

# One Method for Expanding TRIZ Application

- Applying TRIZ to Products that TRIZ can Hardly be Applied to -



**IDEA Inc. Senior Consultant Yoshiharu Isaka**

*The 10th Japan TRIZ Symposium 2014*

**株式会社** **IDEA**  
*Innovative Development of Engineering as our Ark*

# Purpose

# Position of presentation theme

Even if TRIZ is explained to a new company,

- (1) There are no subjects to be solved
- (2) There are only subjects solvable even without TRIZ

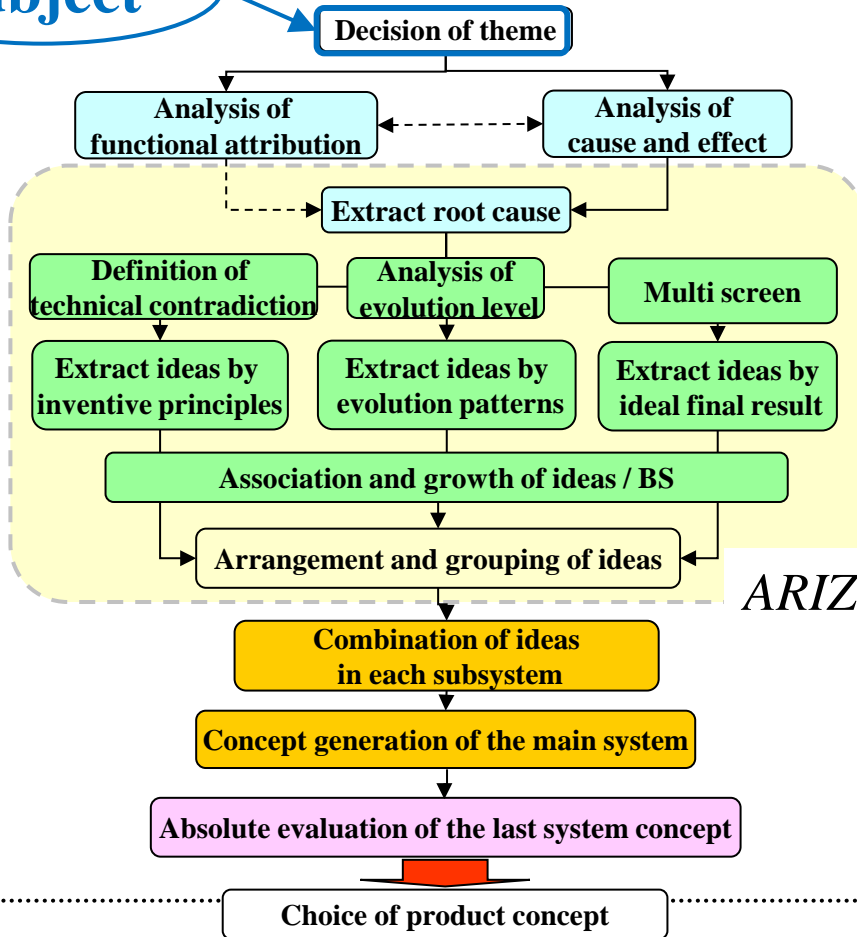
## Subject

The true nature of the problem  
Extract root cause

Dig up ideas by TRIZ

Enabling ideas (select and combine)

Absolute evaluation of the system



are the kinds of answers we get in some cases.

These cases mean “**TRIZ is unusable.**”

This situation prohibits TRIZ implementation even one thinks “applying TRIZ will contribute more to business management.”

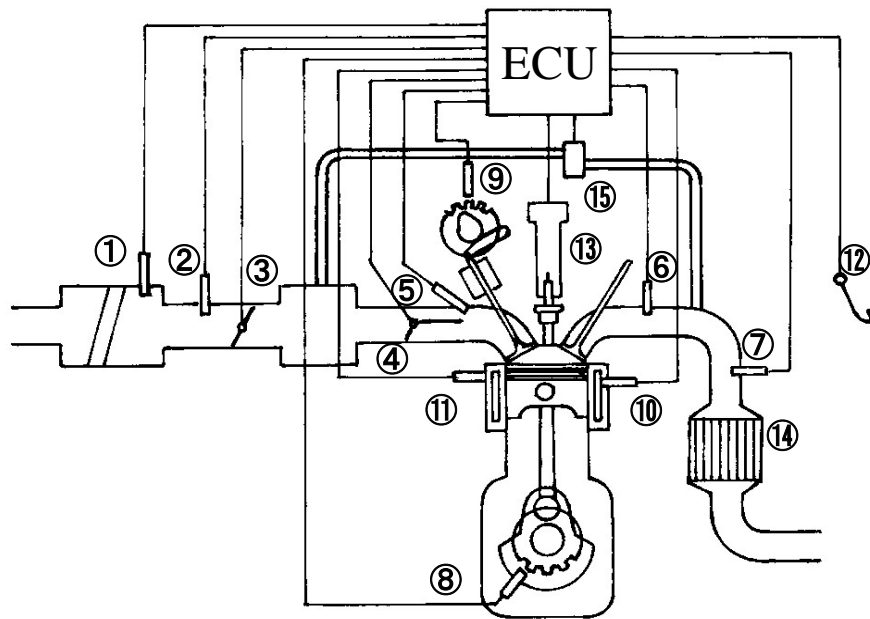
For implementation, the subject to be solved must be presented before implementing TRIZ.

Therefore, a methodology for theme setting will be proposed.

