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# Electronic Materials Business Briefing

June 12, 2019

Tadahiko Yokota, President, Ajinomoto Fine-Techno Co., Inc.

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I. Overview of Ajinomoto Fine-Techno Co., Inc.

II. Development of Ajinomoto Build-up Film<sup>®</sup> (ABF)

III. Electronic Materials Business Update

# I. Overview of Ajinomoto Fine-Techno Co., Inc.

Founded: September 1942

Common stock: ¥315 million

Employees: 295 (as of April 1, 2019)

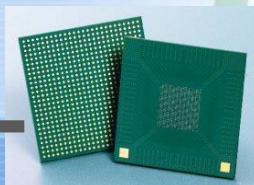
## Functional Materials Division

- Adhesives
- Dispersing agents
- One-component epoxy resin curing agents
- Flame retardants



## Electronic Materials Division

ABF



## Activated Carbon Division

- Activated carbon
- Adsorption resin

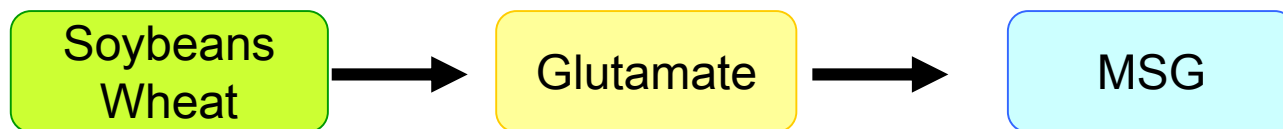


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# II-1. Origin of Electronic Materials Business

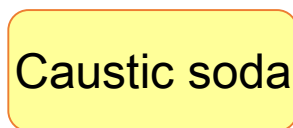
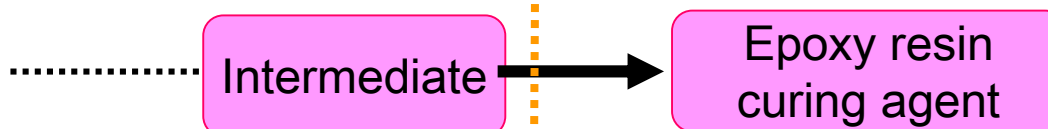
Synthesized MSG – Effective utilization of intermediate

Extraction (pre-war to early post-war)



↓

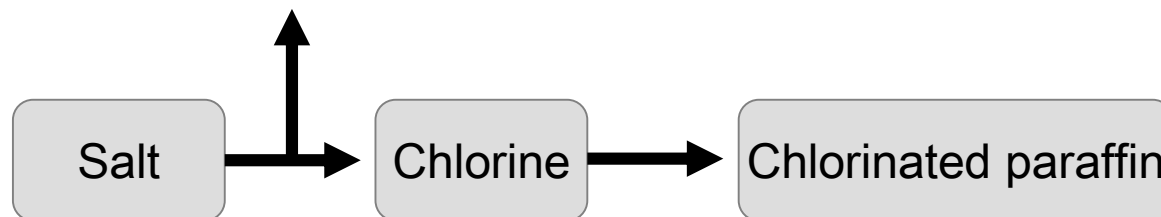
Synthesis (1960s)



Led to current electronic materials business

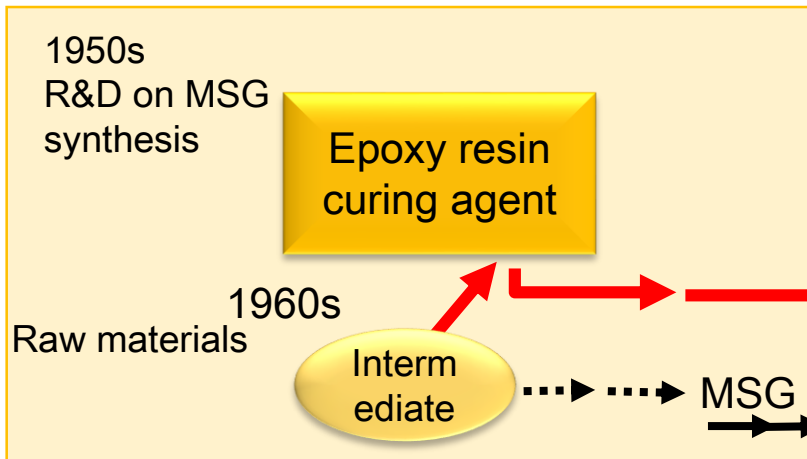
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Fermentation (today)



# II-2. Origin of Electronic Materials Business

Interlayer insulating material for semiconductor packaging has its origins in technology used to develop epoxy resin curing agent



1999: Advent of Ajinomoto Build-up Film® (ABF), an interlayer insulating material for semiconductor packaging

