



EVOLUTION OF FAB MATERIALS SUPPLY – PERSPECTIVES ON COLLABORATION

**STRATEGIC MATERIALS CONFERENCE 2006
HALF MOON BAY, CA
JANUARY 12, 2006**

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OUTLINE

1. Methodology
2. Background
3. Perspectives on Collaboration
4. Perspectives on R&D
5. Conclusions



METHODOLOGY



INSIGHTS BASED ON A SURVEY OF THE CGMG

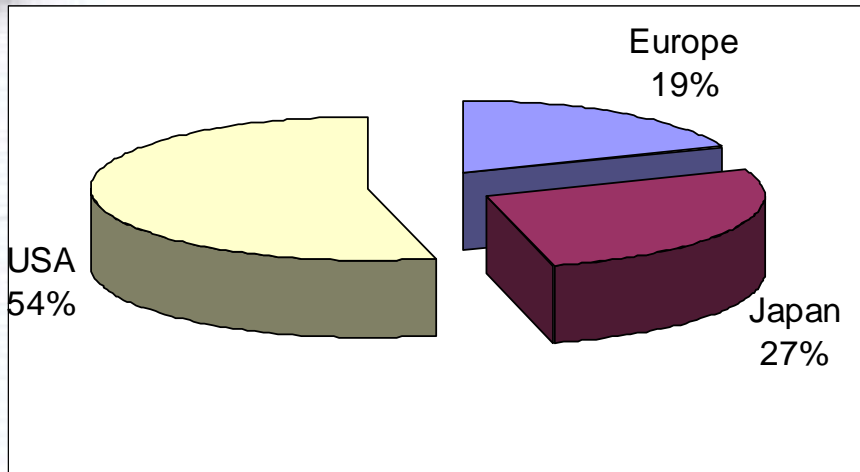
METHODOLOGY

1. Survey completed in November and December 2005
2. High statistical relevance with 100% CGMG participation in 2005. Selected other chemicals and materials suppliers also participated
3. 31 respondents from 25 companies
 - The 25 companies represent approximately 2/3 of \$8 billion wafer fab materials market
 - 19 of the 25 constitute the Executive Committee of the CGMG

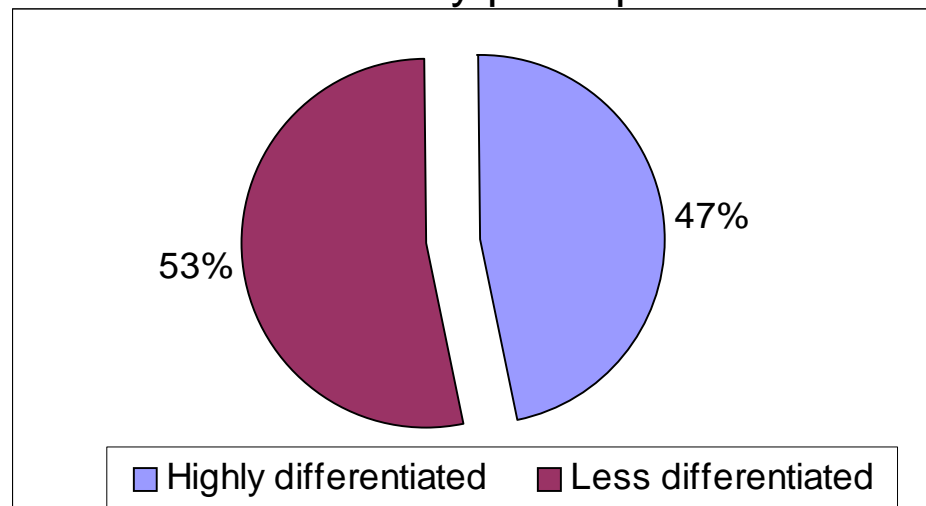


SURVEY PARTICIPANTS

Geographic distribution of survey participants:



Product distribution of survey participants:





BACKGROUND

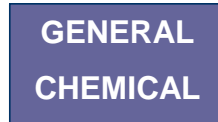


CGMG MEMBER COMPANIES

3M

BOC EDWARDS

Honeywell



OHKA AMERICA, INC.





CGMG ACTIVITIES

1. IP/JDA
2. Market Statistics
3. Consortia Scorecard
4. Global Care
5. Strategic Materials Conference
6. Enabling Materials Consortia
7. Communications
8. Ship to Control



CGMG - JAPAN MEMBERSHIP EXPANSION

Semicon Japan – December 2005

1. Hitachi Chemical
2. Mitsui Chemical
3. Tri Chemical
4. Asahi Glass Chemical
5. Taiyo Nippon Sanso
6. Ube Industries
7. Mitsubishi Chemical
8. Handy Chemical
9. Central Glass
10. Shin Etsu
11. Mitsubishi Corp.
12. CASMAT



CASMAT

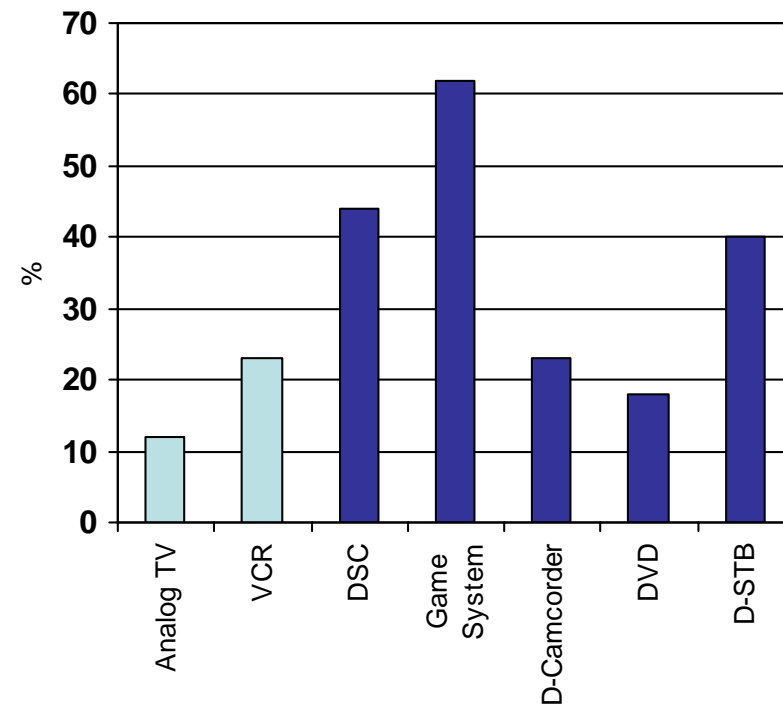
1. Dr. Kawamoto is speaking at SMC
2. CASMAT Member companies include:
 1. JSR
 2. Sumitomo Chemical
 3. Sumitomo Bakelite
 4. Sekisui Chemical
 5. TOK
 6. Toray Industries
 7. Nissan Chemical
 8. Nitto Denko
 9. Hitachi Chemical
 10. Fuji Photo Film



DRIVERS IN THE MICROELECTRONICS INDUSTRY

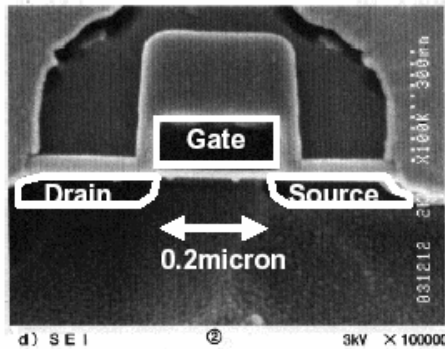
- We are well into the post PC era
- Consumer and Communications devices are significant device market drivers
 - Bringing different market dynamics
- Limits of scaling are beginning to show
- Complexity and capital intensity ballooning

Semiconductor Content

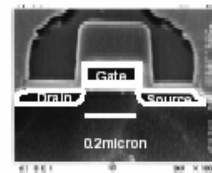




SCALING CHALLENGES



Size 1/2



Favorable effects

| | |
|----------------|------|
| Size | x1/2 |
| Voltage | x1/2 |
| Electric Field | x1 |
| Speed | x3 |
| Cost | x1/4 |

Unfavorable effects

| | |
|--------------------|------|
| Power density | x1.6 |
| RC delay/Tr. delay | x3.2 |
| Current density | x1.6 |
| Voltage noise | x3.2 |
| Design complexity | x4 |

Thermal noise
Heat dissipation
Leakage current
Fundamental size limits



IC INDUSTRY COST STRUCTURE

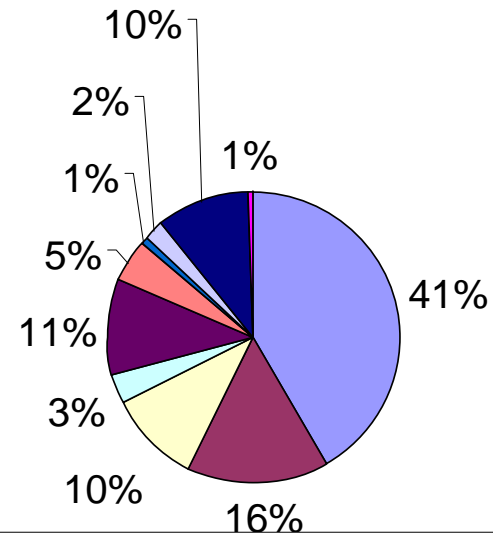
- Value distributed between multiple suppliers to Chipmakers
- High capital intensity in Fabs
- Increasing need to integrate into design

