Business Administration

Lecture No. 2:
Process Analysis on Development and Production

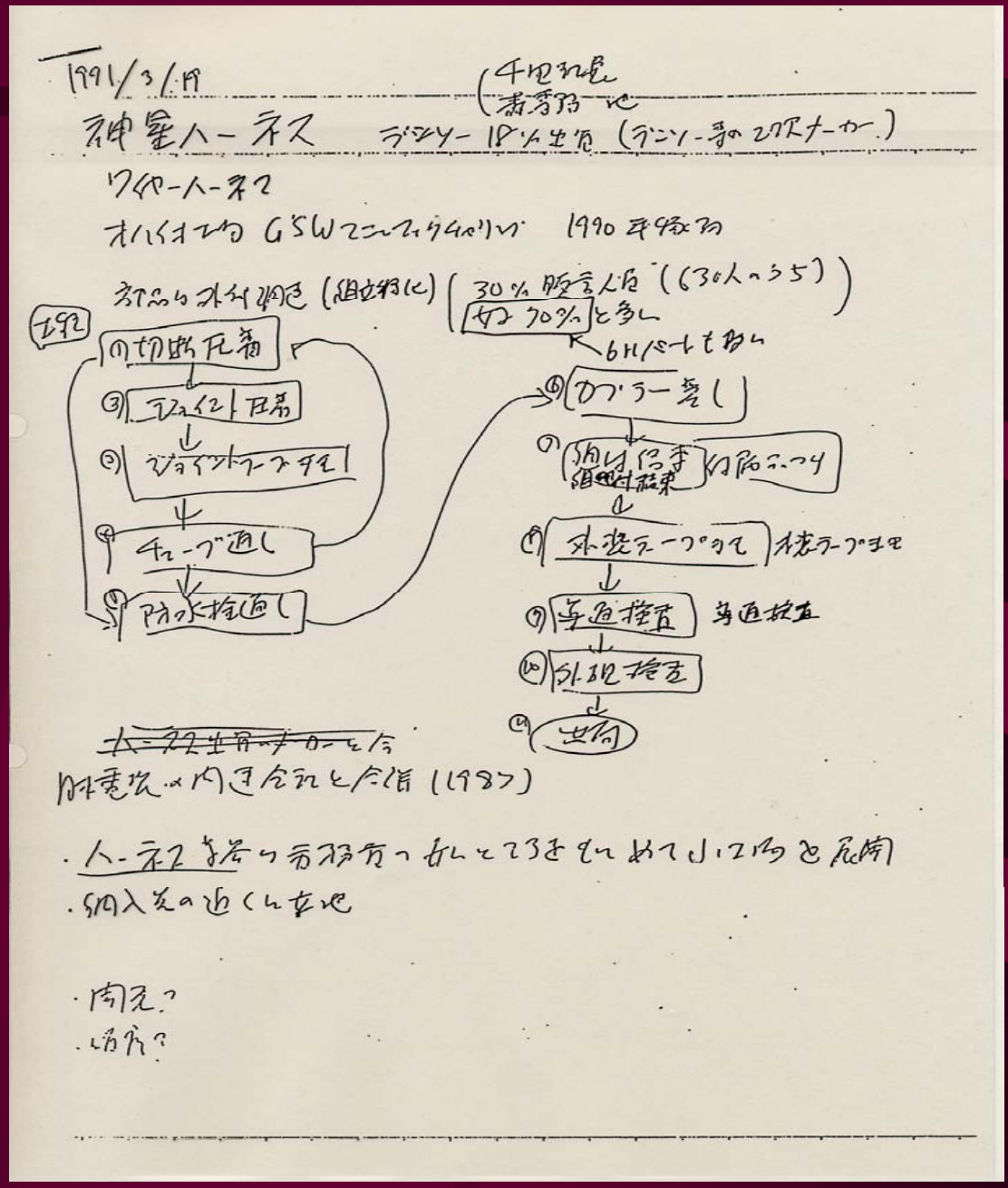
1. Definition of Process Analysis
2. Description of Production Process
3. Examples of Process Analysis
4. Production/Development Activities as Information System

Takahiro Fujimoto

Faculty of Economics, The University of Tokyo

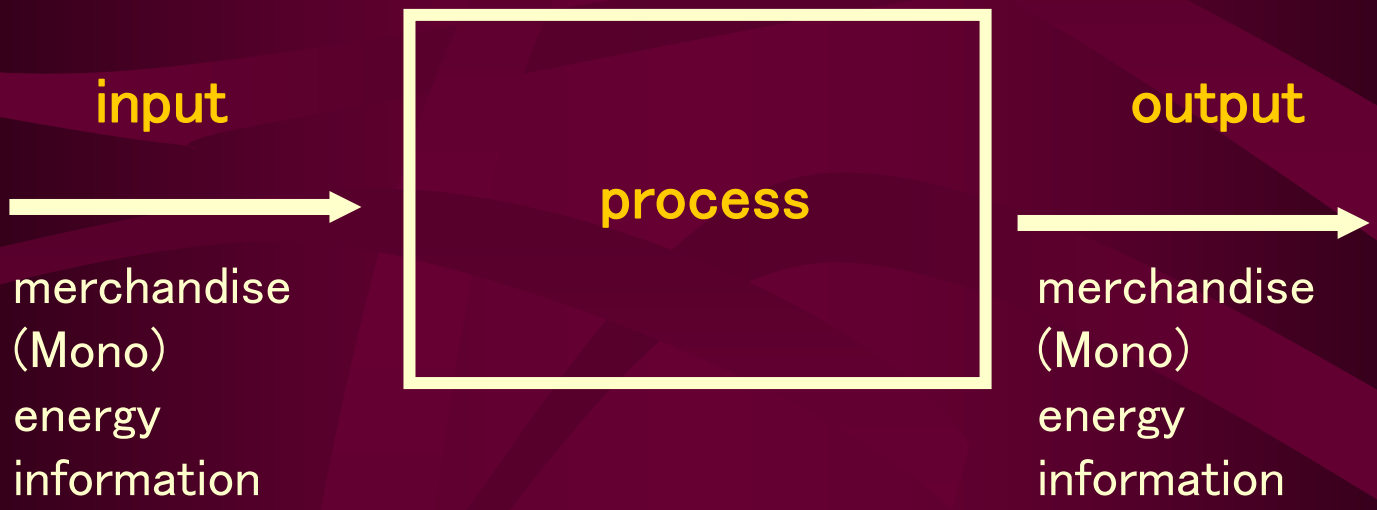
Notes at a factory
on a certain day・・・

Description of a process
is the base.



1. Definition of Process Analysis

Process = ”sequence” “procedure”



flow stock flow

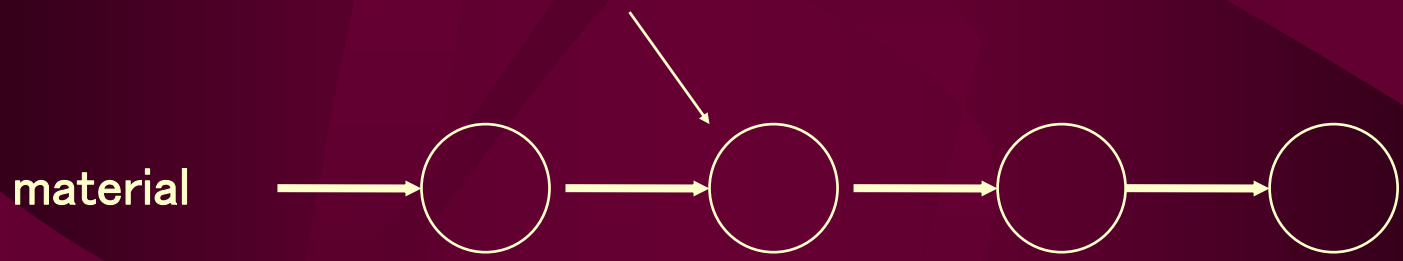
2. Description of Production Process

Process of production = "process"

A portion within a manufacturing company's organization, which, incorporating an input, transforms it to an output with a higher value to that organization

Caution: two different usages of the word "process";

(1) An individual workstation



(2) A sequential chain from material to product

First of all, describe in the form of Process Flow Chart.

(In a traditional production management theory,
focus firstly on a flow of merchandise(Mono))

problem solving:

Utilizing a Process Flow Chart, analyze/diagnose the process, find a problem, form a prescription for an improvement.

3. Examples of Process Analysis

Way to describe a process flow (conventional)

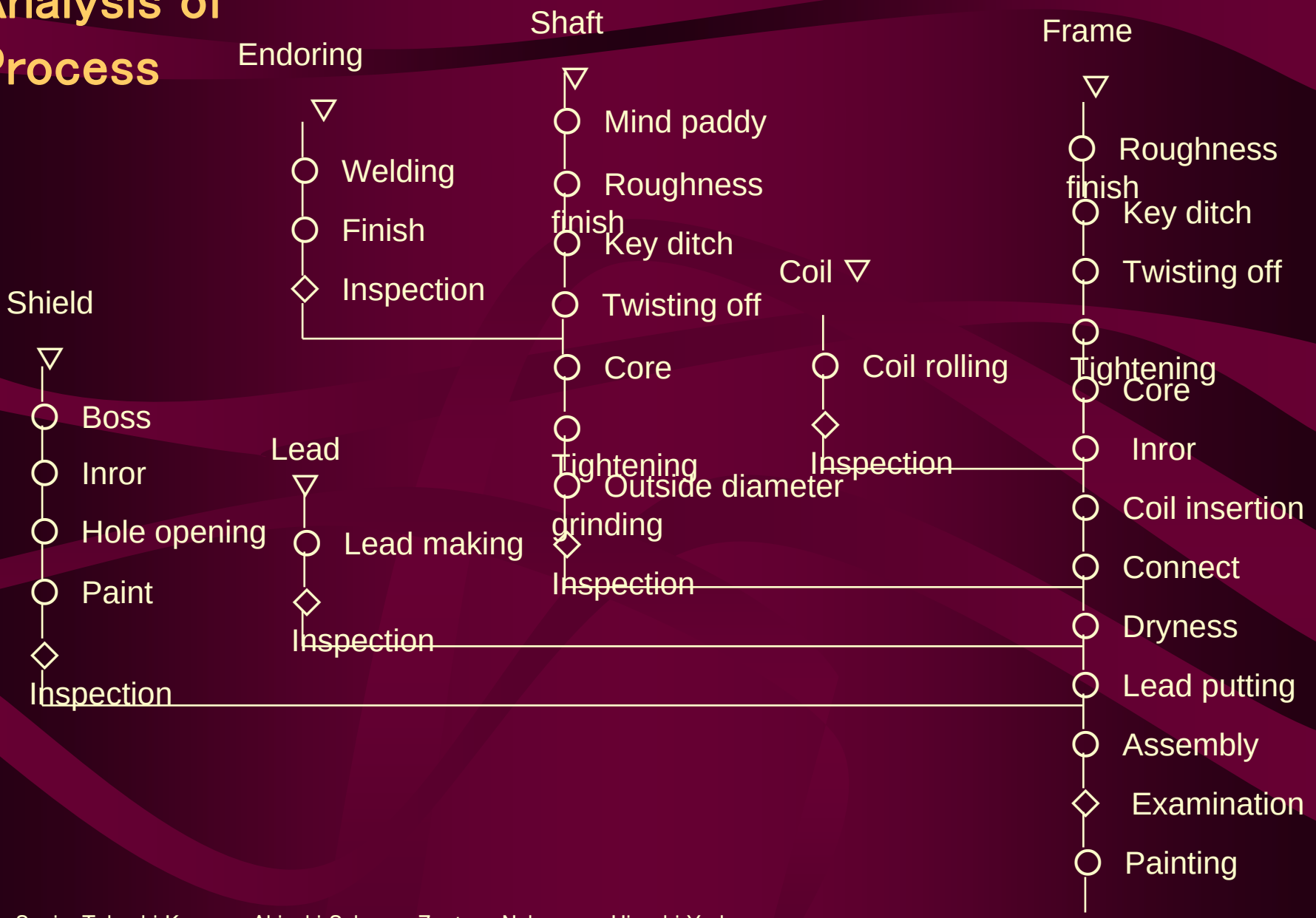
Flow = →

Process = ○

Inventory = ▽ (raw material, in work process, finished product)