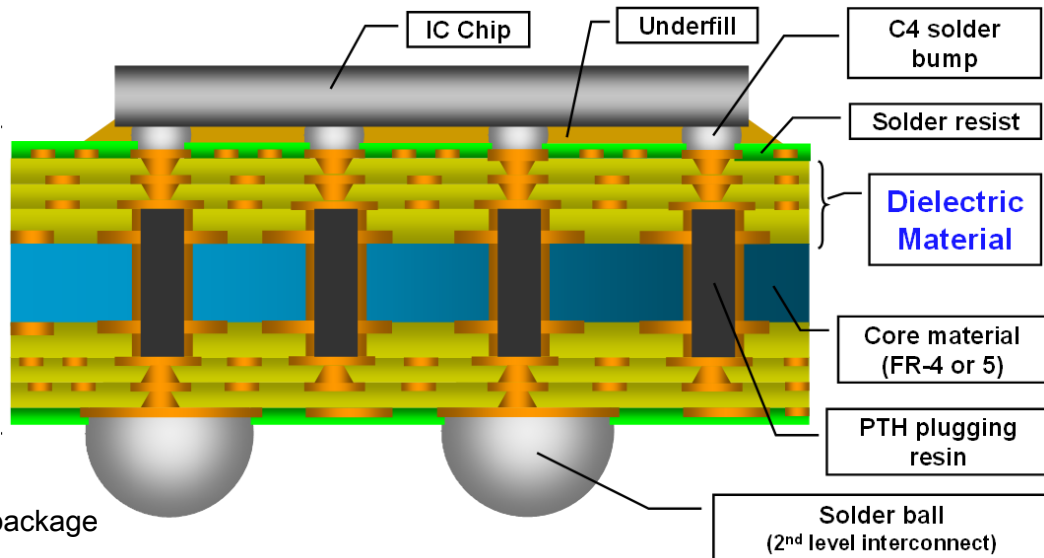


Print Circuit Board (PCB)



Semiconductor package

Semiconductor package cross-section



## II-3. Background of ABF's Development

Two major turning points in latter half of 1990s:

- ◆ Ceramic ⇒ Plastic
- ◆ Wire bonding ⇒ Flip chip connection

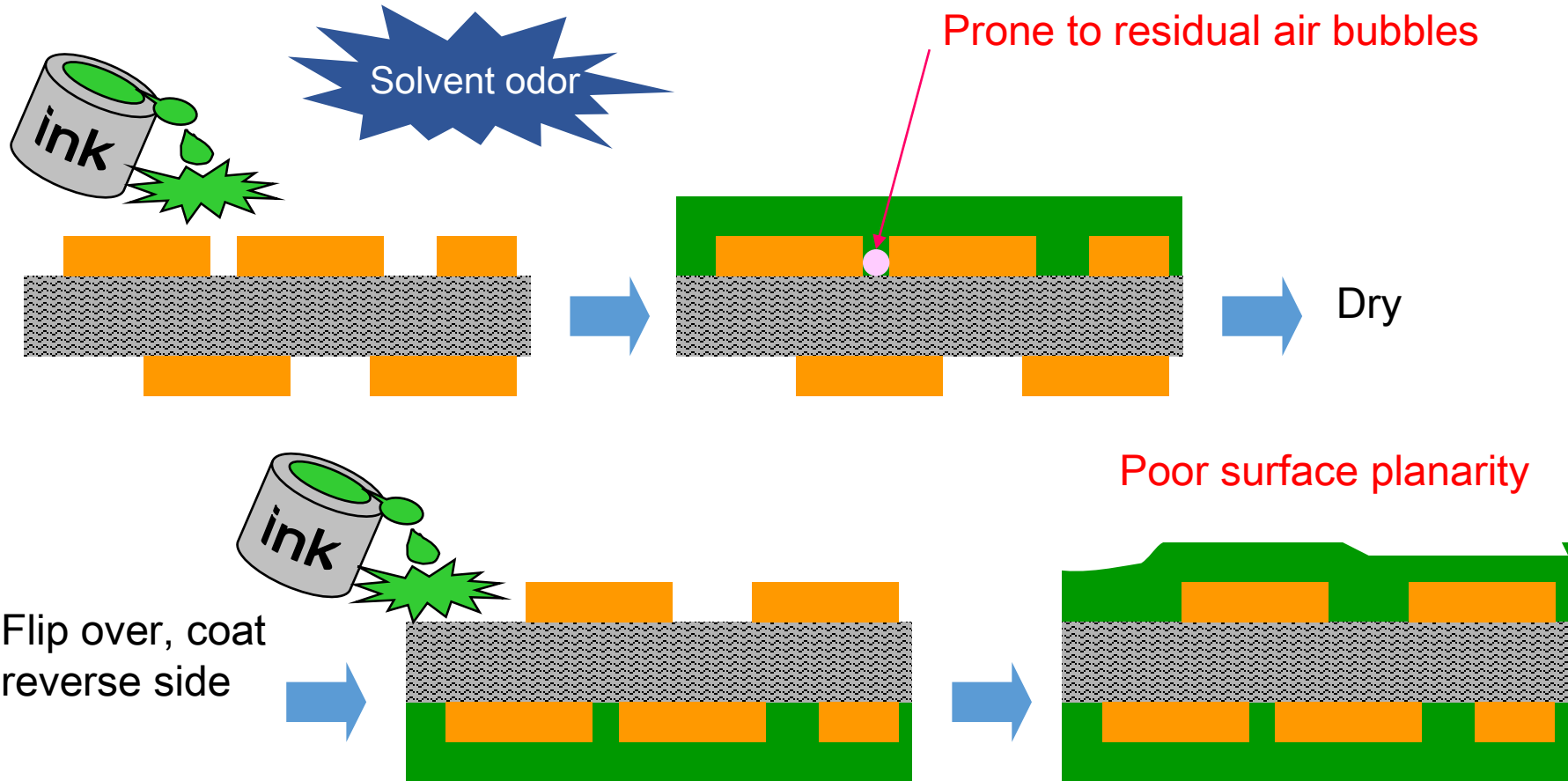


Enabled higher-density interconnects, higher-speed signal transmission, and lighter-weight substrates, setting the stage for mass proliferation of high-performance PCs.