Materials Component of finished wafer cost

200mm 18%
300mm 24% *

***High wafer cost contribution**

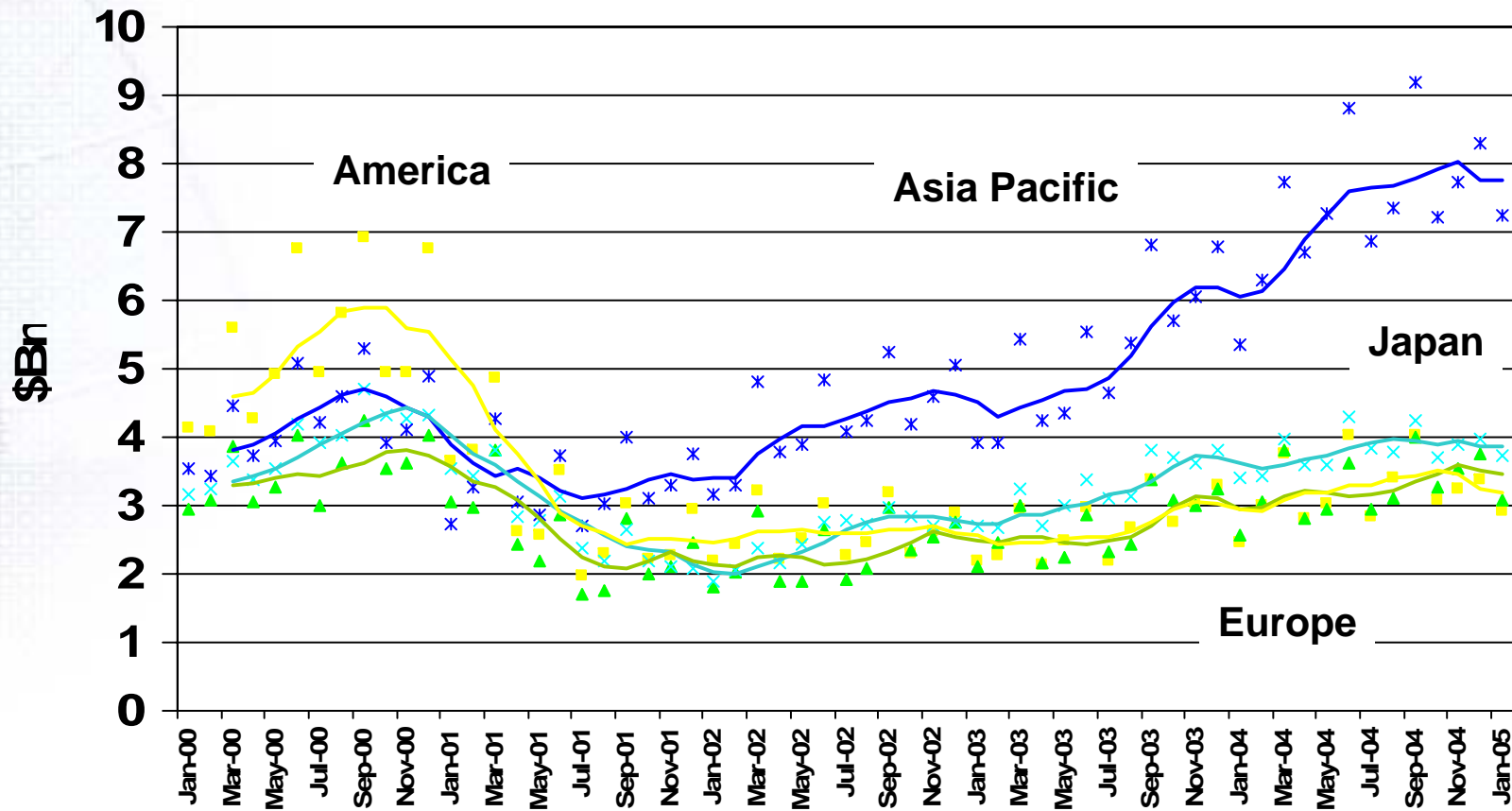
Wafer Cost Breakdown 200mm 130nm Logic



| | |
|------------------------|---------------------------|
| Equipment Depreciation | Equipment Maintenance |
| Personnel | Building Depreciation |
| Building Overhead | Silicon |
| Resist and Ancills | Mask Cost |
| Indirect Fab Materials | Automated Handling System |



REGIONAL TRENDS



Source: SIA

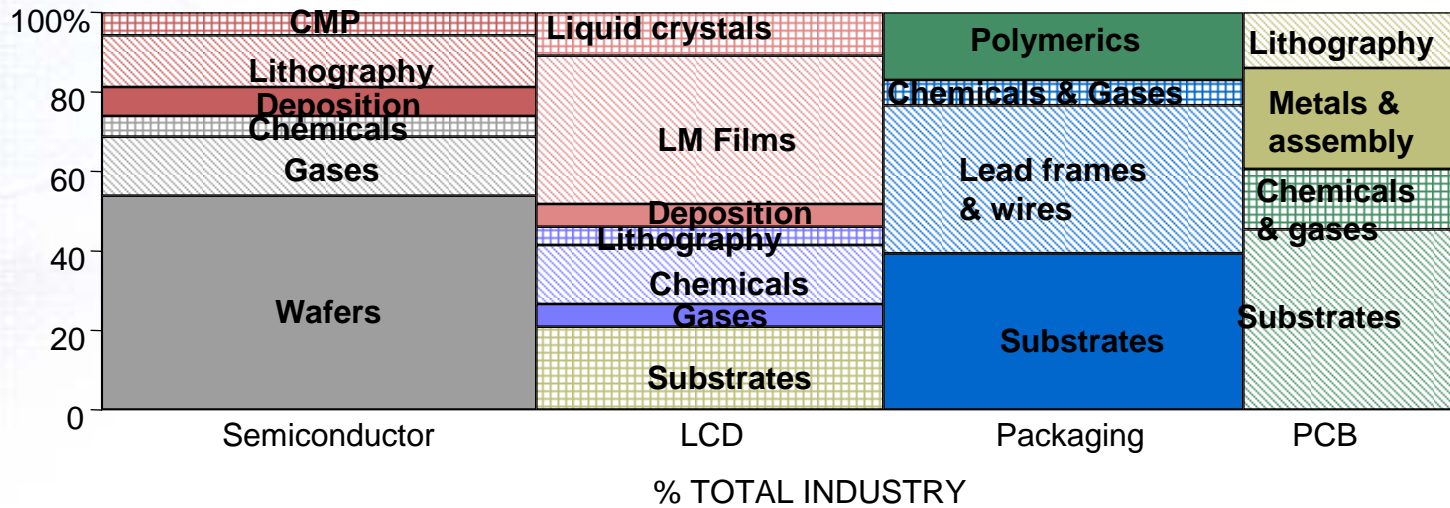


PERSPECTIVES ON COLLABORATION



ELECTRONIC CHEMICALS AND MATERIALS ARE A \$58 BILLION MARKET IN 2005

% TOTAL SEGMENT





THREE LAWS OF ROBOTICS

1. A robot may not injure a human, or allow a human to come to harm
2. A robot must obey orders given by a human where it does not conflict with the first law
3. A robot must protect its own existence