# There is evolution because requirements and problems exist

It is common knowledge in TRIZ that technology evolves following certain rules.

Evolution occurs to solve requirements and problems to functions.



- ① Intake air temperature sensor
- ② Air flow meter
- ③ Throttle opening position sensor
- ④ Intake air control valve
- ⑤ Fuel injector
- ⑥ Exhaust gas temperature sensor
- ⑦ O<sub>2</sub> sensor
- ⑧ Crank angle sensor
- ⑨ Cam position sensor
- ⑩ Coolant temperature sensor
- ⑪ Knock sensor
- ⑫ Throttle operating speed sensor
- ⑬ Igniter
- ⑭ Catalyzer
- ⑮ EGR valve

Remaining items: variable valve structure, less friction and light weight piston and crank , better efficient oil pump and others

【fuel consumption and emission countermeasures to automotive engine】

Even if “control adjustment” in technical evolution pattern has improved, it has basically not changed in the mechanistic point of hardware (a product configured by mechanical system only, which doesn't evolve without requirements)

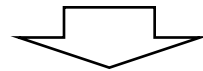
Target  
field -  
products

## Product or technology where TRIZ cannot be used?

There are some production and business goods for which the customer demand has not changed for a quite while.

In case, machinery products has none any revision since start production. Keeping same performance and function by original structure, cause to no difference products between competitors, and no differentiate technology elements

The product has same value (F/C) against competitor and no any attractive quality



The product keeps same structure because there is not any improvement by TRIZ

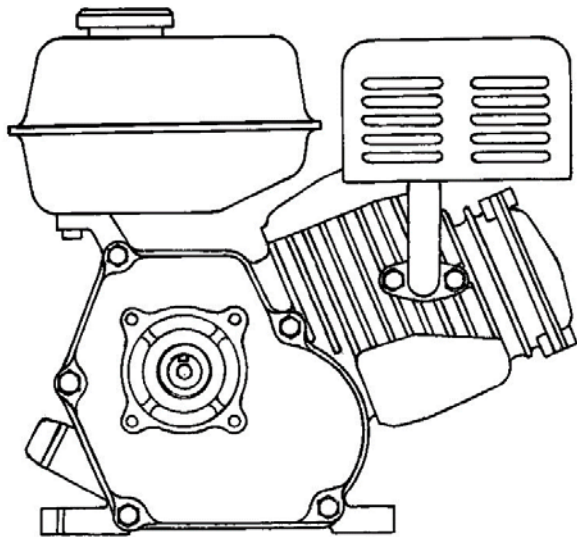
There is not any appeared problem according to customer's requirement

**< Because it is not necessary to use TRIZ, do not guess to operate TRIZ >**

However, the product may not be a selected product without differentiation

# The product does not have evolution cause to no customer requirement or problems claim

In case of multipurpose engine which use for power plant on working machine in agriculture and forestry



Requirement of power plant engine is at least turning shaft  
Same power plant engine is supplied several ten years because customer satisfied as it is

Domestic engine manufacturer produced 12,072,000 units of gasoline engine at domestic and foreign plants

Engine speed has been fixed, any engine structure is OHV system, any engine creates same horsepower. these situation means there is no any significant difference

- horsepower
- load responsibility
- fuel consumption • oil consumption
- consumable goods cost
- durability • reliability
- small size • light weight
- quietness • vibration less
- inspection interval
- maintainability
- easy handling
- exhaust gas cleanness

# At the OEM manufacturer's standing point, the engine is one of configuration parts

- multipurpose engine manufacture's important business point is , if engine is chosen by working machine manufacturer as much as possible , many ordered engines make mass production and lower price also become competitive products
- however, according to working machine manufacturer's standing point, engine unit is only power plant for working machine and no any difference with other engines. because company chooses lower price engine from same horse power, Other than horse power such a functions which are common as well

## Applied sample of multipurpose engine



cultivator



generator



Water pump



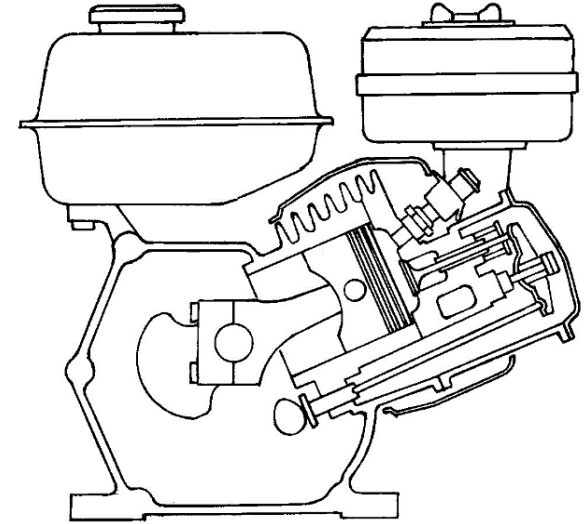
lawnmower



transporter

# 【Question】 How to make discrimination

- Working machine manufacturer's requirement on multipurpose engine is just horse power, price has been decided by horse power amount
- Basic engine structure is almost same dimensions and horse power, also displacement, size and weight are not much difference



Value ( divide Function by Cost ) comparison is very close each other, products does not have any attractive quality requirements ( commodity products)

How to make engine discrimination by multipurpose engine manufacture, this situation for certain choice on Working machine manufacturer



