

Hitachi Zosen Corporation (Hitz) - Osaka University Collaboration

Yoshihisa Nakazawa, Ph.D

**Specially Appointed Professor, DOL, Hitz
Collaborative Research Institute (Hitz-CRI),
Graduate School of Engineering,
Osaka University**

Company Profile Overview

Company Name

- Hitachi Zosen Corporation

Date of Founding

- April 1, 1881 by E. H. Hunter from UK

Date of Establishment

- May 29, 1934

Location of Head office

- Osaka & Tokyo, JAPAN

Offices

- 32 Domestic offices & 7 works in Japan
- 58 Overseas offices & subsidiaries

Capital

- 45billion JPY

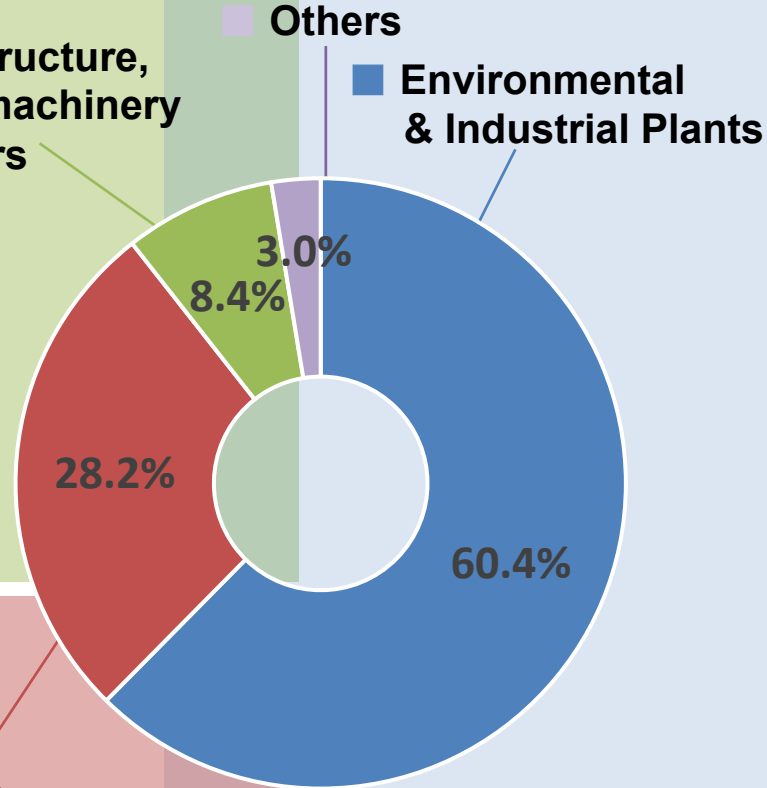
Net Sales

- 378billion JPY

Employee

- 10,580 (As of March, 2019)

Sales Structure by Product



Bridges



Vacume Equipment and Device



GPS Oceanographic Monitoring System

Infrastructure, Precise machinery and others

Others

Environmental & Industrial Plants



Waste Treatment Systems



Desalination plants



Marine Diesel Engines

Machinery, Process Equipment



Pressure Vessels



Tunneling Boring Machines



Waste water treatment



Biogas Systems

Reference Projects for Waste Thermal Treatment

957

Europe
213

Asia
658

North
America
79

Africa
3

Oceania
3

South
America
1

As of March 2019



In Australia, Southeast Asia, Middle East, and South America, Osmoflo has expanded business of desalination and industrial water treatment by utilizing Reverse Osmosis(RO).
In August 2018, Hitachi Zosen Corporation made Osmoflo a wholly owned subsidiary by taking its 100% ownership.

Capability

EPC

Engineering, procurement, construction, and testing of water treatment plants

Operation & Maintenance

- 24 hour active monitoring via Plant Connect
- Through Osmoview (an application designed for smartphones,) condition of plants operation can be monitored.

Lifetime Support

Technical support, spare parts and consumables after sales services

Rental Service

Rental installation up to 5 - 20,000 m3/d if a site needs water urgently or temporarily

Technology

RO (SWRO/BWRO)

Pre-treatment (Ultra/Nano/Micro Filtration etc)

Post-treatment (Remineralization etc)

Demineralization

Disinfection (Ozonation etc)

Corporate Directory

Head Office

Adelaide, Australia

(A factory, which manufactures systems of RO skids inserted into containers for the domestic market, is established next to the head office)

Offices

Domestic : Brisbane / Sydney / Perth / Melbourne
Overseas : India(Engineering Head Office) /
UAE / Oman / Chile



Rental Dispatch

Osaka University's Unique Industry-University Collaboration System, which continued 14 years

Industry **on** Campus

Excellence of society can be introduced to university campus,
enhance education and research ability and make them joined

Employed faculty (including specially-appointed professor) = 3,541 (full-time) + 3,113(staffs) = **6,654people** 2018.May.

