Paradigm change in **Shipbuilding Concept** & **Continuous Improvement**

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Suh, Wanchul [徐 完澈]

My-Kor. Maritime
Proper Mediation Inc.

Problem is the place to start a miracle!

1987 back on the brink of bankruptcy

Daewoo Story

1

It was not an easy year. In its first full year of operation, DSHM suffered a loss of $9 million on sales of $485 million, and for the next few years, Daewoo struggled with the challenges of a building a new business in the face of a continuing world recession in shipbuilding.

As if these troubles were not enough, 1987 saw South Korea gripped by political unrest, and DSHM soon became part of a political firestorm that pulled even the healthiest Korean firms close to the flames. Throughout Korea, the democratic movement swept through workplaces, and newly organized labor unions demanded radical changes in the distribution of wealth and social status. The dispute at the Okpo shipyard was particularly harsh .

2

DSHM: Tragic End to Violent Labor Demonstration: one man dead and 20 injured

The bitter labor dispute between DSHM workers and management reached new depths yesterday, when workers responded to management's decision to close the yard by laying siege to the plant and its president. One worker died and 20 others were injured during the clash with riot police guarding the Okpo Tourist Hotel, where DSHM President Yoon was staying. Twelve companies of riot police blocked the road to the hotel firing tear gas into the crowds of angry workers hurling stones. In the melee, Lee Suk-Kyu, an assembly worker, was hit in the chest by a tear-gas canister and was taken to hospital, where he died at 3.45PM yesterday afternoon.

um Ilbo. August 23, 1987.

3

The labor dispute hewed deep wounds in the isolated community on the island of Kŏje. DSHM came close to total collapse, and many were concerned that the vitriolic battle was destroying any future chance the fledgling shipyard might have had to compete in the world market. Kim Woo-Choong, Chairman of the Daewoo group, was determined that the plant be saved, and in 1987 flew onto Kŏje island to personally supervise DSHM's rebirth.

<Sharing My Unique Experience>

Daewoo came close to the total collapse on 1987.
Chairman Kim's Personal Action: '**Go and live with the Shipyard**'
'Management Innovation & Beyond' started on 1988.
'VISION 90's STARTING' & NSC[New Shipbuilding Method] from 1989

DAEWOO's REBIRTH PROGRAM

① Unity Movement: **'FAMILY VALUE'**
② Benchmarking: 'OPEN EYES!'
③ **Back to the Basics**
④ Behavioral Change

⑤ **Real Learning**
⑥ Elimination of Waste
⑦ Business Restructuring
⑧ **Fast Improving of Shipbuilding**

Case study by Harvard Business School, 1994
On Achievement of VISION 90's Movement between 1990-1993

Successful Transformation [1988-1993]

- 1979: DSME started building ship.
  $9mil Loss, Revenue $485mil.
- On the verge of bankruptcy on 1987
  - Bitter labor dispute between workers and management
  - Worst in QCDSM

Serious & Critical condition: the place to start a miracle!

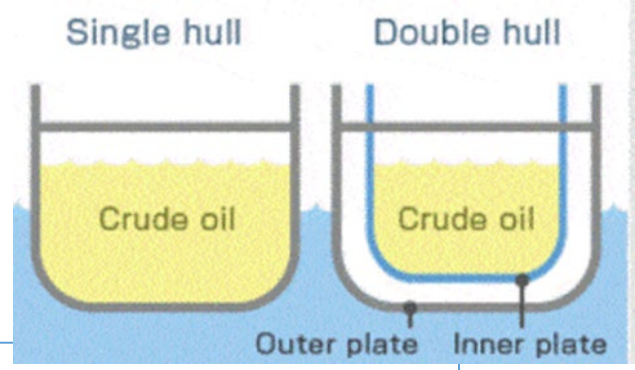
- **Companywide Transformation**
  - MI & VISION 90's Movement
  - Starting on 1988
- **All employees participation**
  - Top management at front
  - Middle-line working hard with
  - Front-line workers together

- **5-year** intensive endeavor
  - Hard-learning: Training, Bench-marking
  - Change: Behavior, Mind, Thinking
  - Building-up Strength
    : People, Technology
    : Organization, Operation System.
- **Holistic Change**
  - People, Method, System.
  - Learning Culture

  ⇒ **Autonomous Improving Organism**
- **Company Sales in 1993**
  - 85% Increase in 3 years
  - **Net Profit of $280m**

Strongest in the world!

Very Large Crude oil Carrier



- **Vessel's name : Al Funtas**
- **Builder : Daewoo**
- **Date delivered : Mar 06, 2014**
- **Type of hull: Double Hull**
- **Flag : Kuwait**

‘ONE HIT PRODUCT’ saves Company

- **3 year endeavor** on VLCC made ‘GREAT HIT’.
- **102 VLCC** Have been built in DSME by 2008.

1979: **My Personal Vision, ‘10% share of the World market!’**

1988: **1st VLCC delivered(13.5 Months, 1.2 Mil. MH)**

☞Starting **‘VISION 90’s Transformation’** on the brink of bankruptcy.