There was strong demand from the semiconductor industry for semiconductor packaging substrates composed of an insulating material that:

- (1) can **easily form insulation layers of uniform thickness**
- (2) is highly heat resistant, flame retardant, and mechanically strong when cured,
- (3) enables **copper microcircuits to be fabricated** atop insulation layers, and,
- (4) has a high degree of both insulation reliability and temperature cycle reliability.

# II-4. Semiconductor production process in latter half of 1990s: Interlayer insulator ink used as build-up material

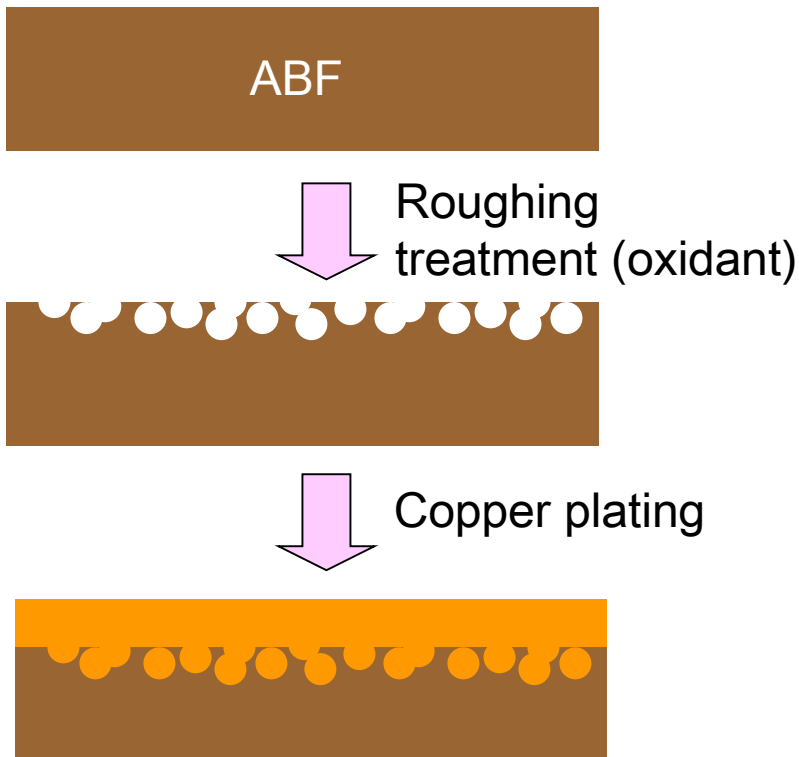


These shortcomings were all rectified by ABF

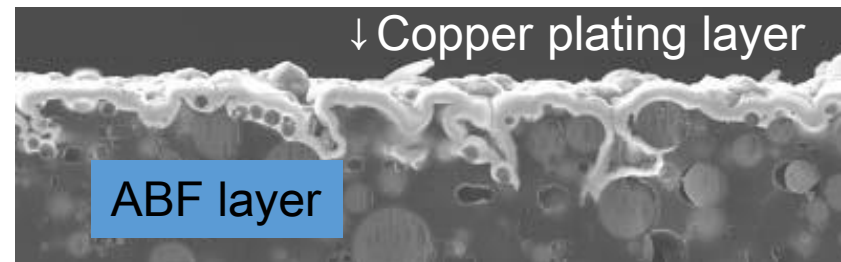


# II-5. ABF facilitates copper interconnect fabrication through plating

Plating can be applied to ABF by roughing its surface (copper interconnect fabrication through plating).



