Global Focus on Knowledge/Winter Semester 2008

Globalization and Industry: Evolution of Organizational Capability and Comparative Advantage in Architecture (1)

The University of Tokyo

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What kind of epoch is the 21st century growing into?

・The fundamentals are globalization ・・ recurrence to the 19th-century-ish world?

・Extreme discussions at the turn of the century have been denied by realities.

・It's becoming clear that this unexpectedly is an epoch taking the golden mean.

World at the Beginning of the 21st Century ・・ Century of Globalization?

- Since the ’90s digital networking technology has changed the world; theory that “the 21st century is an era of digitization.” It is the U.S. that has led this and revived own economy.

- While America’s prominent position stays still unshakable, its self-confidence in absolute predominance of information, military affairs, and finance has wavered since 2001.

①The IT bubble set off in the U.S. has collapsed and American-style corporate governance has shown its own limits.
②The dominating military technology has failed to guarantee the realization of its national interests.
③The highly developed financial technology has not been alchemy to ingenerate excellent articles out of nonperforming loans.

- The American force has continued to be engaged in uphill battles in a number of traditional manufacturing industries, resulting in the largest amount of current account deficit in the world (in 2007).

- China, using as the driving force exports to the U.S. and EU whose corporations operate there, has made its trade surplus monstrously large.

- In Korea and Taiwan, there have emerged in rapid succession products and corporations that are superior to the Japanese force in competitiveness.

- In Europe, Germany has recorded the world’s top level of trade surplus despite the higher Euro.

Globalization and Comparative Advantage

・Why is it that, in a certain country A, instead of an industry X, another industry Y prospers? In the 21st-century Japan what industry will remain, what will be exported, and what will be imported? What is competitiveness of one industry in one country?

Standard answer of economics ・・・ the theory of comparative advantage

Relative level of factor productivity → competitive superiority of one country's industry (classical school Ricardo)

Degree of co between industry characteristics and national characteristics with respect to production factors → competitive superiority (new classical school)

Comparative Advantage Theory of New Classical Economics: Fundamental Logic Structure ……

Country's characteristics ‥

Abundance in productive resources

……

Compatibility

Characteristics of assets possessing comparative advantage ‥

Intensive degree of productive resources for products

Country with abundant workforce

Comparative advantage

Labor-intensive industry requiring plenty of workforce

Country with abundant capital

Comparative advantage

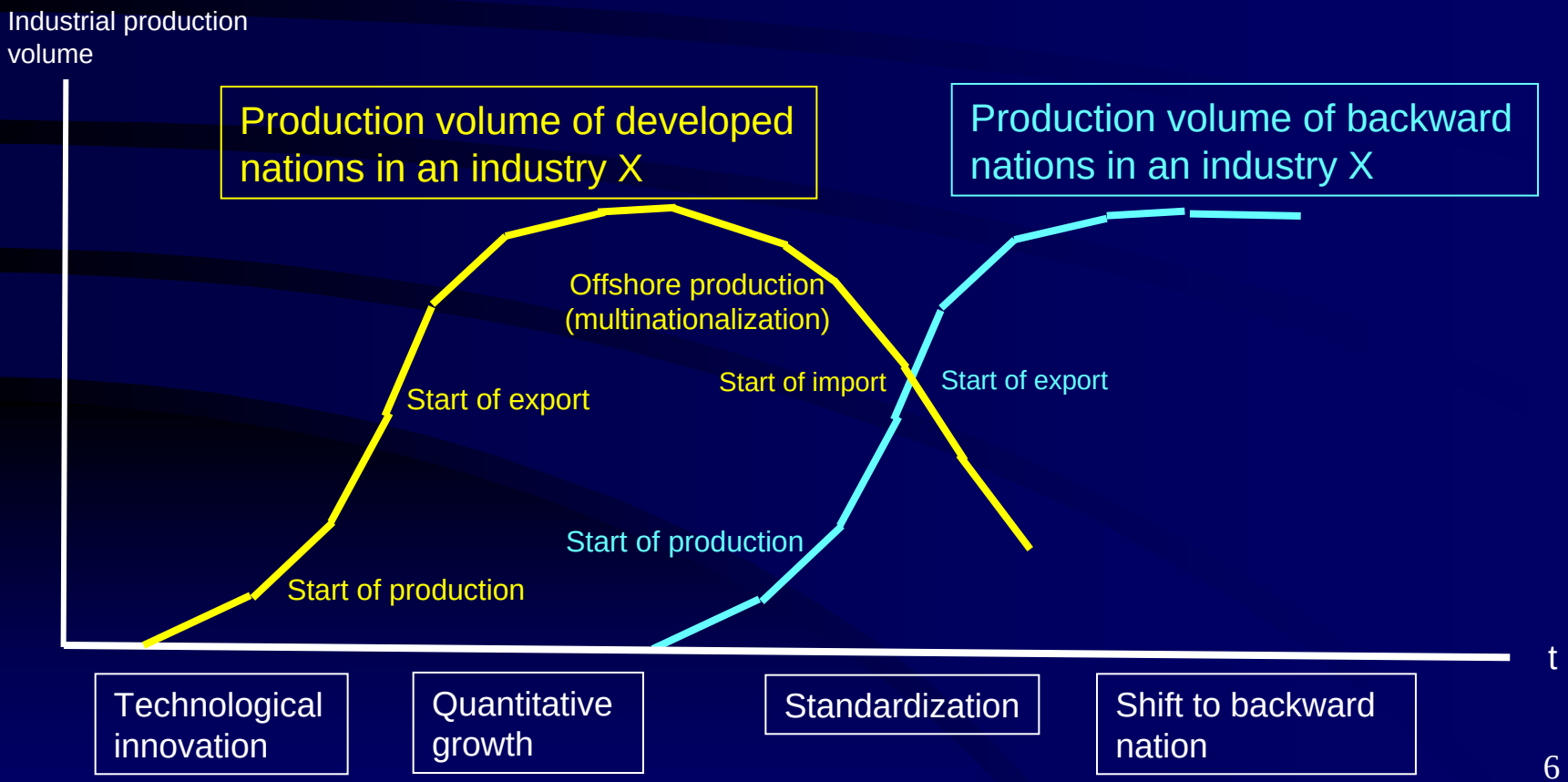
Capital-intensive industry requiring plenty of capital

However ‥ it eliminates gaps in industrial productivity by country. (reality?)

Product Cycle Theory (Staggered Morphology)

A newly designed product is produced firstly in a developed nation with technological capability.

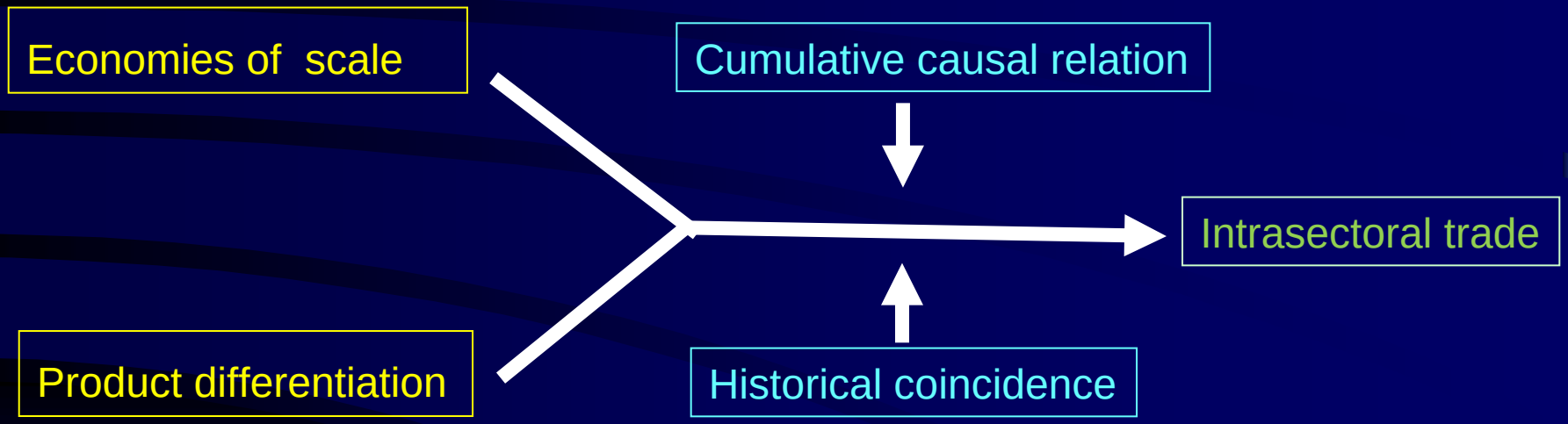
When the design becomes standardized (unvarying routine) the production base moves to a developing nation with low wages.



New Trade Theory (P. Krugman, others)

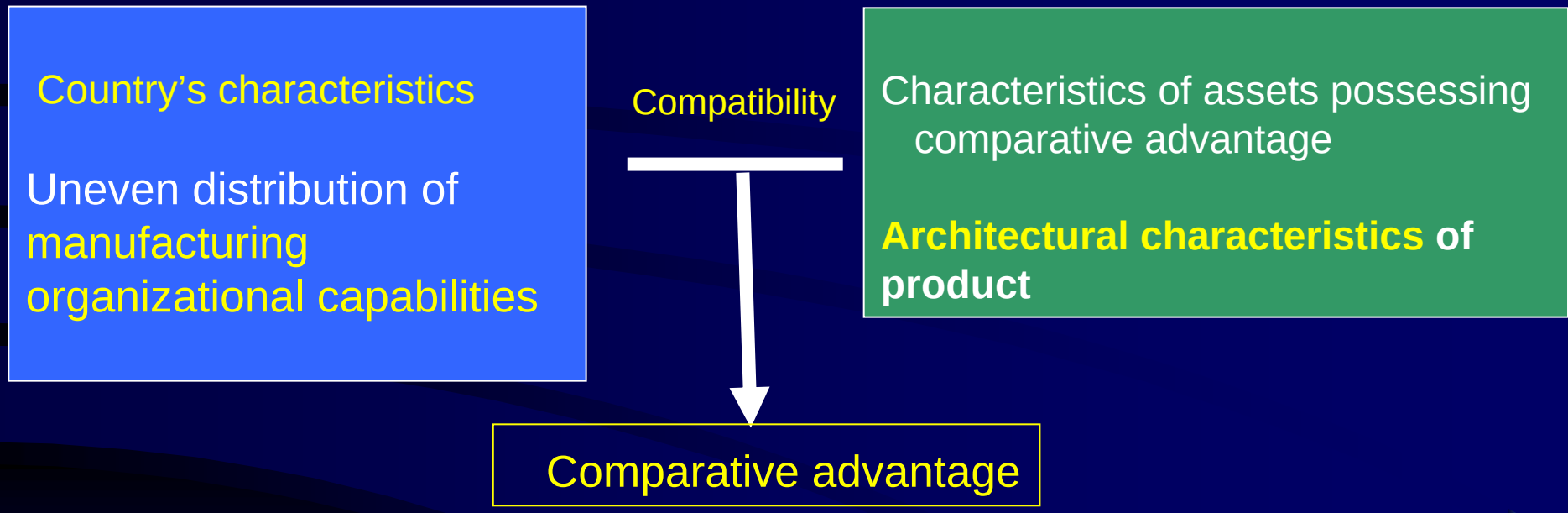
When economies of scale (The more one produces, the less his cost becomes.), and product differentiation (A well-designed product sells at a higher price.) exist,

The production snowballs at a place it has happped to begin.