Inspection = ◇

Analysis of Process

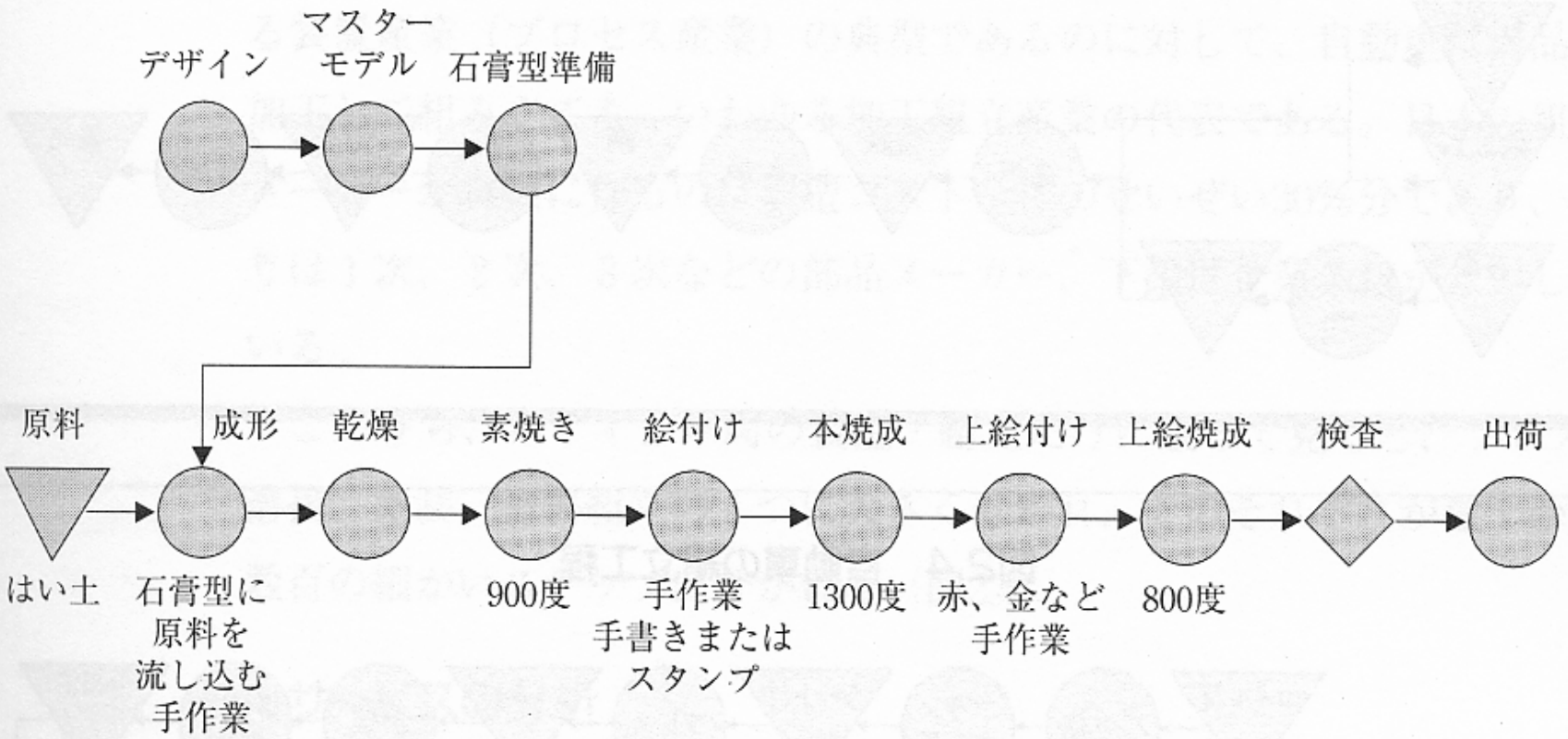


Shizuo Senju, Takeshi Kawase, Akiyuki Sakuma, Zentaro Nakamura, Hiroshi Yada

'Work Research' Japanese Standards Association 1987 (p.46)

Example : porcelain of Arita ware

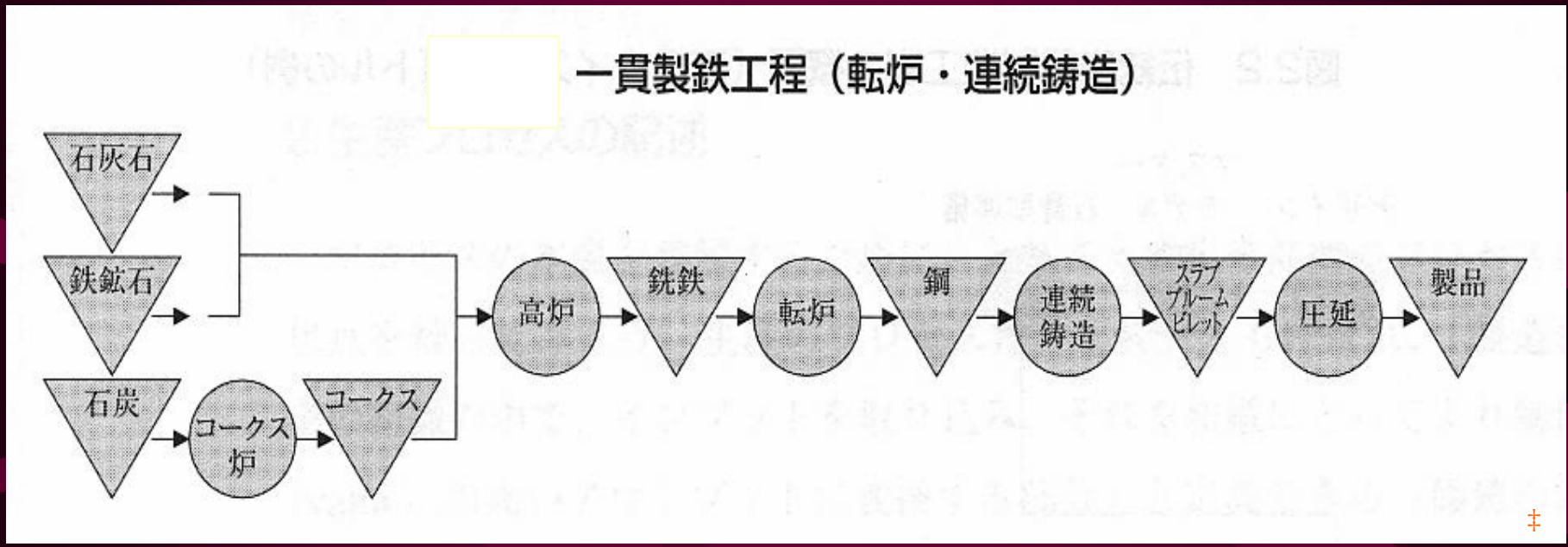
伝統磁器製造工程の概要（高級ウイスキーボトルの例）



注１：原料加工工程、および仕掛品・製品在庫は省略。
２：工程フローダイアグラムの書き方には、特に厳しいルールがあるわけではないが、一応の決まりごととして、加工は大きな○、運搬は小さな○、停滞（在庫・手持ちなど）は▽、検査は◇で表すことが多いので、覚えておくと便利である。

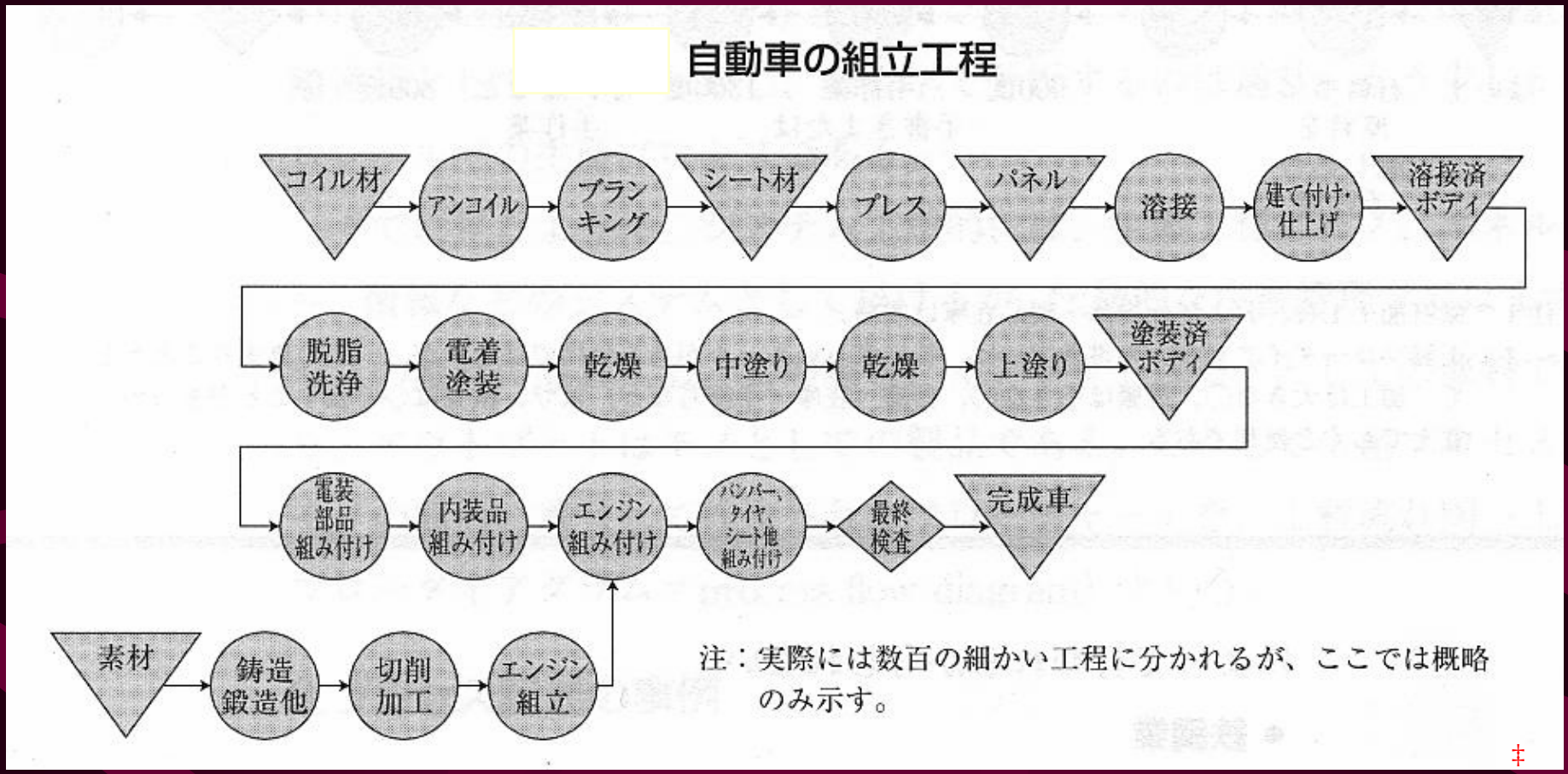
Takahiro Fujimoto 'Introduction to Production Management' Nihon Keizai Shimbun, Inc. 2001 (I p17 figure.2.2)