# Supposition at products planning conference of engine

Discussion in products planning , the subject is almost same characters between all competitors



planning staff

The latest new engine should be satisfied by working machine manufacturer's requirement



engineering staff

Working machine manufacturer's first priority is the price. Horse power is only for comparison

It is difficult to discriminate with pricewise  
Therefore, it is needed to prepare newly requirements

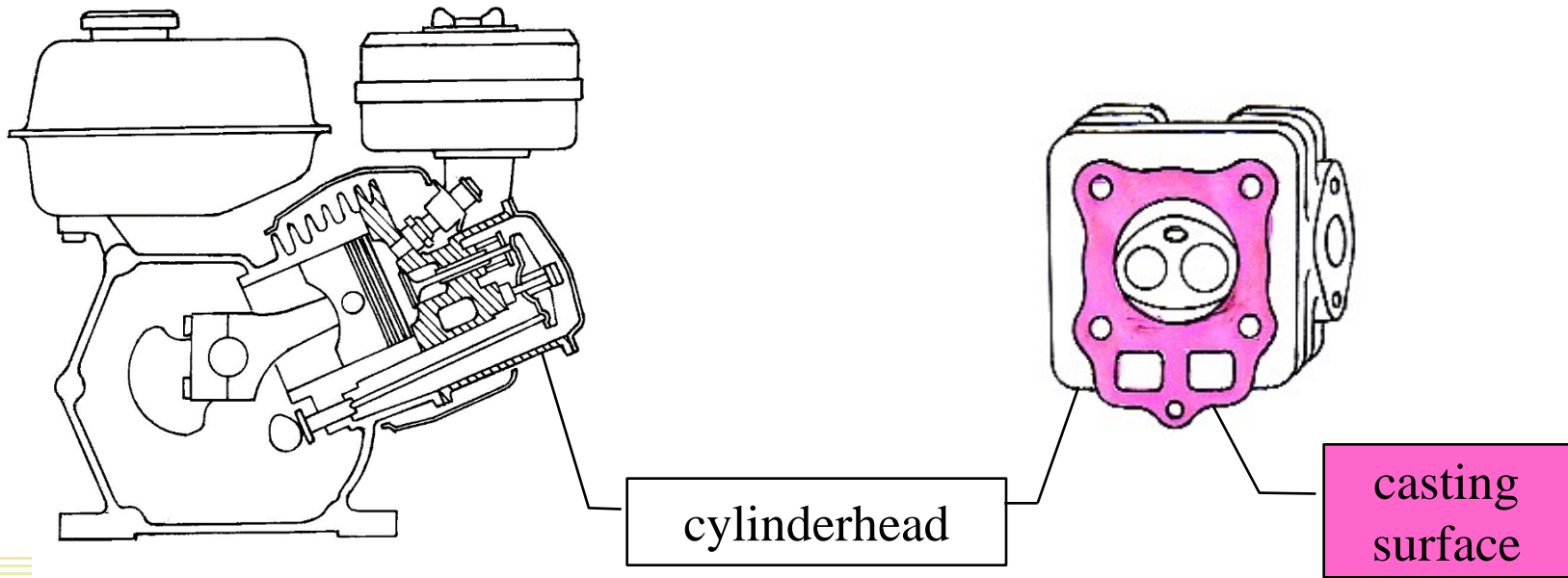
Any other competitors use same structure design , crank mechanism and OHV movement mechanism also same  
Cost down analysis has been done , there is no any quality requirement

However , we cannot sale engine that is same as competitor

Is there none of exclusive design ?



# The engine of leading company



- Mating surface of cylinder head against cylinder where is casting surface but no-machining
- If this situation for cost down as no-machining , but die-mold life become shorter , not exactly reduce cost for business
- Well , what is the purpose to adopt casting surface

# Supposition at products planning conference of engine selection

Engineering staff of engine manufacture how he can explain to working machine manufacturer's staff as satisfied



engineering  
staff of engine  
manufacture

Any engine manufacture has almost same  
function and cost on engine

Do not compare engines with only external  
function and cost , look carefully about  
technical differences

Engineering ability what is difference  
between competitors

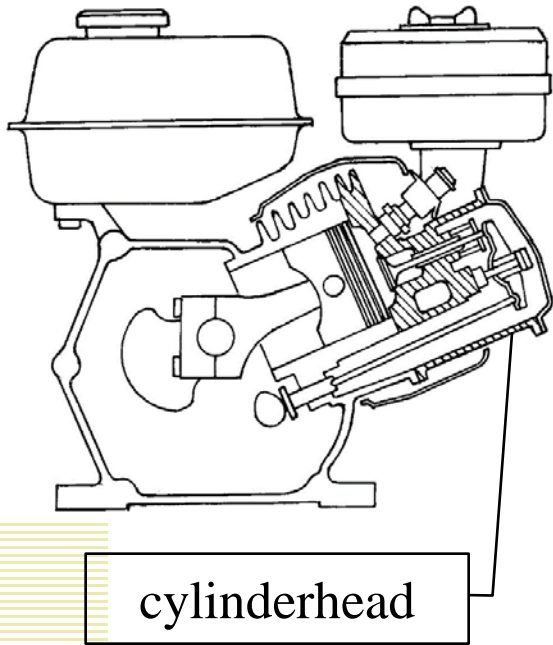
Our product has superior techniques what is  
leading competitors. It shows highly  
engineering difference