・・ but, is it merely coincident that the production of a product A starts in a country X? Is it not natural that the production begins at a place the product design has been drawn?

Theory of Comparative Advantage in Design (Architecture)



By linking an engineering concept of design with an economic idea of comparative advantage, is it not possible to explain a new phenomenon of "minute intra-industry trade" under globalization?

Architectural Comparative Advantage Theory

A foothold location for creation of design information (development) goes in advance of one for transcription of design information (production).

Stated from the standpoint of the open manufacturing, location for and design stronghold should be emphasized more.

Nonetheless, this has not been squarely taken up to date.

① Theory of comparative advantage in a narrow sense ･･･focused on production location, overlooked designing location
② Product cycle theory ･･･emphasized developmental location, which, however, was concluded as being “the U.S.”
③ New trade theory･･･paid attention to cumulative effect of production location, but occluded by calling it “coincidence”

A greater importance ought to be attached to comparative advantage in design, or decision on location for a design stronghold.

A way of thinking originated from this, an idea coming out of job sites ･･･ the theory of comparative advantage in architecture

Its premise･･･While capital moves, organizational capability doesn’t move easily and is unevenly distributed in countries.

To Verify Globalization from this Standpoint Again‥

What moves around globally ‥‥ capital, fund, goods, services getting on electronic media

Era when capital selects countries (Ryoji Musha, *Theory of New Imperialism*)
Financial instruments made into digital information goods ‥‥ flying around globe in a flash
"Globalization" started from the U.S. = notable constriction to American standards

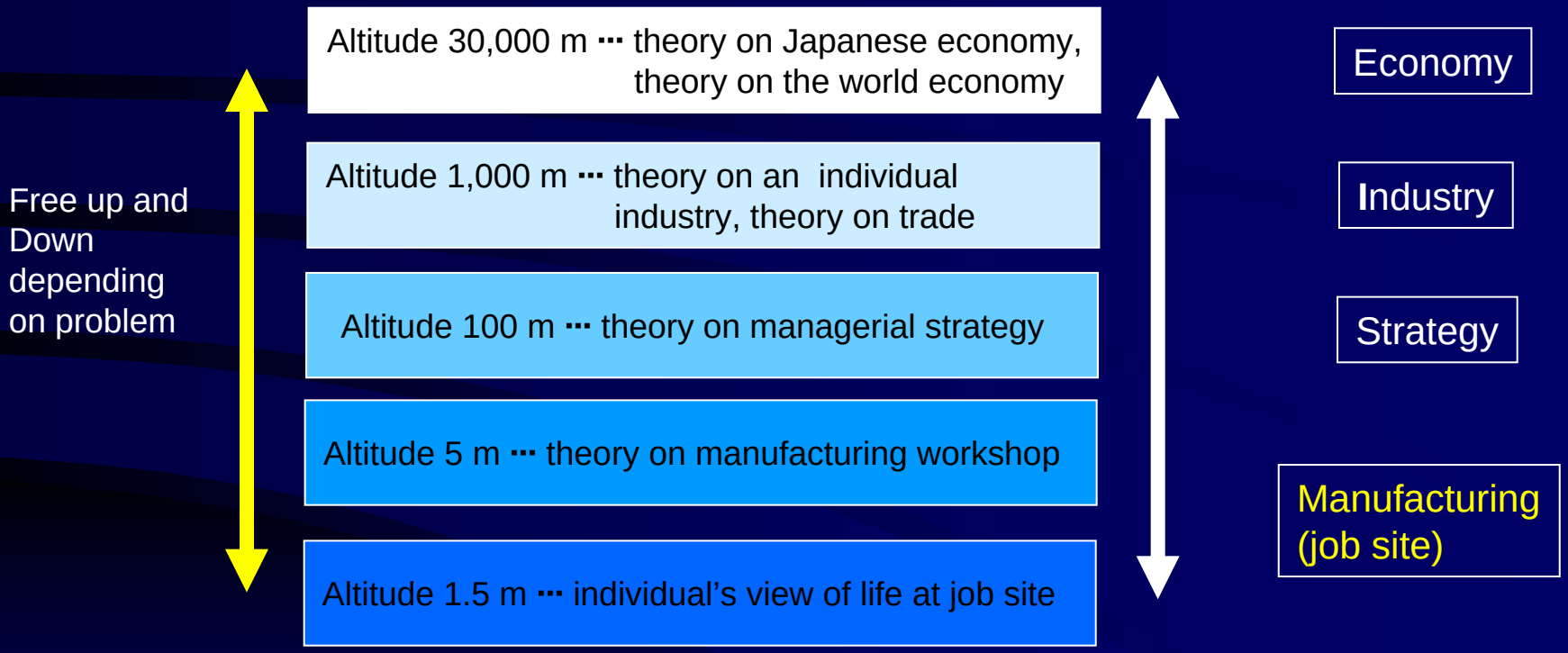
What hardly moves around globally ‥‥ people, organizational capability ‥ staff unevenly distributed

America has collected immigrants for 200 years ‥ but limited countries with capability
China made "short-term domestic immigrants" out of its inland workers (not foreign immigrants)

Organizational capability evolves in an emergent manner pursuant to a particular nation's history.
Organizational capability is fostered by capability-building environment and capability-building competition.
An international transfer of organizational capability is possible with multinational corporations, but takes time.

Accordingly, based upon unevenly distributed organizational capability, a nation's industry builds comparative advantage, is specialized, and divides labor internationally.

Strategic Theory Originated from Manufacturing Job Site ・・・
for Which Advanced and Flexible Raising and Lowering are Needed



Viewpoint of manufacturing workshop for an analysis of globalization

Uneven Distribution of Organizational Capability and Compatibility of Architecture

What is “open manufacturing”?

Perceptional Change to Design-Based “Open Manufacturing”

Former narrowly-defined view on manufacturing

Good story but ‥ no stretch

	Production job site	Development/purchase/sales job sites
Manufacturing	Production site of manufacturing	
Nonmanufac-turing		

Future broad view on manufacturing ･･･ “open manufacturing”

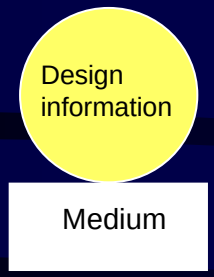
To originate an idea not from “thing” but from “architecture”

	Production job site	Development/purchase/sales job sites
Manufacturing	Production site of manufacturing	Development/purchase/ sales sites of manufacturing
Nonmanufac-turing	Servicing site of service industry	Development site of service industry

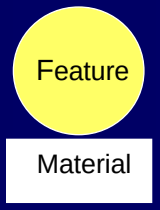
“Manufacturing” Is to Make “Good Current of Design Information”

Idea from job site/actual article ・・・ Focus on “design” rather than on thing

Actual article＝Design information＋Medium

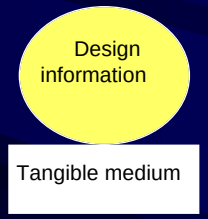


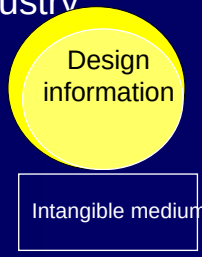
Aristotle ・・・Article＝feature＋material （feature being essence）



Products (goods/services) are artifacts (that which are designed beforehand).

If medium is tangible, it’s manufacturing (goods) . If medium is intangible, it’s service industry



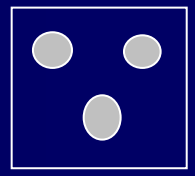


Chief source of value added lies in design information. (Medium is a vehicle to convey it.)

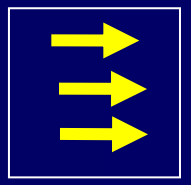
Open (broad-sense) manufacturing ・・・is, relying on an artifact, to create, transcribe, and transmit design information, and to make a current for that information to reach customers, and to gain customer satisfaction and economic effectiveness.

“Intrinsic Technology” and “Manufacturing Technology”

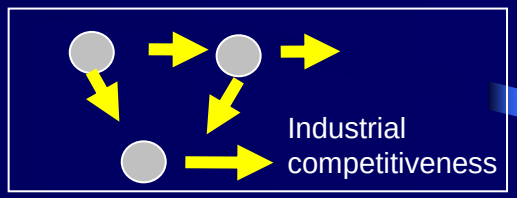
①Intrinsic technology ・・ Causal knowledge in which specific structure brings forth specific function; Important, but likely to turn into a “solitary island” if left alone.



②Manufacturing technology ・・Knowledge to make a “current of design information” bound for customers ・・possible to be owned jointly between different sectors (both manufacturing and service industries)



To industrial competitiveness, ①intrinsic technology and ②manufacturing technology are closely connected with each other.



“Manufacturing technology is general-purpose technology for knowledge transfer across industries.
(from competition-fulfillment industry to competition-insufficient industry)

“Manufacturing instructor” engages in knowledge transfer across industries.

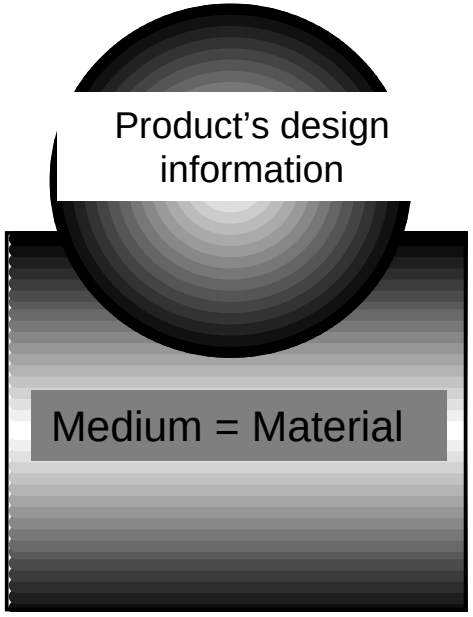
And yet formerly, the discussion focused on intrinsic technology (government, mass communications, industrial circles, the academic world).

Only in the 3rd-term Basic Program for Science and Technology did it come to be acknowledged…
“Manufacturing technology” is one of the 8 pillars.

Conception that “Value Added Resides in Design Information”

A product is a medium (= material) upon which design information has been transcribed.