Example : articles of steel



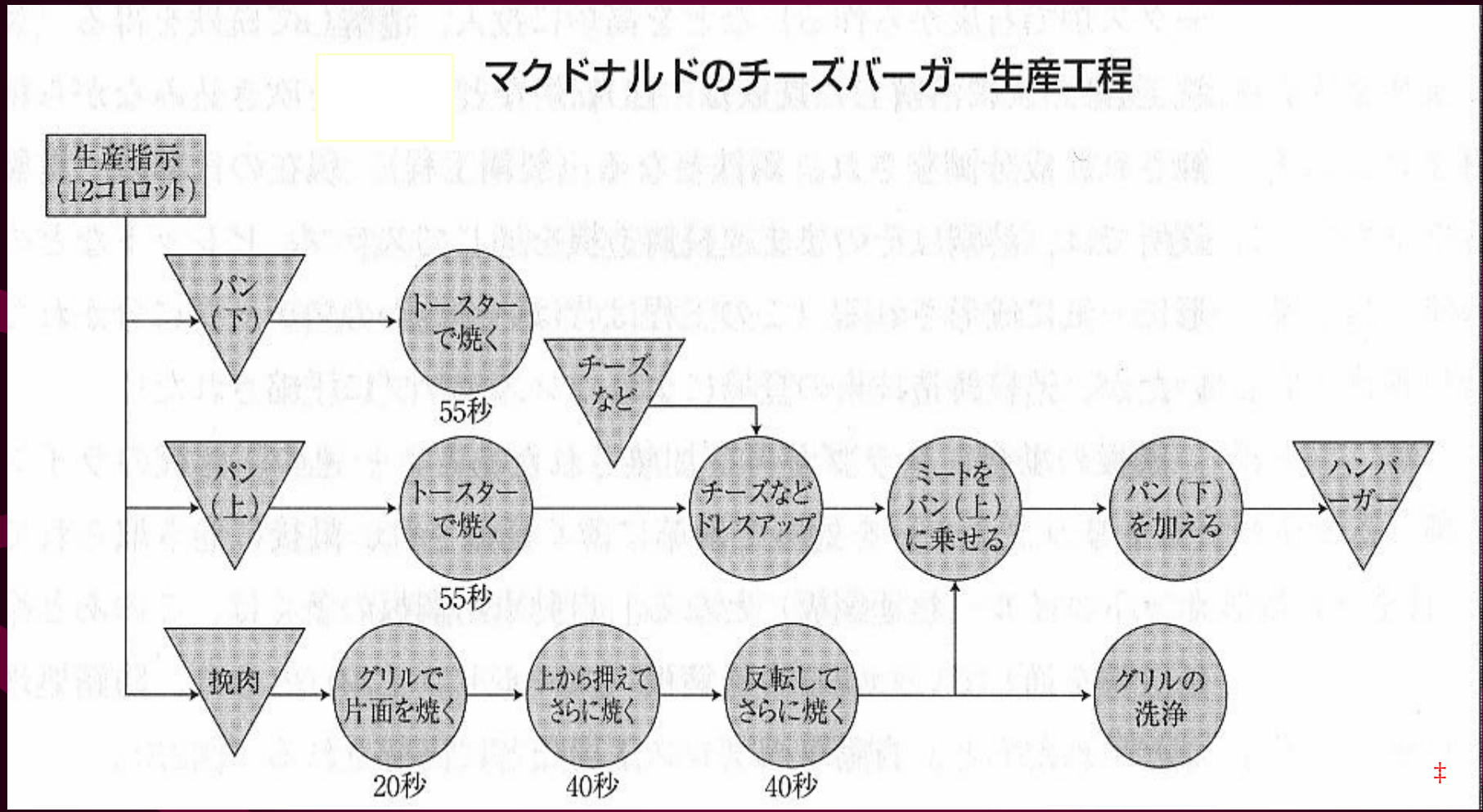
Takahiro Fujimoto 'Introduction to Production Management' Nihon Keizai Shimbun, Inc. 2001 (I p18 figure.2.3)

Example: Production Process of Automobile (auto maker's self-manufacturing portion)



"Takahiro Fujimoto 'Introduction to Production Management' Nihon Keizai Shimbun, Inc. 2001 (I p18 figure.2.4) "

Example: McDonald's Hamburger



"Takahiro Fujimoto 'Introduction to Production Management' Nihon Keizai Shimbun, Inc. 2001 (I p18 figure.2.5) "

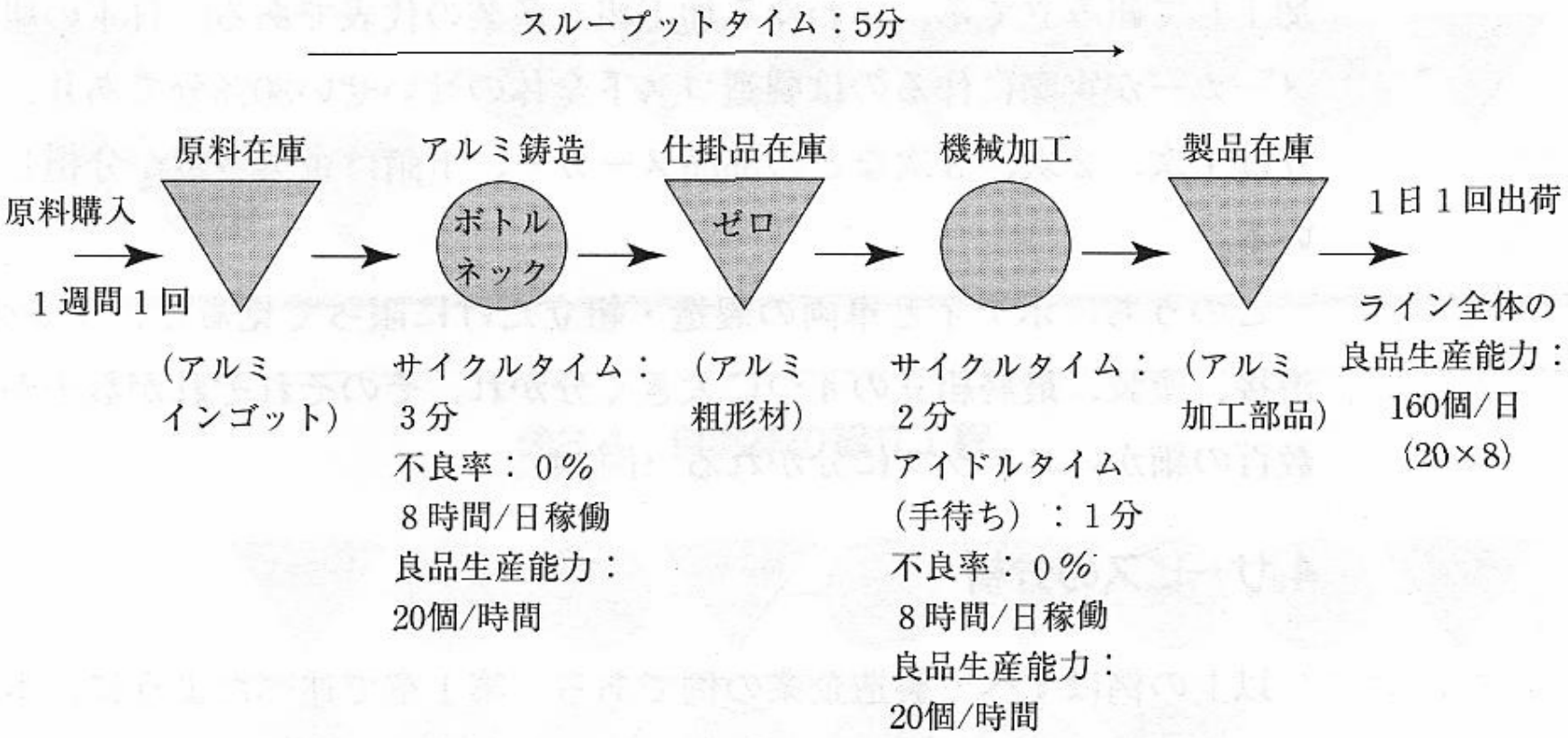
Important Concepts in Process Analysis

- Cycle time
- Idle time
- Throughput time
- Production capacity
- Bottleneck
- Defect
- Yield
- Down time
- Set-up time

Example of Process analysis:
Find out bottleneck and increase production volume (1)