None other competitor can operate  
engineering techniques



engine  
select staff

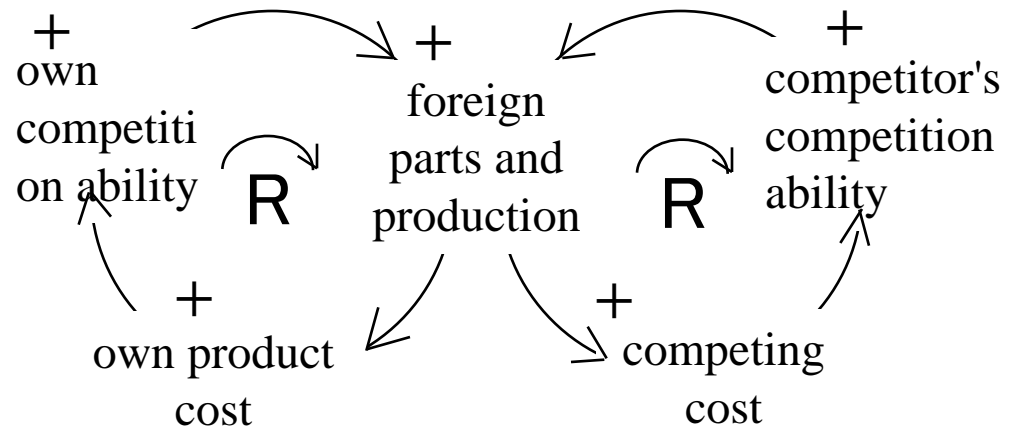
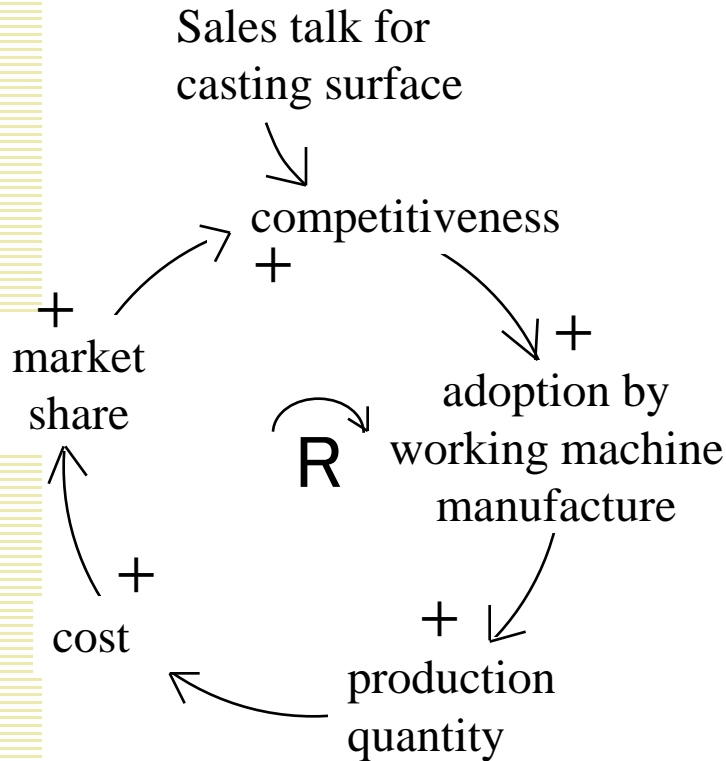
# Vender convince to buyer with good sales talk



Most machining manufacture machines cylinder head mating surface. Without machining the mating surface as casting surface what is only our company. It means internal engineering and quality control as higher engineering level. We assure to buyer what choose our products. That is good sales talk.

- for the responsible person of engine selection as target customer can satisfy , and also possible to explain in own office , new competitive selection axis without function or cost that is " mating surface by casting surface "
- The view point mere cost down which cannot be discrimination.

# Circulate chart of causation in business competition



Circulate chart for success by trigger with sales talk

Current circulate chart as pricing competition

Leading company was not leading since beginning

# Importance is before TRIZ

- The products on leading company will be sold as expectation. Products on leading company has competition ability and some difference between others( Idea of casting surface which cannot contemplate from current quality requirement or value enrichment )
- if does not conscious newly competition axis , work hard with small amount of cost down , continue current process such as adopt import parts which procedure does not contribute effective competition
- Newly BNE theme can be used TRIZ such subjects are "machining less mating surface to be sealed against combustion pressure" and "extend die mold life at mating surface"

Simple structural machines are usually on stagnant technical evolution TRIZ action for these products , pre-stage of TRIZ practice consider sales talk relate to product enrichment what is important



# Develop products which to be sold

Latent needs to be grasped target customer



planning  
staff

Any manufacturer's products have same structure.  
They are no difference with function and cost.  
Sales section should work hard for sale



engineering  
staff

Produce good product which does not relate  
to good sales. but, good sold product is good  
product. It is important to develop and  
produce for good sale