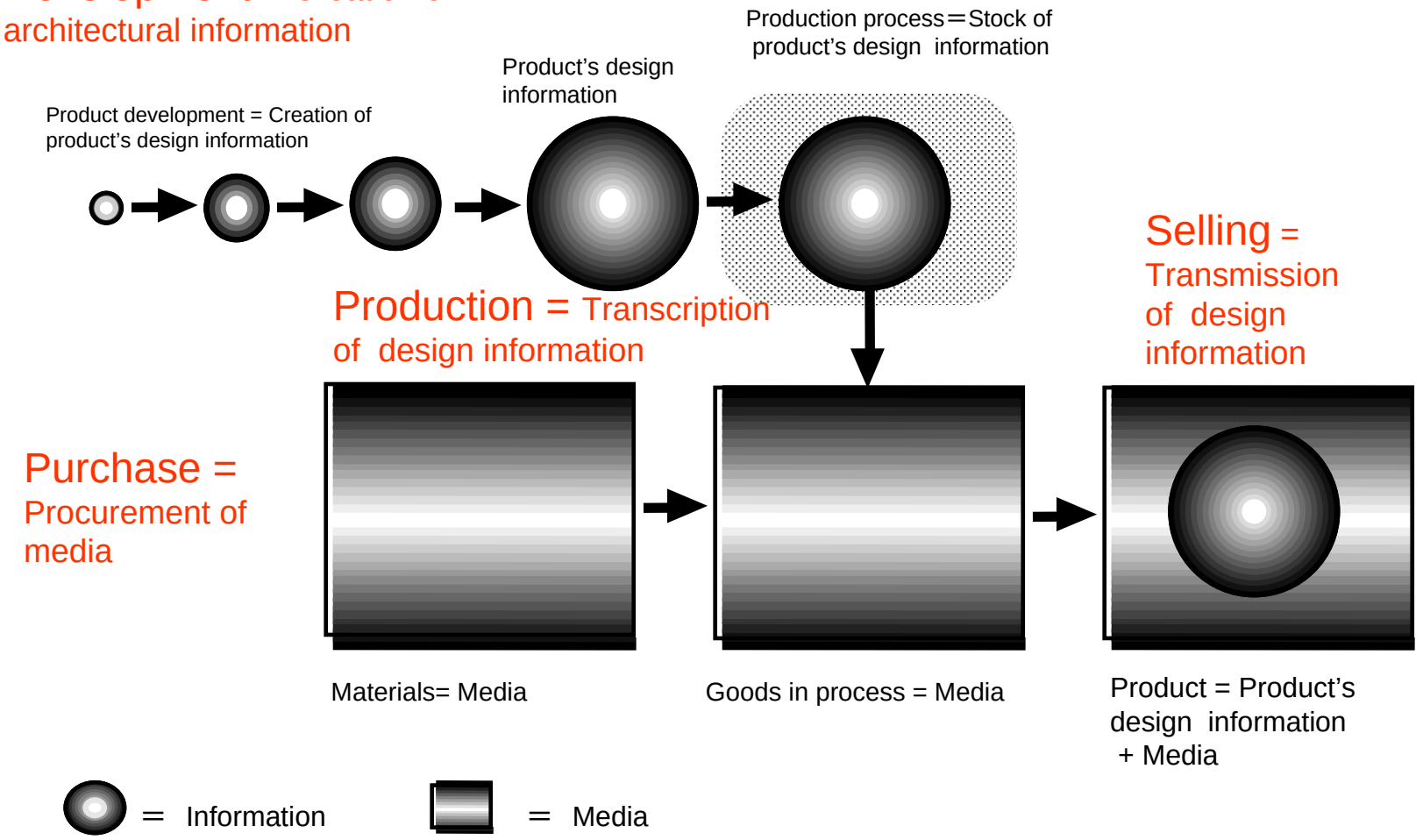
A product is a material (medium) upon which design information has been transcribed.



Product = Information + Medium

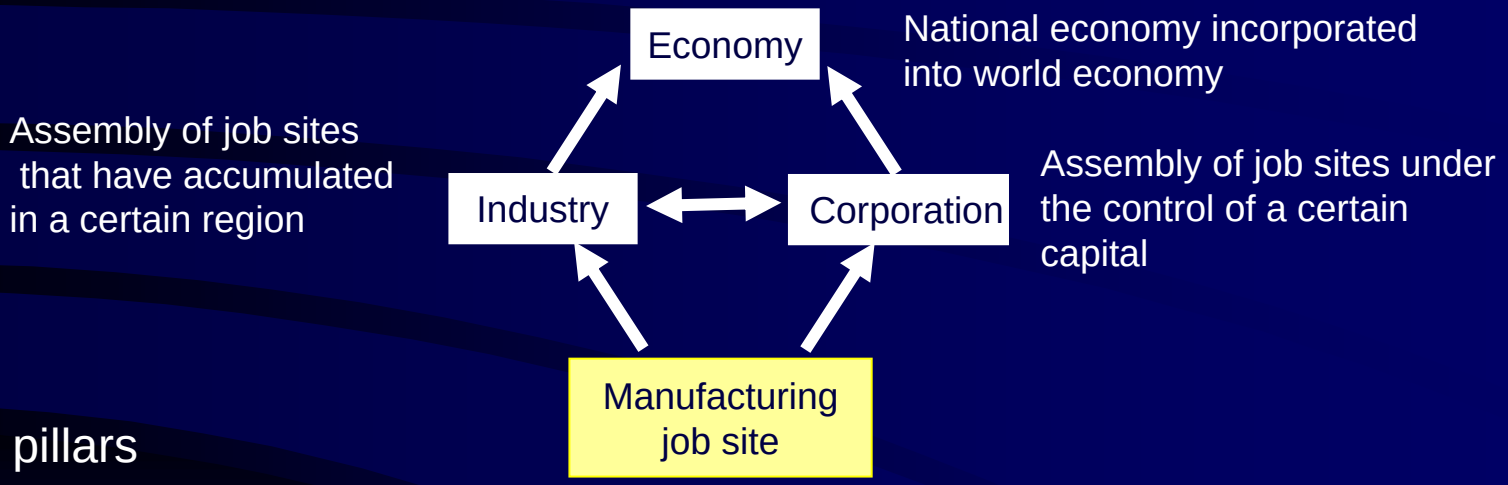
Manufacturing Job Site･･･To Include Production, Development, Purchase, and Selling

Job site = A spot where design information flows toward customers (market)



“Strategic Theory/Industrial Theory Initiated at Manufacturing Sites”

Strategic theory/industrial theory: with special attention to “design information” that is unevenly distributed in manufacturing job sites, to start with an observation of the state of design in a product/process with an open mind, and to reconstruct it from thence.



Two pillars

① Organizational capability for manufacturing = talent for a “way to pass through design information” peculiar to a specific corporation

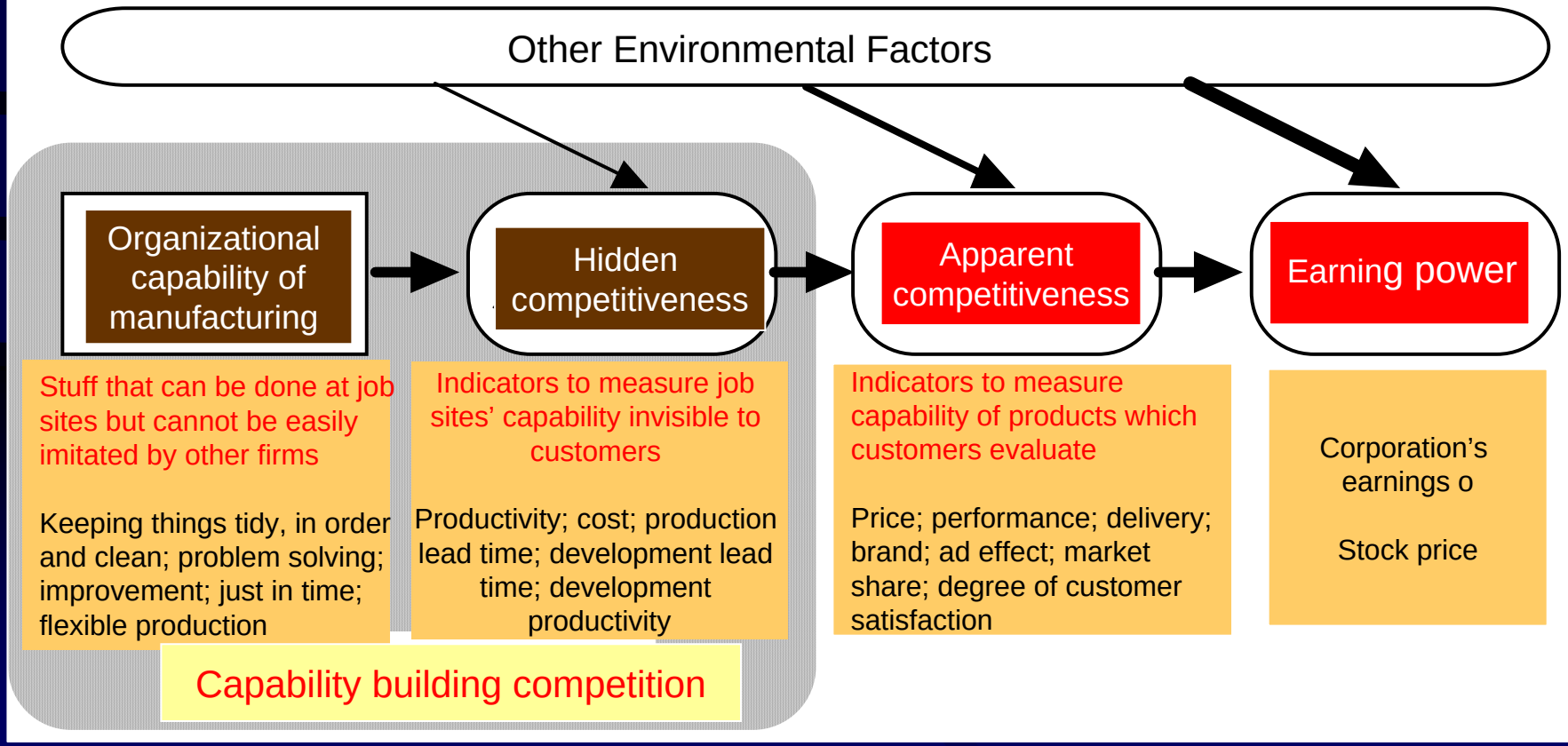
② Architecture (design concept) = a “way to link design information” for a specific product/process

Competitiveness and Organizational Capability: To be Grasped in Multilayered Manner