1990: ☞ [R&D] Development of New VLCC Building Concept & Design for Production

1993: **Double Hull VLCC(9 Months, 540K. MH)**

<Case study, Harvard Business School> **Meteoric Improvement!**

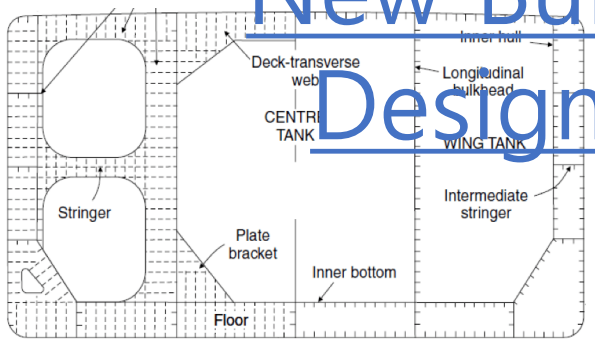
☞ Big gains on 1992: Daewoo built **10% of total world Production**[1.7 mil. GT]
Net profit, $280mil

2008: **102nd VLCC delivered. 20% Market share** (Total 506 VLCC built since 1975)

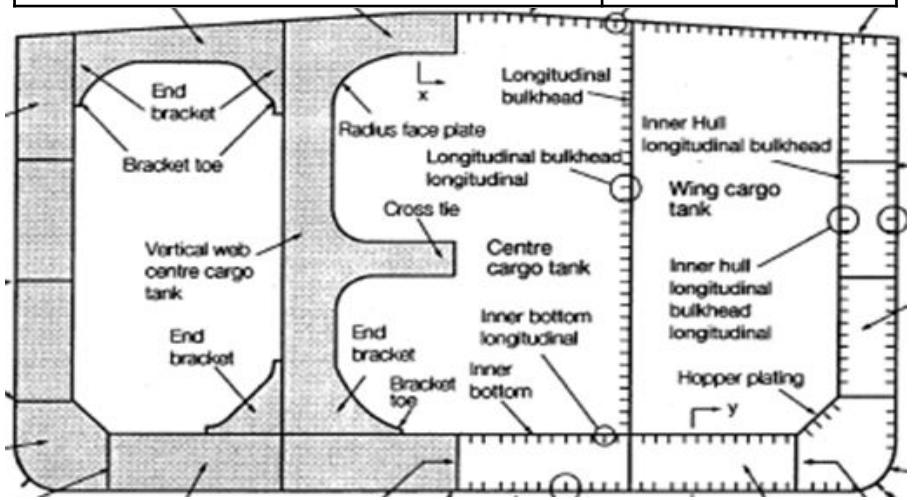
☞**Design-for-Production & New Production Method**
made BIG CHANGE in Production.

- **SHORT Delivery: 13.5 months → 9 months**
- **HIGH Productivity: 1.2 Mil. MH reduced to 540k MH**

New Building Concept & Design for Production



Principal Dimensions	
Length overall (LOA)	**333 m**
Extreme breadth (Beam)	**60 m**
Molded depth	**30.5 m**
Keel to Masthead (KTM)	63.5 m
Net Tonnage	108,113 Ton



After Design change for Production	
No. of Blocks	50%
No. of Steel pieces	**79.6%**
Pipe Works (Ton)	**84.9%**
Cable length	**77.0%**

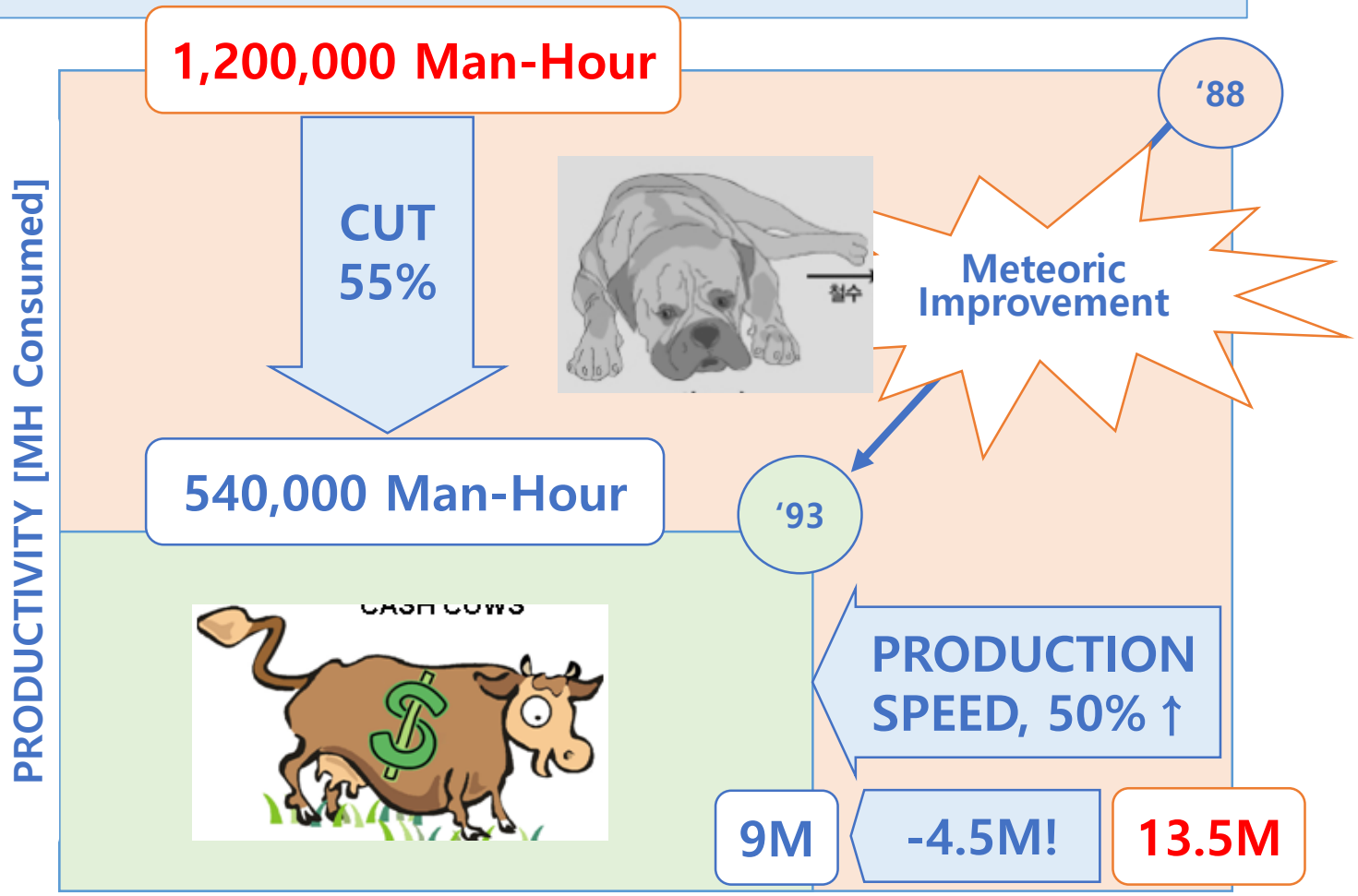
[Success Example] Very Large Crude oil Carrier