Organization

2000年 組織連携

Sponsored research
委託研究
(共同研究)

2006

Joint Research Chairs
79 (2019.sep.)

2011

Research Alliance Lab
19 (2019.sep.)

98

(2019.sep.11)

Company Researchers (Engineering)

Special Appointed Fellow	29
Special Appointed Researcher	16
Visiting Fellow or Researcher	216
Total at Company researchers	261

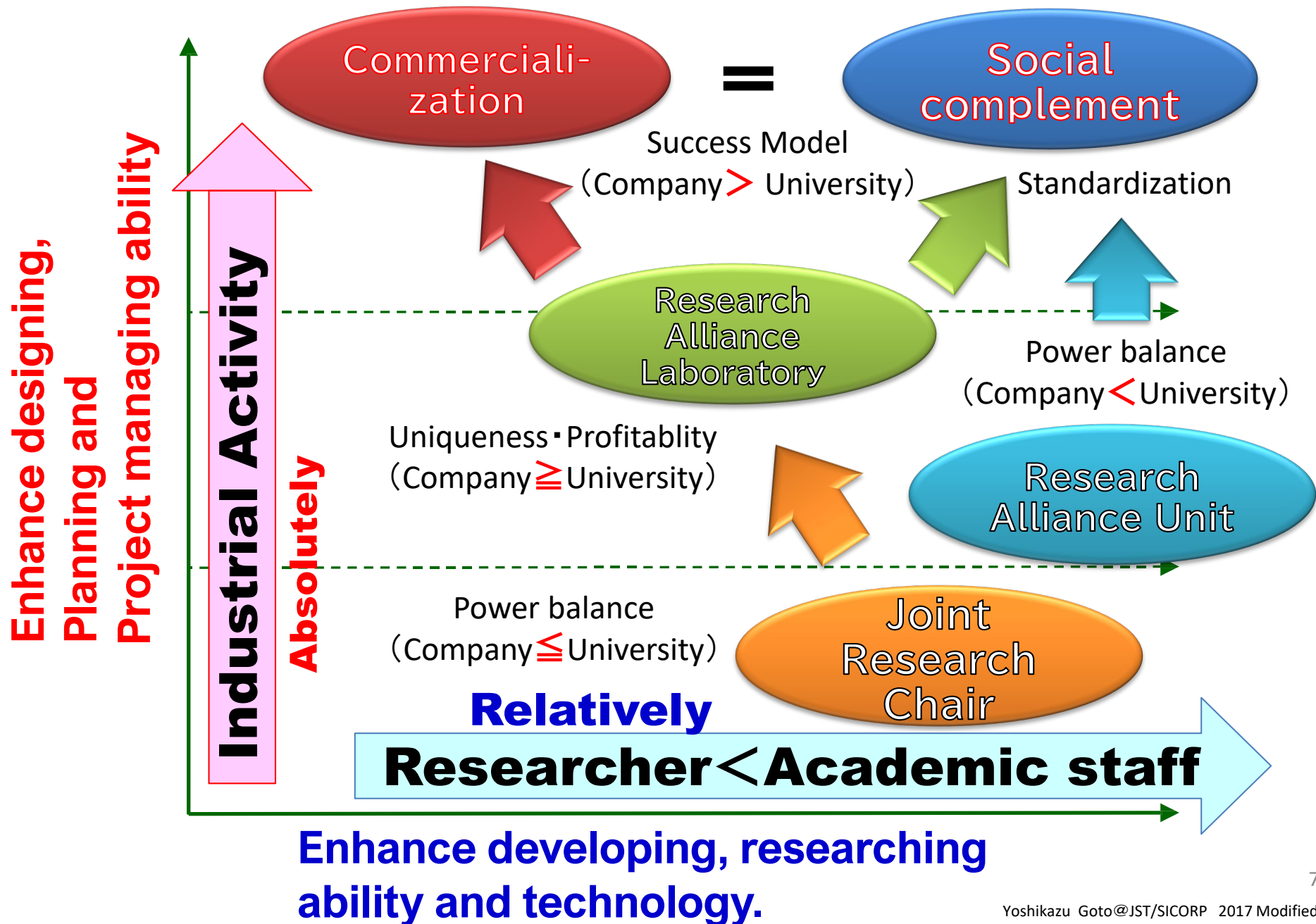
At a certain time, activity and quality of university depends on the quantity of researchers

488 Academic staff in Engineering Faculty + Over 250 Company researchers from companies



“Silicon Valley” of Osaka University formed naturally

The Relationship of Industry and University



What does a company really want from the university-industry research collaboration ?