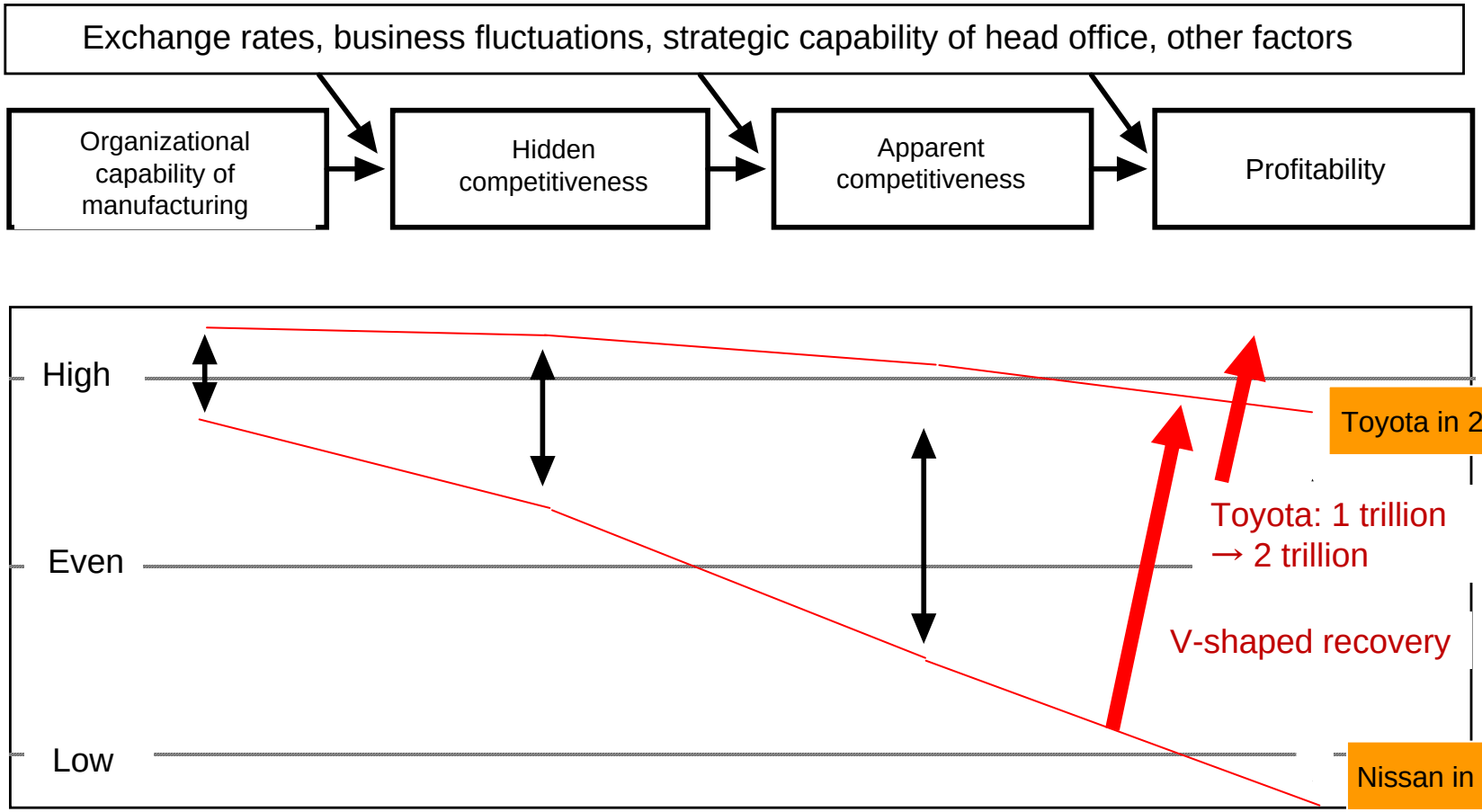
Grasp Competitiveness in Multilayered Manner：“Job Site for Starter” or “Start from Profit Anyhow”

①Capability building for start ・・ “Job site = train own body,” sports-oriented strategy of Toyota style

②Start from profit picture ・・ “Head office = use own head,” Western style (Chinese style) strategy



Framework for Multilayered Evaluation of Competitiveness
Example of Japanese Auto Industry



Imbalance Between Manufacturing Capability and Strategic Planning Capability

Particularly when a competition-fulfillment corporation manufactures a product of lapping-type architecture, "organizational capability in manufacturing" at job sites did not seem to decline much.

Challenge 1: And yet it is likely that productivity in "the first line corporations" is several times as large as that in "general corporations," which cannot be neglected. A challenge is to raise an overall manufacturing capability of Japan.

Challenge 2: Further, even with corporations having strength in job sites, "strategic planning capability" is insufficient in general.

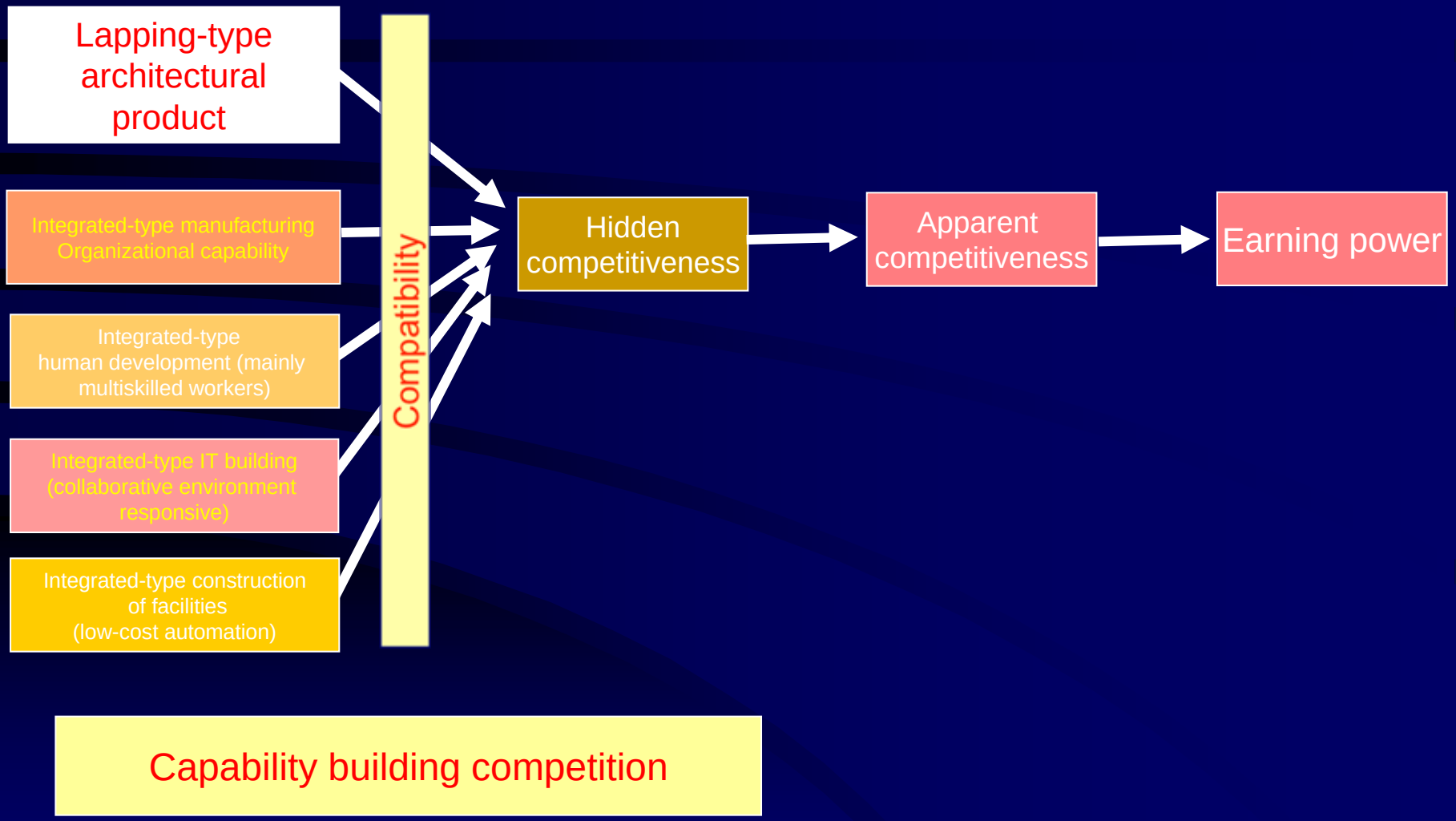
・・・ "Twisted phenomena" between operation and strategy
Syndrome of "strong plants, weak head offices"

Goal of our nation's manufacturing corporations in the 21st century

・・・ coexistence of strong job sites and strong head offices

First step for this: to accurately measure own company's organizational capability, competitiveness, earning power, and evaluate them calmly. No measurement, no improvement.

Competition and Compatibility Generate Competitiveness



Manufacturing = Making Current of Design Information

Let's Think of Manufacturing from Point of "Designing"

A product is a medium (= material) upon which design information has been transcribed.