プロセス分析（数値例）

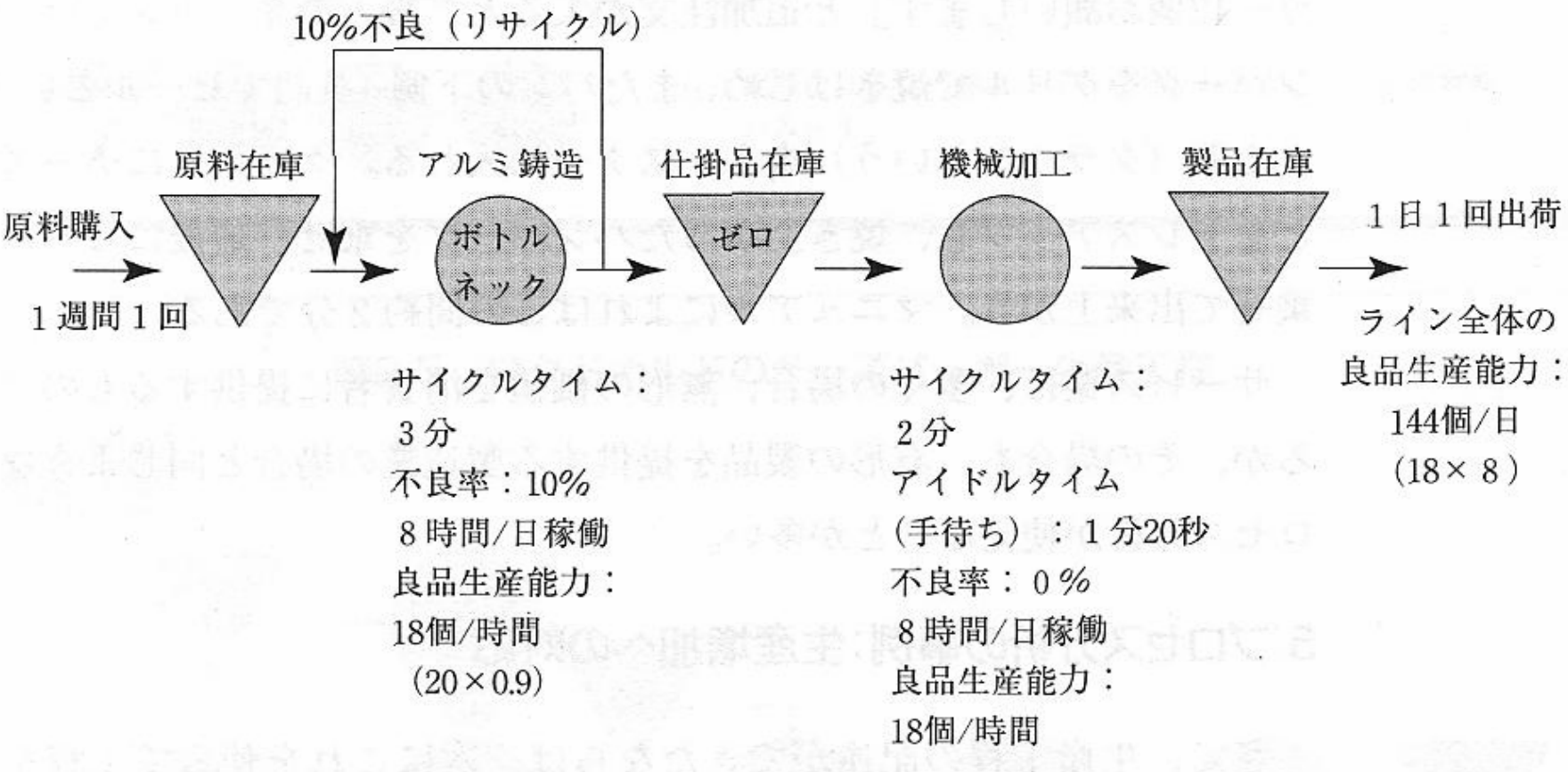
1. Case of defective fraction at 0 (zero)%



Takahiro Fujimoto 'Introduction to Production Management' Nihon Keizai Shimbun, Inc. 2001 (I p20 figure.2.6)

Example of Process analysis:
Find out bottleneck and increase production volume (2)

2. Case of defective fraction of casting at 10%--production capacity?

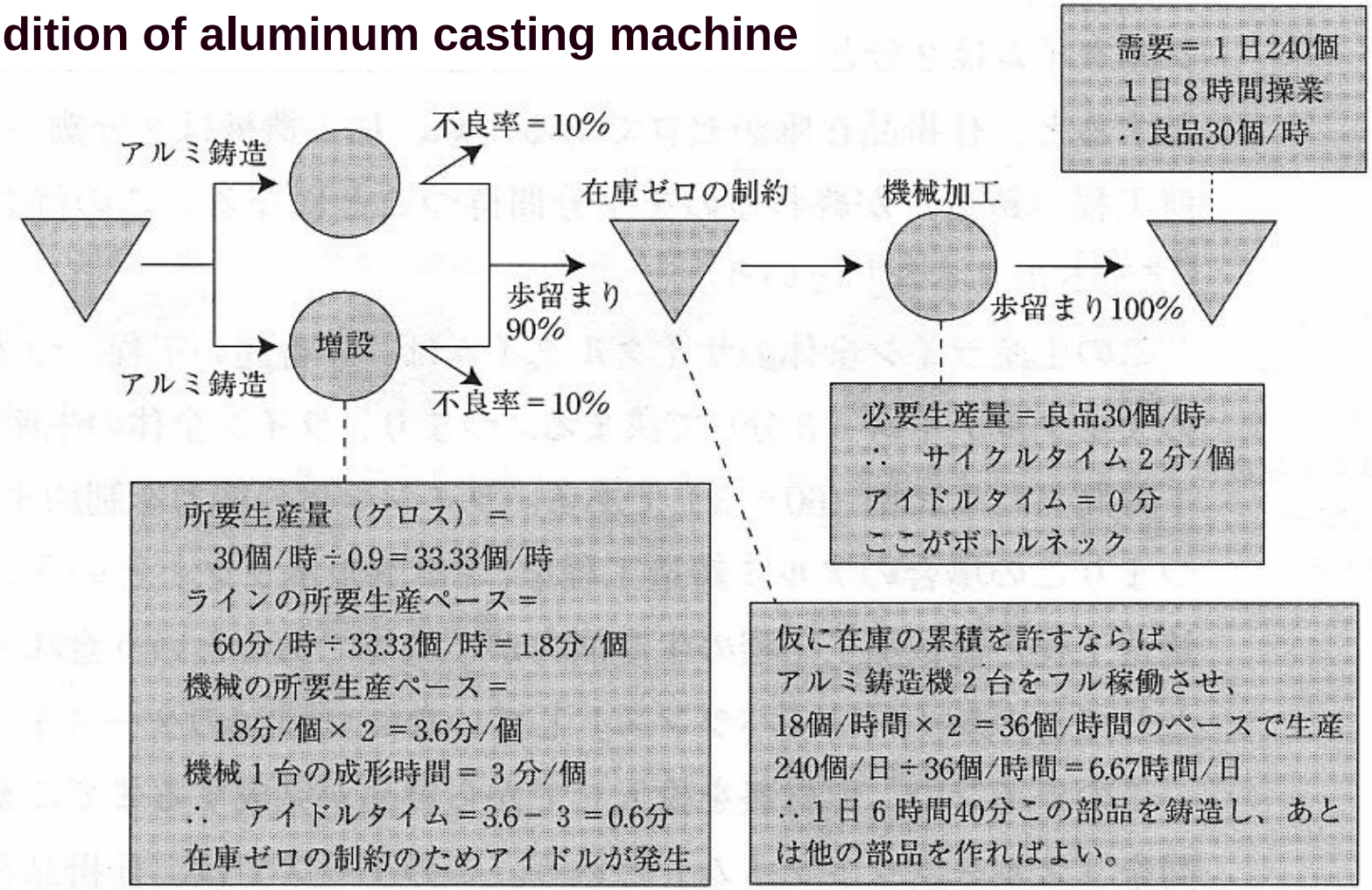


Takahiro Fujimoto 'Introduction to Production Management' Nihon Keizai Shimbun, Inc. 2001 (I p20 figure.2.6)

Example of Process analysis:
Find out bottleneck and increase production volume (3)

図2.7　プロセス改善分析の例（日産240個への増産）

1.Addition of aluminum casting machine

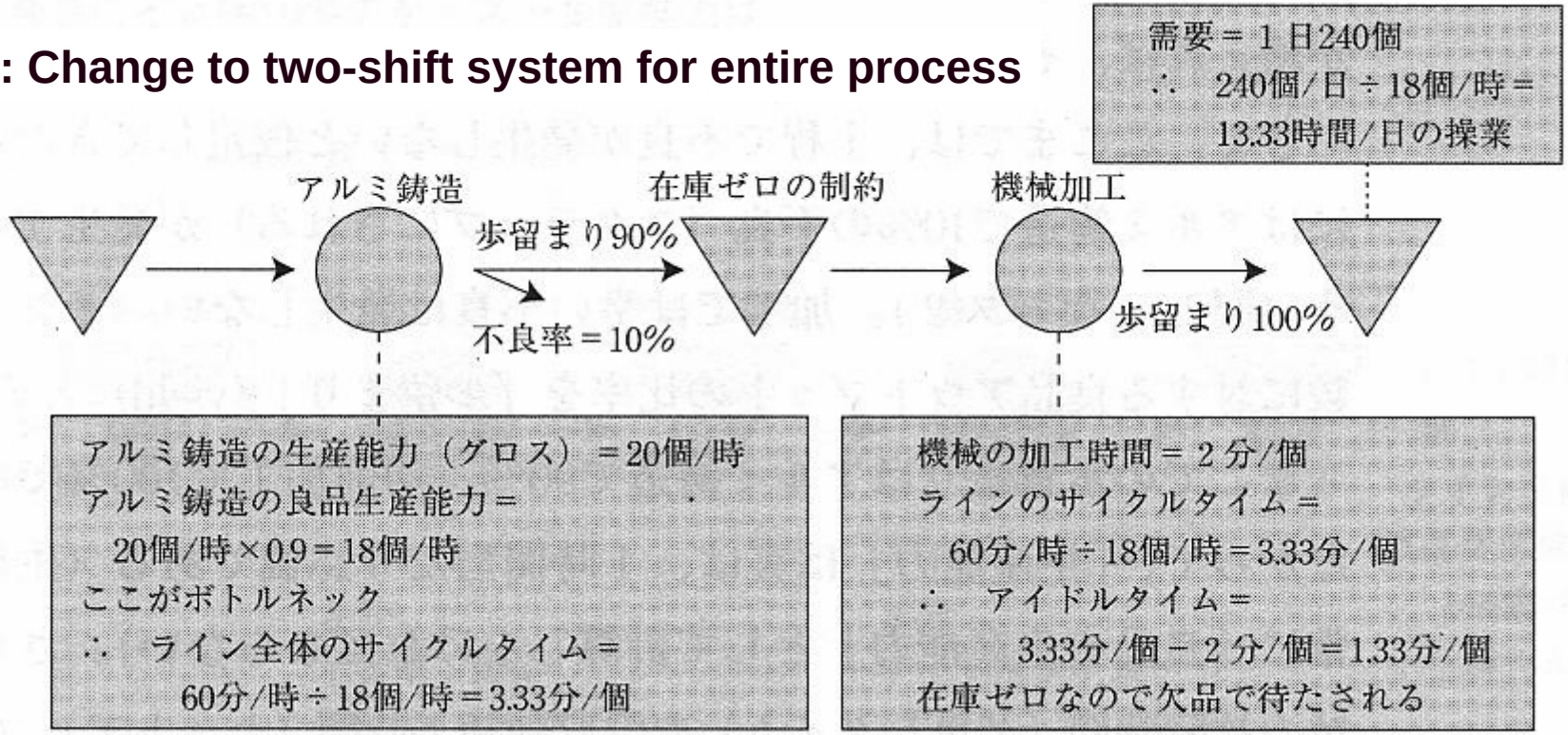


‡

Takahiro Fujimoto 'Introduction to Production Management' Nihon Keizai Shimbun, Inc. 2001 (I p22 figure.2.7)