1988: 1st VLCC
* Dying Dog[Big Loss]

1990-1992: VISION 90s
* NSC+CI[New Paradigm]
* 3 year Endeavour

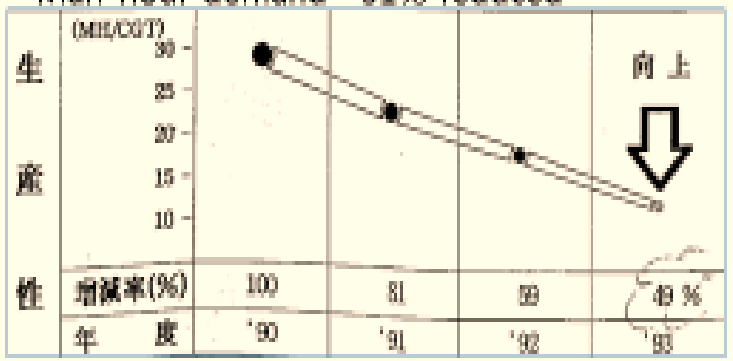
1993: 1st D/H VLCC
* Bright Star

2008: 102nd VLCC
* 20% out of 506
* Healthy Cash Cow

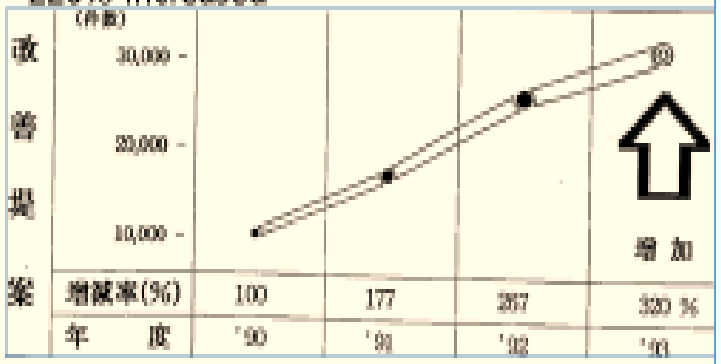


One Big Success led Companywide Improvement[1990-1993]

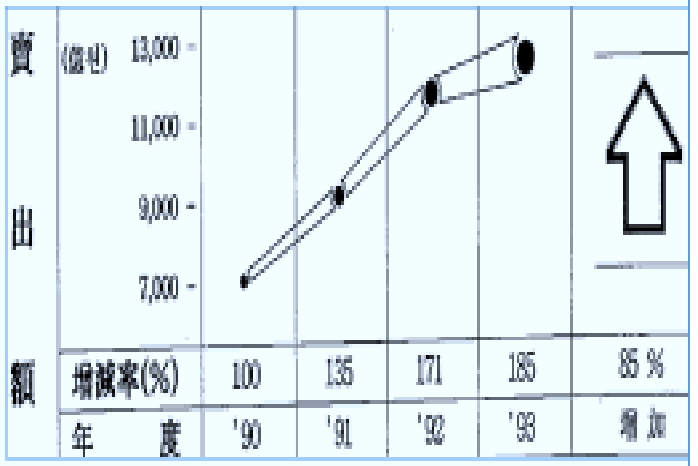
- **Productivity Increase**
  Man-hour demand→51% reduced