1st. Excellent students



2nd. New business

**Because, It is an investment of
4 million AUD for an employee**

**Favorite phrases of
Japanese company's CEOs**

How much can it sell ?

Too late !

**In result, Industry-
University-Government
cooperation was necessary**

History of Hitz-CRI in Osaka Univ.

DNA research



Plant farm



Factory



Products



Put on the market



Business

NEDO Project(1999~2011)
(Beginning of Joint-Research)



NEDO Plants Function Modification Project(1999~2006)
NEDO Plants Material Production(2005~2011)
NEDO Research Cooperation Project ODA(2008~2009)

Hitz Biomass Development Joint Research Chair
(2010.1~2012.9)



Internal development theme:Eucommia Elastomer
NEDO Green Sustainable Chemical(2009~2012)
NEDO Research Project ODA(2011~2012)

Hitz (Bio) Research Alliance Laboratory
(2012.10~2017.3)



Internal development theme:Eucommia Elastomer
NEDO Technology Development of Non-edible Biomass(2013~2016)
MAFF subsidy project(2013~2015)

Hitz Collaborative Research Institute(Hitz-CRI)
(2017.4~2020.3) As a section of Hitachi Zosen



Internal development theme:Eucommia elastomer
Business theme(2)
JST industry-university utilization development(2014~2019)
NEDO research digital bio(2018~2019)

Next Step ; 2020.4~2023.3(3years)
Hitz-CRI

Develop to a section of Hitachi Zosen on regenerative medical
instruments and information technology

One Mountain Gunma
Pre(100years)
Planted in 1928

トチュウ トチュウ *Exornis ardisia* D.D.
漢字名: 杜仲
樹高: 10-30m
原産地は中国大陸中部で、植物園などで栽培される樹木と混交される植林が多い。
樹皮や葉にはクワシムシなどの害虫が食害を受け、落葉でも引き裂くと二重皮の葉が引き、樹皮は剥がれ、落葉はトチュウの葉に食害を受ける。
[石川県環境林産部農林部 関東森林管理センター 樹木部]



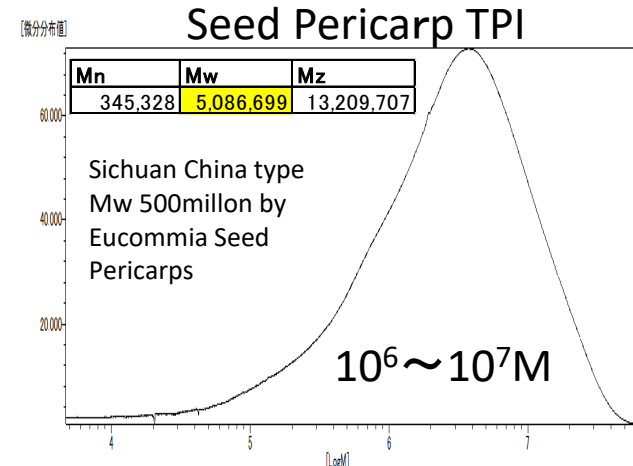
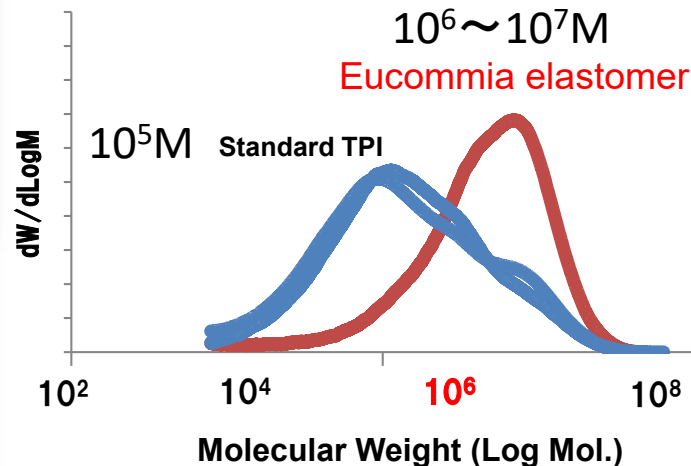
Leaves