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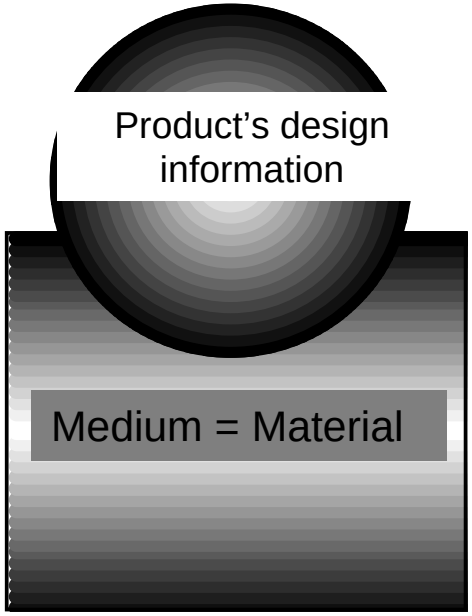
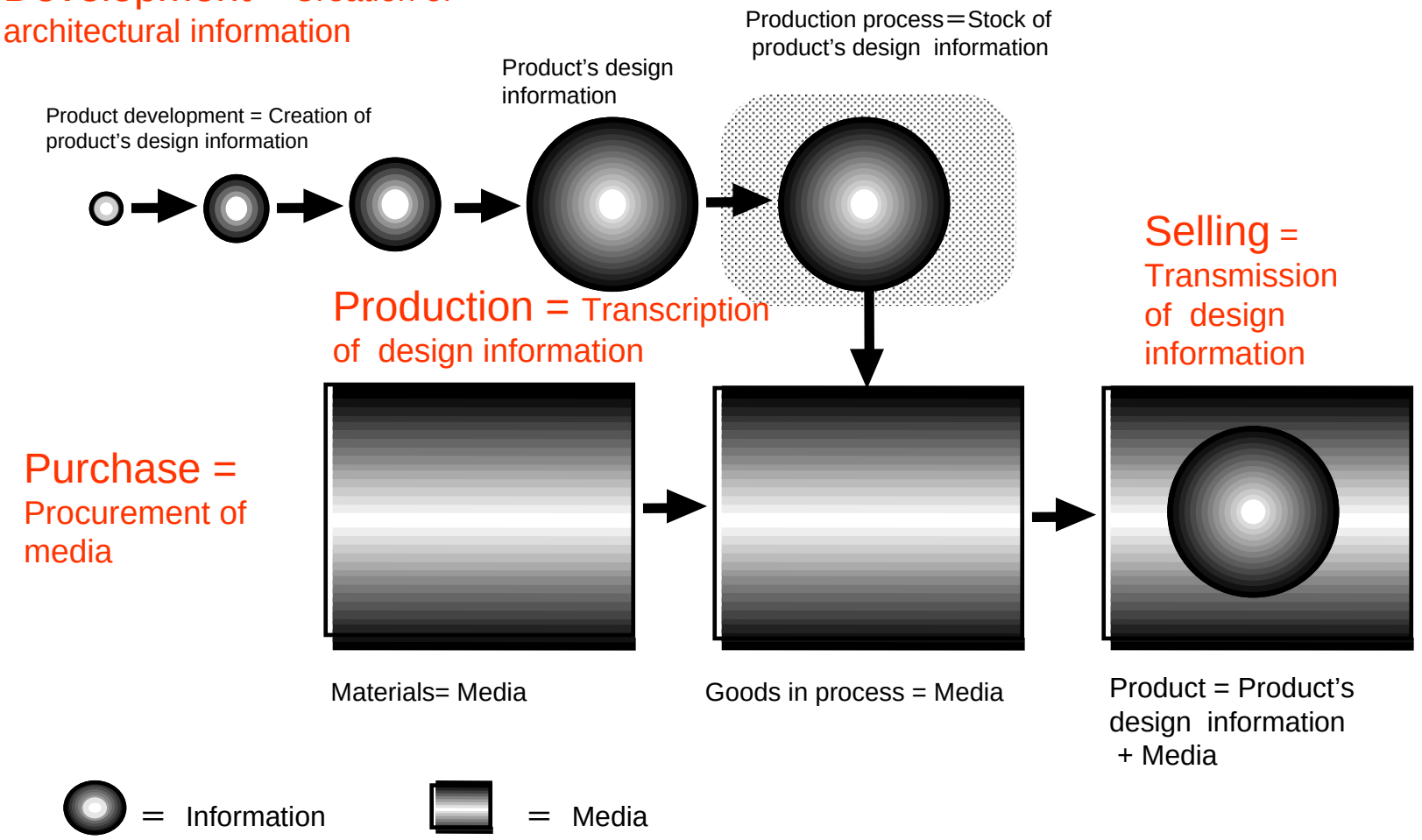


Product = Information + Medium

Manufacturing Job Site ･･･To Include Production, Development, Purchase, and Selling

Job site = A spot where design information flows toward customers (market)



Design information

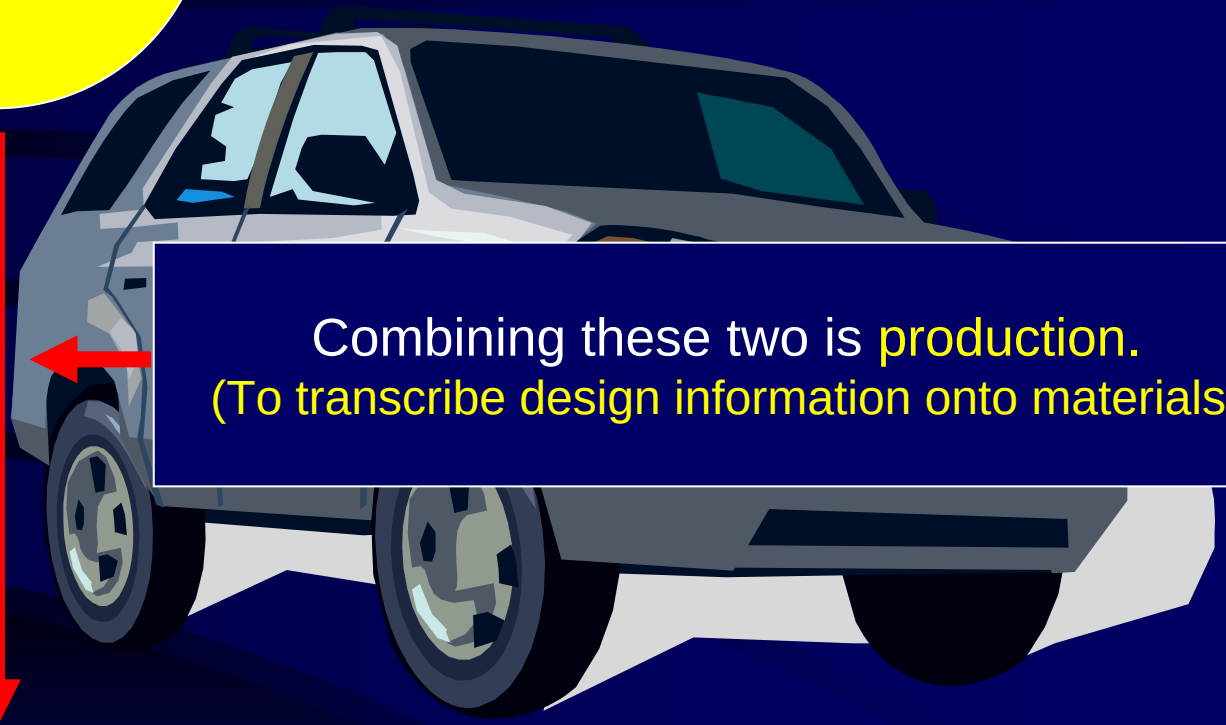
Body design customers think cool

Iron sheet of 0.8 millimeters thick

Material = Medium

Body design customers think cool

Creation of this is development.



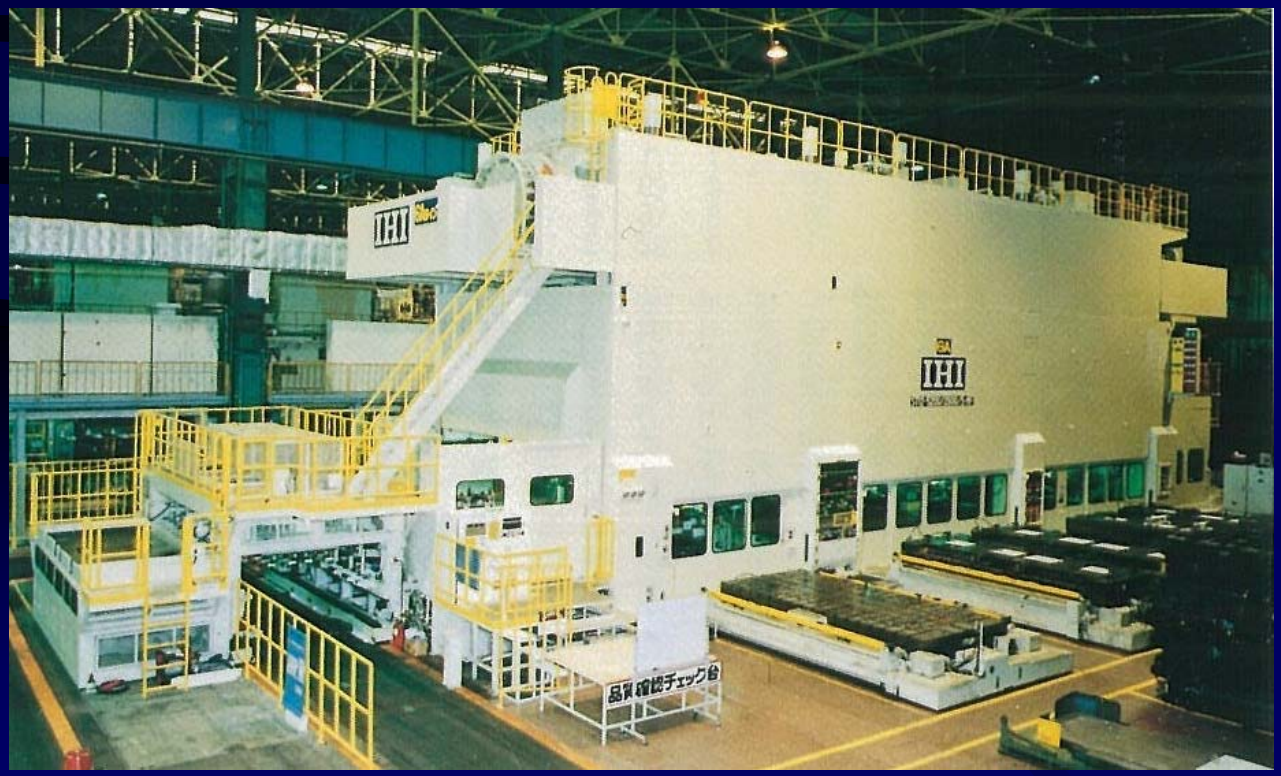
Combining these two is production.
(To transcribe design information onto materials)

Iron sheet of 0.8 millimeters thick

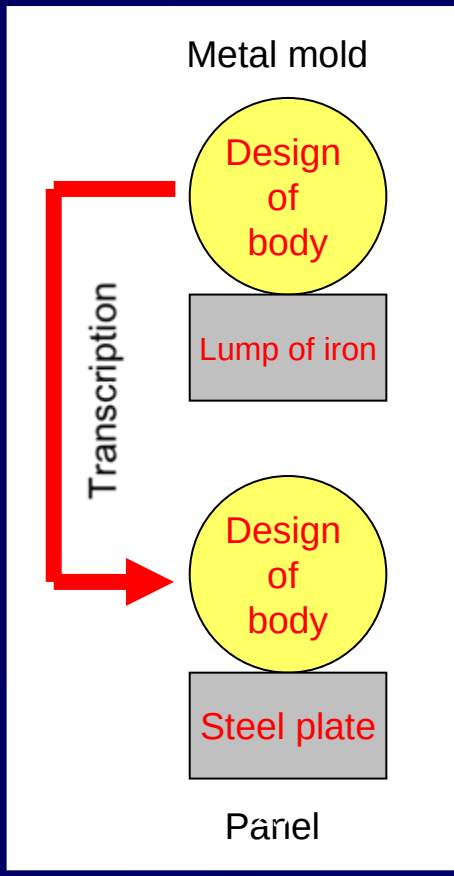
Procurement of this is purchase.