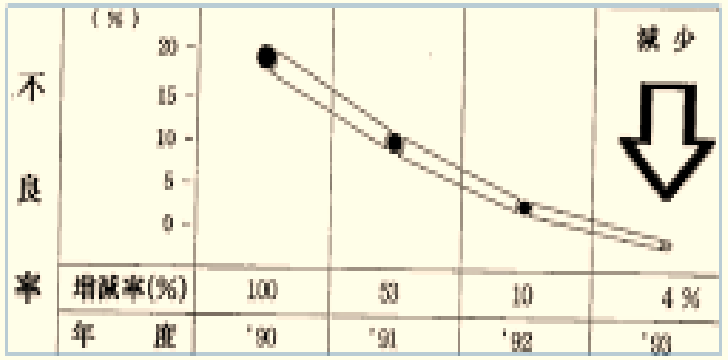
- **Suggestions for improvement**
  220% increased



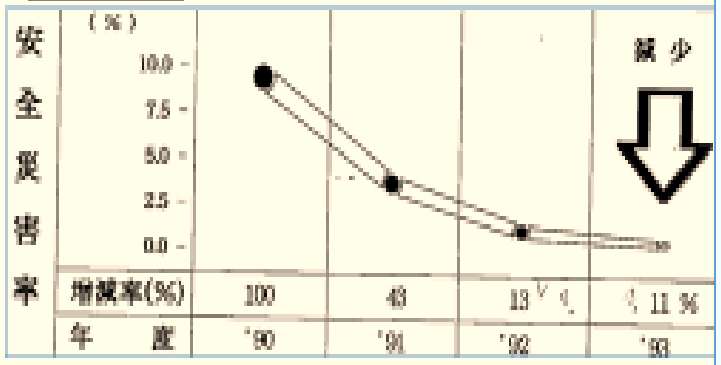
- **Total Sales**: 85% increased



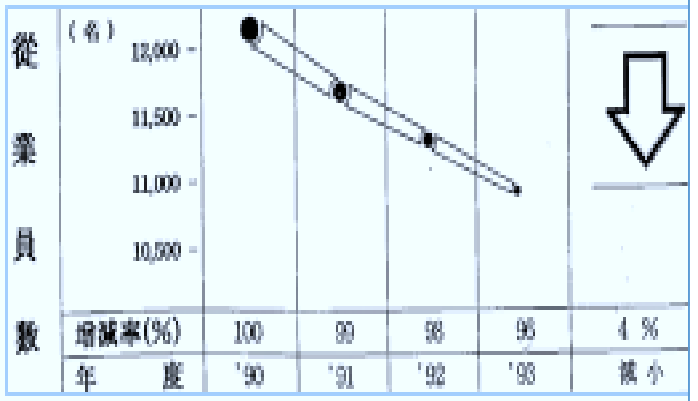
- **Defect Ratio**: 96% eliminated (20%→0.8%)



- **Accident**: 89% eliminated



- **Number of Employees**: 4% reduced



*DSME Restoration progra

DSME, Winner of Company Innovation on 1993 from Korea Management Associati

Harvard Business School

9-695-001
October 1, 1994

Daewoo Shipbuilding and Heavy Machinery

With the sound of the waves of the East China Sea kissing the shore of Kŏje island, Park Dong-Kyu, executive vice-president and General Manager of Daewoo Shipbuilding and Heavy Machinery (DSHM), Ltd. looked out over the ocean and considered the course that lay ahead.

Autonomous CI Culture

By 1994, DSHM had become one of the most efficient shipbuilding companies in the world. Probably more important, DSHM had recently benchmarked itself, and found its Okpo shipyard to be the fastest improving. Over the seven years between 1987 and 1994, Daewoo had built what many companies were still striving for: a plant that had learned how to learn—and was becoming better at it every day.

Learning Culture

New Shipbuilding Concept

Despite DSHM's meteoric improvement path, there remained two driving goals which had eluded even the most inventive shipbuilding companies: speed and productivity. Construction lead time was becoming one of the key competitive elements in the industry. Daewoo's major competitors had each announced major capital investment project to speed up their manufacturing process, and become more productive. Daewoo had no such plans, relying instead on the promise of continued gains from its unique improvement methods, rather than further capital investment to maintain its targeted 10% share of the world shipbuilding industry.

It was a gamble. Could the shipyard continue to improve as it had over the past five years, and would this incremental path provide the needed capacity?

Daewoo's 2nd BIG HIT PRODUCT

LNG Carrier + LNG-Powered Ship

▪ 35% Market Share by Mar. 2018.[159/474]

1989: R & D Started

1992: **1st LNGC contracted for Domestic Ship owner**

2000: 1st LNGC contracted for Foreign Ship owner (Exmar in Belgium)

2018: **121 LNGC delivered by Mar.**

☞**159 LNGC contracted [35%] of Total 474 LNGC ordered in 30 years**

LNGC Market Prospect by 2030: 456 LNGC expected to order

[On order(Daewoo 39/Total 106 LNGC), New Demands and Replacement]

South Korean shipbuilder, Daewoo Shipbuilding & Marine Engineering has clinched an order for LNG carrier duo from an Oceania-based ship owner.

…Out of 13 clinched by the South Korean giants, DSME has received orders for 6 vessels this year. In total, 14 LNG carriers have been ordered this year.

Both vessels will be outfitted with **MEGI Engines** (M-type, Electronically controlled, Gas Injection Engine) and **Full Re-liquefaction system**.

The contract value for the two liquefied natural gas tankers is at $365 million. The two vessels with the capacity to transport 173,400 cubic meters of the chilled fuel each are scheduled for **delivery in the first half of 2021**.