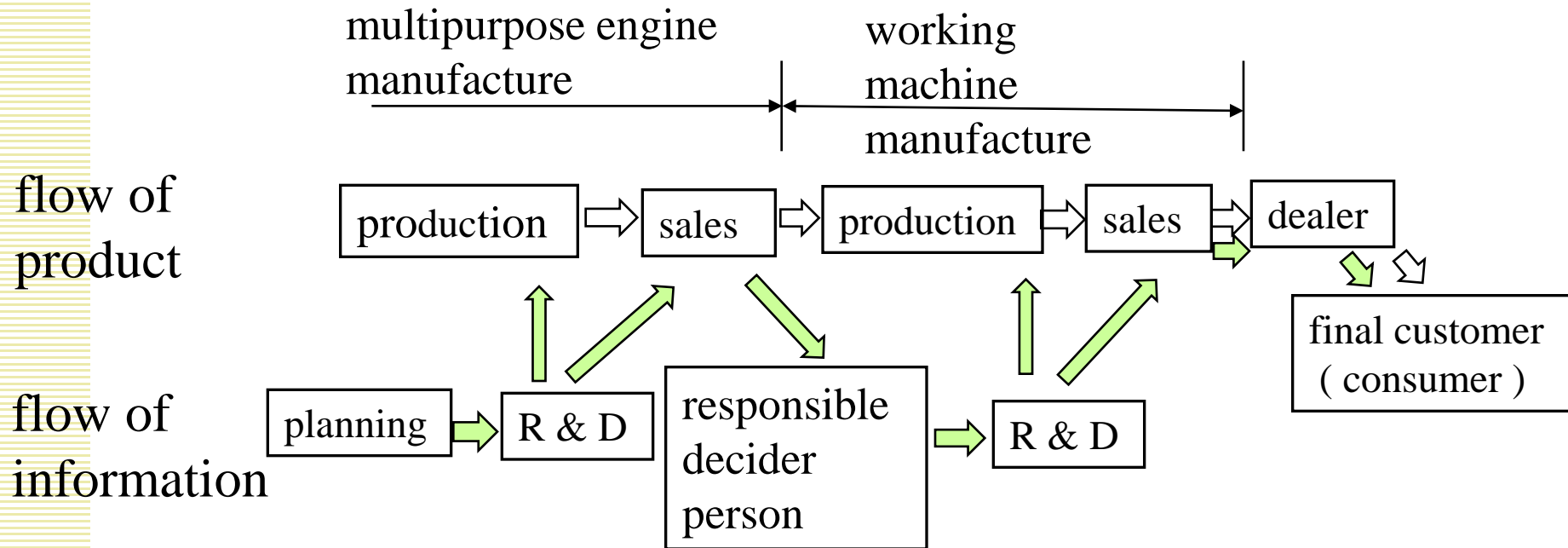
Extract quality requirement which does not  
help for new subjects. Reduce cost subject is  
also face to dead lock

Who is the customer.  
What is the customer required.

People operating product who is the real  
customer. Ask requirement why now ?

# From the beginning , what the target customer

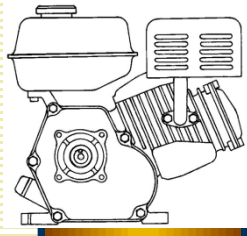
## Next process , customer ?



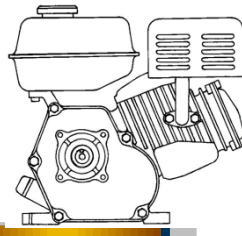
At the engine manufacture's R&D section , planning to correspond many usage for the consumer to satisfy.  
but , OEM customer is working machine manufacture's responsible decider person

# Necessity , it is target customer's agreement

competitor's  
product



own  
product



- How to get agreement from target customer as responsible decider person
- It is needed the point of view , other than current physical function's enrichment



planning  
staff

General point of view , if there is no difference between products then responsible decider person is in trouble. let him to have self-confidence for the explanation to own company



engineering  
staff

Other than function and cost , somehow make the discrimination other point of view , think about technique which competitor has not done yet





# Now , how to operate ?

in the past , introduced many conception method. which maybe easier to extract improved idea for products. so , try it to improve subject.

## Concept mining

Think about customer's satisfaction what the latency needs without saying

## Fault listing method

That remind I maybe improve it , the point of view about looking for fault then might be found newly ideas

## Opposite setting method

think about reasonable situation , dare contradict proper subject that contradict venturous , it may create new conception by other than current point of view

## Focusing method

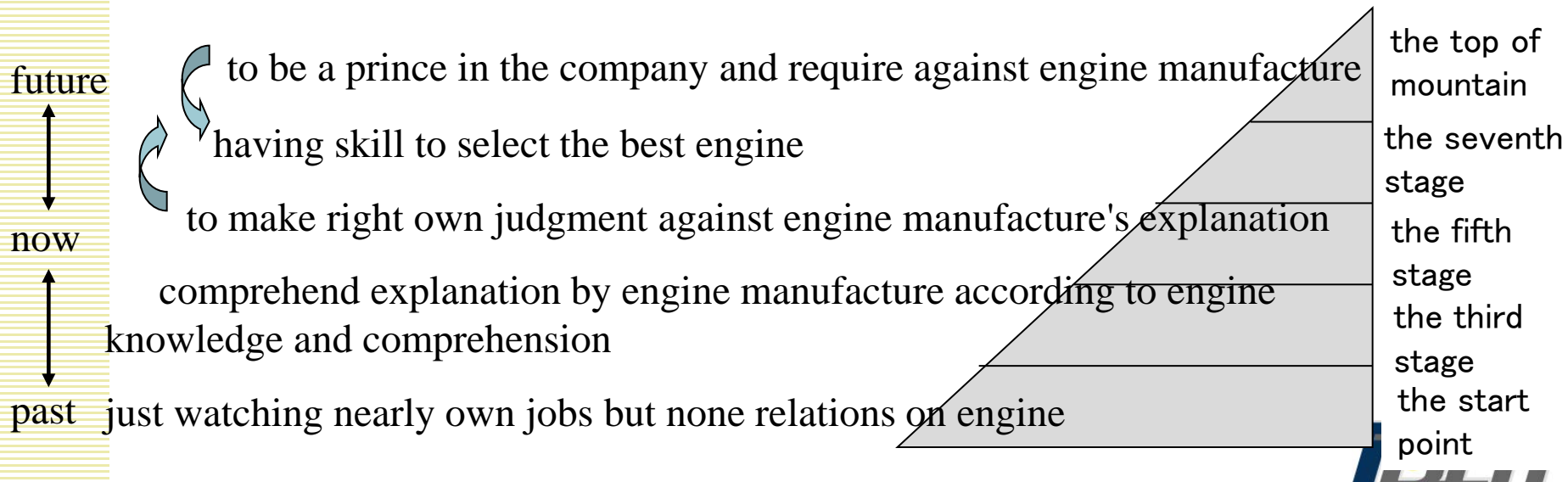
element or character at the none related new field , forcibly connect to the subject then reach to new conception