Example of Process analysis:
Find out bottleneck and increase production volume (4)

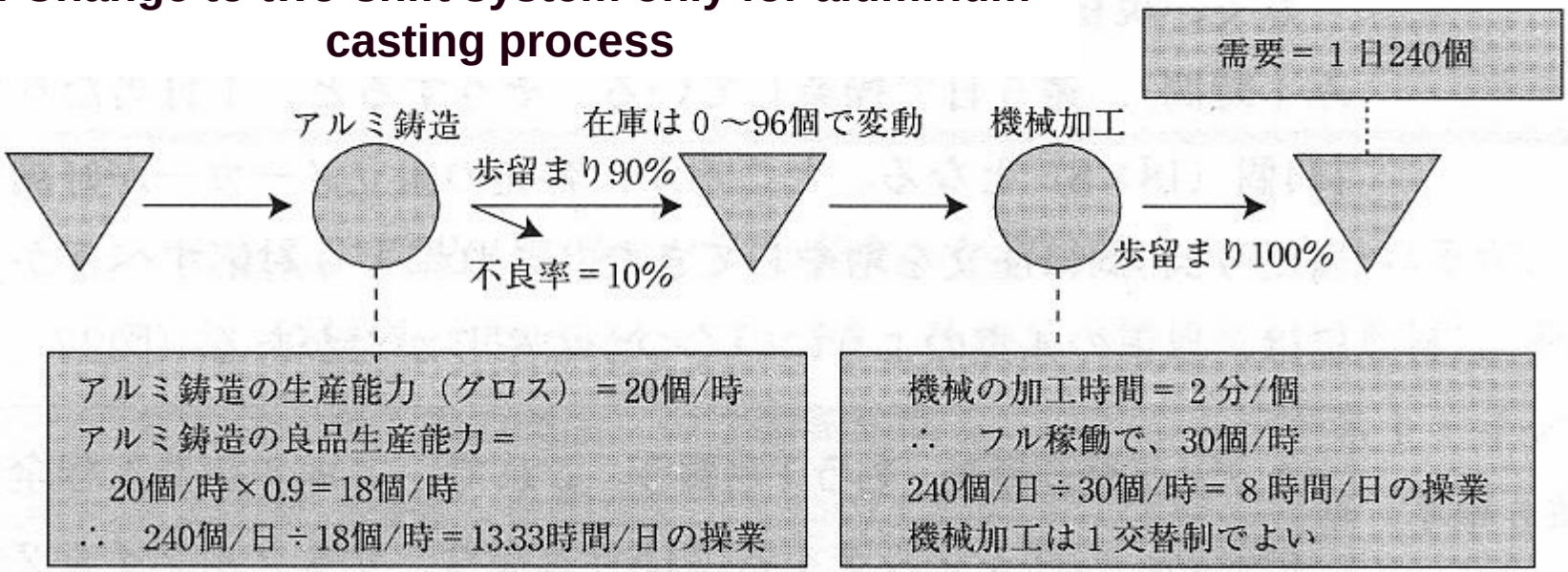
2: Change to two-shift system for entire process



Takahiro Fujimoto 'Introduction to Production Management' Nihon Keizai Shimbun, Inc. 2001 (I p22 figure.2.7)

Example of Process analysis:
Find out bottleneck and increase production volume (5)

3: Change to two-shift system only for aluminum casting process



Takahiro Fujimoto 'Introduction to Production Management' Nihon Keizai Shimbun, Inc. 2001 (I p22 figure.2.7)

Application of Process Analysis:
Bottleneck and “Theory of Constraints”

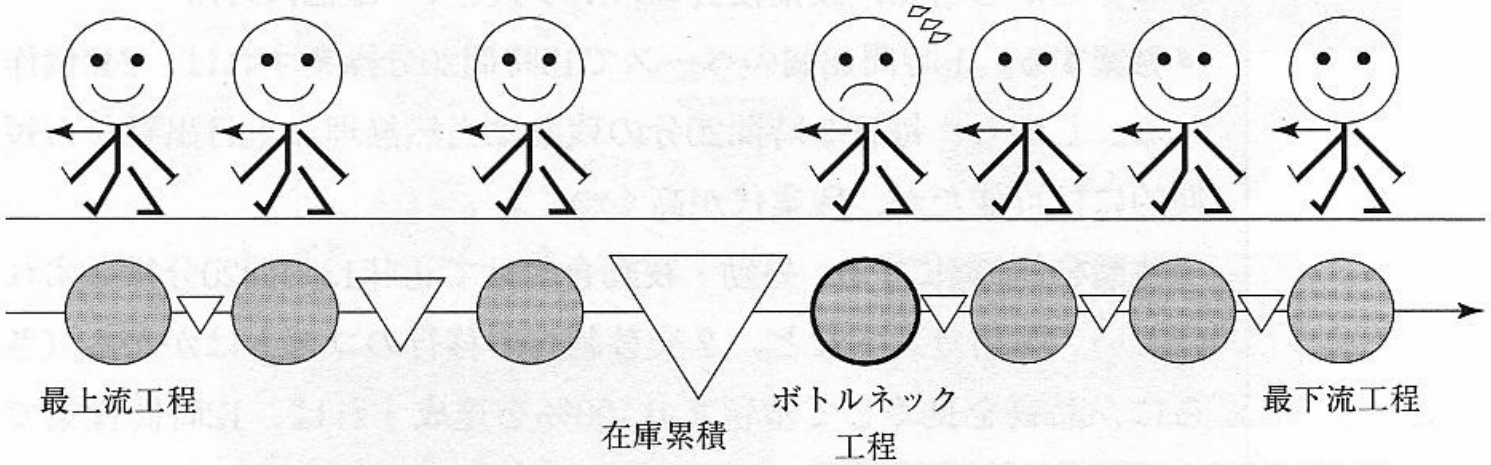
Theory of Constraints;TOC（Goldratt）

Find a bottleneck → Bring bottleneck up to a full operation
→ Synchronization

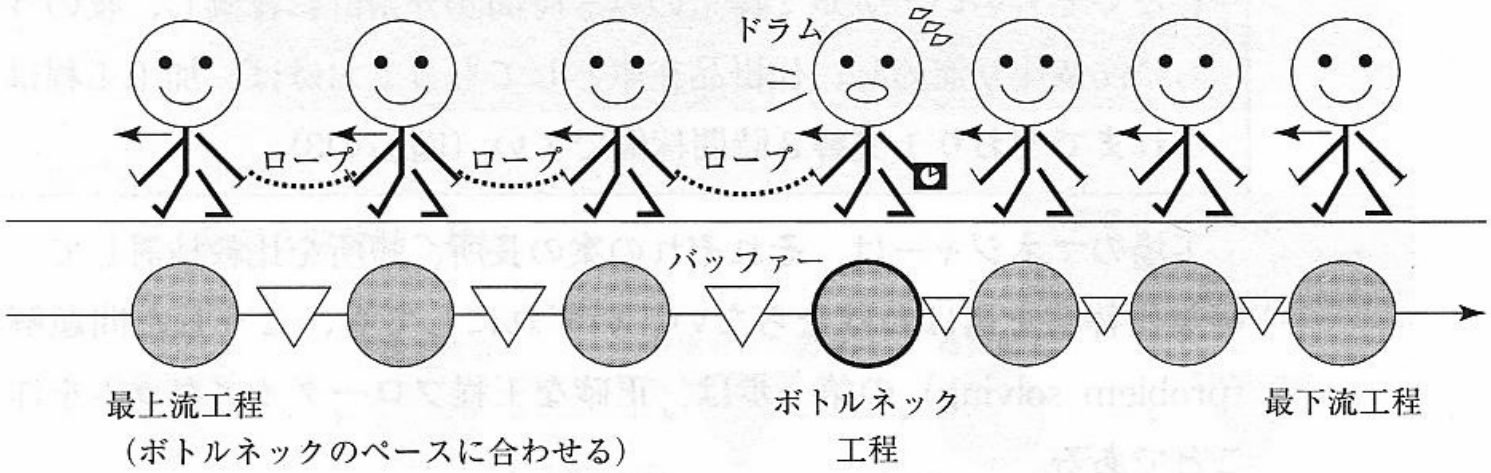
Analogy of “Array of Children in School Picnic”・・・
“Drum/Buffer/Rope”

「ドラム・バッファー・ロープ」のアナロジー

The head goes previously fast when left.



Then, the previous child ties with the rope, and a slow child takes the rhythm.



‡

Takahiro Fujimoto 'Introduction to Production Management' Nihon Keizai Shimbun, Inc. 2001 (I p24 figure.2.8)

4. Production/development Activities as Information System

Process flow chart (focus on a flow of merchandise (Mono))

——— fit to a strict quantitative analysis

But in order to grasp a manufacturing system as a whole (product development, purchase, production, sales, and consumption), another perspective is necessary in that activities of a manufacturing company is viewed as "Design Information"

Reference: "Capability Building Competition", Chukou Shinsho

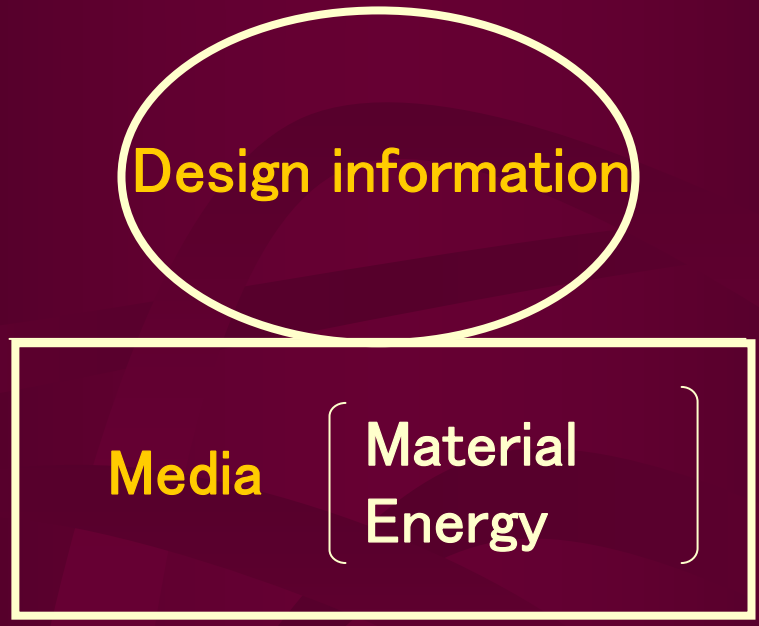
Coordination among development, production, and marketing is important, where the design information is their common term.