<Posted on March 16, 2018 by DSME>

Great Potential WITHIN US

Techno change

<Paradigm Change Ⅰ>
New Shipbuilding Concept
from Shipbuilding
to Ship Manufacturing

<Paradigm Change Ⅱ>
Auto-CI Business Process
Continuous Improvement
from 'Alienated' to 'Relevant'

Socio change

All People matter……<Ⅰ>
Family Values
Build Renewed Trust

All People matter…<Ⅱ>
Learning Culture
Learn how to learn

<Paradigm Change Ⅰ>
New Shipbuilding Concept
from Shipbuilding
to Ship Manufacturing

→ **SYNCHRO*-Production System**

: Simple & Compact Flow Lane

: Continuous Improvement for Smooth Flowing without STOP

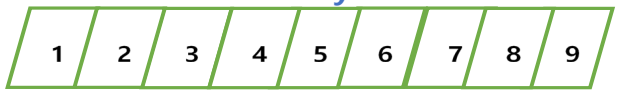
SYNCHRO*-Production Flow Lane

P.No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
Level	Block Assembly + Outfitting + Repair Painting									Block Painting		Grand Module Assembly						Dock Construction						Test & Trial		
WS	B1	B2	B3	B4	B5	B6	B7	B8	B9	P1	P2	G1	G2	G3	G4	G5	G6	D1	D2	D3	D4	D5	D6	T1	T2	T3

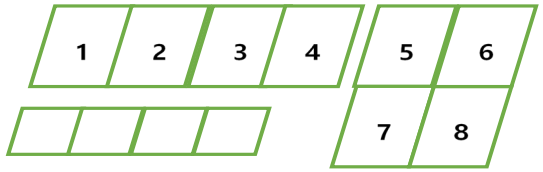
SCHEMATIC OF PRODUCTION FLOW

■ Regular type Blocks
[Continuous Flow Line Production]

• Flat Block Assembly Line

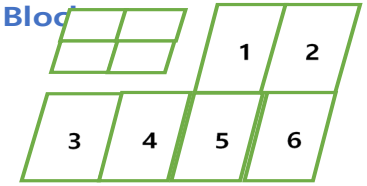


• Curved Block Assembly Line



■ Irregular Blocks[Job-shop Production]

• Fore/Aft-end Block



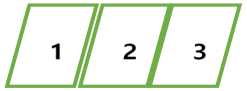
■ Minor Assembly[Batch Production]

• Similar type in a large quantity

① Blast
② Coat

① Set:
② Fit-up:
③ Weld:
④ Outfit:
⑤ Paint:
⑥ Zone Completion

① Set: One-Time-Setting
② Fit-up:
③ Weld:
④ Outfit:
⑤ Paint:
⑥ Zone Completion



① MC
② STW
③ ITT

- Main Flow Lane: '26' Processes in Line
- Simple Production Streams
- Shortest Logistics

Operating Principles
Harmonious, yet well Disciplined and Immediate Problem-solving

Group Technology is employed.

GT is a method for applying mass production techniques
to a variety of products in widely varying quantities.

GT is '..a manufacturing philosophy;
the parts having similarities (Geometry/manufacturing process)
are grouped together in order
to bring the benefits of mass production, that is
Higher Productivity, Speedy production.'

GT is a general principle....

① Many problems are similar and

② by grouping SIMILAR problems,
a **SINGLE SOLUTION** can be found to a set of problems,

③ thus SAVING TIME and EFFORT to produce
interim product **with perfection in time**.

Giant Lego kit at Shipyard: Accuracy, On-time

from the keel up, using comparatively small and light pre-built subassemblies. DSHM's process was completely different. DSHM pre-erected enormous superblocks at the side of the dry dock which were then assembled in the dock like a giant Lego™ kit. Pre-erection was difficult: it required tremendous accuracy in manufacturing. Each of the blocks was a whole section through the ship, replete with pipes, wiring conduits, and occasionally half a room! These components had to fit perfectly together once built. While this would have been difficult even in a smaller scale assembly process, it was made much more challenging by the fact that many of the blocks were the size of office buildings. However, the advantages of overcoming this problem were also great. First, pre-

Principles of SYNCHRO-Production

[Principle1] **PWBS[Production-convenient** Work Breakdown System]

『PWBS employs Logic of Group Technology for applying Mass production』

: **Utilize the Entire shipyard!**[Block Division, Work Sequence]

: **IHOP**(Integrated Hull, Outfitting and Painting) **Production method**

: Maximize Indoor Production/Minimize Outdoor Production

[Principle2] **ZONE Completion as Discipline**

: Interim Products-in-process to be '**complete**' in Q & CD

[Accuracy & Completeness]

『Zone is Cost-centre, Problem-area which exactly match organization』

[Principle3] **TAKT Operation**

『TAKT time: Fixed Time of Interval of Production flowing』

: TAKT Time[=Production speed] designed by PE & PP.

: Entire shipyard to be synchronized by TAKT.