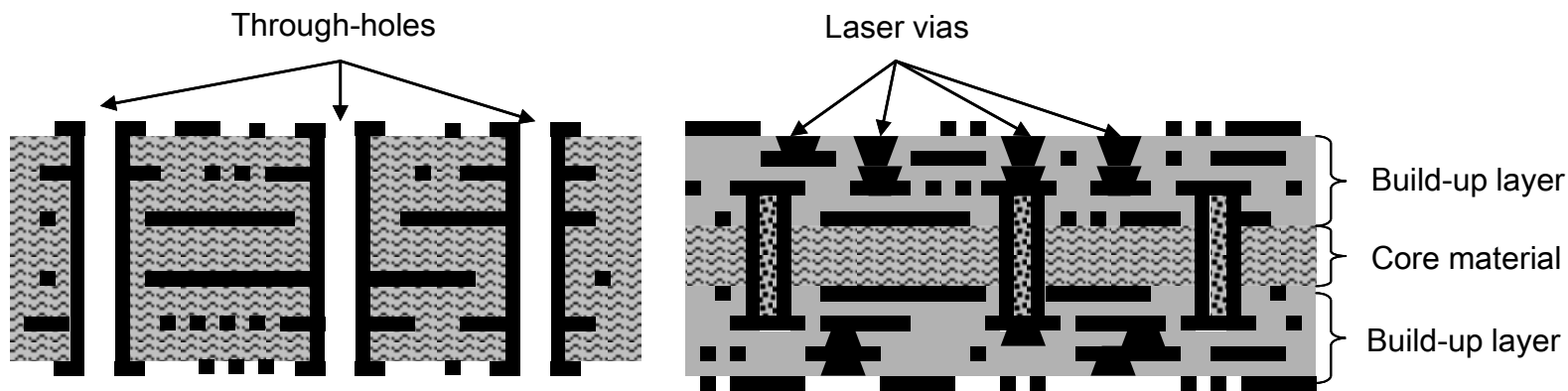
Cross-section view



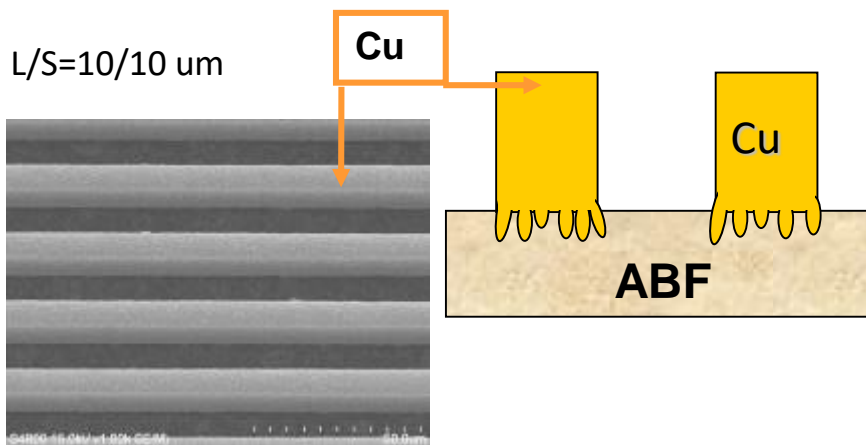
# II-6. New printed circuit board manufacturing method

## Build-up method

A method of manufacturing multilayer printed circuit boards by sequentially adding laminate layers, laser drilling to make vias in them, fabricating interconnects, etc.



Use of ABF enables forming fine copper pattern and, in turn, smaller devices

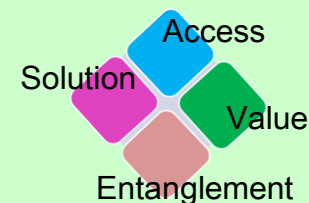


## II-7. ABF's distinguishing attributes

- ◆ World's first film produced from liquid resin
- ◆ Easier to use than liquid materials
- ◆ Manufactured through low-waste, environment-friendly process



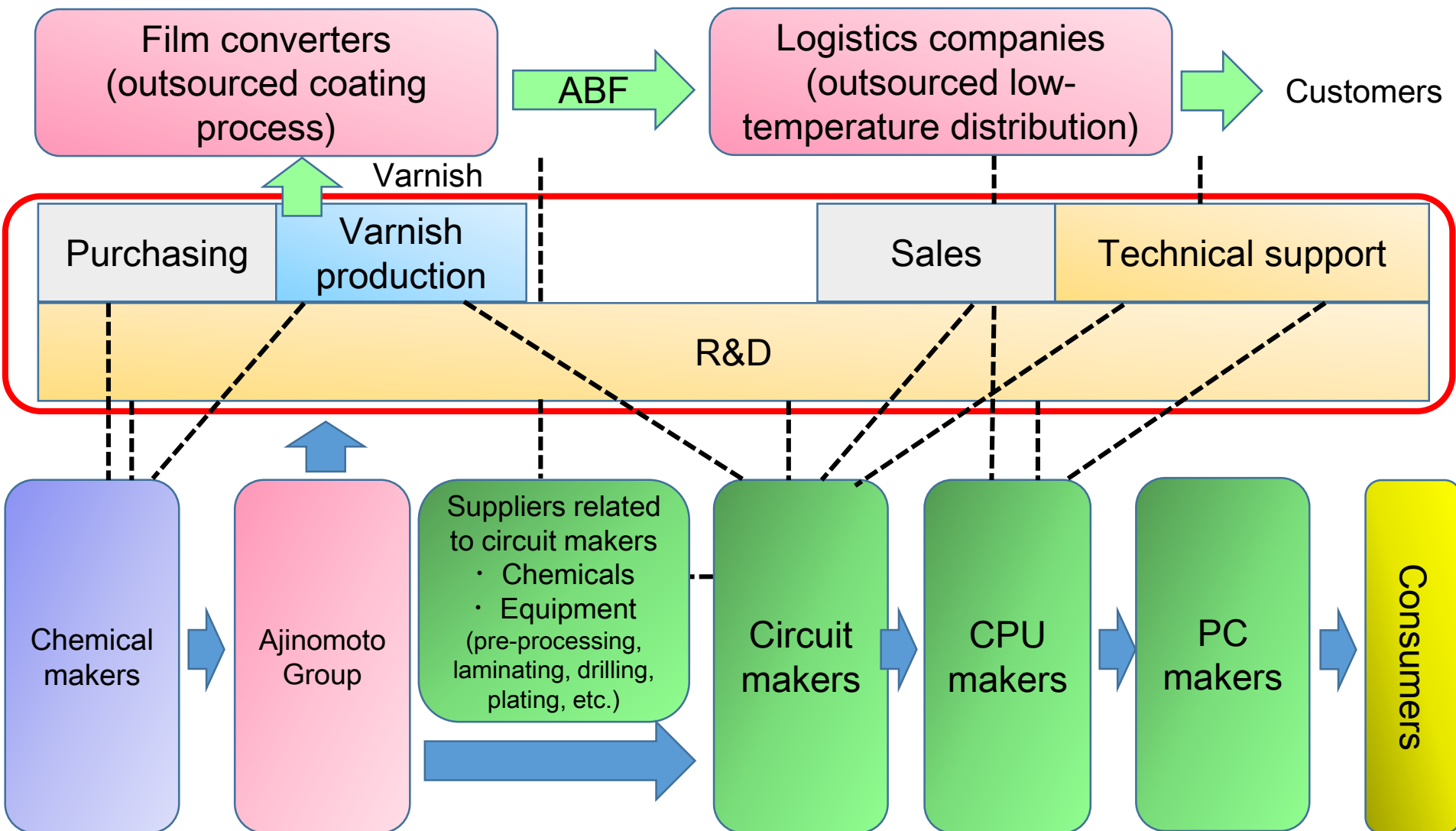
With our **S.A.V.E. sales** approach, we closely collaborate with customers from the product development stage onward after first ascertaining their **true needs**.