Cortex

(Japanese Name:杜仲、Tochu)、(Scientific:*Eucommia ulmoides* Oliver)
(Chinese Name:Du-Zhong) , (English Name: Hardy rubber tree)
Distribution:Temperate Latitude(Cultivation Distribution :China-Japan Area)
Feature:Deciduous, height over 20m, one genus one species, Dioecious,
Drought resistant(400mm/year)

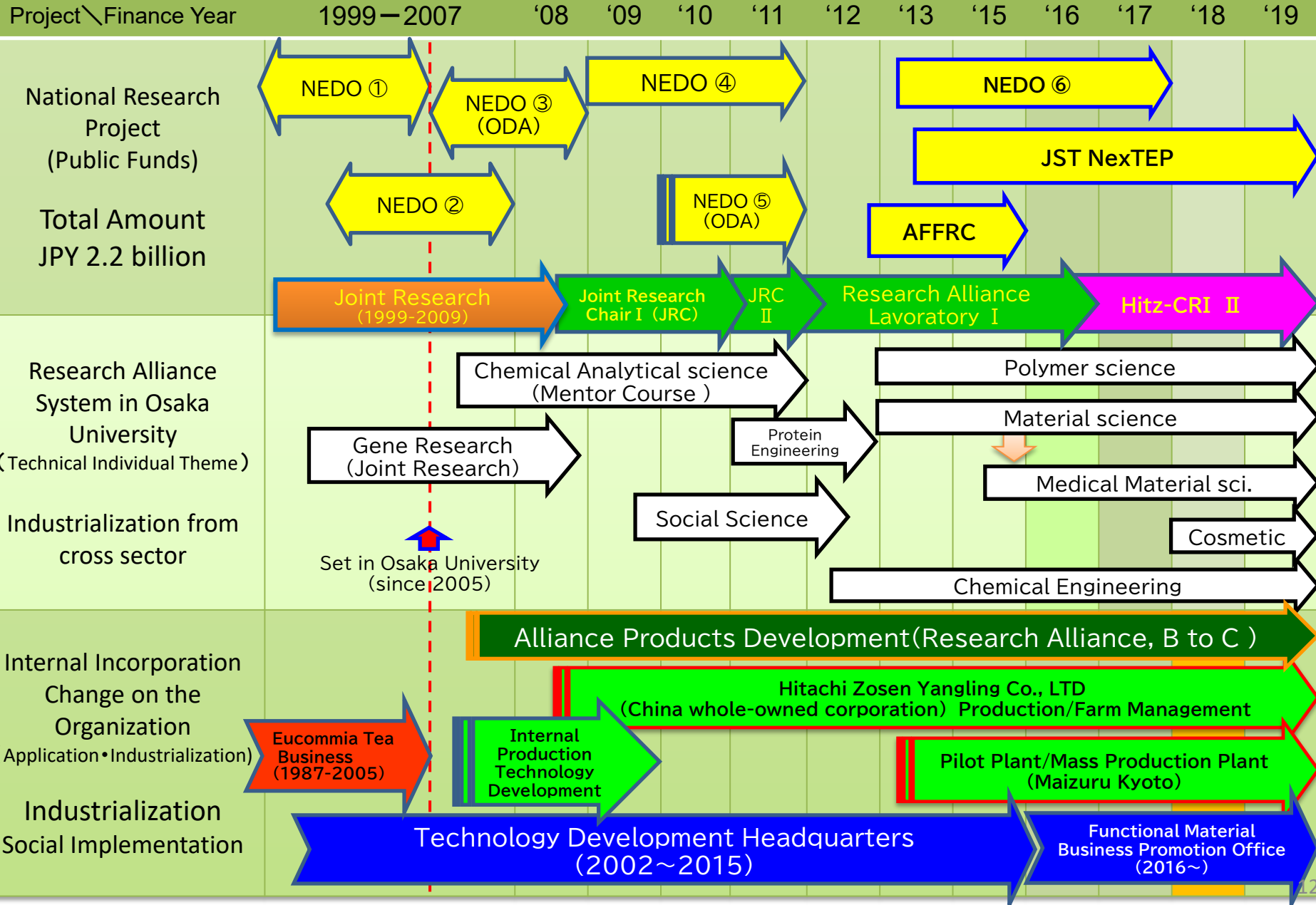
Utilization:Edible Drug(Cortex:Tonic drug, Leaves·Petioles :food)
Specified Healthy Food(Blood Pressure No.1), Tochu Tea.
Shade Tree, Tree Cultivar



Size Exclusion Chromatography analysis

Management of Research Development

(National Project, Research Alliance, Commercialization)



