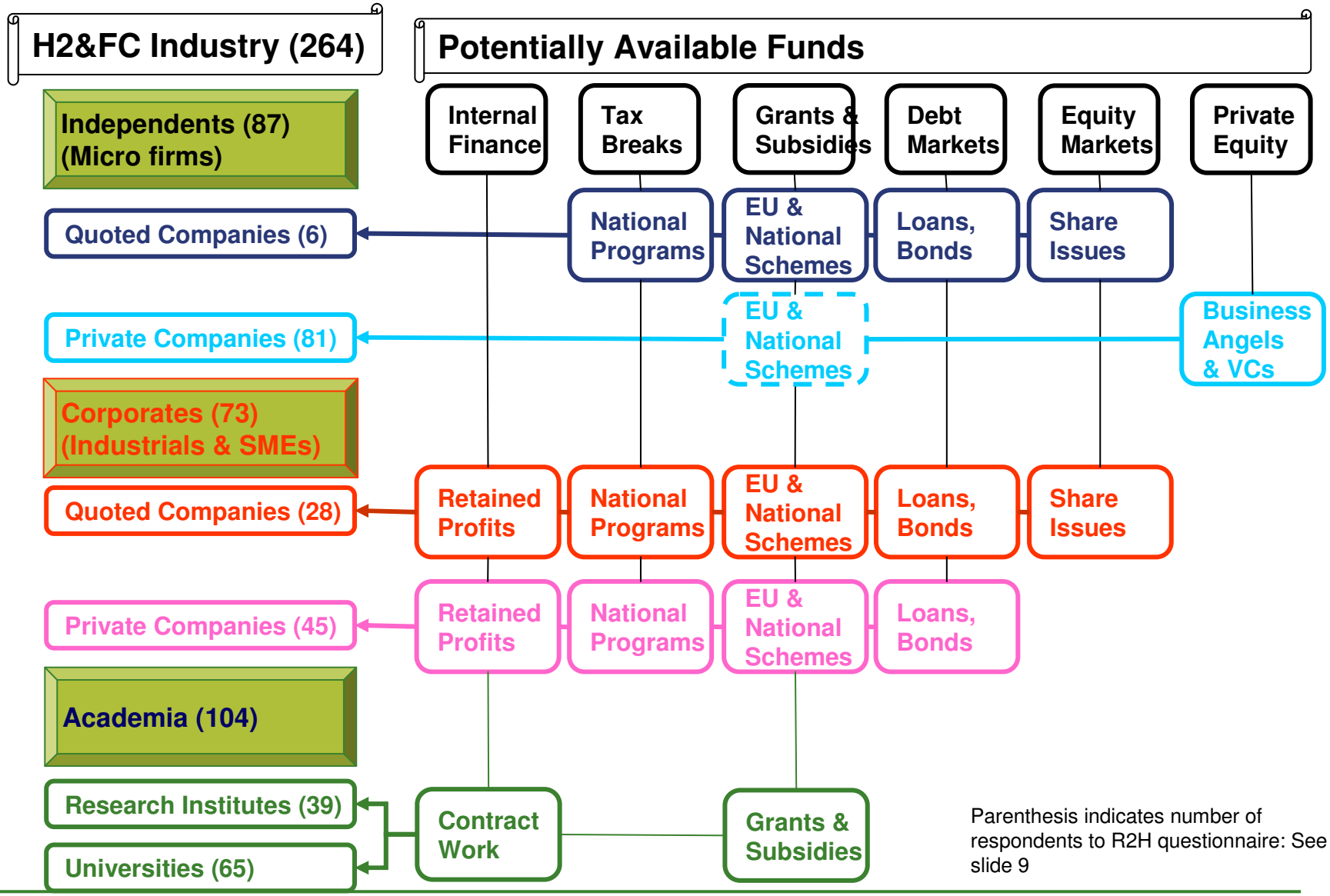


Funding level	Incubator phase/ seed-corn funding	Multi- round financings	IPO	Trade Sale
Capital providers	'Angels'/government corporate sponsorship	Venture Capital funds	investment banks/ Stock Market	Corporates
Comment	Little investigative rigour	IPO -2 to 5 years Detailed business plan required	Full prospectus for listing	Full technical due diligence

Corporates typically funded from company funds & subsidies, Academics typically funded by governments –