Since its launch, ABF has continuously been used by major semiconductor makers as a certified material

# II-8. Value chain

## Asset-light model based on outsourcing of coating and logistics



# II-9. ABF manufacturing sites

- ◆ Varnish production
- Coating company
- ★ Logistics company

Coating contractor (Gunma Prefecture)



Gunma Plant  
\*Increased production capacity  
\*Risk diversification

Ajinomoto Fine-Techno (Gunma Prefecture)



Ajinomoto Fine-Techno (HQ)



Coating contractor (Niigata Prefecture)



F-LINE Corporation

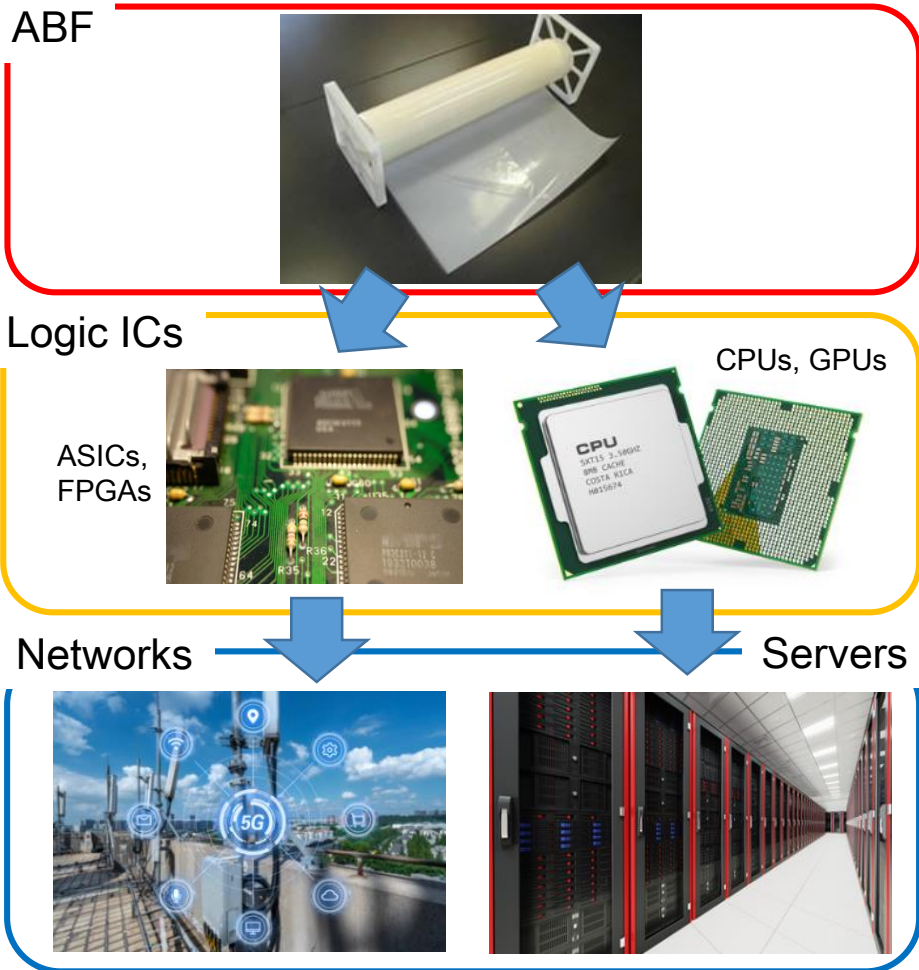


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# III-1. Semiconductor market environment