Number of researchers and educators in Hitz-CRI

2019.Sep

Item	Movement of human resource(past⇒now)	Number of persons	Remarks
Human Resource Development	Hitz-CRI Registered students	260	Total(Master60%(DR20%, MS40%)、BS40%)
	Academic staff ⇒Hitz employee	2	As a group leader
	Hitz employee ⇒ Academic staff	5	Kyusyu University 1, Ningxia University 1, Osaka University 1, Nagoya University 1, International Rice Center 1
	Post doctor⇒Hitz regular employee	9	foreigner(3), Ph.D (5)
	Non-regular⇒regular employee	3	foreigner(1), Ph.D (1)
	Part time⇒Part time	3	Hope for part time、Ph.D(1)
	Graduate with the communication	12	Works of many companies

Result of Research and Development in Hitz-CRI

FY2019 Sep.

Item	Total	Finance Year									
		2019	2018	2017	2016	2015	2014	2013	2012	2011	2010
Peer-reviewed paper	24	1	1	2	4	1	2	3	2	1	7
Commentary	19	1	1	0	1	4	2	3	1	3	2
Book	6	1	0	0	1	1	0	1	0	1	1
Conference presentation	45	5	6	6	5	5	5	5	5	3	3
Patent	39	2	5	6	7	12	2	3	2	4	0
Press	44	3	6	6	4	8	4	3	3	3	2
Exhibition, PR	25	2	3	4	4	4	3	2	1	1	1
Commercialization	2	1	0	1	-	-	-	-	-	-	-
Number of researcher	302	30	34	35	33	38	42	33	28	17	12
Number of female researcher	-	6	6	5	3	4	4	4	4	4	3

「Industry on Campus」 University-based Innovation

Innovation Settled on Campus
(Osaka-u Techno Alliance Bd. 8F)



Material Production Corporation (Xi'an China)



Civil Production Plant (JST NexTEP)

Steady supply of the biomass (China)



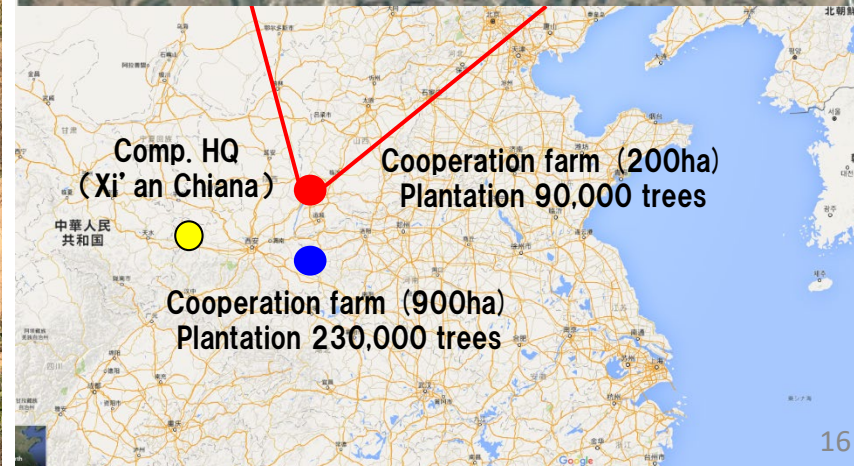
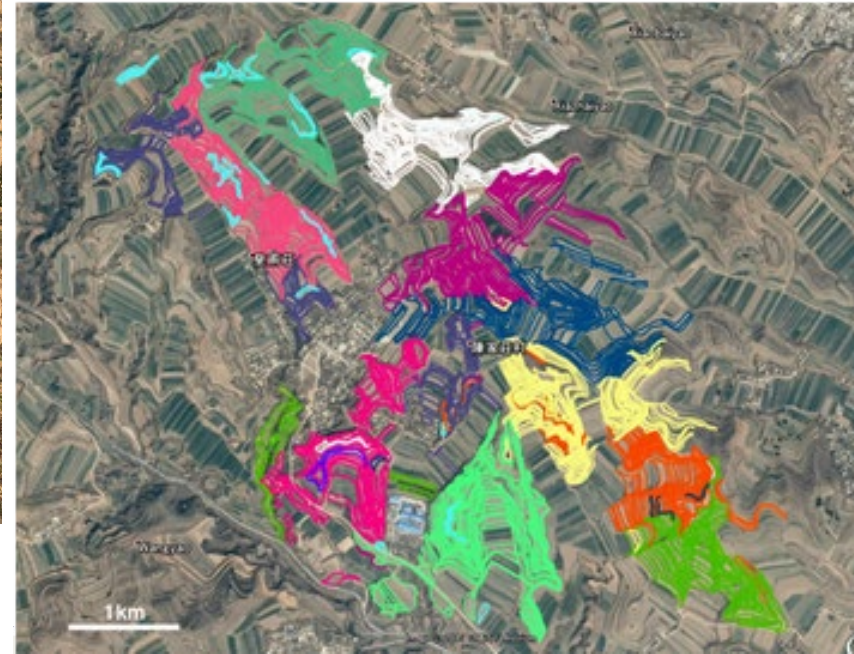
90,000 trees / All Female by Grafting / Seeds since 2017 15