# Hypothesize concept mining and mountaineering chart

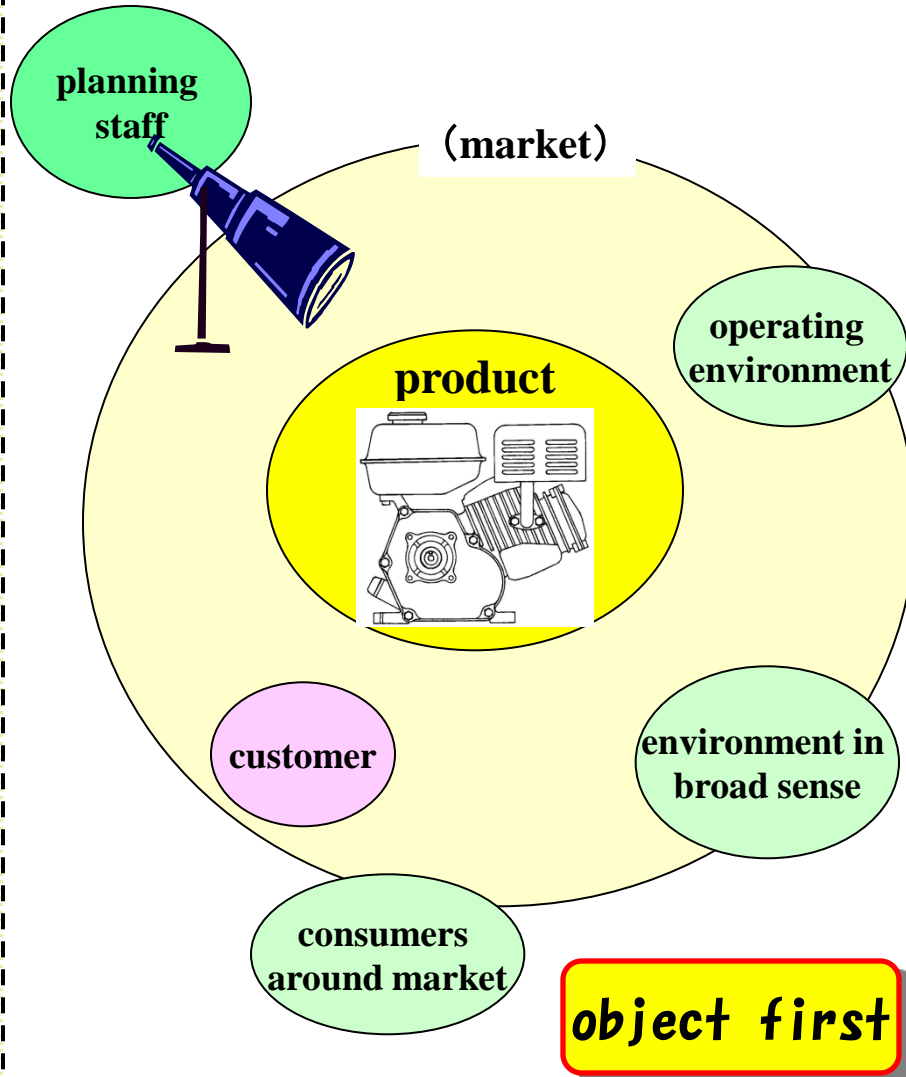
Everyone has desire as I want to be so on. But for now , move on one step instead of high jump toward summit of desire. When consumer purchase product who choose for one's desire of self satisfaction but function of product.