What is Happening at Press Plant ･･･Production = Transcription

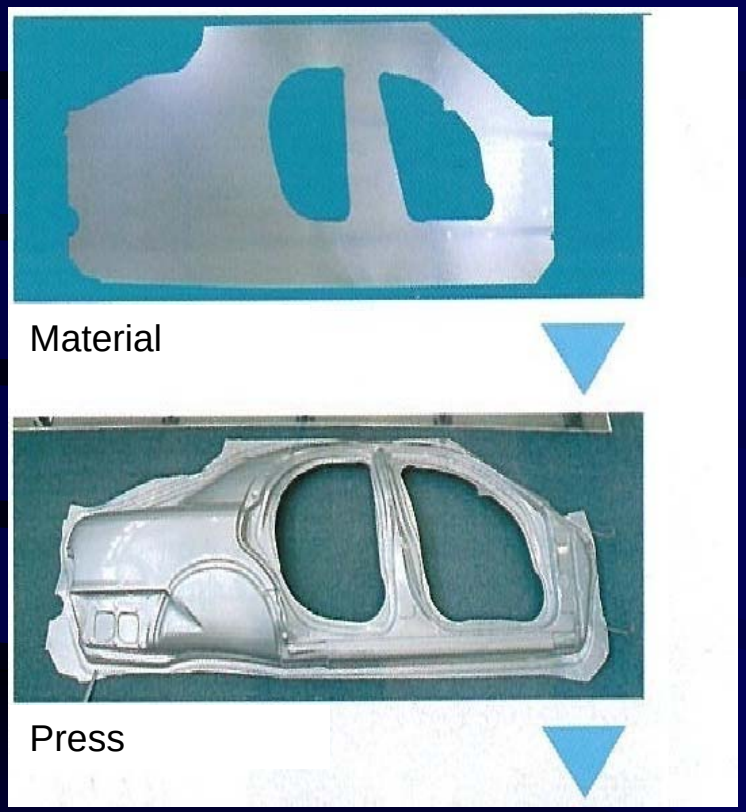
- Metal mold ＝ Design information implanted in a lump of iron
- At a speed of about 10 times a minute, this information gets “transcribed” on steel plates consuming 1,000 tons of energy, just like a printing process.
- I.e., press production is an activity to transcribe design information held in the metal mold.
- If failed, steel plates get torn, bent, creased; that is, transcription errors.
- How fast, cheaply, and accurately the transcription gets done is up to the job-site capability.

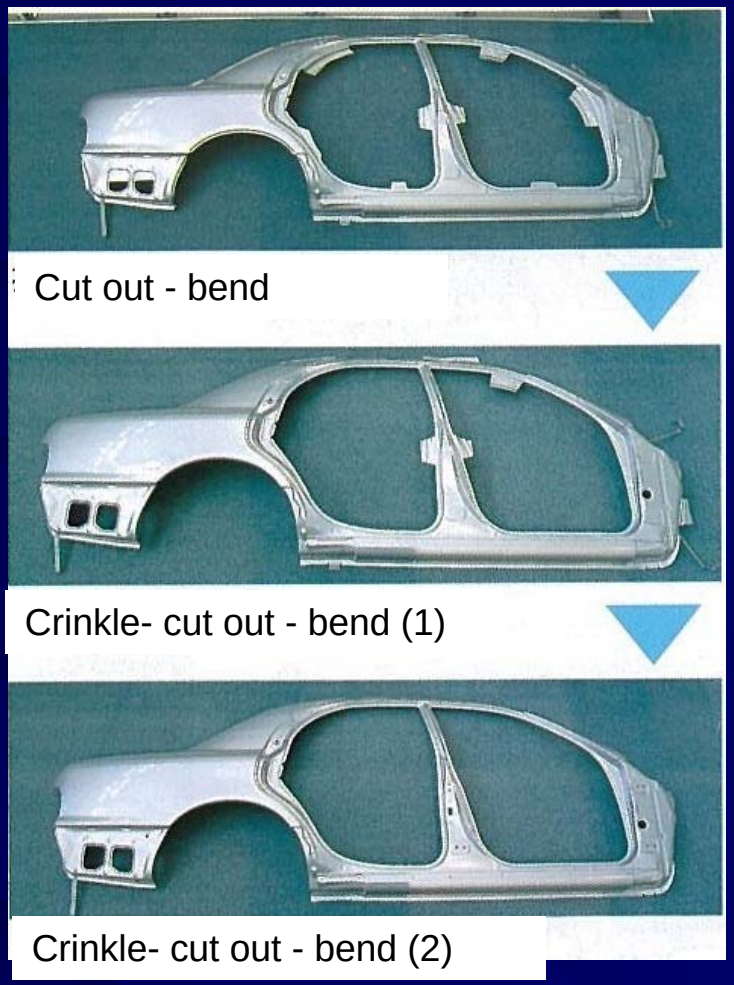


‡ Figure: from TOYOTA Commemorative Museum of Industry and Technology



Iron Sheet Absorbs Design Information Held in Metal Mold and Turns into Automotive Side Body





That is, to transcribe the design information held by a metal mold onto a medium of an iron sheet.

‡ Figure: from TOYOTA Commemorative Museum of Industry and Technology

Manufacturing is ‥ To make a “current for design information” bound for customers, and to make this current uninterrupted, efficient, and accurate.

Body design customers think cool

Sale → Use → Interpretation

Customer satisfaction

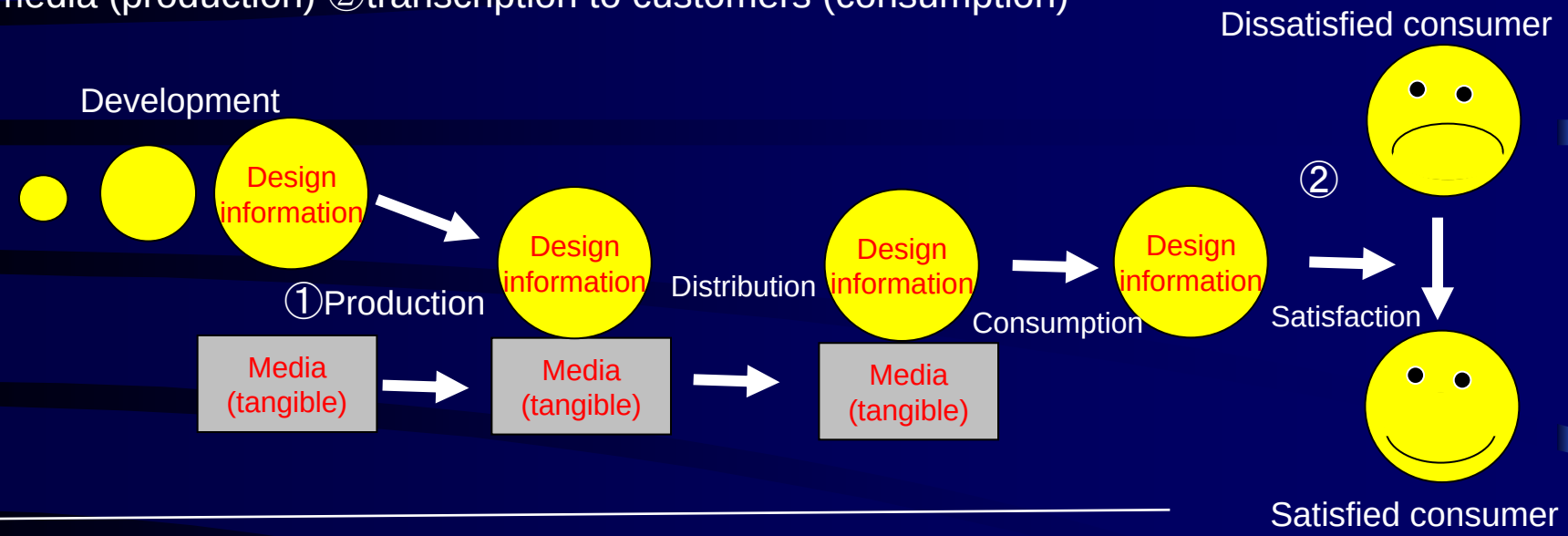
Iron sheet of 0.8 millimeters thick

Product = Design information
+ Material (medium)

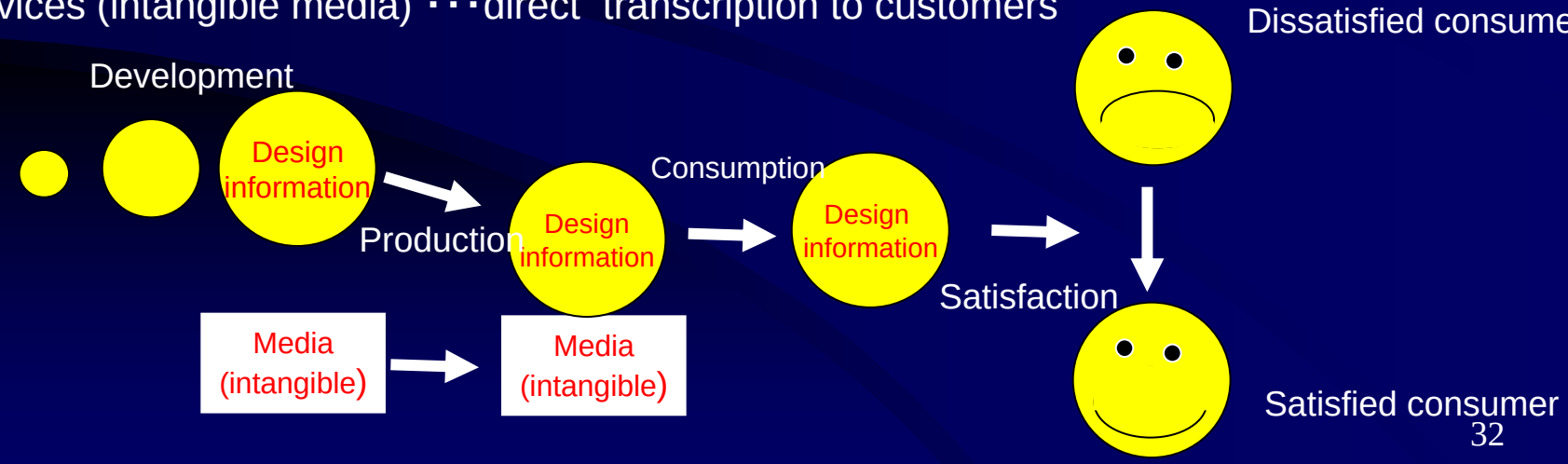
To create design information is development.
To procure media from outside the company is purchase.
To transcribe design information onto materials is production.
To transmit it to customers is selling.