Stable Supply of Biomass Materials

(Diversity Clone Farm)

Farm in China Loess Plateau (Rainfall 400mm/y)

Diversity with different harvest seasons
make stable supply

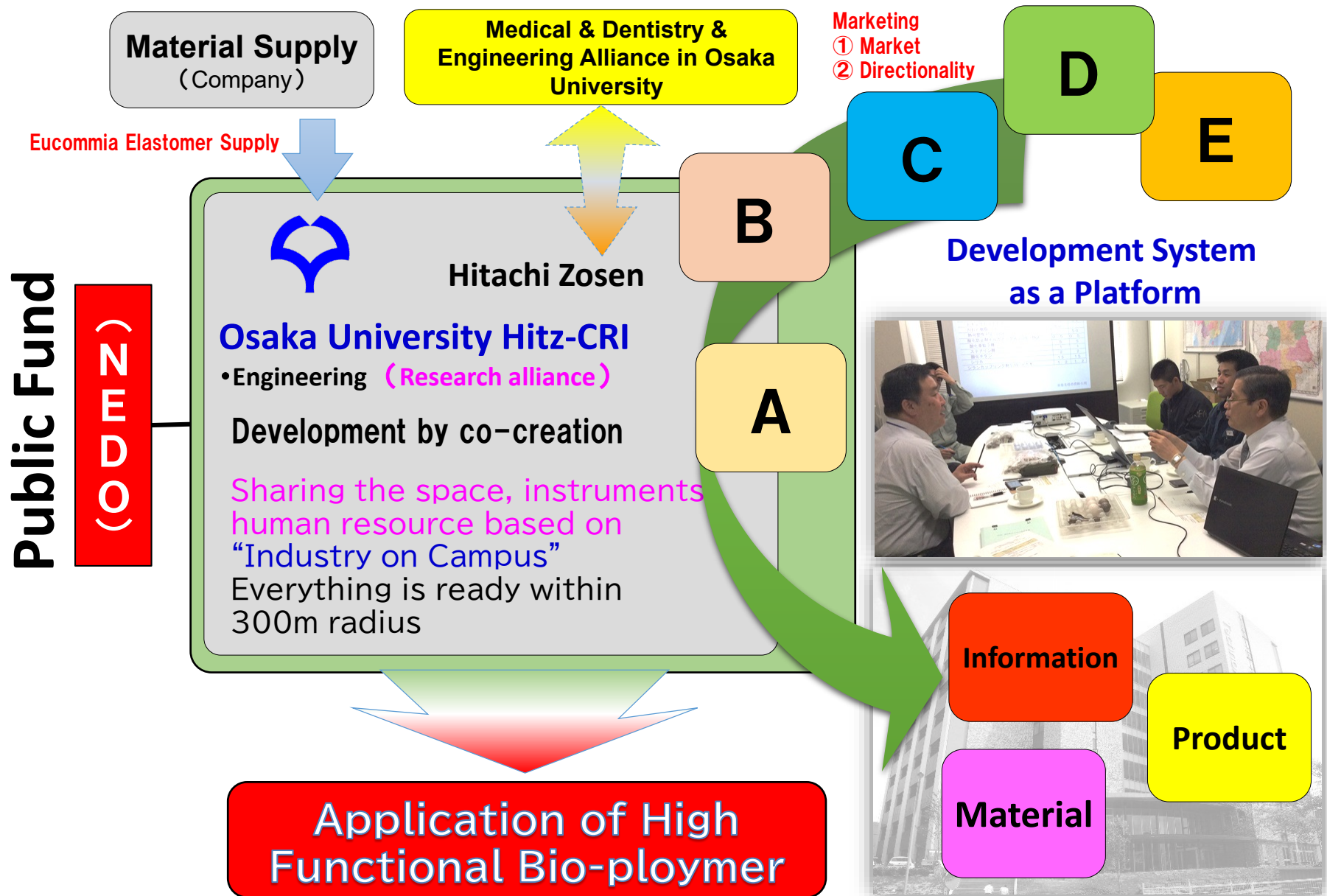


Develop New Process & Production Plant



Application Development by Research Alliances

Example: Official Funds → Hitachi Zosen/Hitz-CRI → Other Company (Subcontract)