Independents typically entirely dependent on equity funding

Company Types and The Failure of Public Support Instruments



Parenthesis indicates number of respondents to R2H questionnaire: See slide 9

4. Early-Stage Companies & Investor Requirements

a. **The Types & Roles of Early-Stage Financial Investors**
b. **Investor Requirements: of the Business Model**
c. **Investor Requirements: of the Management**
d. **The Failure of Micro Companies: To appreciate ....**

The Types & Roles of Early-Stage Financial Investors

- Business angels
  - Provide their own money to finance seed and early-stage developers
  - The often also provide their own business experience and expertise

- Venture capitalists
  - Channel capital raised from their clients to high risk innovative companies & ideally
    - Provide financial & strategic expertise
    - Provide expert knowledge of the wider industry
    - Open their network of contacts with potential commercial & research partners, potential customers and introduces qualified managers as the company expands

Investor Requirements: of the Business Model

- Protected technology (preferably utilised in application-specific development) and/or technological lead over competitors
- Transparent ‘unique selling point’ – what problem is solved
- Technology addresses large and/ or strongly growing markets
- Above average growth potential
- Scalable business plan
- Realistic manufacturing strategy
- Supported by development and financial milestones
- Transparent exit strategy for investors, through either stock market listing or sale

Investor Requirements: of the Management

- High level of personal commitment (often evidenced by earlier financial commitment)
- Understand the technology and its potential applications
- Focussed on product not technology (Sales = Products)
- Willingness to engage and delegate responsibilities to appropriately qualified staff
- Willingness to share profits
- Willingness to relinquish control

The Failure of Micro Companies: To appreciate ...

- The Fact that H2&FC Companies are not Ordinary Equity Investments
  - Investment outcome is potentially binary i.e. many H2&FC businesses face huge success or catastrophic failure
- The Need to to provide evidence of real 3rd party risk sharing such as
  - Partnerships in R&D, marketing and product development
- An Appreciation of the Risk Concerns of the Investor, including:
  - Regulatory risk (e.g. Policy shifts)
  - Technical risk and crucially
  - Management
- The Fact that Investors interests are limited by relatively short time periods
  - Governments are driven by long term economic growth (Employment)
  - Corporations are driven by long-term survival
  - Financial investors are driven by short to medium term cash flows
- That the Returns on early stage investments on Average Result in:
  - 34% total loss
  - 13% partial loss or breakeven
  - 17% returns greater than 25%
  - 13% returns between 25 – 49%
  - 23% returns greater than 50%

Source C. Mason; R. Harrison

> "Large increases in costs with questionable increase in performance can be tolerated only for race horses and fancy spouses"
>
> Lord Kelvin

Concluding Remarks

- The Road to Commercialisation Begins with Savings
  - For economicaly successful companies this is a mixture of retained profits, debt, equity & government subsidies
  - For start-up companies equity is the only practicable option

- The Global Fuel Cell Industry Displays Disruptive Attributes and Few Scale Effects
  - Such emerging industries can be expected to be best suited to new market entrants
  - As expected the European industry is populated by micro companies and academic institutions

- But Europe Has a Poor Track Record in Developing New Technologies
  - Public instruments include tax-breaks, capital allowances, subsidised loans and partial subisides
  - Such instruments are geared towards economically successful compnaies, which are good at incremental innovations (e.g. ICE), not mew entrants, which are particularly suited to disruptive innovations (e.g. FC)
    - Where are the European Microsofts, Googles, Cisco Systems, Texas Instruments etc.?