[Principle4] **Pull production to eliminate Waste**

: Waiting Time, Idling Resources, Inventory and Stocks-in-process

Operation of SYNCHRO-Production=CI

- **TAKT is Target & Harmony**
  : It is 'Cardinal Rule' in shop operation [Target-Driven]
  : Harmonious operation must be there to keep line flowing smoothly.
- '**Standard Work Practice**' [Detailed Working Procedures]
  - is not only **the element of Production Flow Lane** but also the **framework of an entire production system**.
  - And it is more of a **Visual Management** Tool.
- **Synchronized Production** system best for problem-finding
  : Production Flow Lane is a '**FISHING NET**' to catch problems
  : Workshop floor is the **bustling 'SPOT' to solve** them collectively & immediately.
  : Continuous Improvement to achieve the higher efficiency
  →**Standardizing upward!**
- **Alignment with Vendors**

<Paradigm Change Ⅱ>
CI-contained Business Process
Continuous Improvement
from 'Alienated' to 'Relevant'

→Auto-CI* Business Process

: 'Being-Better' CO-WORK Organism built in BP.
: CI embedded in Daily Routine

Harmonious Auto-CI* Business Process

Built-in CO-WORK Organism for Optimal Design + Problem-solving

Product Design Design for Production	Production Engineering Efficient Production Flow	Production Planning Uniform Work Load
Initial Design Basic Design	PWB (Block Division) [Best Production Method]	Macro-Plan
Detailed Design	Work Sequence Diagram [Production Process]	Detailed Shop Schedule
Production-friendly Information	Detailed Work Procedure [Stability of Processes]	Weekly Work Execution Program
	Productive Work	
	Standard Work Practices	

Right Direction x Collaboration

- Total Optimum! Collaboration
- Accurate Information Exchange On time
- Perfect Preparation for Work
- Problem Solving & Feed-Back

How to CO-WORK?
[Notice! Direction of Arrow]

Work Culture

Optimal Design for Production

∑ 10 year Efforts for In-house Design

Objectives of Optimal Design for Production

To reduce **production costs to a minimum**, compatible with the requirements of the vessel to fulfill its operational functions.'

- ODP to **balance the demands of performance with production.**
- Design and Production should go hand in hand, that is Concurrent Engineering. It embodies **team values of cooperation, trust and sharing**.

It is vital that '**optimal design for production**' starts early in the design process.

The designer has the greatest influence on the cost of the vessel during the earliest design stages when the basic configuration are being decided.

- All design features to be compatible with characteristics of the **shipyard facilities.**
- **Production principles and procedures** to be applied to all individual design
- To coordinate the inter-relationship between machinery, electrical and outfitting work with structural work, in order to eliminate interface problems.

Outcome of Co-work organism

- **[Optimal Design]** Design & Production co-work for **Production-friendly Information**.
- **[Problem-solving]** Production Engineer should be always at Front for **Dynamic Problem-shooting**.

Optimal Design		SYNCHRO-Production		High Productivity Short Delivery
• Design for Low Cost • Production-friendly Information	✖	• Building strategy • Production Method • Best Work Practicing	=	**Production-friendly Information**
• Material Take-Off in Time • Material Order Request • Pallet List for Material Supply by Work Package		• Skill-up & Multi-skilled • Teambuilding • Work Package =Material Pallet		**On-time Supply of Materials aligned with Vendor**

There is a constant improvement of product[Design] and process[Production] during shipbuilding.

The Method and Practice change over time.

⇨ **Clean, Safe, Highly Efficient Auto-CI Shipyard**

Terrible Daily Life locked in Vicious cycle..... No improvement, No hope

No CO-work, Firefighting, Giving-up, Ignorance

Product Design Design for Design (?)	Production Engineering Dysfunctional	Production Planning Fruitless scheduling	
Initial Design Basic Design	PWB (Block Division) [Production Method]	Macro-Plan	Thick Barriers No target-oriented
Detailed Design	Work Sequence Diagram [Production Process]	Detailed Shop Schedule	Disconnected Confusion, Rework
Production-friendly Information	Detailed Work Procedure [Stability of Processes]	Weekly Work Execution Program	Lack of Information Poor Preparation

Production

Standard Work Practices

Chronic Disease:
Delay, Bad Quality

Harmony is the competitiveness!

Company	Employee
Productive, Constructive Profitable, Competitive	Cooperative, Motivated Satisfied, Happy

All people matter.....

All People matter……< I >

Family Reunion

Build Renewed Trust

→ **Family Spirit, Good Citizenship**

- Sweet Home!
- Great Workplace!
- Wonderful Community!

Heal the deep wounds in relationship, Renew Trust

The 1987 dispute had been painful and divisive for everyone and both management and the union knew that neither was likely to benefit from continued disruption. Yet resolution seemed difficult to find. Daewoo management eventually took the initiative to resolve the crisis and Chairman Kim's personal action—to go and live with the plant—sent a strong signal of Daewoo's commitment to the shipyard to both union workers and field managers.

Kim's first step was to heal the deep wounds in the relationship between management and union, and to begin to build renewed trust among them. Kim started a *'unity movement'* which played on traditional Korean values and encouraged both sides to begin to act like members of the same family. The company sponsored a family training program which also included members of the community as a whole as well as its own workers' families. It also sponsored cultural events, and a variety of education programs. Many employees were single men so Daewoo sponsored opportunities for the single men to meet single women from other Daewoo affiliated companies (for example, in electronics and textiles).