Product development activities are, in essence, "Production of Design Information".

Advancement of information technologies (CAD, CAE, PDM, ERP, SCM…)

Analysis of Mono-Zukuri system is, in fact, an analysis of design information.

Production Resources = Design Information + Media



The same format applies to products, products in work process, molds, numerical control programs, work proficiency, and, work manuals.

Re-interpretation of Development/Production System by "Design Information = Value Theory"

"Information" (in broad term) is a pattern of Mono and energy, and potentially represents certain other things and matters that are meaningful to human beings

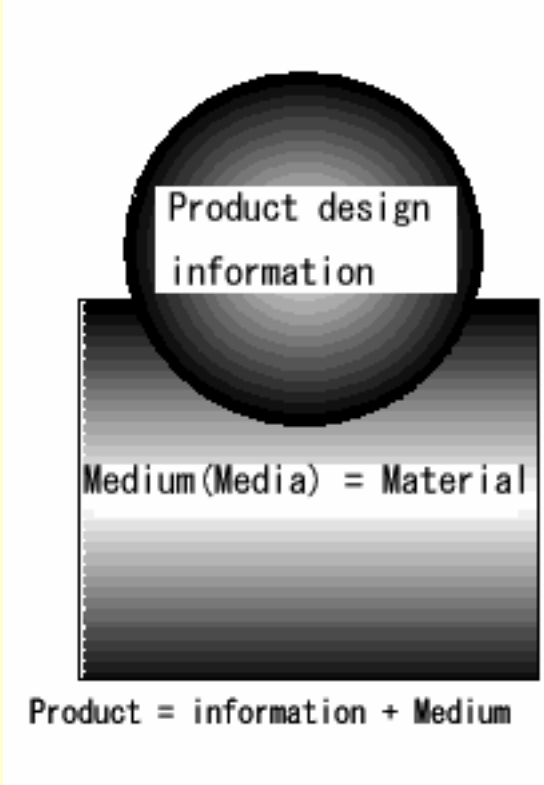
We, as consumers, consume not products per se, but a bundle of "design information" embodied as products.
"Products" are useful media (material = Mono or energy) that are engraved on their top with useful "added value = information" (value-carrying information), i.e., "product design information".

"Added value = information" gets originated, accumulated, and transcribed within the Mono-Zukuri (manufacturing) system of a company, and ultimately, pours into "products", and crystallizes there.

A company transmits a bundle of information confiding to its products, which a consumer receives and interprets the meaning thereof, thereby creates customer satisfaction.

A product is a medium, i.e., material, to which the design information has been transcribed.

A product is material (medium) to which the design information has been transcribed.



Substitute “Mono-Zukuri” with “System of Creating/Transcribing Design Information”

Product = a bundle of information

Sales = an activity to transmit to a consumer a bundle of information confided to a product

Production = an activity to repeatedly transcribe product design information onto raw material and a product in work process

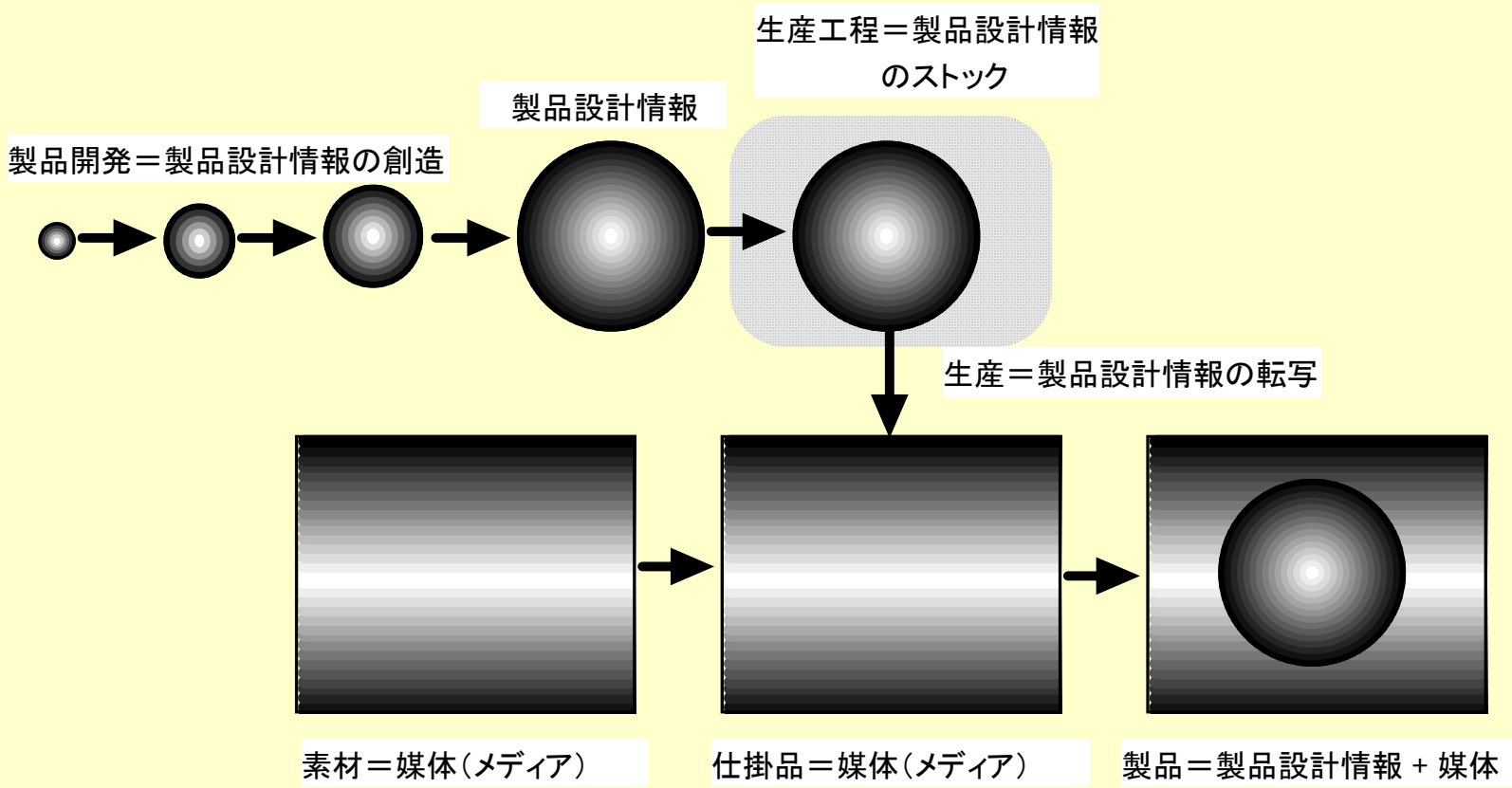
Product Development = an activity that ranges from originating product design information, and to assigning it on production process

Consumption = a sequence for a consumer to treat a bundle of information embodied in a product and transform it to customer satisfaction

Competition = a situation where plural bundles of information (product) compete to persuade a consumer

Production = Transcription of Design Information
Development = Creation of Design Information

Development is a creation of design information: Production is a transcription of design information.



Example: Design of Auto Body and Press Process

Body design customers think cool

Design information

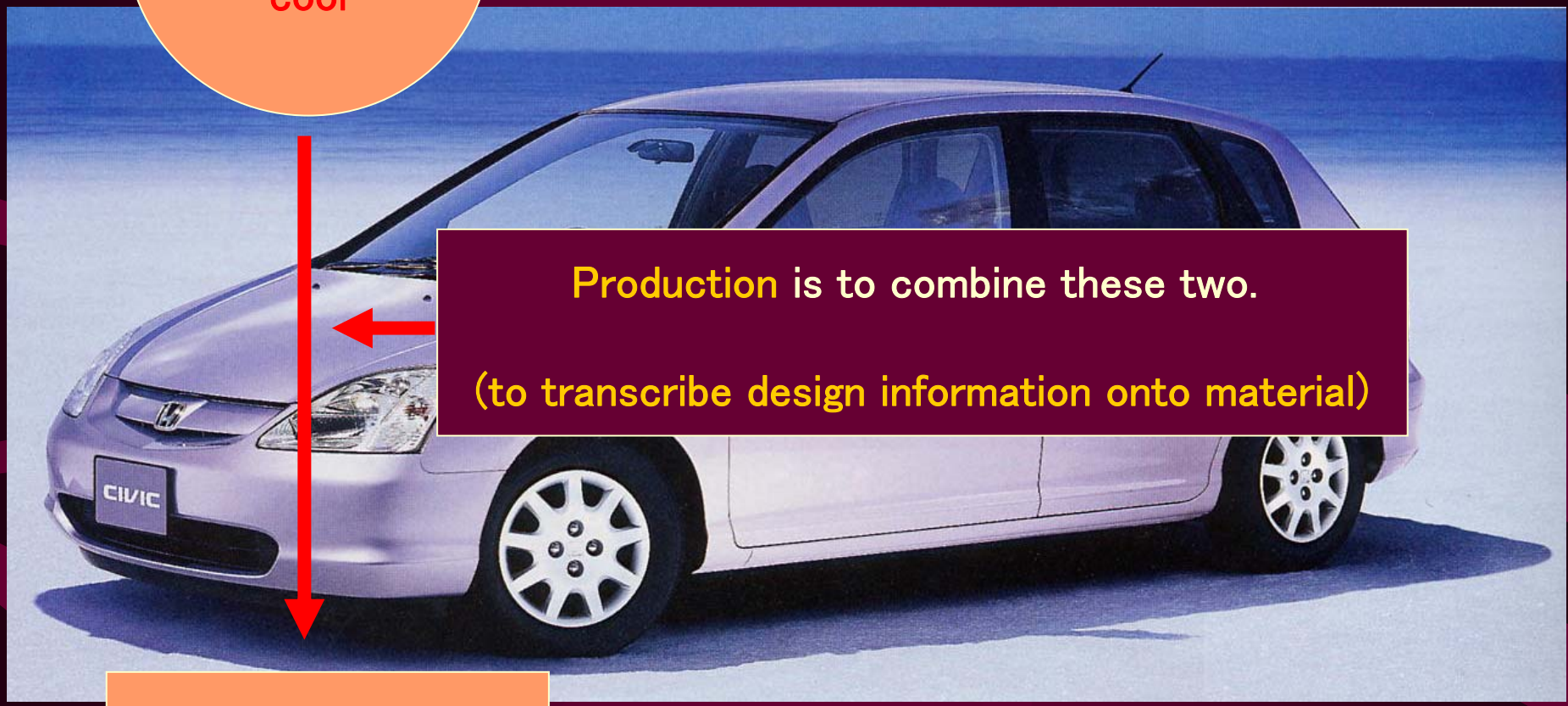
Steel plate of 0.8mm thick

Material = medium

From Pamphlet of Honda Motor Co.,Ltd.