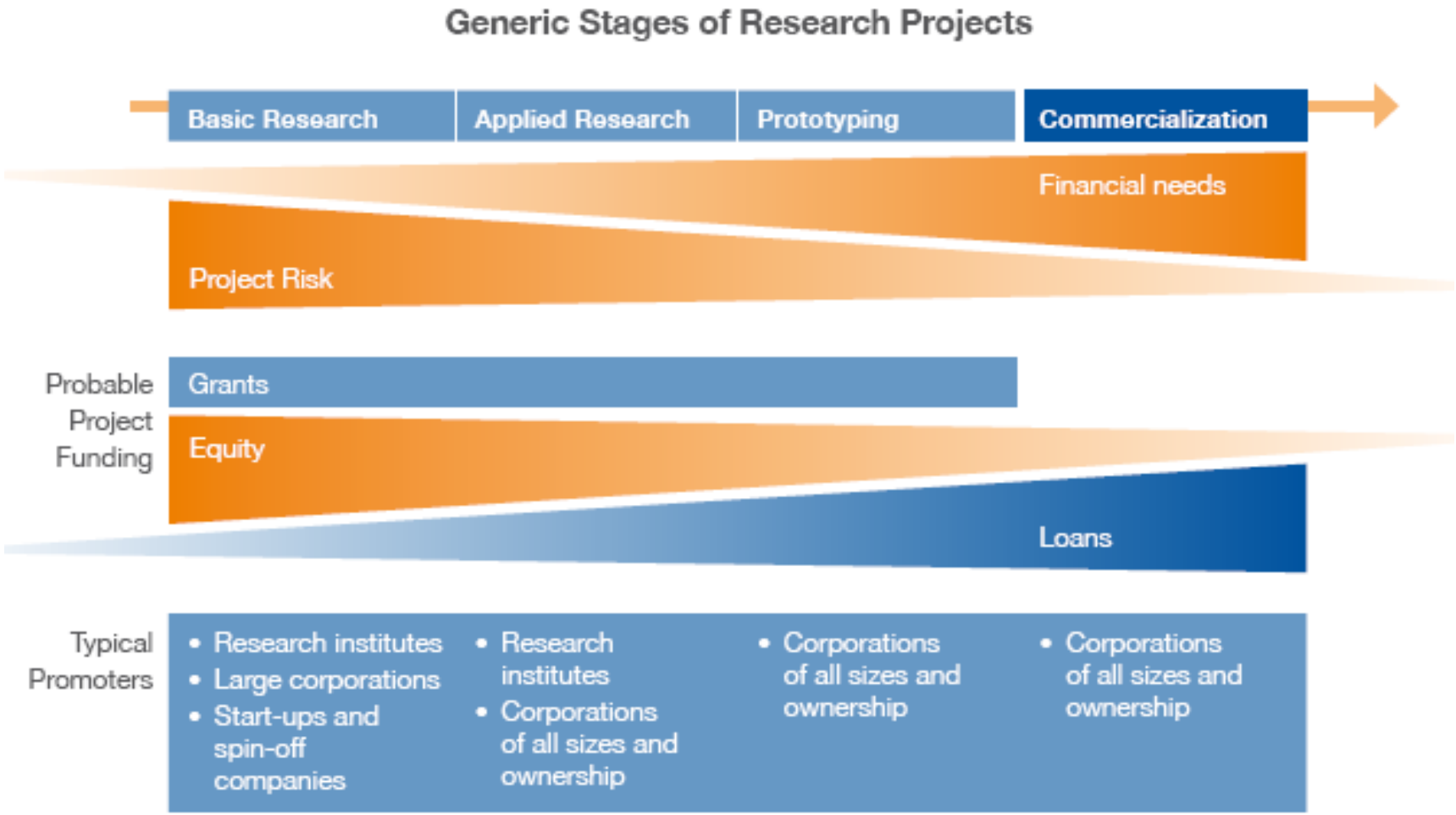
- Meanwhile European Start-up Companies Lack the neccessary Financial Skills
  - The average European start-up at best fails to understand the importance of finance, and at worst is hostile to financial investors

- Is Europe's H2&FC Industry Characterised by Market failures?
  - With emerging companies unable or unwilling to learn to speak finance and a set of public support instruments geared towards companies with a vested interest in incremental rather than disruptive innovation
  - All set against a backdrop of fragmented labour & financial markets cast in culturally ingrained risk aversion

Appendix

1. Debt & Equity in the Context of Technical Risk
2. Financial Instruments Matrix
3. Funding Stages for Privately Owned Technology Developers
4. Total Equity Raised by Independent H2&FC Developers up to 2005/6