- **Canteen at the mid-night**
- **Apartment at 7 in the morning**

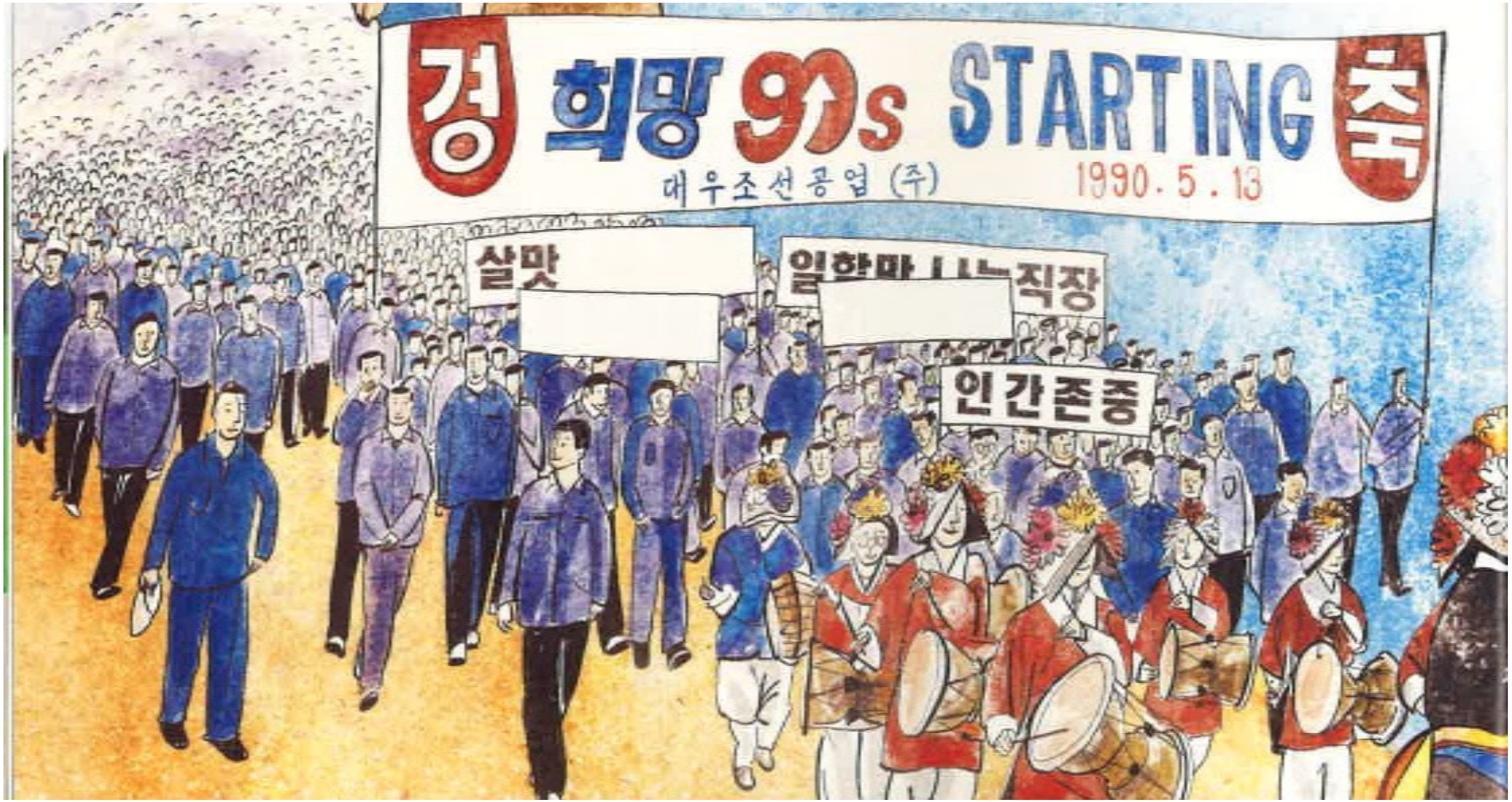
Family Reunion, Renewed Trust

Cultivation of 'Family spirit'

All members of the community joined as a whole as well as own employees' family.

- Family Bonding Program
- Shipyard open on Children's day
- Education for Employees' wife
- Sponsoring the opportunities for single men to meet single women
- Joint Wedding ceremony
- Cultural Event for Employees & their family

⇒Vision 90's STARTING


경
희망 90s STARTING
축
대우조선공업 (주)
1990. 5. 13
살맛
인간존중

Higher Values
Good Citizenship

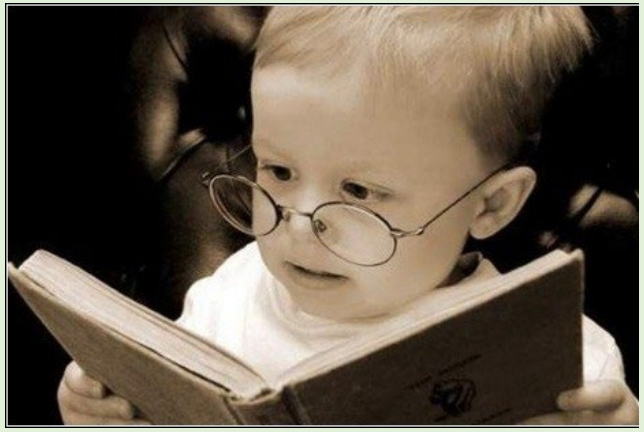
- **Good Behavior**
  - ① Morning cleaning:
    Voluntarily Earlier than 08:00
  - ② Time-keeping:
    Work starting 1 min. before 08:00
  - ③ Gardening after working hour
  - ④ 'No cigarette butt'
  - ⑤ Garbage disposal
    : Separate collection