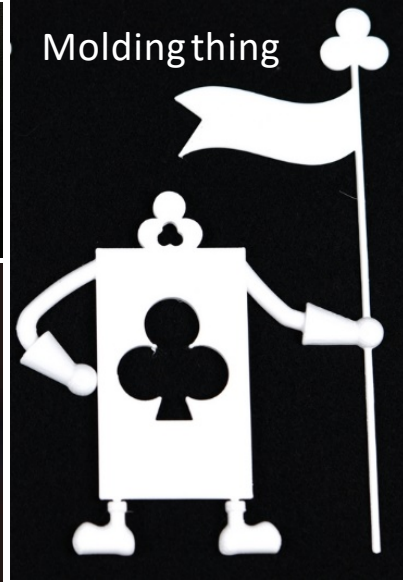
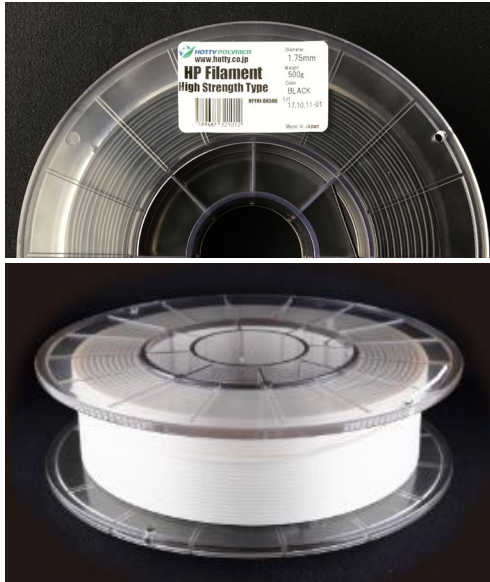
Application of Eucommia Elastomer



- ① Derives from Plant (Plant biomass)
- ② Hydrophobic soft polymer and Plant hydrocarbon material
- ③ Molecular weight one million, Narrow Molecule, Linear stereoregular structure
- ④ High impact resistant, Tensile properties
- ⑤ Low temperature thermo plasticity
- ⑥ Negative human patch test, No cytotoxicity, and Skin sensitization Allergen free, etc.-safety tested

Commercialization I (3D Printer Filament)

Available on Amazon japan.com, Since 2017.11



Most of the biopolymers are hard, the soft feature of Eucommia elastomers works well.

Sales three times higher than PLA filament in one month after release



<https://www.youtube.com/watch?v=IkciUPN9vOc>



Commercialization II (Golf Ball)



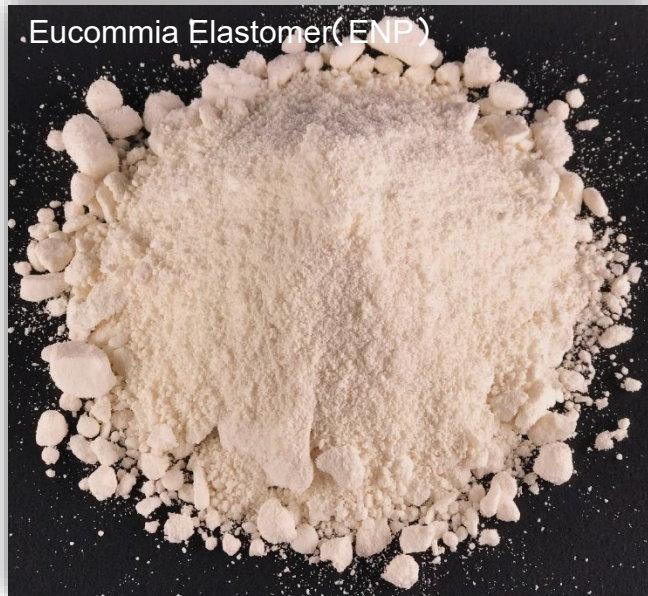
(Sale start, 2019.May)



- Structure 2core 1 cover 3 pc ball
- enjoy the stop after spinning
- Main target golfer HS30~40m/sec
- Price \$9.25/p
- First Shipment 20,000boxes
- Half dozen/box