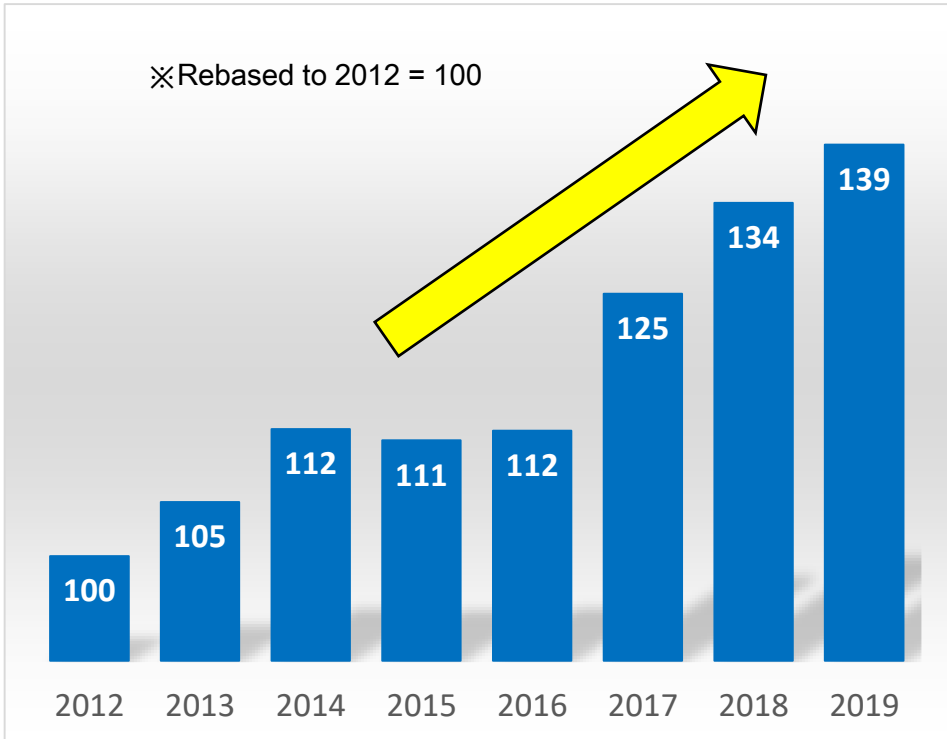
Market's long-term growth trend projected to continue

Server CPUs/GPUs and ASICs\*/FPGAs\*\* for network applications will drive market growth going forward



\*ASIC: Application-specific integrated circuit  
 \*\*FPGA: Field-programmable gate array