Asimov & Campbell, 1940



THREE LAWS OF MICROELECTRONICS

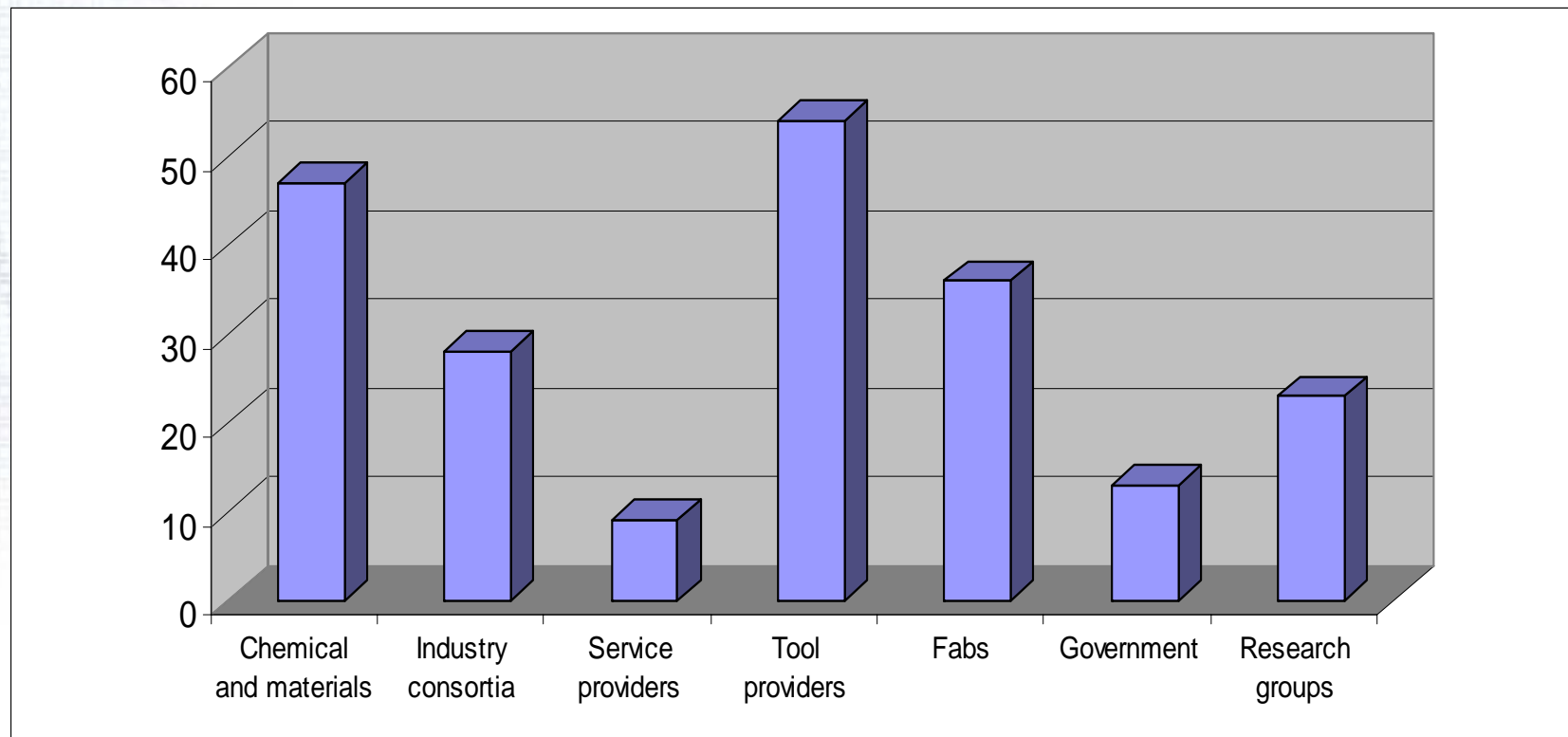
1. Scale density by 2.0X every 2 years
2. Keep the cost roughly the same while achieving the first law
3. Implement flawlessly

Moore et. al, every 10 minutes since 1972



TOOL PRODUCERS ARE CURRENTLY THE LEADING CANDIDATE FOR PARTNERSHIPS

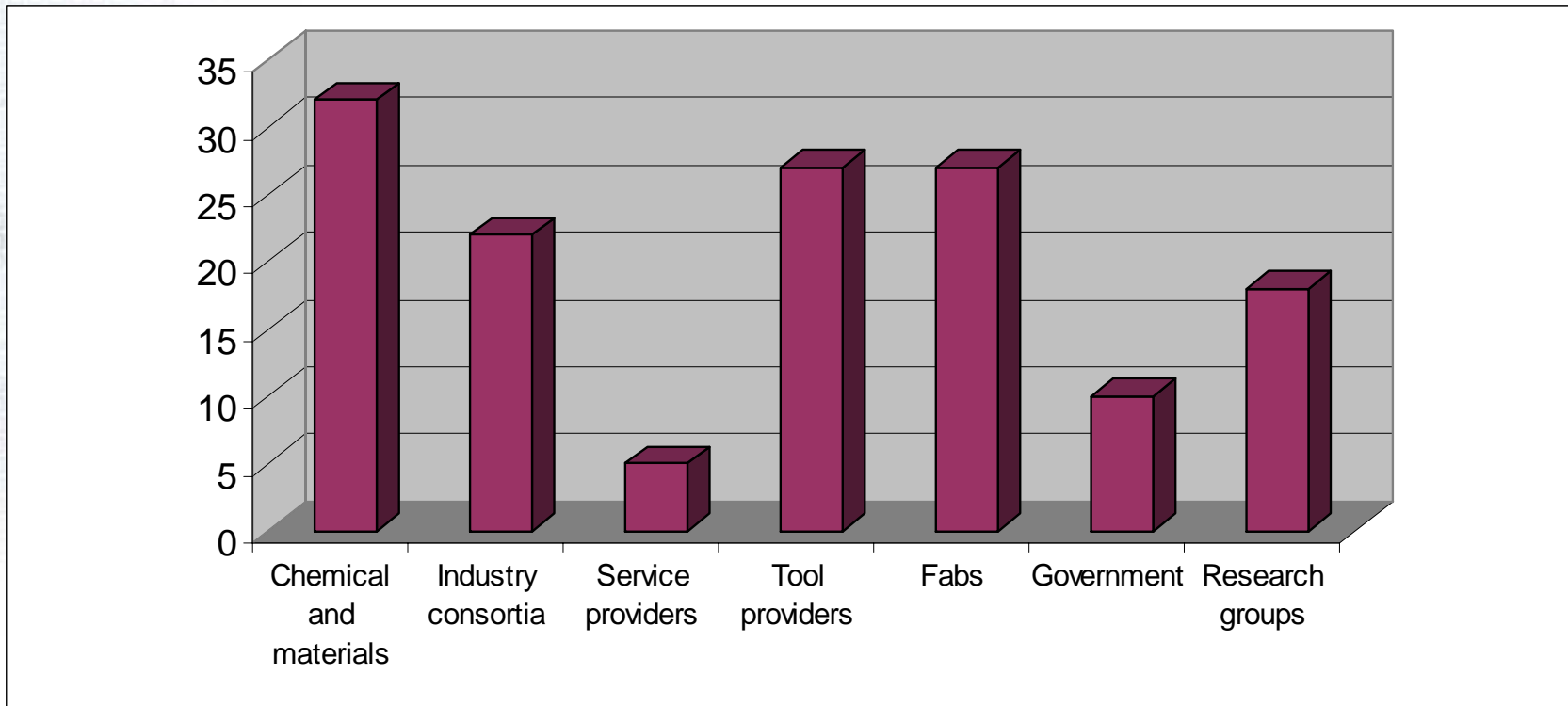
Number of existing partnerships and alliances – all respondents





CHEMICALS SUPPLIERS WILL BE THE LEADING CANDIDATE FOR PARTNERSHIPS

Number of planned partnerships and alliances – all respondents

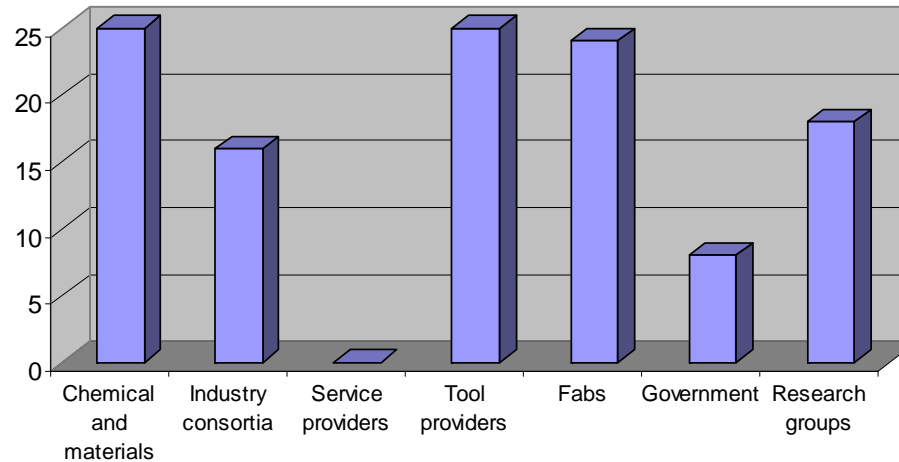




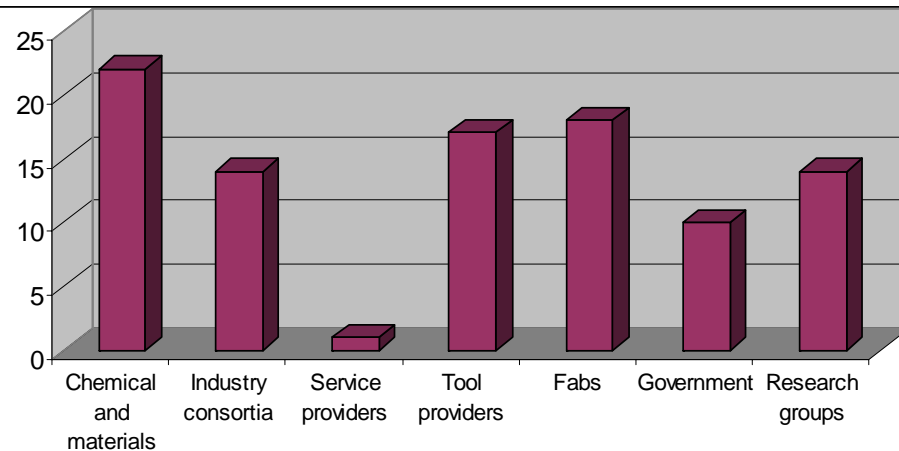
SUPPLIERS OF HIGHLY DIFFERENTIATED PRODUCTS ARE SATISFIED WITH THE CURRENT DISTRIBUTION OF PARTNERSHIPS