## Self satisfaction of mountaineering chart for engine select staff

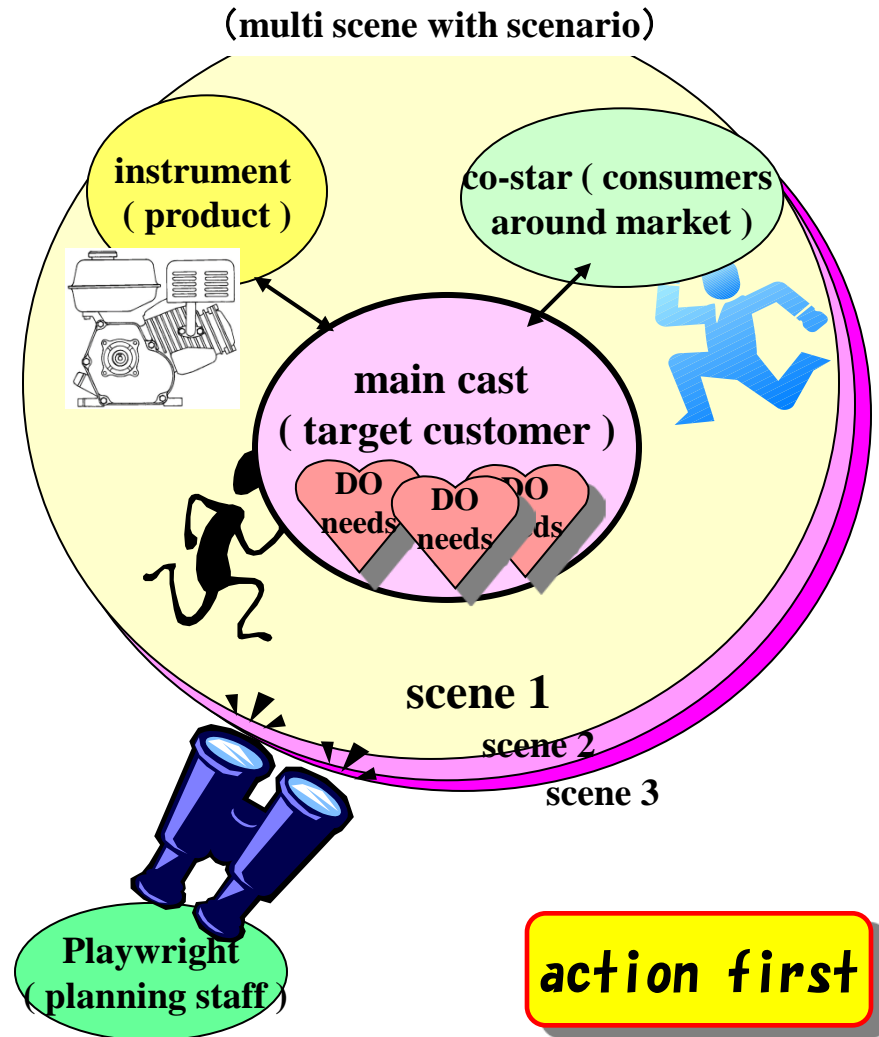


# from "core of object" to "core of action"

## <current sample of product planning>



## <newly proposal>



# value setting by customer's request

hypothesis : customer wants to be ○○ that customer desire the scenario



extract as quality requirement convert to substitution character describe the needs specifically and expand



## key needs method

consumer's value of substitution character

engine select staff  
 want to be admitted on the job  
 ↓  
 want to convince in office  
 ↓  
 want to select the best much engine  
 ↓  
 somehow , want to find out factor of discrimination

<p><b>roots needs</b></p> <p>condition · existence needs</p>	<p>wealthy(wealthy mind life)                  respect(want to be respect)                  progress (progress one's self)                  affection (want to be loved)                  Health (keep healthy)</p> <p>personality(to be own personality)                  pleasure (live enjoy)                  emotion (heart thrill)                  cross mind (in friendship)                  comfortable (live comfortable)</p>
<p><b>personal needs</b></p> <p>action needs</p>	<p>purpose and measure join as chain for getting roots needs</p>
<p><b>have needs</b></p> <p>own · purchase needs</p>	<p>purpose and measure relates for getting personal needs</p>

# extract ideas from fault listing method

parts	fault	improving idea	sales talk	cost
cylinder head	too many number of cooling fins	eliminate fins at rocker arm moving space	should not only simply reduce fins	
	cooling fins locate only side surface	add fins on lengthways	if develop smaller and lighter	?
	rocker arm moving space is wider	long term subjects as springs , ports and so on	if develop smaller , lighter and other design	?
	intake and exhaust port passage bend right angle	insert insulator in intake passage	if obviously increase horse power	×
	exhaust pipe is needed due to exhaust outlet locate side way	change direction to upward	but cannot get cost effect	

# extract ideas from opposite setting method

parts	hypothesis	opposite setting	problem	idea for solution	sales talk	cost
cylinder head	locate cooling fins	none cooling fins or less fins	happen seize or deform	make shorter fin and thicker fin	if able to make downsizing	○
	locate intake and exhaust port	none port passages	cannot pass gas flow	extend exhaust pipe and insulator	×	
	fasten bolt on cylinder	remove all fasten bolts or reduce bolts	cannot seal	liquid sealant	×	
	intake and exhaust port has constant diameter	vary sectional area	unknown mechanism	not available this moment	if improve fuel consumption	?
	made by aluminum die casting	other than aluminum other than die casting	cooling , weight , strength	sheet metal , plastic and etc. long term subject	?	



# extract ideas from focusing method

parts	convenience store's character ▪ factor	utilize character	improved idea	sales talk	cost
cylinder head	bright lighting	good viewing	widen air ventilation	×	
	single floor construction	lower roof	wedge shape combustion chamber	if it is able to increase power	○
	seems same drawing layout	shape , layout	port passage sectional area	if it is able to increase power	○
	locate on busy street	many stores	add oil cooling system and reduce fins	if it is able to downsize	×
	many products turn	changing	thin wall thickness of rocker arm space	×	
	part time workers in store	concurrent job	unify push rod case and rocker arm cover	×	

# evaluate as sales talk

## competition influence / effect evaluation

- " can't be / never thought " realized idea — ◎
- " can't think why it's done " adopted idea — ○
- " eyes be opened such procedure " adopted idea — △