Body design customers think cool

Development is to create this.



Production is to combine these two.

(to transcribe design information onto material)

Steel plate of 0.8mm thick

Purchase is to buy this.

From Pamphlet of Honda Motor Co.,Ltd.

Things Happening in Press Factory ・・・ Production = Transcription

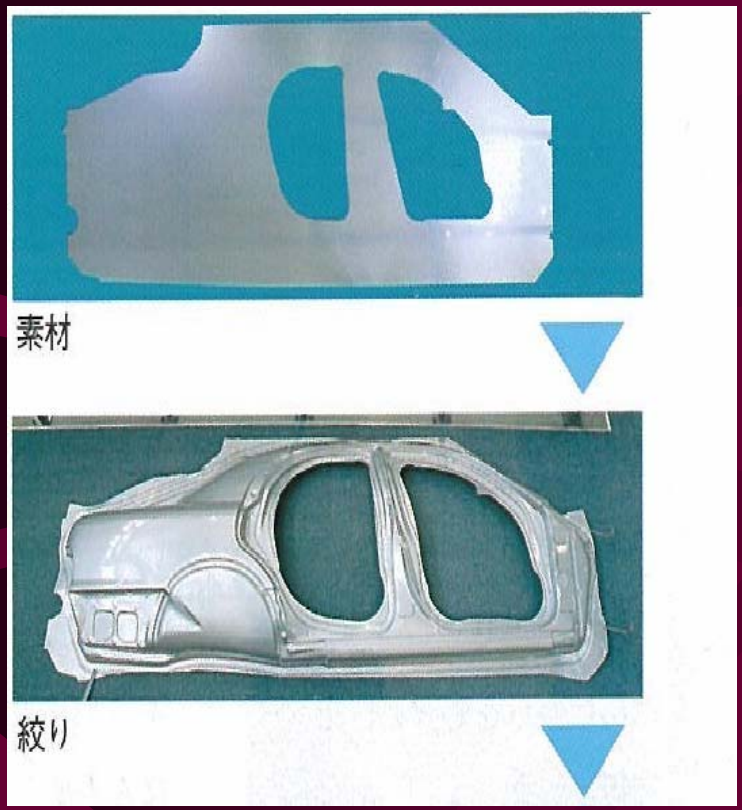
- Mold = Design information of “cool-looking body” is being buried in steel block.
- That information gets ”transcribed” to steel plates, at a pace of nearly 10 times per minute, using energy exceeding 1000 tons. Just like printing.
- In fact, a press production is an activity to transcribe the mold’s design information to steel plates.
- However, unless properly done, steel plates break, buckle up, and pucker. In other words, a transfer mistake happens.
- Workmanships at the floor is judged by how fast, cheaply, and accurately the transcription gets done.

Figure: from TOYOTA Commemorative Museum of Industry and Technology

Press Process:

Steel plates absorb the design information possessed by a mold,

and transform into an auto's' side body.



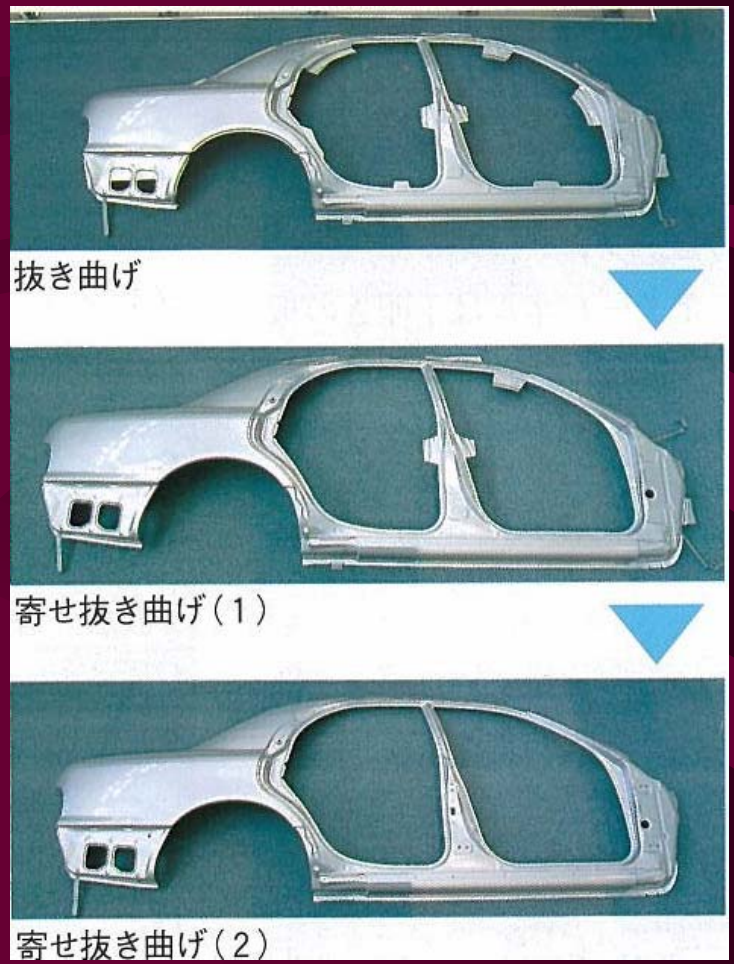
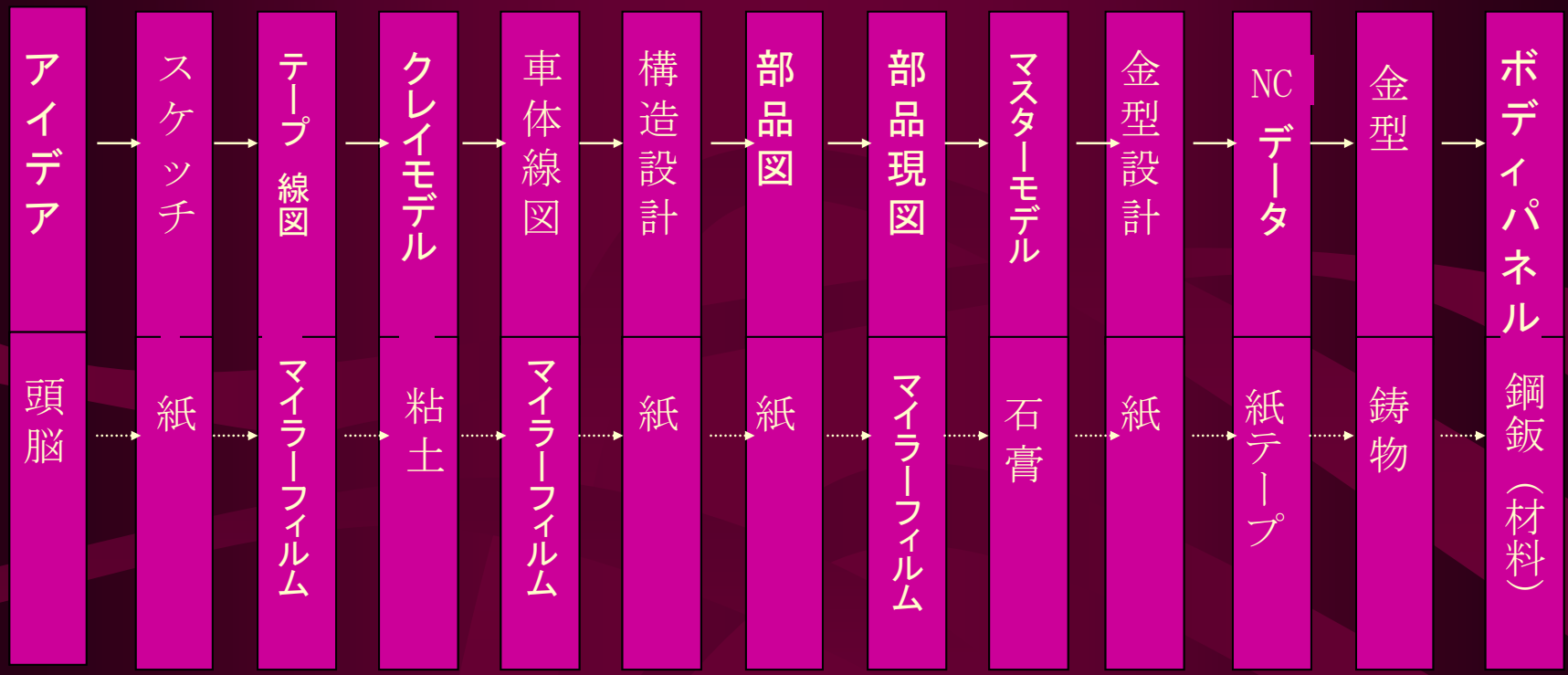


Figure: from TOYOTA Commemorative Museum of Industry and Technology

In fact, design information possessed by a mold gets transcribe to material called steel plates.