Number of existing and planned partnerships and alliances – highly differentiated suppliers

Existing



Planned

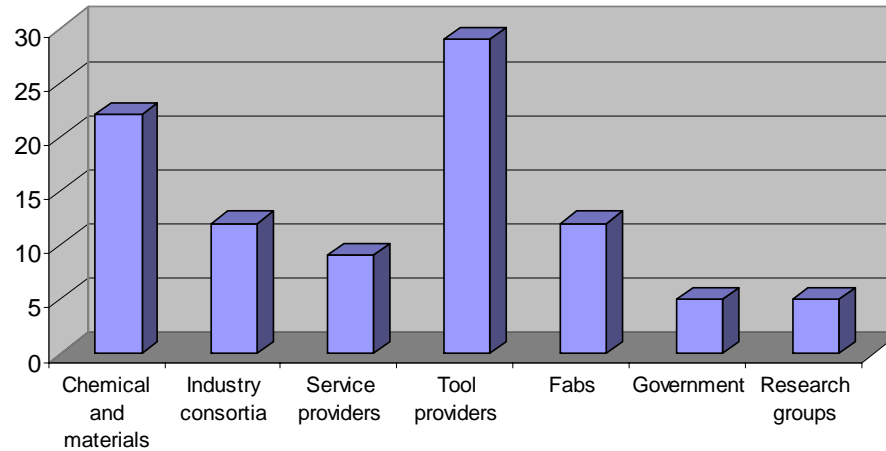




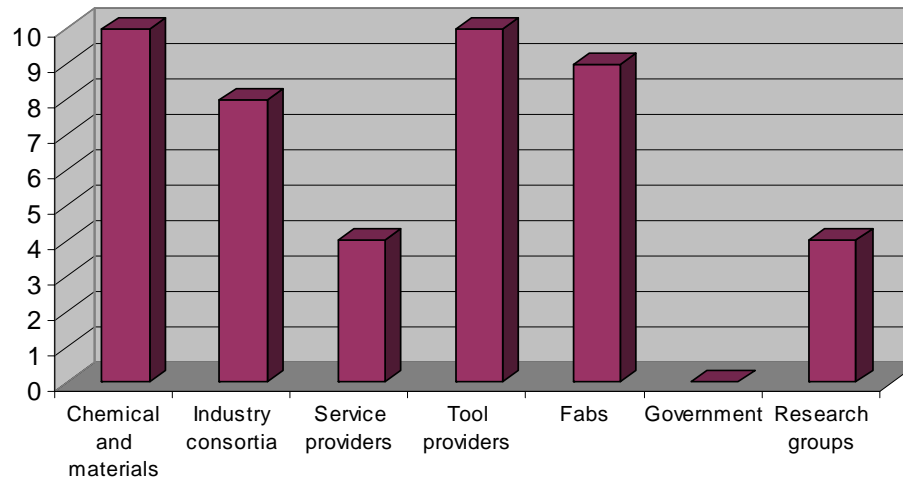
SUPPLIERS OF LESS DIFFERENTIATED PRODUCTS WILL RE-ALIGN PARTNERSHIPS

Number of existing and planned partnerships and alliances – less differentiated suppliers

Existing



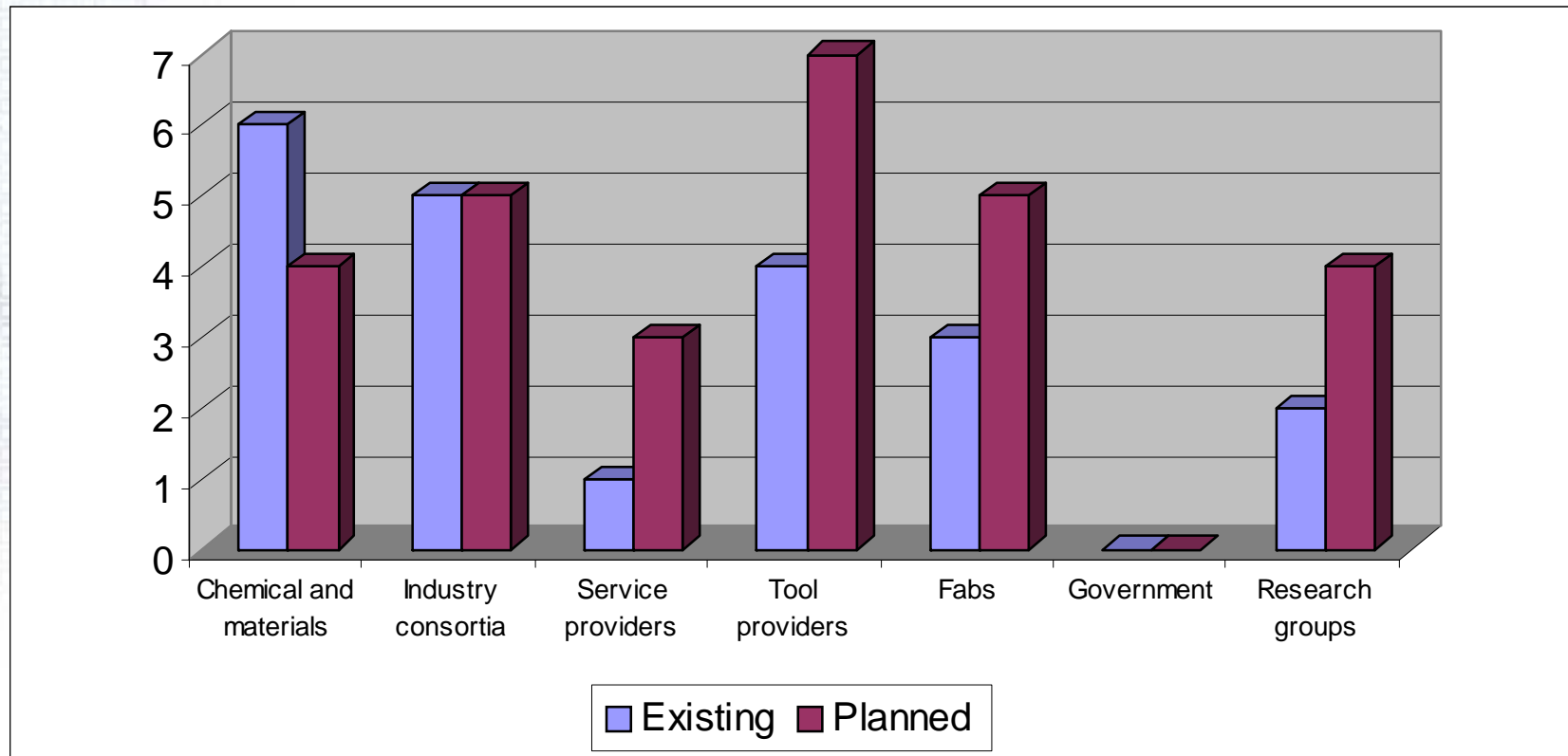
Planned





TOOL PRODUCERS AND FABS ARE THE LEADING CANDIDATE FOR PARTNERSHIPS

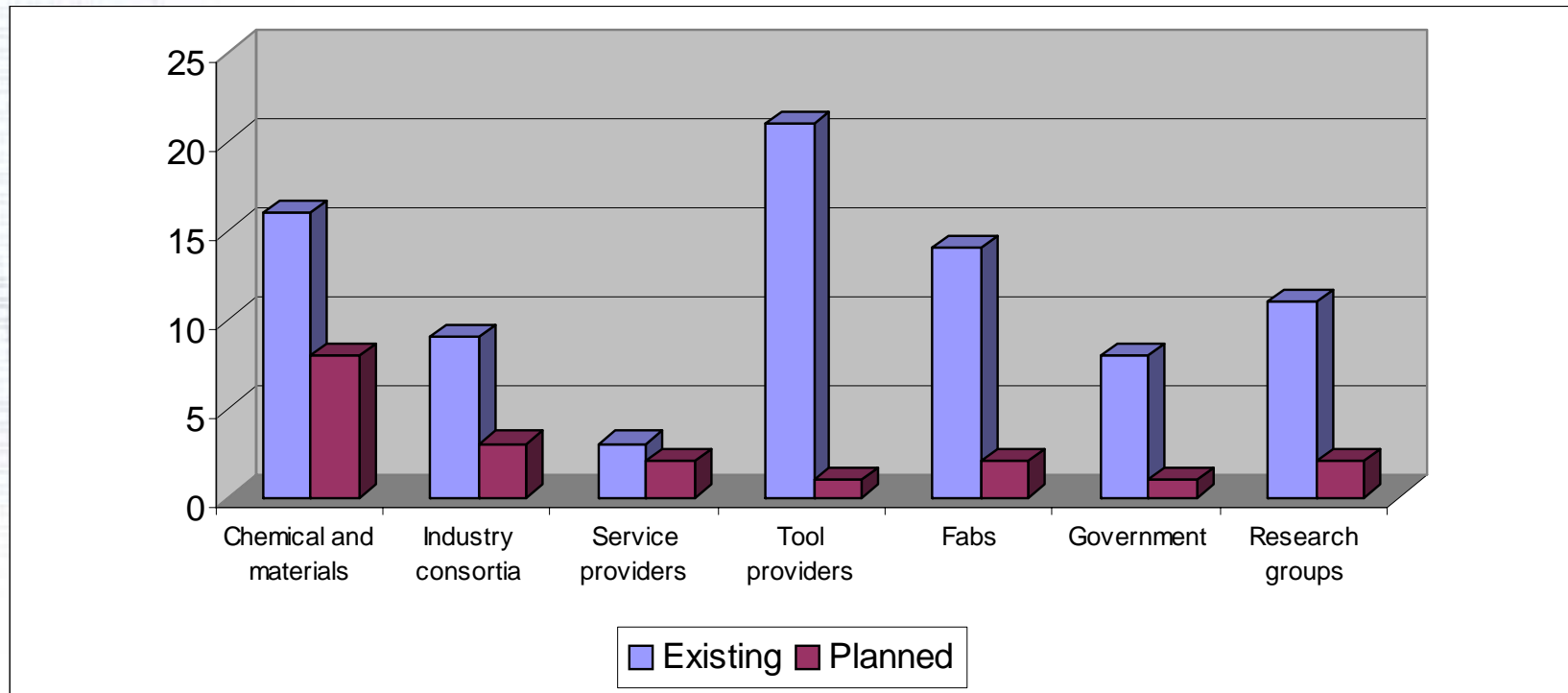
Number of existing and planned partnerships and alliances – European suppliers