Goods (Tangible Media) and Services (Intangible Media)

・Goods (intangible media) ・・・indirect transcription in 2 steps : ①transcription to media (production) ②transcription to customers (consumption)



・Services (intangible media) ・・・direct transcription to customers



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Globalization and Industry: Evolution of Organizational Capability and Comparative Advantage in Architecture (2)

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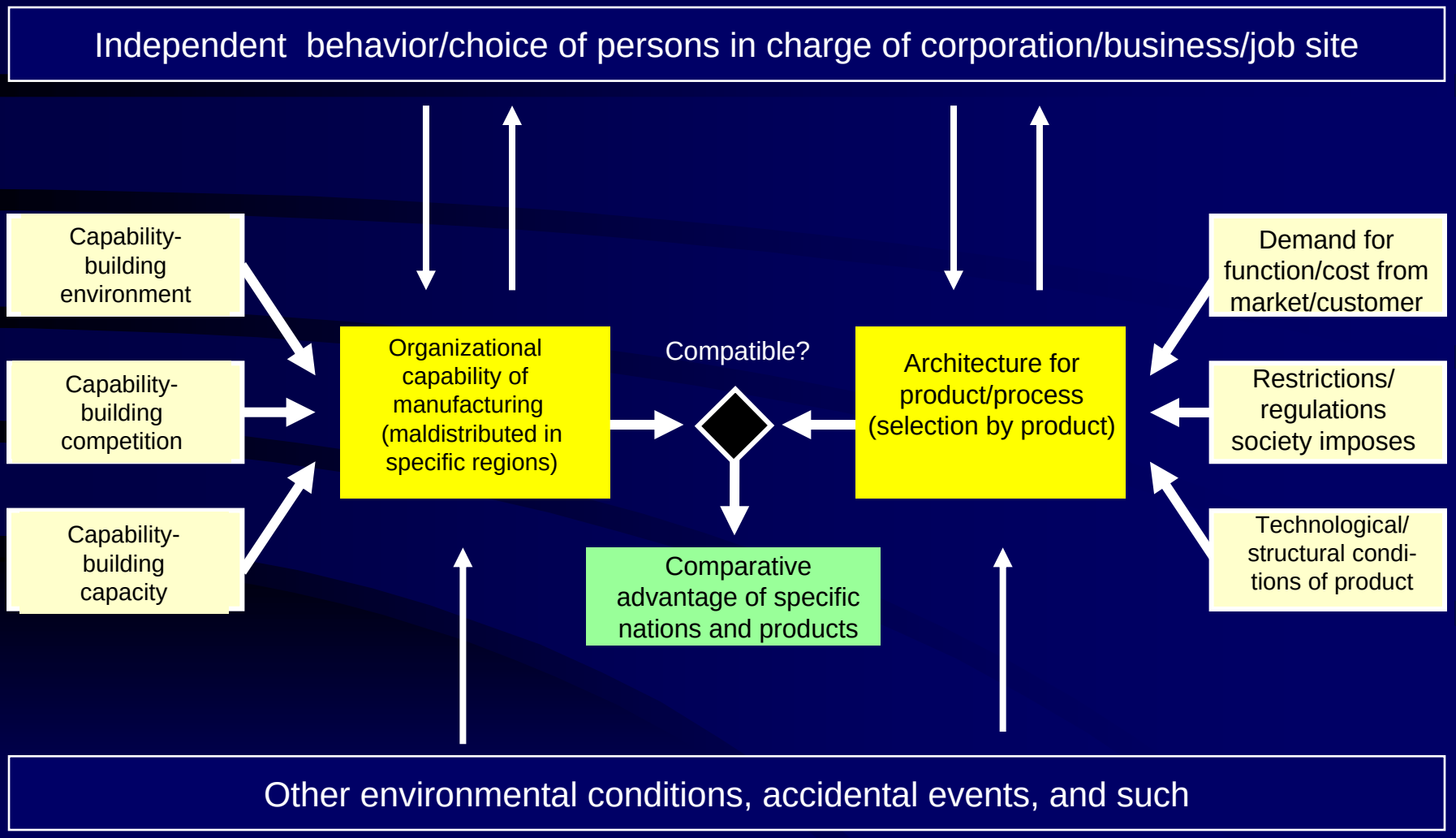
Organizational Capability of Integrated-type Manufacturing

— It includes all of production, development, purchase, and selling.

Basis: Teamwork of Multiskilled Workers

Hypothesis about Compatibility Between Organizational Capability and Architecture—Sketch of Whole Span



Integrated-type Organizational Capability In Manufacturing Seen As "System For Creation/Transcription of Design Information" (E.g., Toyota)

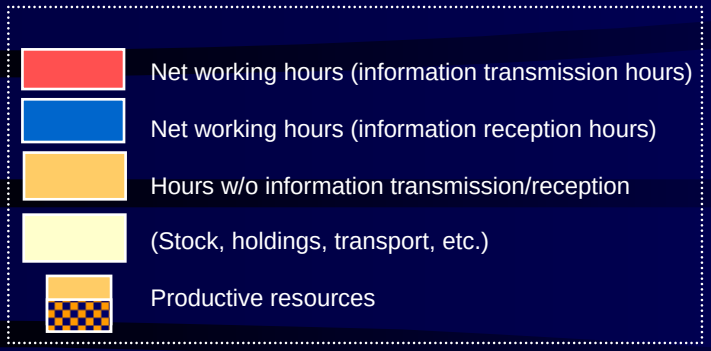
① Production：can be explained uniformly as "transcription of design information of high density/accuracy from process to product"

② Product development：can be explained uniformly as a "bundle of the prompt and integrated problem-solving cycle"

③ Supplier sytem：can be explained with the three routine, mutual complementarirty of "long-term stable dealing," "capability-building competition among the few," and "to entrust in a bundle."

In short ･･･ it's an "organization that is quick on the uptake of intellect (design information)."

Organizational Capability of Integrated-type Production: Concentration on Density and Accuracy of Information Transcription



Productivity of 1st process (man-hour per unit)

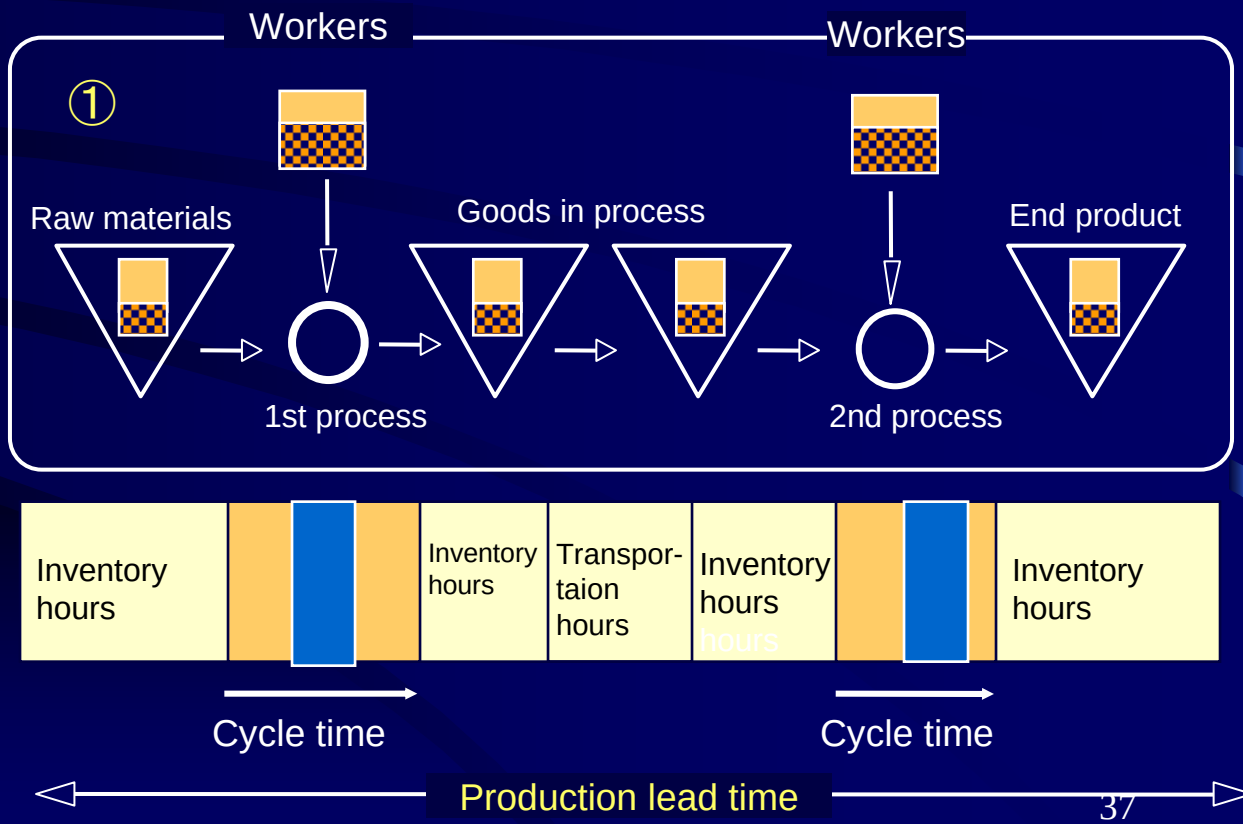
② Cycle time

Productivity of 2nd process (man-hour per unit)

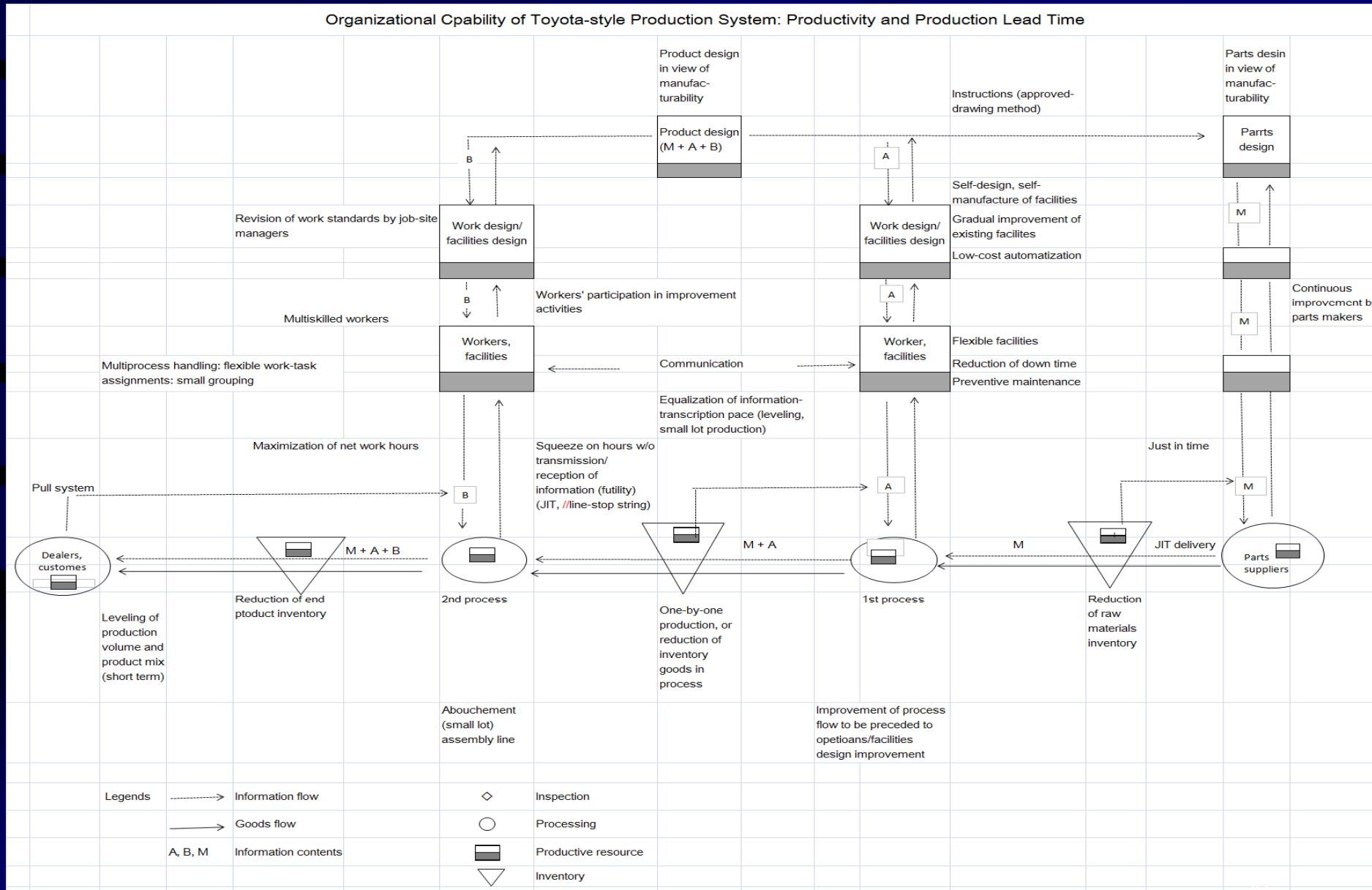
② Cycle time

Transmitting side (productivity)