Development/production activities are the creation/transcription of design information: Example of developing body panel



concept creation and product planning

product design

process design

production

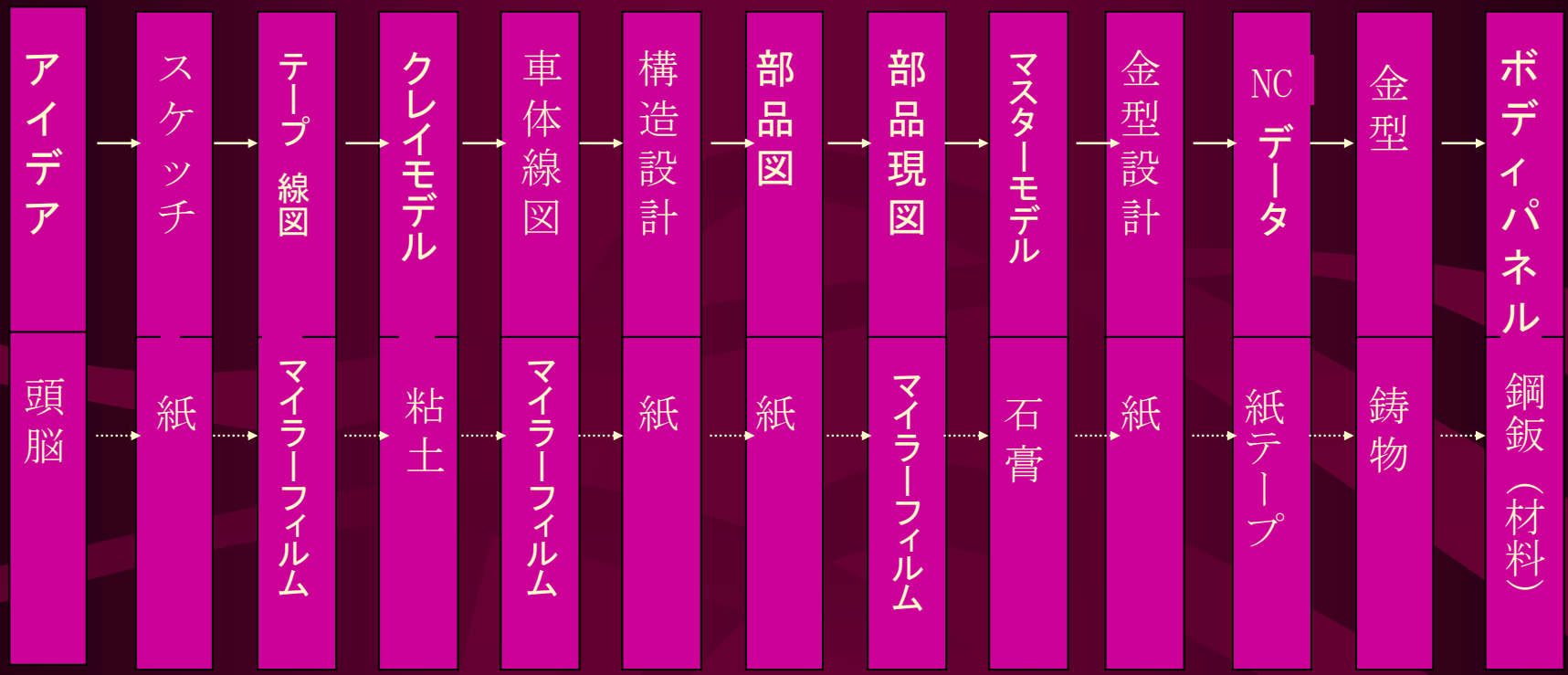
product development

legends

transcription

modification

Development/production activities are the creation/transcription of design information: Example of developing body panel



concept creation and product planning

product design

process design

production

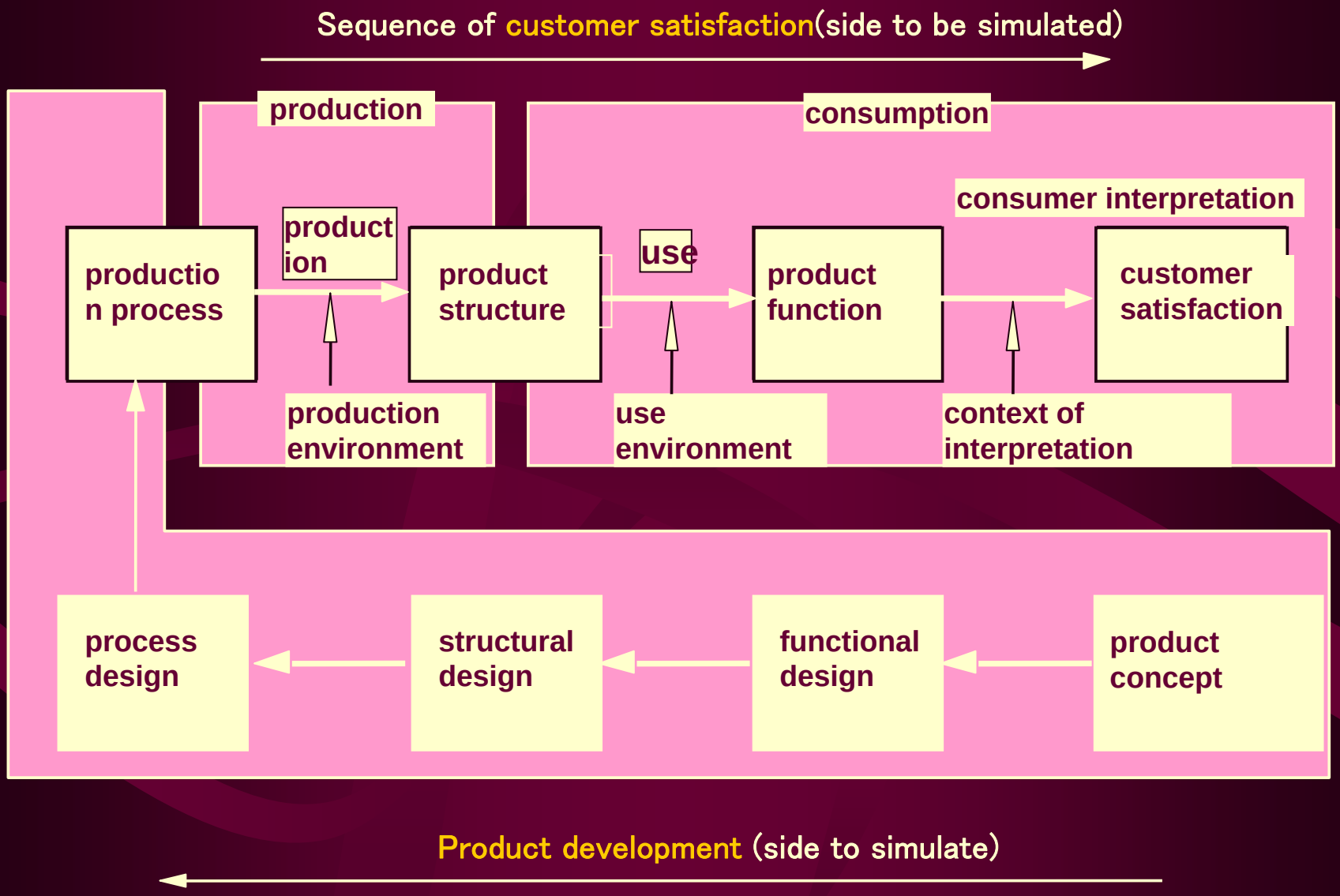
product development

legends

transcription

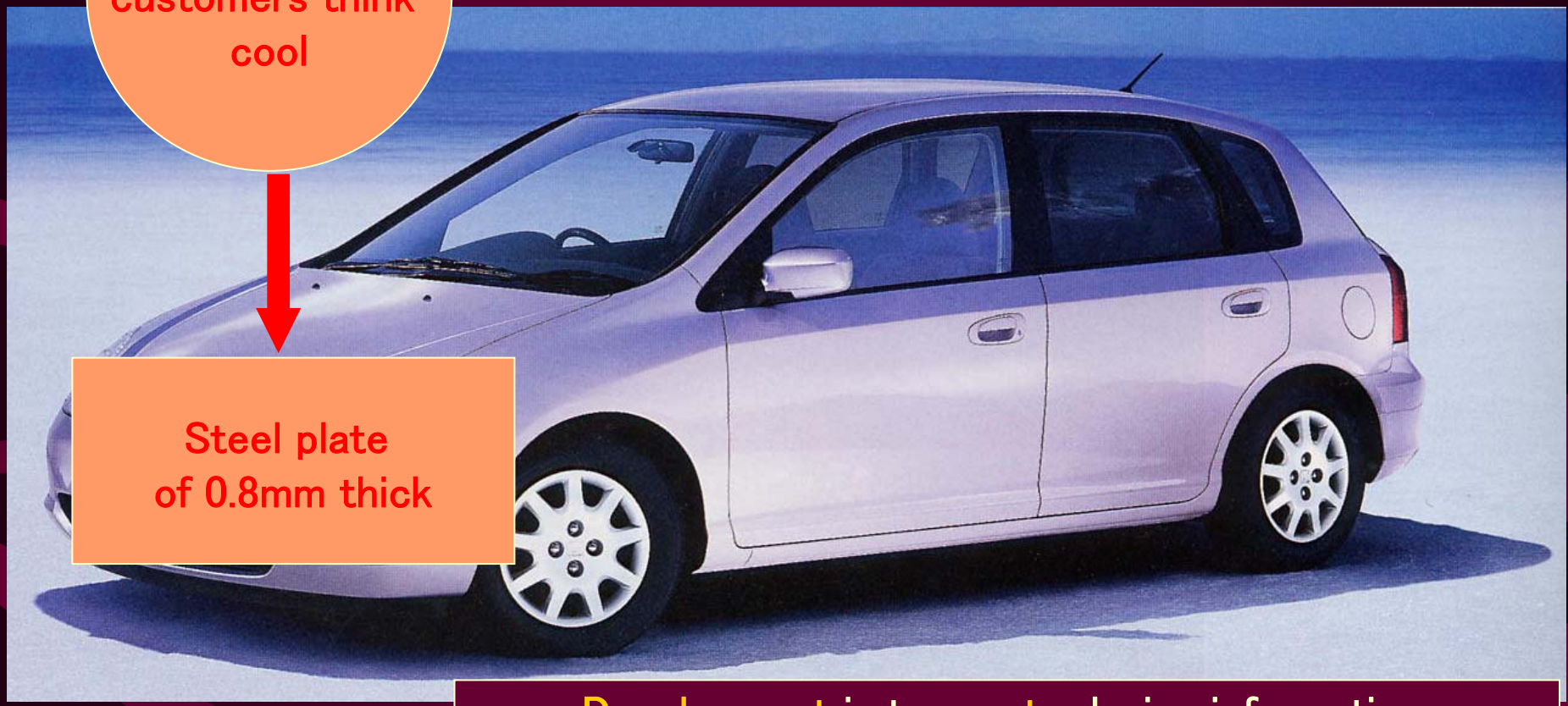
modification

Product development is a creative process of design information based on a simulation of the sequence of customer satisfaction.



Recap:
A product is the design information which has been transcribed to material (medium).

Body design customers think cool



Steel plate of 0.8mm thick

Development is to create design information.
Production is to transcribe design information to material.
Sales is to transmit that information to customers.

From Pamphlet of Honda Motor Co.,Ltd.

Summary: From a view point of design information, take a new perspective on development/production activities.

Product development ・・ Create a new design information
Production ・・・・ Repeatedly transcribe a design information from a process to a product
Consumption ・・・・For a consumer to get satisfaction from an information tucked inside a product

Based on the above points of view, apply a different thought to Mono-Zukuri system (routine).

Mono-Zukuri ＝a total system of development/production/purchase (including a part of sales)

Organizational capability of Mono-Zukuri ＝
a capability of an entire organization to better create and transcribe design information on the floor level as compared to competitors, and to relate such advantage to own products' competitiveness.

Organizational capability of Mono-Zukuri cannot be copied easily.
Cannot be bought quickly. Has to be accumulated.