JAPANESE SUPPLIERS ARE CONTENT WITH EXISTING ARRANGEMENTS

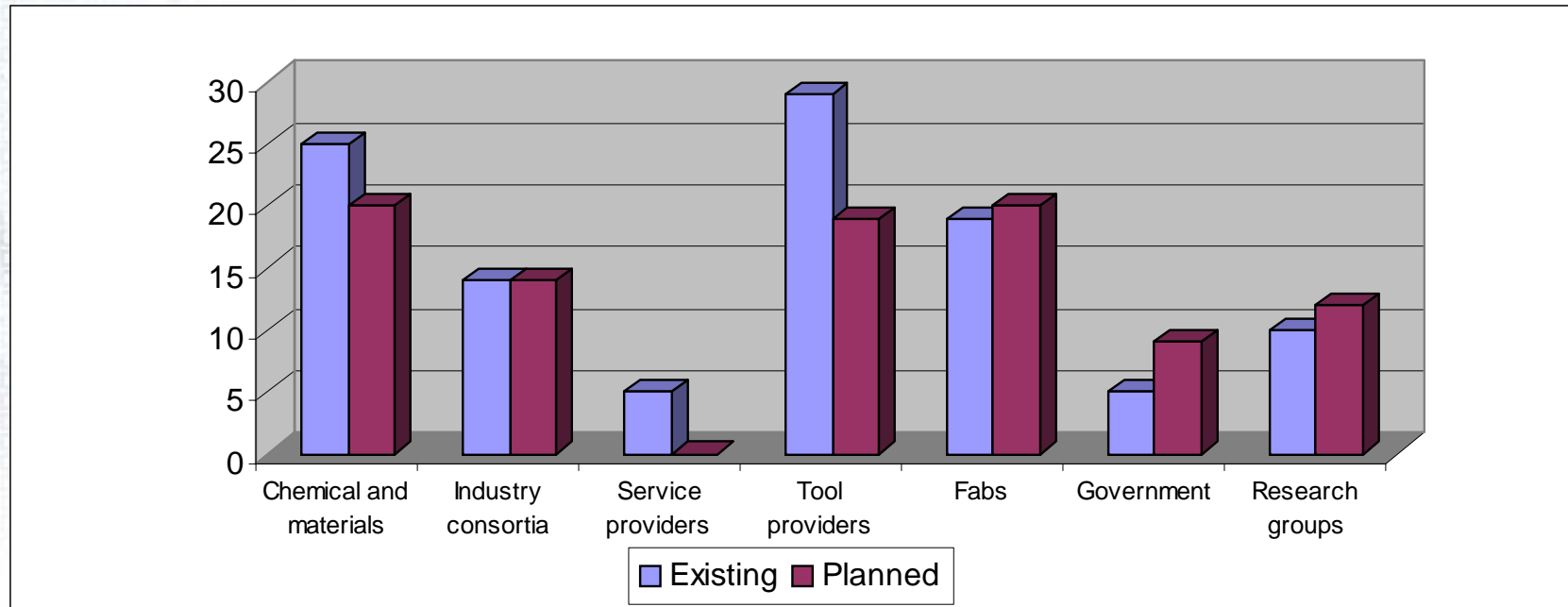
Number of existing and planned partnerships and alliances – Japanese suppliers