Debt & Equity in the Context of Technical Risk



No Revenues, No Capital → No Debt

Source: EIB Guide to Financing Projects from European Technology Platforms

Financial Instruments Matrix

	Debt		**Equity**		**Subsidies**	
Type of Instrument	**Bonds**	**Mortgages**	**Publicly traded shares**	**Privately traded shares**	**R&D Grants: e.g. EU Framework Grants**	**Tax Credits: e.g. accelerated depreciation**
Examples of users	Institutional Investors, Financial companies	Companies, Home owners	Institutional investors, Private Individuals	Business angels, Venture capitalists, Corporate Venturers	Companies Universities Research Institutes	Companies
Typical Issuers	Companies, Governments	Retail banks Building societies	Quoted Companies	Private Companies	National & local governments, European Union	National & local governments
Constraints	Ability to pay interest & principal	Ability to pay interest & principal	Capacity to generate profits and pay dividends	Ability to show superior technology & management	For companies, proven capacity to match the subsidy	Ability to make profits to benefit from tax credit
Purpose of issue	Debt allows companies to pursue their own interests by leveraging profits with little or no impact on control. Unlike equity, debt can attract tax breaks with interest payments treated as a cost. Typically companies choose a mixture of debt and equity that suits their aims and the current state of the economy. E.g. as interest rates fall companies may seek to finance increased investment by debt rather than issuing new equity to shareholders.		Equity gives companies the freedom to pursue their own best interests in the manner they regard as most appropriate, as well affording them the ability to make use of various government subsidies, such as EU Framework grants. However, subsidies related to income tax relief require a company to generate taxable profits.		Subsidies can allow both governments & companies to pursue social welfare & profit simultaneously by promoting economic growth (jobs). In the case of R&D, subsidies encourage firms to pursue socially beneficial projects that otherwise may be lost to society. The drawback for newly emerging companies is that they often do not have the capital required to match grants nor the profits to benefit from tax breaks.	

Funding Stages for Privately Owned Technology Developers

I. **Seed Capital** *(Typically raising less than €300,000)*
   a. **Company Characteristics**: ' technology' is a scientific concept with a potential future use which has yet to be practically demonstrated. Rrisk of failure and thus loss of capital for the investor at its highest.
   b. **Use of Capital**: to cover the cost of 'proof of concept, to pay salaries, develop the business plan & fund additional technical and market research. Unlikely to meet banks requirements for lending and very few venture capital funds will invest at such an early stage
   c. **Sources of funds** Friends & Family, maybe business angles

II. **Start-Up / Early Stage:** (Typically raising less than *€3m*)
   a. **Company Characteristics**: business concept technically proven, an outline business plan is in place, although likely based on fairly rudimentary market forecasts. Few, if any, non-scientific members of staff may as yet exist. There have been some high profile, though not public failures by fund managers attempting to raise funds to invest in the sustainable energy industry
   b. **Start-Up / Early Stage: Use of Capital**: develop the technology from 'proof of concept' to prototype Some patents may be filed or granted. Specialist members of staff, including project engineers and experienced start-up business executives will be hired to enable the start of the transition by the company from technology to product developer. Stricter financial controls will need to be put in place.
   c. **Sources of funds**, friends & family, specialist early-stage VCs &/or corporate ventures with a strategic interest are active at this stage. Although the broad energy sector is starting to attract the venture capital community, few funds exist with the expertise needed to invest in the H2&FC sector.

III. **Development Capital/ *Expansion Capital:*** (Typically raising in excess of €*3m*)
   a. **Company Characteristics**: prototype demonstrated. Collaborations established to access addition technology, engineering, routes to market. Most continue to be loss-making, which limits ability to raise debt fom lending institutions
   b. **Use of Capital**: to participate in the funding of collaborations & expand workforce e.g. marketing and finance. The company may also need to move to more spacious or more convenient premises. The business may also be looking to acquire specialist teams or to acquire businesses to accelerate its growth beyond what is possible organically. Once companies have established the market viability of their product, they often require additional capital to expand and bolster their infrastructure, to accelerate market penetration or to expand into new geographic markets.
   c. **Source of funds** Venture Capitals, Corporate ventures, hedge funds)

Different actors invest at different stages

Total Equity Raised by Independent H2&FC Developers up to 2005/6

Independent Quoted H2&FC Companies	R&D Spend to Latest FY $m (% of total)	Employees FY Latest (% of total)	Equity Raised to end last FY US$ m (% of total)	Number of Companies
North America	$176.107 (91%)	2,132 (91.9%)	$3,360.679 (92.6%)	16
Europe	$9.525 (4.9%)	89 (3.8%)	$131.414 (3.6%)	6
Australia	$7.904 (4.1%)	100 (4.3%)	$136.303 (3.8%)	1
Total	**$193.535**	**2,321**	**$3,628.396**	**23**

Source: CoreTech Ventures, based on Company Annual Reports and Stock Exchange Publications