2007/08/06 11:40 Takahiro Fujimoto, "Manufacturing as a System of Design Information", ISSS Tokyo 2007

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Jim Kijima

Takahiro Fujimoto, Professor, Manufacturing Management

[Takahiro Fujimoto]

Takahiro Fujimoto

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Read social systems theory when an undergraduate at University of Tokyo

- One of first English books read with von Bertalanffy
- Wrote paper on systems approach to irrigation

Entered business administration, particularly of manufacturing, now moving to the services sector

Manufacturing Management Research Center, University of Tokyo since 2003

Systems thinking a common approach

- Many engineers by training, some social scientists

Root view of manufacturing:

- Continue view of material flows
- Would like to expand view to service sectors, by introducing the ideas of design
- Design concept from engineering, social theories of trade theories and competitiveness from economists and management
- Herbert Simon had tried to combine these in the Sciences of the Artificial, which is a big influence

Focus:

- Often visit factories, at least once per week
- Look at the flows of value to the customers
- Where does the value reside? Materials, not really.
- Most cases it's the design information

e.g. a cup: it's made of plastic, sometimes it's glass or metal

- There's someone's design thinking behind this
- The essence of artifacts is design information

Economists haven't thought of products this way, have thought of them as things that are already designed

- But someone designed it, somewhere
- A missing link in standard economics

Design-based competitive advantage

- Key concept: design information has value
- Firm's products and processes are artifacts that have been designed
  - This doesn't say anything about materials, could be product or a service
- Manufacturing is the creation and transmission of design information to customers
- e.g. Toyota people think about manufacturing this way, as value flows, and they try to make good flows of value: fast, smooth, precise, accurate information flows to the customer
- Monozukuri: manufacturing capability as a distinct ability to handle flows of design information toward customers
- Service sector is low productivity

Product-process architecture

- Design is common denominator

Basic idea:

- All products and services are a combination of the design information, plus the medium (material)
- Compare to Aristotle: object as form and material, and form is more essential
- Products (as goods and services) are artificial, i.e. something designed
- If the medium is tangible, it's manufacturing; if intangible, it's services

Penrose, nature of the firm

Manufacturing as the control of flows of design information between productive resources

- Design information goes together with materials
- Development, production and sales can all be explained by these ideas of manufacturing as design flows

Value-added time

e.g. body exterior press shop

- Information transmission time = value-adding time
- Information non-transmission time is MUDA (waste)

Organizational capabilities:

- From Nelson and Winter (evolutionary economics) ideas of organizational routines, as repeated control of design information flows between productive resource

Toyota: high productivity and high quality

- Their focus is muda
- Muda is unnecessary non-transmission time, which includes inventory, over-production, and defects on the information receiver side
- Toyota has 600,000 Kaisen activities, because it still has lots of muda

Toyota has 3 layers of capability:

- Routinized manufacturing capability
- Routinized learning capability (kaizen)
- Evolutionary capability (capability-building capability)
  - There are many mistakes that were made, that aren't report, but the failures are source of capabilities
  - (Have written a 400-page book on this)
  - Fortune favours the prepared mind

Don't rush to connect profit performance from organizational capability, at least two intermediaries

- Organizational capability --> Productive performance --> Market performance --> Profit performance
- First two are arean of capability-building competition
- Good companies are alwsys looking at productivity performance: productivity, lead time, conformance quality

Productive performance of Japanese companies was higher in the 1990s, but profits were lower, which speaks to long-term effects

- By late 1990s, Japanese were slow to catch up on profits, suggesting weak strategy but strong operatoins

Architectural thinking and industrial classification

- If decompose the products, are they general components or specific components?
- Modular architecture: product function hierarchy and product structure hierarchy are one-to-one
  - Can recombine, e.g. computers, bicycles
- Others have integral architecture, e.g. motorcycles
  - Need teams to solve simultaneous equations
  - Good retention of employees
  - Illusion that Japan is good at high-tech products, much moved to China

Integral architecture: many-to-many mapping between function and structure

Open architecture

Three types of architectures: closed-integral, closed-modular, open-modular

- Closed integral: Japanese automobiles
- Closed modular: American trucks are good at this, body on frame
- Chinese products: quasi-open modular architecture, on Chinese local markets
  - Seldom see this in India motorcycles, but do see this in China, where have mix and match of copied types

Japanese cars, 90% are product-specific, compared to computers that are only 50%

Two-staged design process, linked by trial-and-error coordination

- Japanese are good with this, due to long-term employment

Design-based comparative advantage

- Economists ignore where design is done, focusing on where manufacturing is done

Predictions on architecture-based compariative advantage (by country)

- Integral axis and modular axis:
- Japan most integral
- China and Korea most modular

e.g. steel trade pattern, economists can't explain

- Cars use different types of steel in different parts of cars
- Japan exports outer panels, whereas inner panels are Korean

Implication to Japanese Industrial Policy

- Protectionism tries to protect slowest runnings
- Want to chang to front-runner-oriented industrial policies
- Slowest runners need to be handled by social policies, not industrial policies

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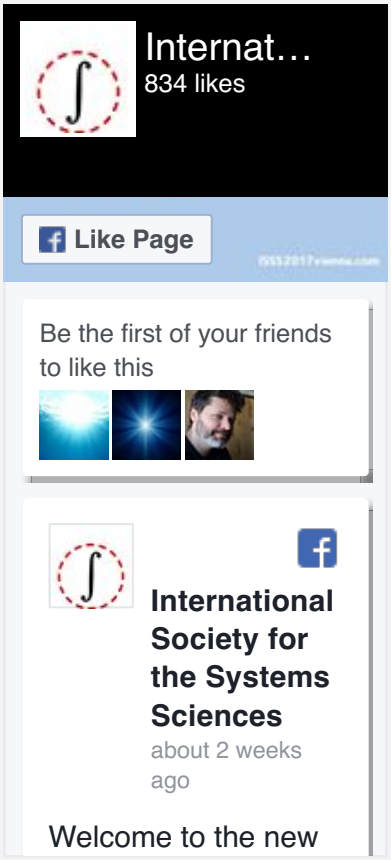

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