USA SUPPLIERS ARE LOOKING TO ENHANCE RELATIONSHIPS WITH CUSTOMERS & RESEARCH GROUPS

Number of existing and planned partnerships and alliances – USA suppliers



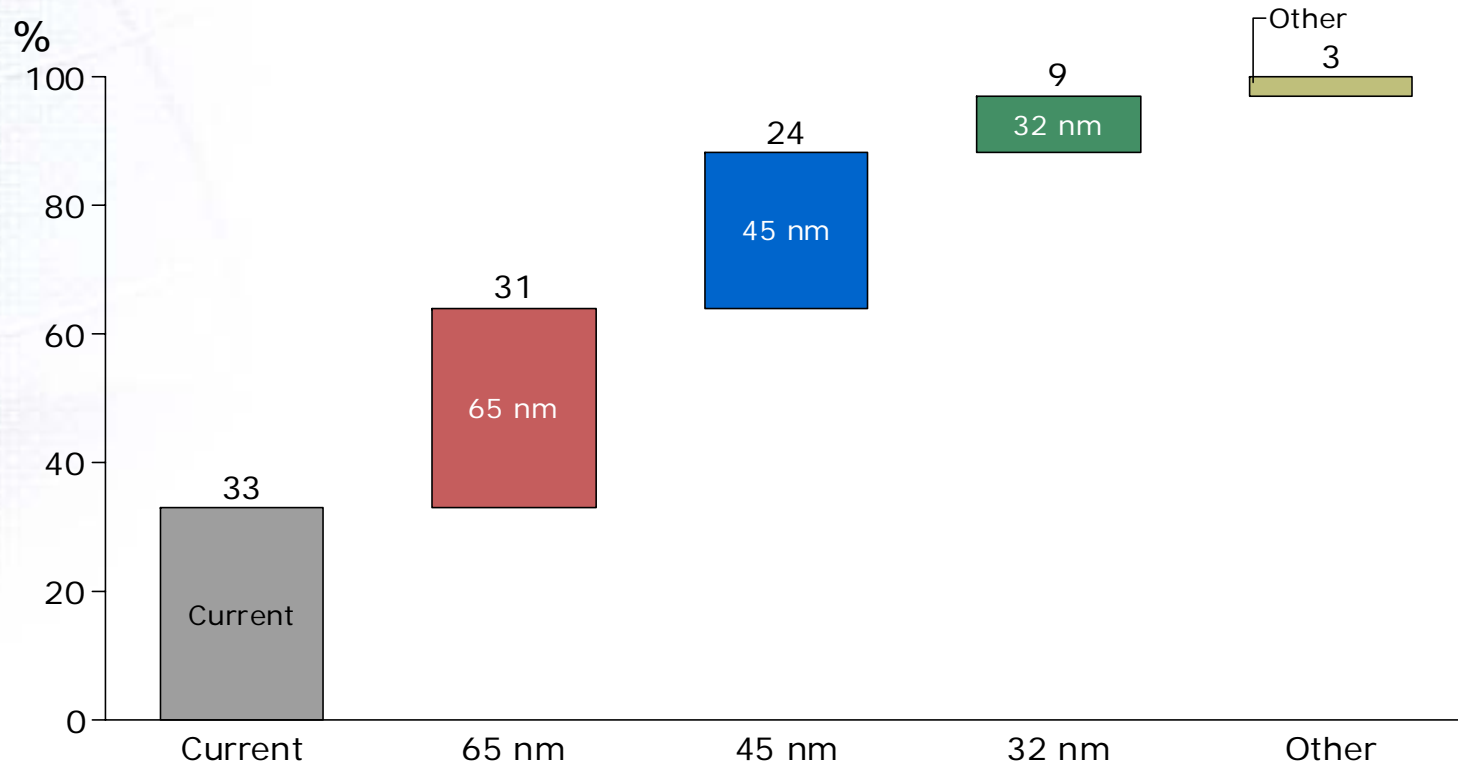


PERSPECTIVES ON R & D



ALMOST TWO-THIRDS OF EFFORTS ARE FOCUSED ON CURRENT AND 65 nm NODES

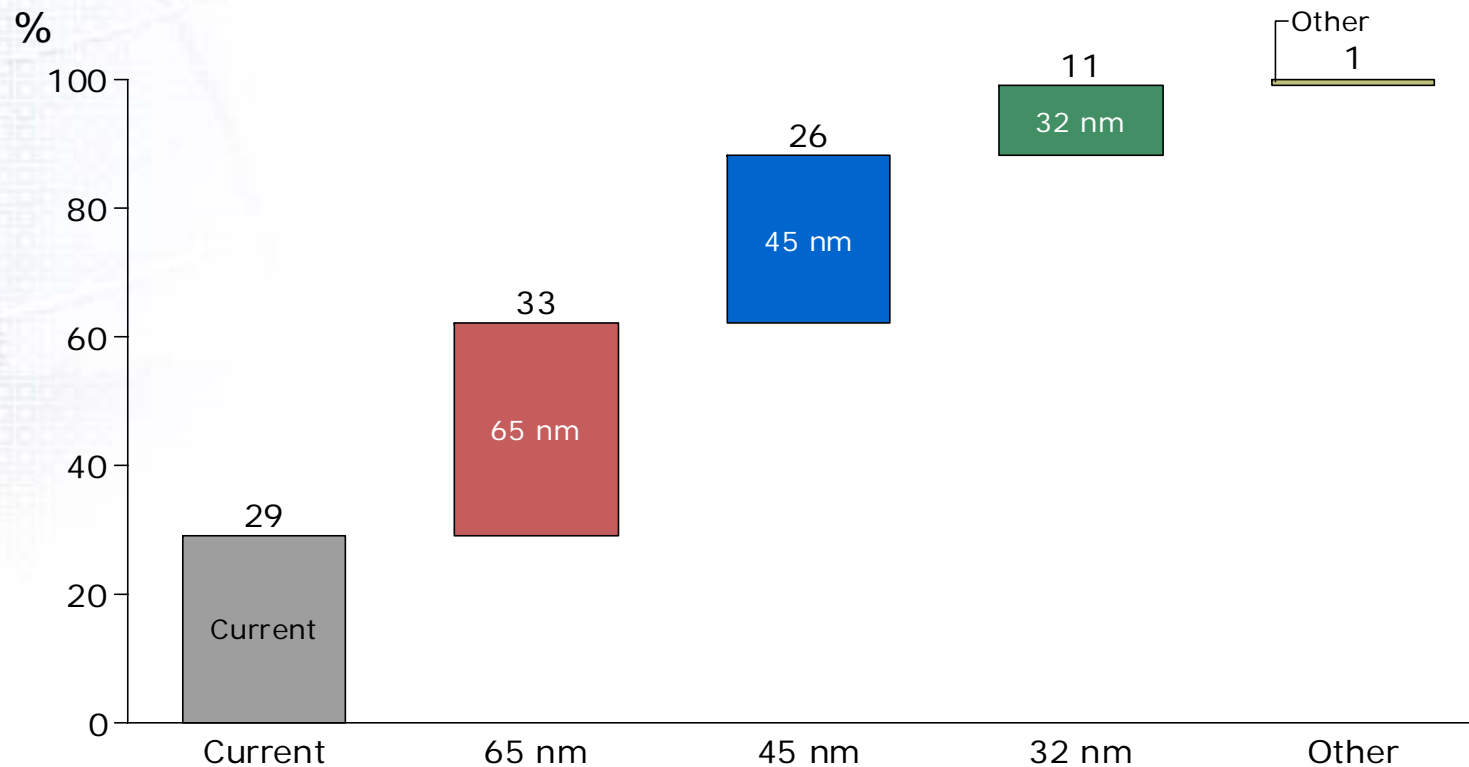
Allocation of development projects by technology node – all respondents





SUPPLIERS OF HIGHLY DIFFERENTIATED PRODUCTS HAVE A GREATER FOCUS ON 65, 45, AND 32 nm NODES

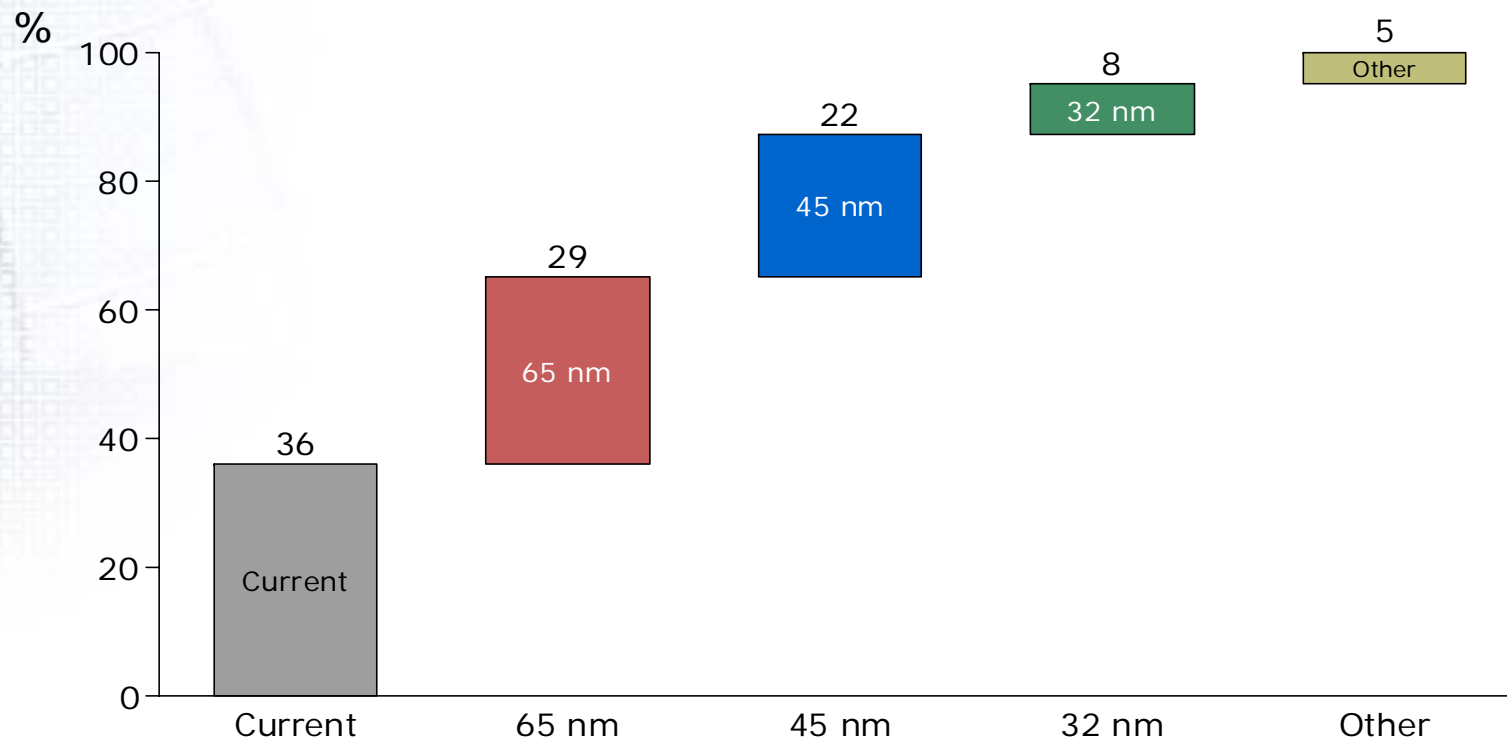
Allocation of development projects by technology node – highly differentiated products