- **Good Citizenship**

  Service to the Community
  - ① Cleaning Downtown & Beach
  - ② Repair of Houses in Rural village
  - ③ Helping farmers in busy season
  - ④ Maintenance of **Playground**
    : 38 primary schools in Koje island

⇒ **Change of Behavior**

⇒ **Change of Personality**



All People matter……<Ⅱ>
Learning Culture
‘Learn how to Learn’

→‘Making People’ Philosophy

: Education for the Whole person and **All** Employee
: Permanent In-House Training School

"We sent our employees, both field workers and managers at all ranks, to the most efficient Japanese manufacturers[1] for benchmarking as well as education and training. We sent all employees, not just managers or a particular group of workers. The reason was that we believed workers could do the best job of benchmarking when they saw their best competitors doing their own jobs. For instance, a welder on the line is the best person to benchmark welding. He can compare his skill against that of the best welder in the world. Likewise, the welder himself is the one who can derive most benefit from observing the benchmarked welding process."

Suh Wan-Chul, Executive Managing Director

Making THINGS is all about making PEOPLE.
<Daiichi Ohno, TOYOTA>

By 1994, more than half of the workforce had been through the education and training program.

Education and training is a long term investment

Don't see education and training as a stand-alone operations issue, a tactical, rather than a strategic interconnected system that includes vision, strategy, and business plan.

- **Basic & Essential Course**

  →'BASIC' makes THE BEST.

  - Workmanship
  - Communication skill
  - Leadership skill

- **Professional Training & Education**

  ① Foreman School
  : **700 persons, 3 months**

  ② Profit-making IE → **Efficiency, TAKT**
  : All Production Engineers
  : Workers (**6,000** persons)

  ③ Value Engineering → **Optimal Design**
  : All design engineers

  ④ Total Preventive Maintenance
  : 'My Machine' Movement

  ⑤ Management Innovation
  : All person in Administrative & Supporting department

‘Real learning’ gets to the heart of what it is to be human.

7 Principles for ‘Real’ Learning

① Basic & Essential Curriculum
② All employees
③ Compulsory
④ Practical exercise-centered
⑤ Prominent teachers in long-term basis
⑥ In-house Training by In-house Trainer
⑦ Long-term program for 2-3 years

700 Actual CEOs at Work floor

The most important initiative addressed the training and educational needs of the hourly staff. First, the entire work force was divided into small groups, each comprising 10 to 15 members. This small group structure became the primary unit from which the on-going improvement endeavor was built. Education and training were based on this close-knit small group structure.

Training began with operators rather than supervisors. "A small group is like the roots of a tree. If these roots are healthy, the tree will flourish" observed Mr. Chung. The course addressed the

700 small working groups in Production unit

An additional benefit of the small-group-based training scheme was that the members in a small group came to know one another extremely well. A production process based on the same small group structure was then a logical and effective work unit. Moreover, since managers had participated in the education program alongside operators, trust began to be rekindled between the two parties—and common goals again became clear. Once it became clear that each group's fate was tightly intertwined, things began to change. Operators began to become active in making suggestions to improve inefficient operations or eliminate excessive consumption of resources. In turn, Daewoo management devised an incentive system to encourage and reward such suggestions, and also tried to build a process for more systematic learning and experimentation for those problems requiring higher level of engineering expertise.

This is the brief story of 'Dream comes into reality'.

Recap

Paradigm Change…

SYNCHRO*-Production

: Simple & Compact Flow Lane
: Continuous Improvement for Smooth Flowing without STOP

Auto-CI* Business Process

: **CO-WORK Organism** for Being Better within BP.
: CI embedded in Daily Routine

All People matter…

Family Reunion Build Renewed Trust

→ Sweet Home!
→ Great Workplace!
→ Wonderful Community!

Making People

: Educate **All** Employee for the **Whole** person
: Learn how to Learn
→**Learning Culture**

Bright Future of
Malaysian Maritime Industry!

Great Potential
WITHIN US

We have Solid Platform & Good People

① Strong Platform:

- National Shipbuilding program: RMN, APMM, LKIM
- OSV: Big Demanding in 5 years
- OFS: Great Latent Demand

② Confident Young People:

- Our living hope for the better future
- BIG Potential & 'CAN-DO' Spirit within them

We have to set a 'Realistic Best' Business Strategy for Sustainability.

[Step Ⅰ] **Raise Our 'Standards'**
Change what I demand of myself.

[Step Ⅱ] **Change Our Limiting 'Beliefs'**
Empowering beliefs-sense of certainty-
is the force behind great success.

[Step Ⅲ] **Figure out Our 'Vision & Strategy'**
Knowing is not enough!
We must take action.

Our Vision, Strategy

③ Become
‘World Best Provider’
ONE Specific type of Ship

3-5 year Endeavour will surely make
Big gains for more than 20 years. …
Daewoo story proves it is realistic and Practical.

Screw it. Let's do it!

Visionary LEADERSHIP

The Middle East is not a region of tensions and conflicts but a region where cultures, civilizations and innovation can meet and flourish.

Mohammed Bin Rashid Al Maktoum,
Flashes of WISDOM, p46