Receiving side (lead time)



Toyota System Observed from Current of Design Information (Productivity/Production Period)



Takahiro Fujimoto 1997

Organizational Capability of Integrated-type Product Development (E.g., Motorcar)
Basis: “Early and Conciliatory Problem Solving”

① Joint development/linkage coordination with a parts maker
・・・ design- in/approved drawing method

② Effective use of organizational capability of production job site for product development
・・・ trial manufacture, steel mold, mass-production startup

③ Overlap-type development
・・・ overlapping and linkage coordination in product development and process development

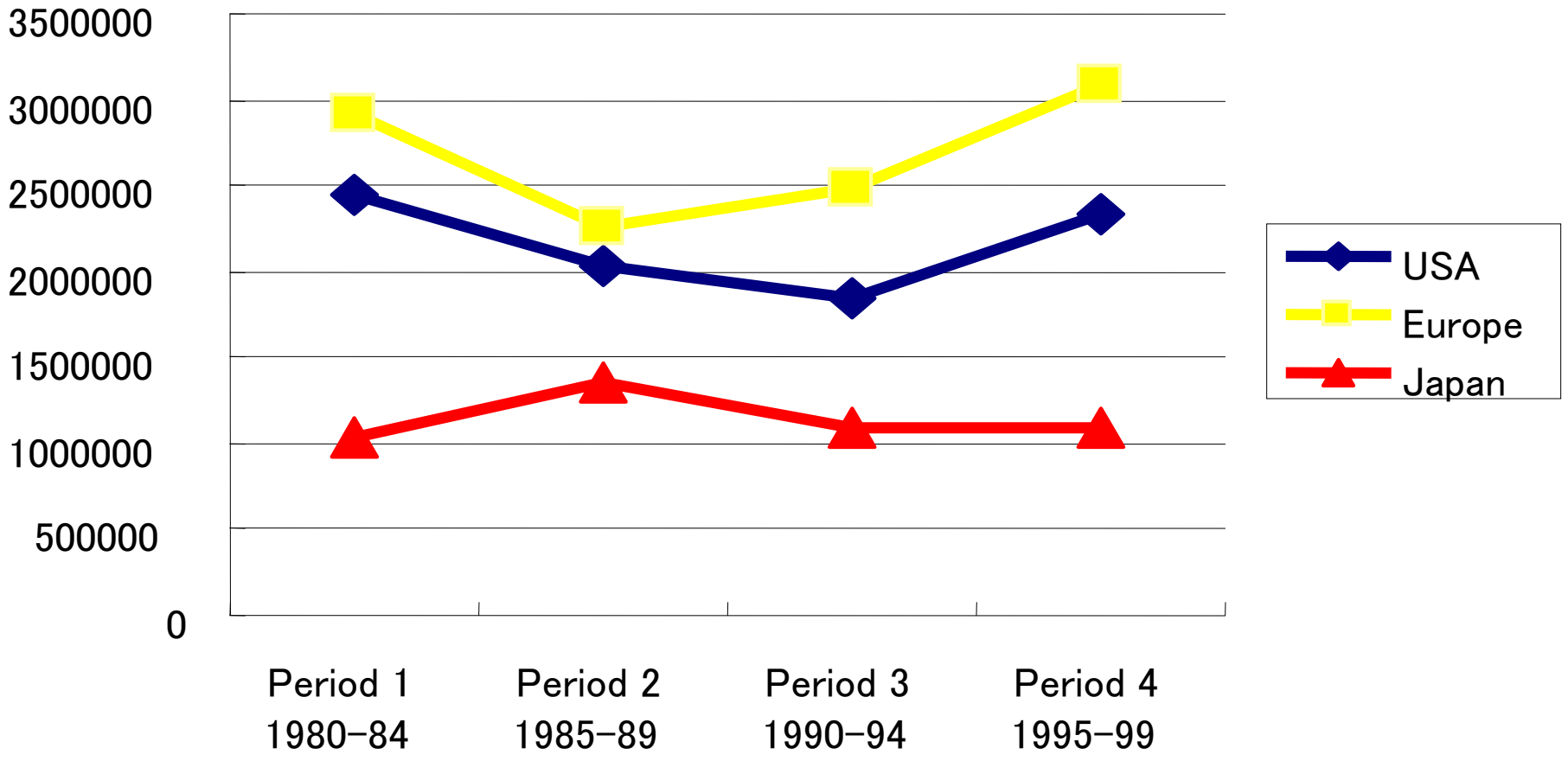
④ Project team by a select few ・・・ teamwork by multiskilled-type engineers

⑤ Heavyweight product manager ・・・ a strong development leader with concept responsibility
(The above from research by Clark and Fujimoto)

⑥ Overlap and linkage coordination between projects
(Research by Nobeoka)

⑦ Front loading ・・・ moving up of problem solving by development support IT
(Research by Thomke and Fujimoto)

Development Productivity of Motorcar: Japan's Shifts Nearly Twice as Much as US/Europe's



Fujimoto, Nobeoka, Thomke, Data for Global Motorcar Product Development Research Project (Chart drawn by Nobeoka)

Organizational Capability in Integrated-type Purchase: Long-term Merit System

Three basic patterns (Supplier system's "three sacred emblems of sovereign rule")

- 1 Long-term stable dealing
- 2 Harsh capability-building competition among a few suppliers
  (development competition and such)
- 3 Structure of division of work by "entrusting in a bundle"

There is reciprocal complementarity among them. → contributing to competitiveness

A basic premise is "capability of multimodal assessment" on the part of an orderer:
for that purpose are in-house production, a group for improvement.

"Long-term merit system" that evaluates without haste the work behavior of suppliers over a long period of time

⇔ Long-term relation system (an overly relaxed situation where relation is the key to order placement)

Three Levels of Organizational Capability Building

(1) Manufacturing capability ・・・ capability to make better currents for a few million times a year

To be always conscious of hours (net working hours) that produce value to customers

To make a current of process by going upstream starting from customers

To spread out maximization of net working hours (minimization of futility) throughout the whole company

That is, simultaneous improvement of transcription density/accuracy of design information.

(2) Improvement capability ・・・ capability to make better currents for a several hundred thousand times a year

Problem finding：mechanism (bringing into sight) that cannot help revealing problems (futility, mistakes)

Problem solving：to make tools routine (standardization) ; to be thorough about education on tools

Everybody circulates standardized problem-solving cycle (PDCA cycle) .

(3) Evolution capability ・・・ capability to evolve the above mechanism (routine) for several decades

The whole organization's "mental preparedness" to be always conscious of "customer satisfaction" and "competitiveness"

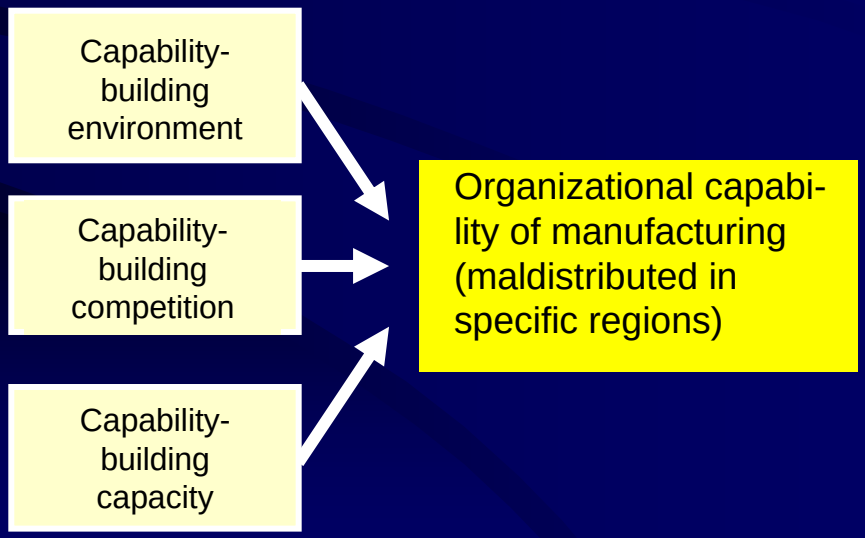
For everyone to carry out a matter of course continuously

--- "follow up," "lateral unfolding," "brake," standard"

At any cost (even with a lucky mistake), to finish with "capability building" at the encd

Logic to Explain Maldistribution of Organizational Capability ··· Evolutionary Process

Structure, function and development
of integrated-type manufacturing capability



Framework of Evolutionism in Positive Social Science

Positive framework that explains justification for existence of a social system or an artifact for which rationality after the fact is recognized without relying upon rationality before the fact

How to explain existence of a certain social system?

① Structural theory ・・・ what it is
② Functional theory ・・・ for what purpose it has been made
③ Developmental theory ・・・ from where it has come

Situation in which, in order to explain a certain structure, functional logic (existential logic) and developmental logic (becoming logic) have to be prepared as being different ・・・ evolutionism's role

Specifically ・・・ to explain existing a social system or an artifact as the result of variation, selection, and retention.

Maldistribution of Organizational Capability in Industrial Level

Common experience during the rapid growth period brings forth an uneven distribution of organizational capability in a flock of job sites (industry).

"Economy of scarcity" ‥ needy circumstances in youth

→ By holding back intracompany specialization (toward multiskilled workers), and
By promoting intercompany specialization,
To expedite intracompany and intercompany cooperative works (teamwork)

Lack of productive resource, under a certain condition (existence of capability-building capacity), nearly compels productivity enhancement (high-altitude training effect).

Subsequently, if productive resource becomes sufficient, sn output grows explosively.

Subsequently, if an output becomes excessive, competition becomes accelerated.

The above is most likely to be an unintended result (a lucky break, a thing done in jest coming true).