SUPPLIERS HAVE LESS DIFFERENTIATED PRODUCTS HAVE A GREATER FOCUS ON CURRENT NEEDS

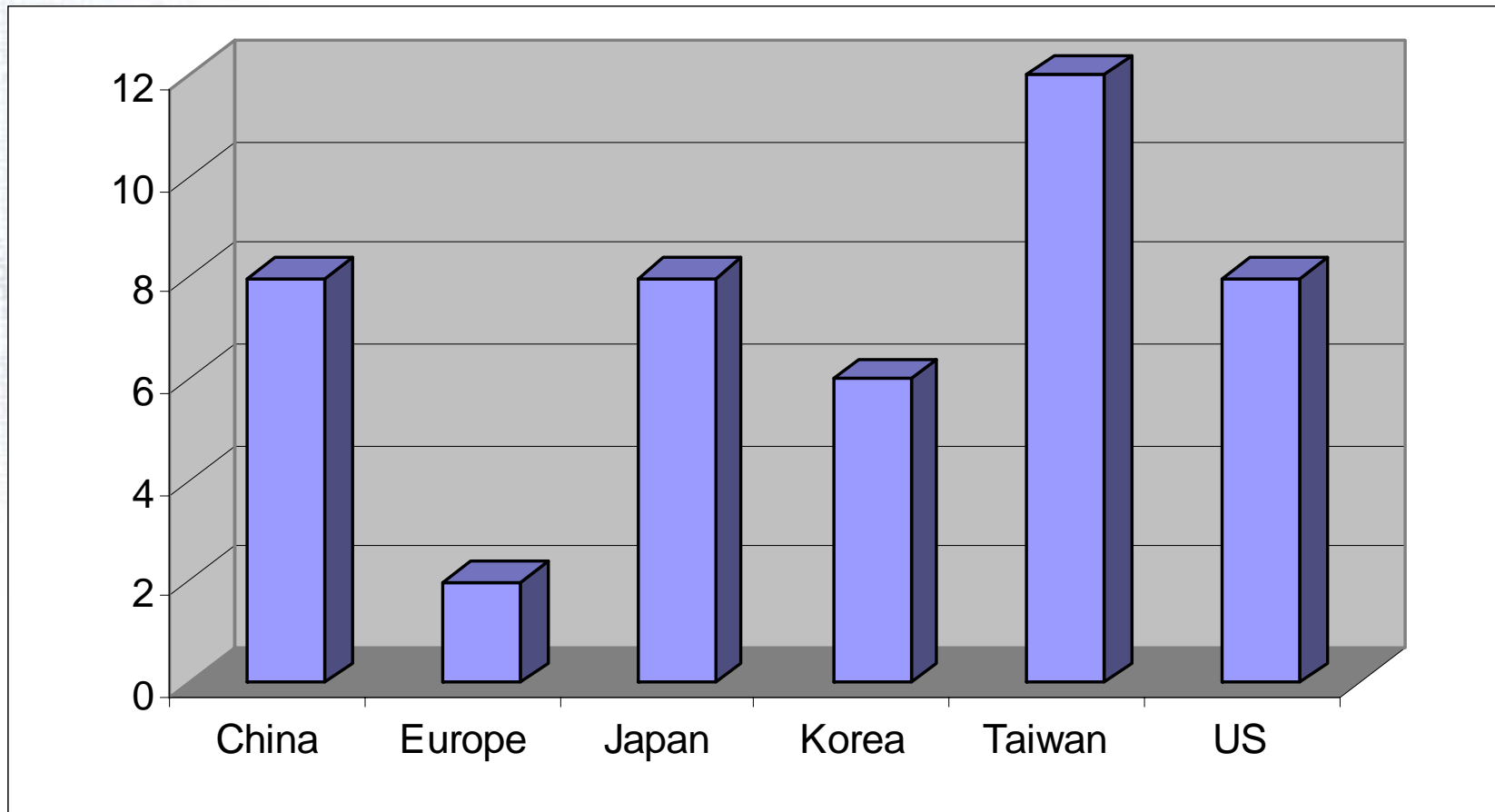
Allocation of development projects by technology node – less differentiated products





GREATER CHINA IS BEING TARGETED FOR FUTURE R&D INVESTMENT

Which geographic region is my company prioritizing for R&D investment – all respondents

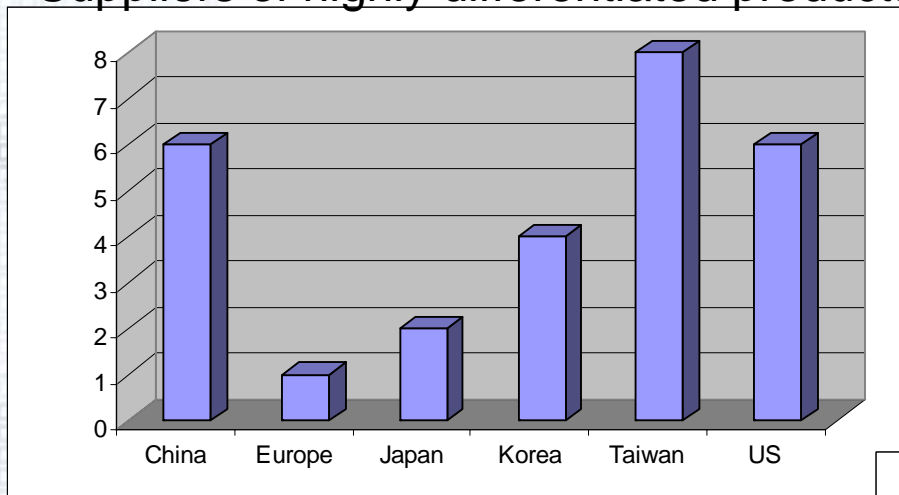




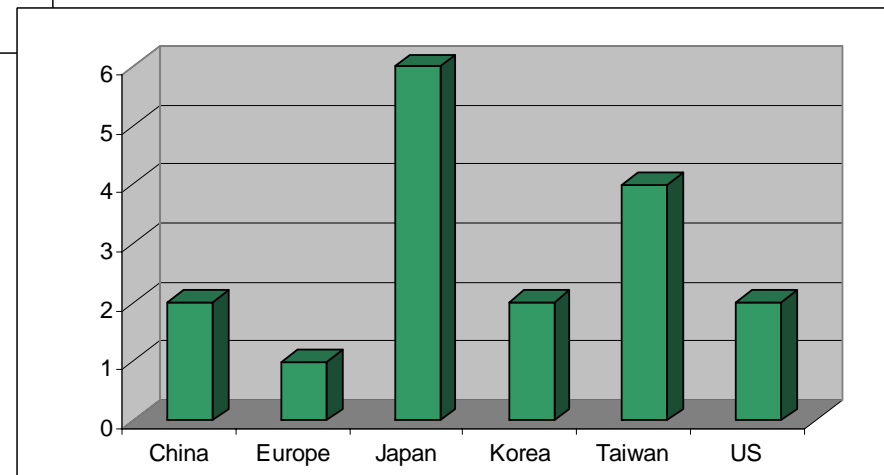
GREATER CHINA IS BEING TARGETED FOR FUTURE R&D INVESTMENT

Which geographic region is my company prioritizing for R&D investment – product differentiation

Suppliers of highly differentiated products



Suppliers of less differentiated products

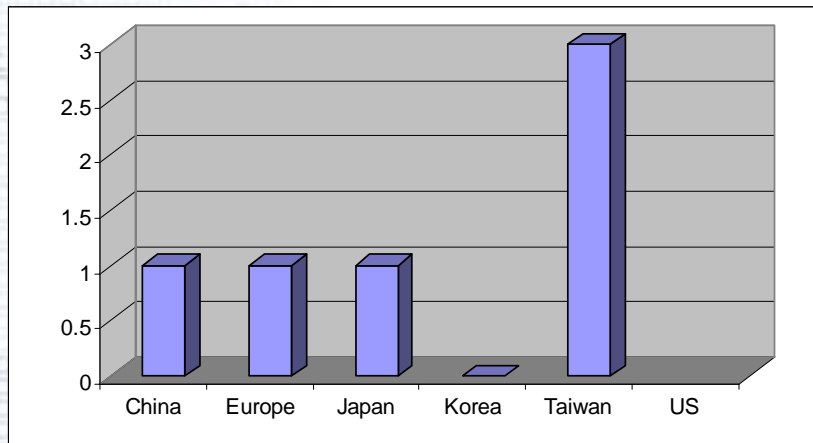




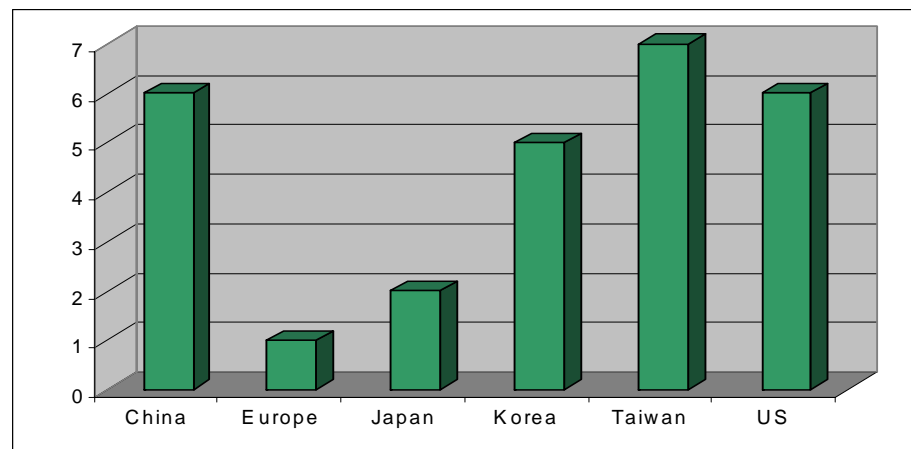
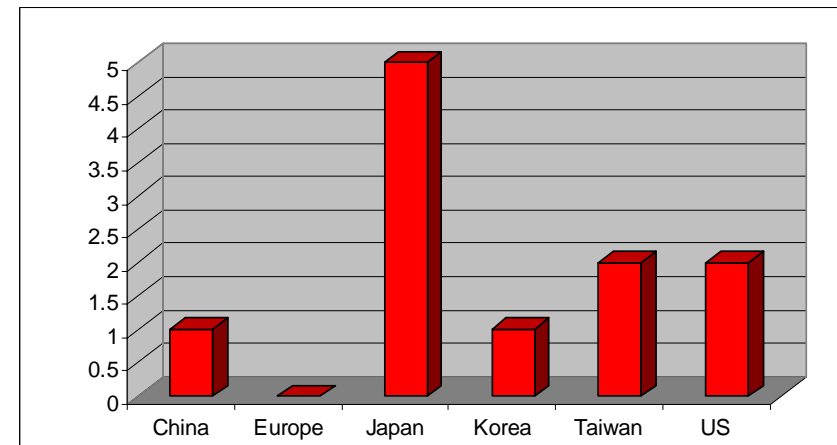
JAPANESE SUPPLIERS ARE KEEPING R&D AT HOME