<Logic IC product market forecast>

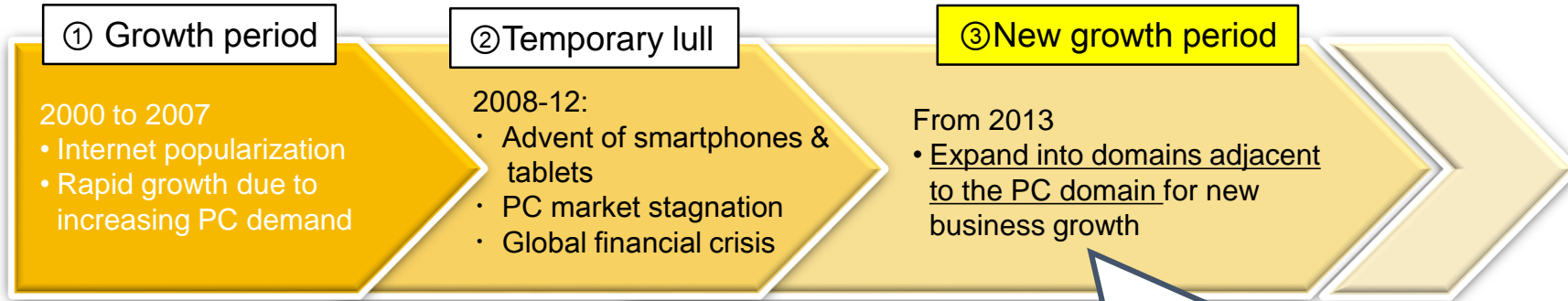


※Source: Ajinomoto Fine-Techno

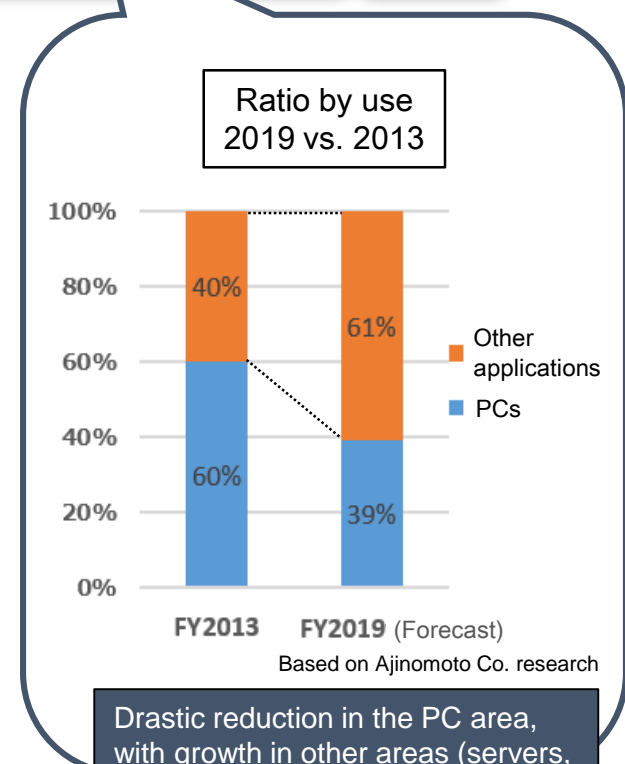
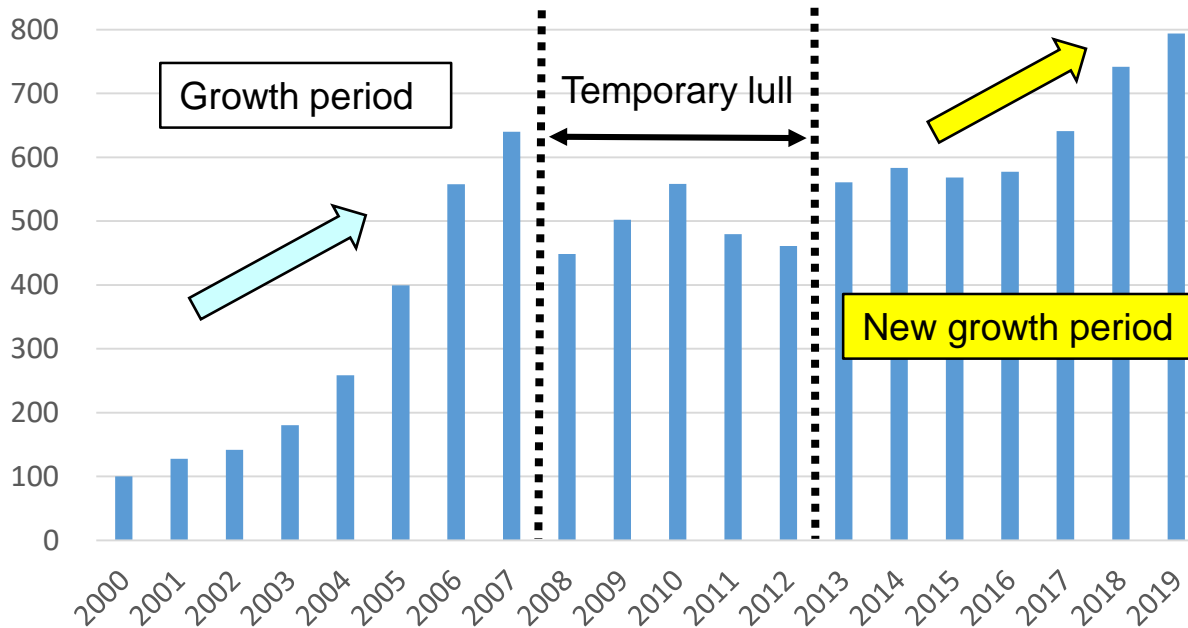
# III-2. ABF sales

## New growth phase driven by expansion to non-PC applications

1999  
Birth of  
Ajinomoto  
Build-up  
Film



<Sales> ※Sales rebased to 2000 = 100



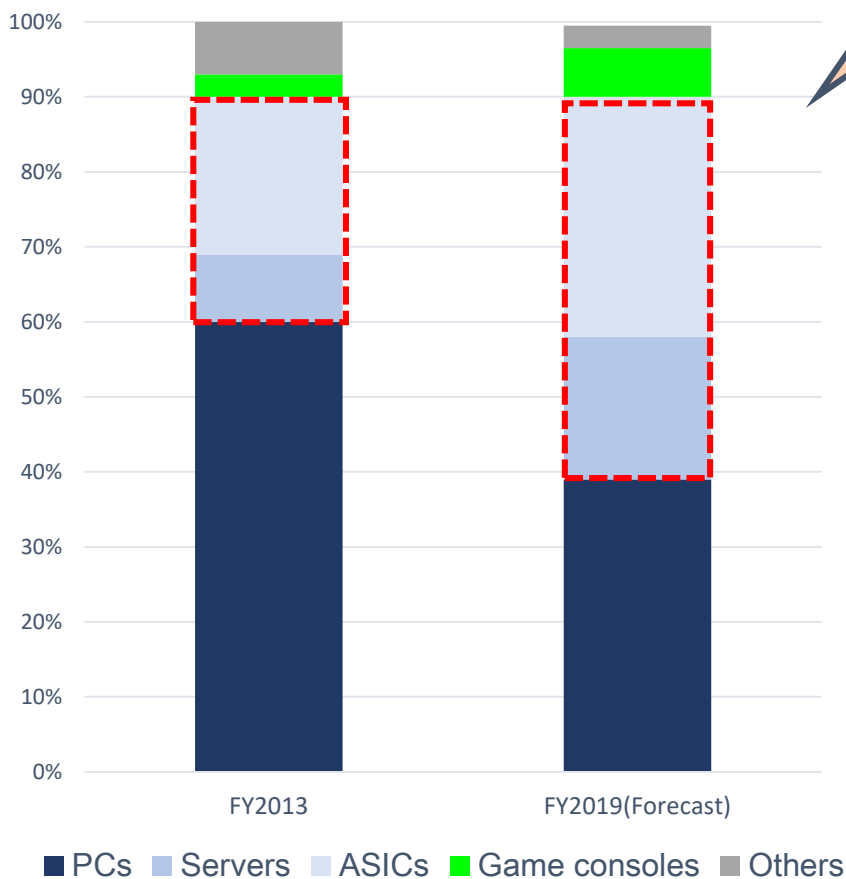
Drastic reduction in the PC area, with growth in other areas (servers, telecommunications, etc.)