Application of Cosmetic Material

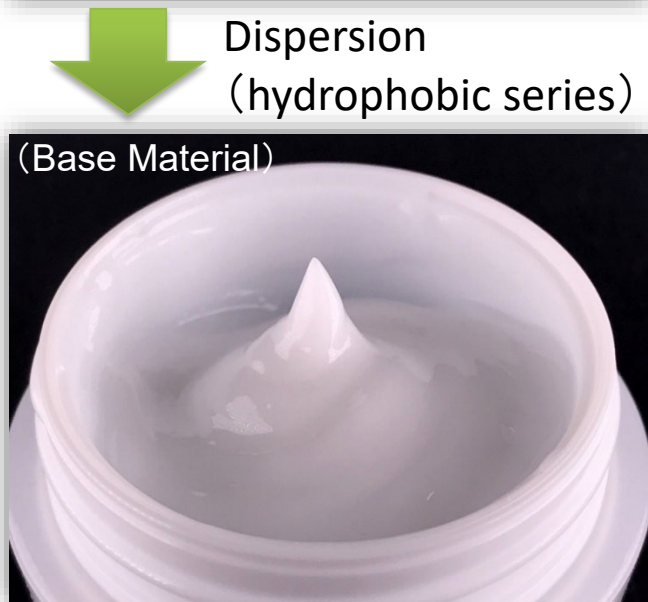


As a kind of polyisoprene derives from plants, Eucommia elastomer can be applied to hydrophobic cosmetic base material instead of petroleum hydrocarbon material.

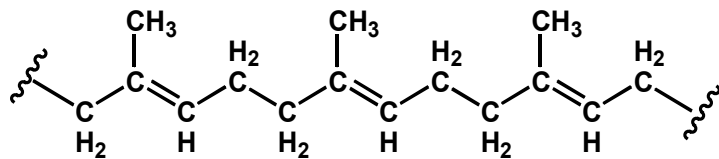
Hydrocarbons are roughly classified into chain hydrocarbons and cyclic hydrocarbons, sometimes it is also called mineral material because of synthesizing & purifying method from petroleum.

There are liquid paraffin, paraffin, vaseline, microcrystalline wax which represent hydrocarbons from petroleum.

Eucommia elastomer is not biodegradable and is gradually degraded by the involvement of light, oxygen, microorganisms and the like. It costs almost 1 year to be degraded naturally and doesn't cause micro plastic problem.



Adaptation to the Self-Care Field



Main Component : *trans*-1, 4 Polyisoprene

INCI: Eucommia ulmoides pericarp extract

Eucommia Elastomer



ENP is White powder.
It is disintegrated calmly in the natural world

S-ENP additive (cream)



Sample added to cosmetics (cream). recommended concentration is 1% or less.

Skincare

Face wash-Cleansing-Lotion-Moisturizer -
Milk liquid -Beauty liquid -Cream-Sunscreen
-Lotion, soap, Oil-Chemical peeling-pack etc.

Make up

Makeup- base Foundation- Concealer-
Mascara - Eyeshadow-Lipstick- Lip gloss- Lip
liner etc.

Hair care

Shampoo-Conditioner-Rinse in shampoo-
Treatment-Hair color-Hair conditioner-Hair oil-
Pomade-Hair tonic-Dyed hair-Wig.

Nail care

Manicure-Base coat-Top coat-Cuticle
remover-Cuticle oil-Nail art etc.

Replacement

Perfume-Cologne-Deodorant-Baby Powder-Lip
Balm-Soap-Vaseline-Plant Oil-Mineral Oil-Oil-
Beeswax-Wax-Wood Wax-Paraffin-

Complete Course of E. Elastomer Business Model

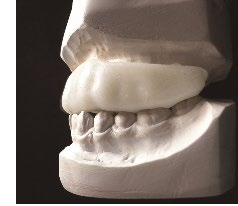
Farm(China•Shanxi•Henan) 200ha (90,000trees)



Farm management



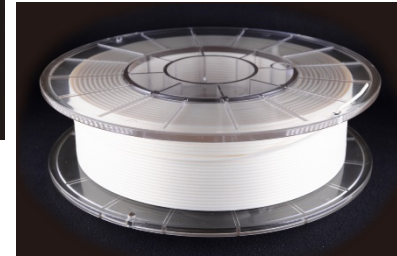
Sport material



Cosmetic material

Additive

Chemical material



Functional chemical material

Biomass of Stable supplyment



Hitachi Zosen Yangling Co.,Ltd (China)

Import & Export
(China to Japan)

Eucommia Plastic

Mass production plant
(Maizuru factory, Kyoto)



Hitachi Zosen (Japan)

Osaka University
Hitz-CRI



Eucommia Elastomer

7 Key Problems of SDGs Goal Involved in This Project