Which geographic region is my company prioritizing for R&D investment – geographic considerations

European suppliers



Japanese suppliers



North American suppliers

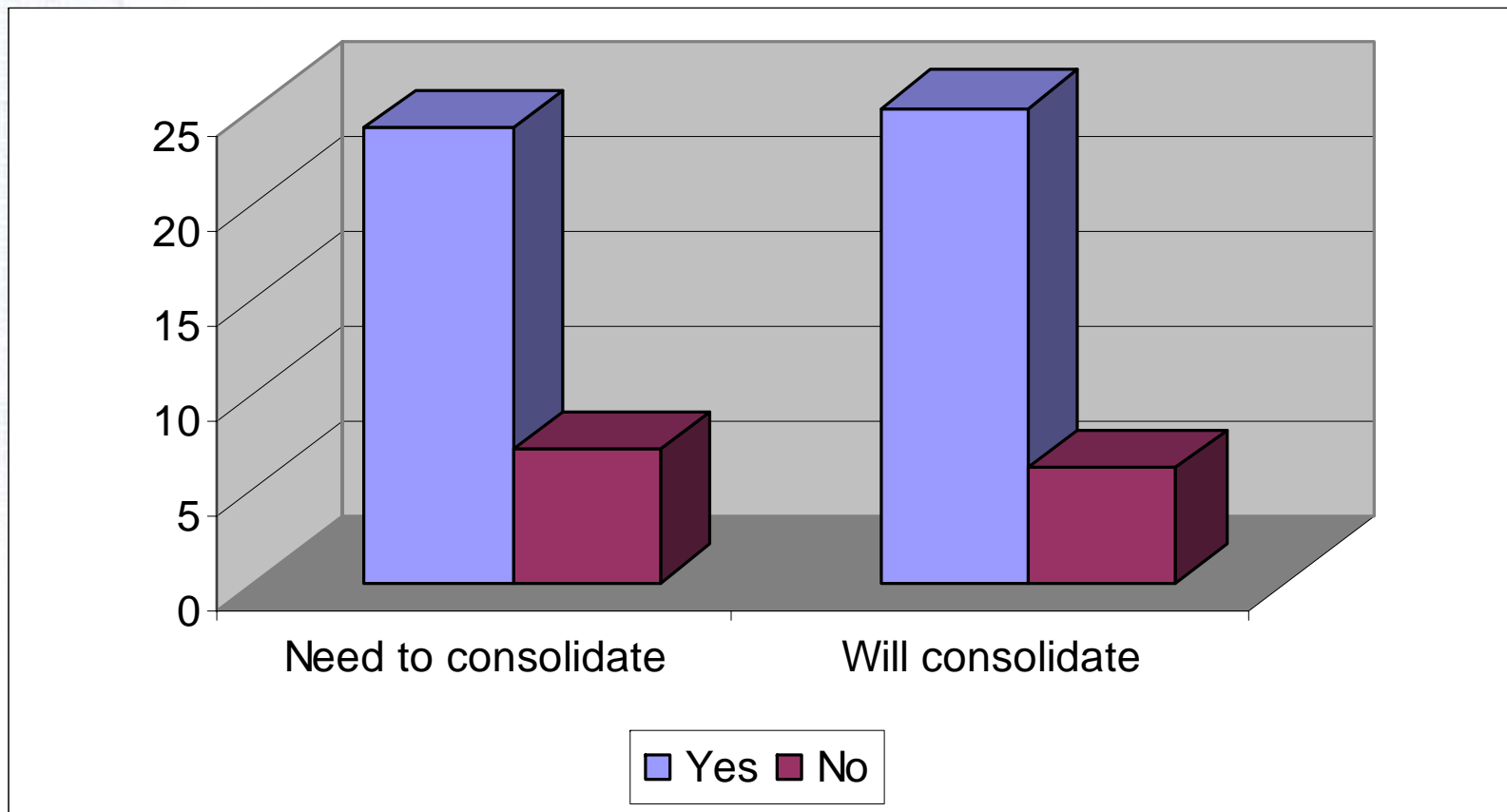


CONCLUSIONS



SUPPLIERS BELIEVE CONSOLIDATION IS LIKELY

Do you believe that the industry needs to/will consolidate





CONCLUSIONS

Market Characteristics

- Many leading suppliers are in Europe, Japan, and the US, serving a market which is focused and growing in Asia
- Suppliers wish to enter development partnerships
- Suppliers find external or government development support attractive
- There is a development focus on the short term win



CONCLUSIONS

Tactical trends

- Companies making products for ICs desire to add products for the LCD market
- Avoid commoditization by introducing new, technology based products
- Focus development on current and next generation products

Strategic Concerns

- Consolidation is viewed as both needed and likely
- If all competitors are following the same course how will each develop a differentiated strategy?



THE EM SUPPLIERS DILEMMA

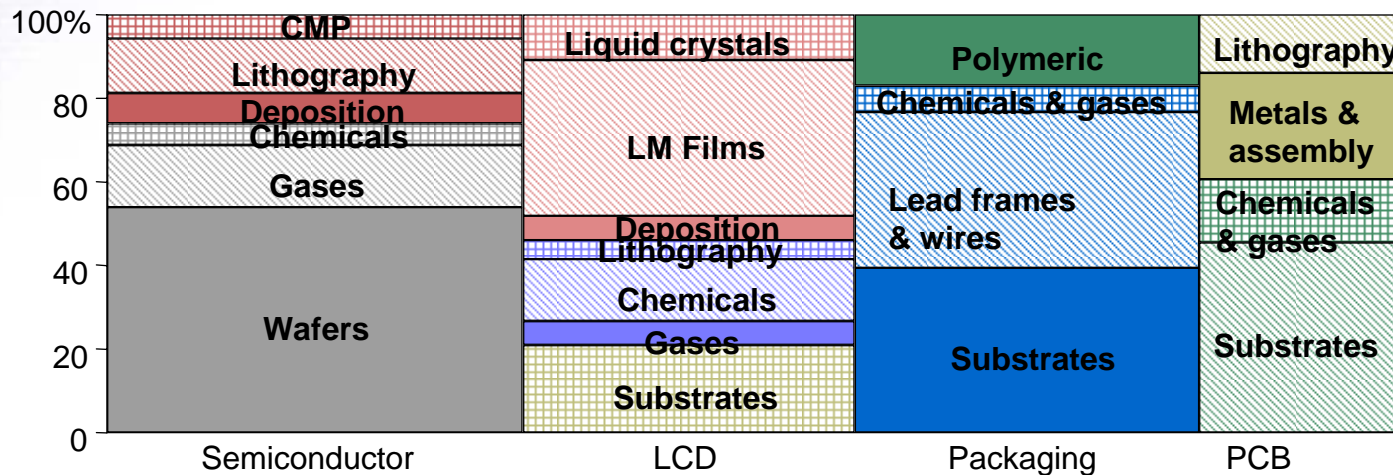
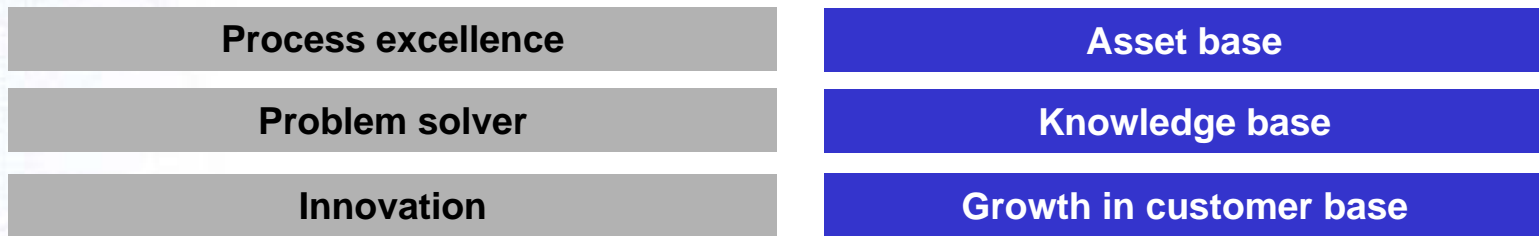
1. To achieve growth suppliers must
 - Innovate to meet the pace of the roadmap, and keep the time to market of enabling products short
 - Understand the basis of the risks that are involved in meeting the stated needs, and balance them for economic returns

2. Parallels to other materials
 - No more “moon shot” philosophy?
 - Have fundamental innovations come to an end?
 - Decade of materials
 - New materials will enable new devices through their physical properties
 - Processes are (almost) set?
 - It is increasingly difficult to integrate new processes into our current manufacturing schemes



STRATEGIC CONSIDERATIONS

1. Significant opportunities are becoming rarer in the Microelectronics world
2. There exists, and will always exist a need for enabling materials
3. Parallel markets are using many of the same technologies, but need innovative materials





Thank you!