# III-3: Expansion of other applications

Growth in sales for server and communication applications in conjunction with advent of 5G

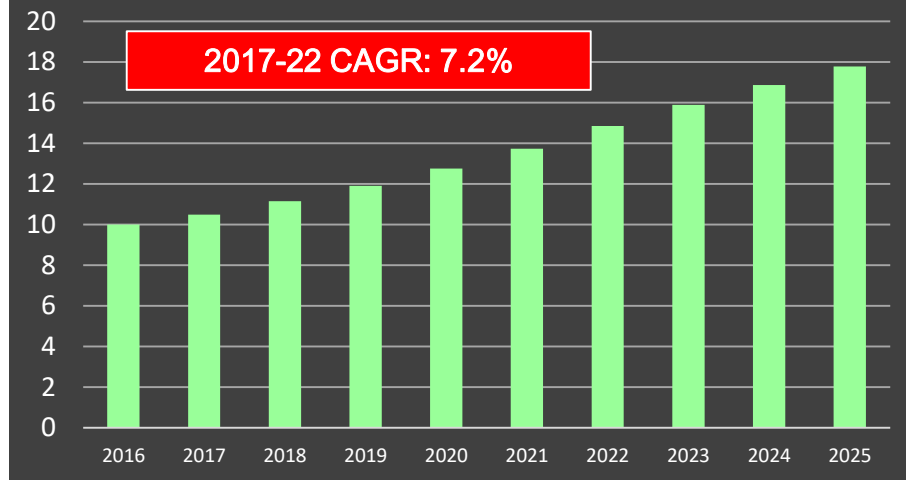
Detailed breakdown of Ratio by use  
2013 vs. 2019



Use of ABF for high-frequency applications

- ◆ Launching to market of ABF able to achieve low dielectric tangent
- ◆ Developing new materials able to meet customers' needs

Forecast number of data center servers (mn units)



※Source: Ajinomoto Fine-Techno

Cloud services market expansion is driving:

- ◆ Steady growth in number of installed data center servers
- ◆ Growth in communication infrastructure

# III-4. Business network expansion

Taiwan/China activity hubs

Taiso Commerce Inc. established in Taipei in 1988

Ajinomoto Shanghai Specialty Chemicals Co. Ltd. established in Shanghai in 2018

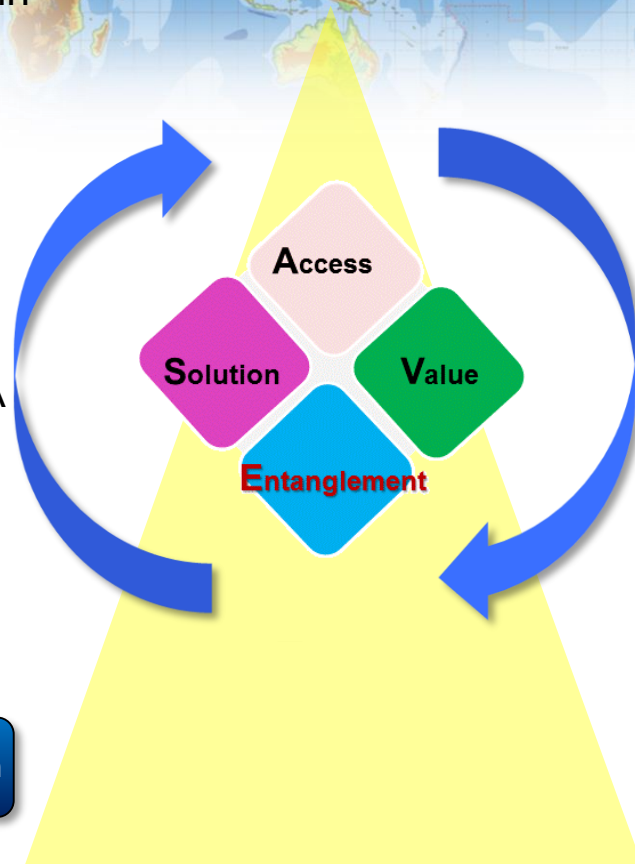


North America activity hub AFT-USA established in Silicon Valley in 2015



Access to globally leading-edge information

Global market/customers



Space for collaboration on value creation with customers  
AFT Future Creation Center established in 2016



Facility for envisioning and co-creating the future with customers

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