## Goldfire Innovator™ evolution pattern to the evaluation

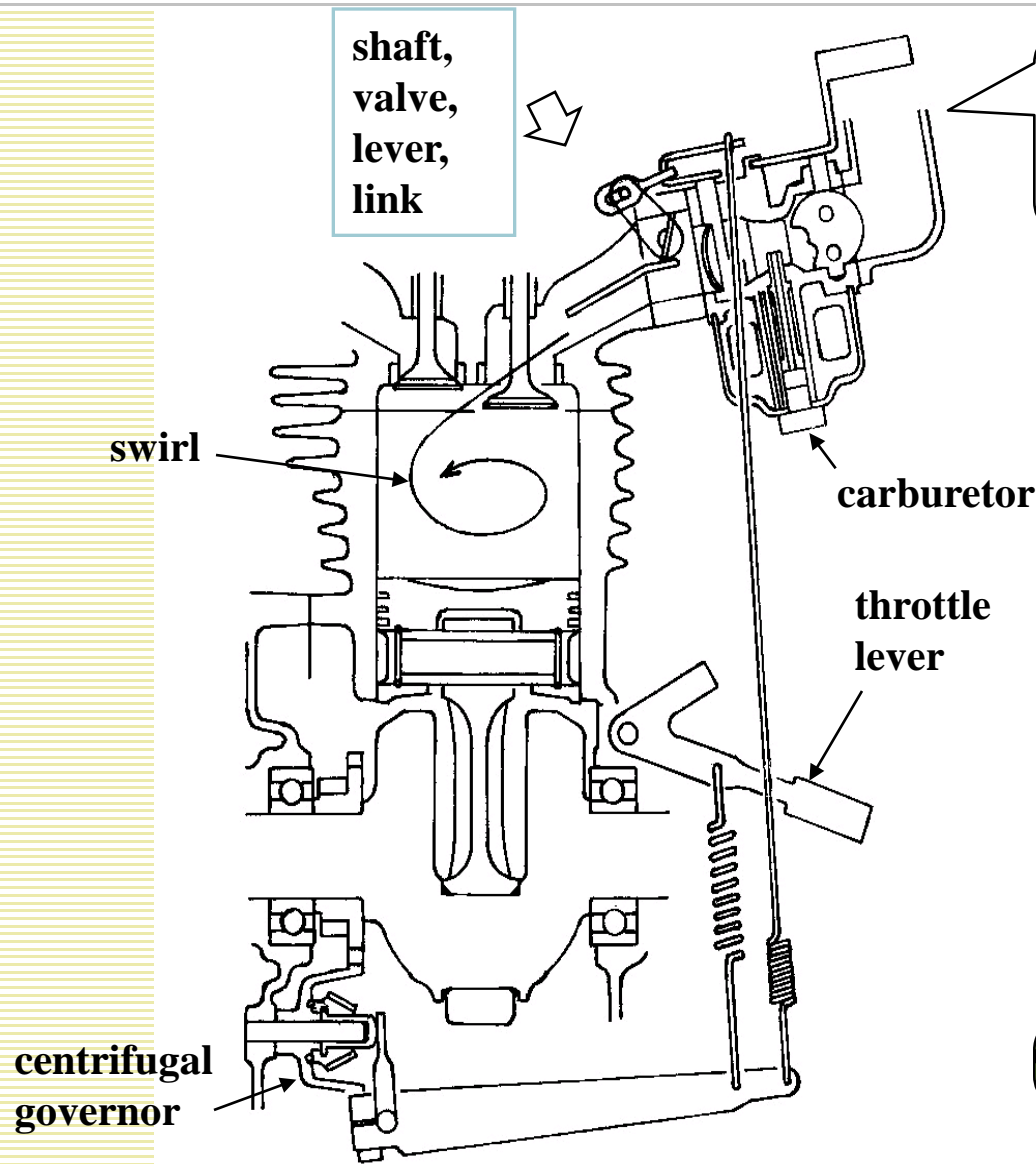
- ① new substance innovation
- ② improved substance innovation
- }
- ⑱ trimming

19 evolution pattern applicability  
( precedent engineering possibility )

idea for sales talk	effect	evolution pattern
shorten / reduce cooling fins	○	⑱ trimming
wedge shape combustion chamber	△	—
variable intake port sectional area	◎	⑪ variability adjustment
port passage sectional area	△	—
reference ) Mating surface of cylinder head against cylinder where is casting surface	○	—



# materialize variable intake passage area's idea



specifically , set up passage partition by unified insulator, valve locate one side and link to throttle

expecting effect  
at partial load area , intake air flow from one side of air passage occur swirl in cylinder , combustion efficiency improve , mixture gas can lean burn becomes improved fuel consumption

presumed problem

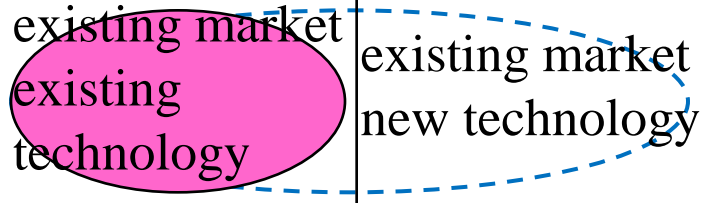
- wavy change intake air amount in every cycle , overtly appear wavy torque amount
- wavy turning engine speed in closed port start opening zone

it is solvable by  
TRIZ

# able to lead in market with existing technology

**conclusion**

new market	new market existing technology	new market new technology
existing market	existing market existing technology	existing market new technology
	existing technology	new technology



extract ideas from SFR method and similar conception method

explained cases at multipurpose engine take warning from those examples for the many kinds of machinery system products

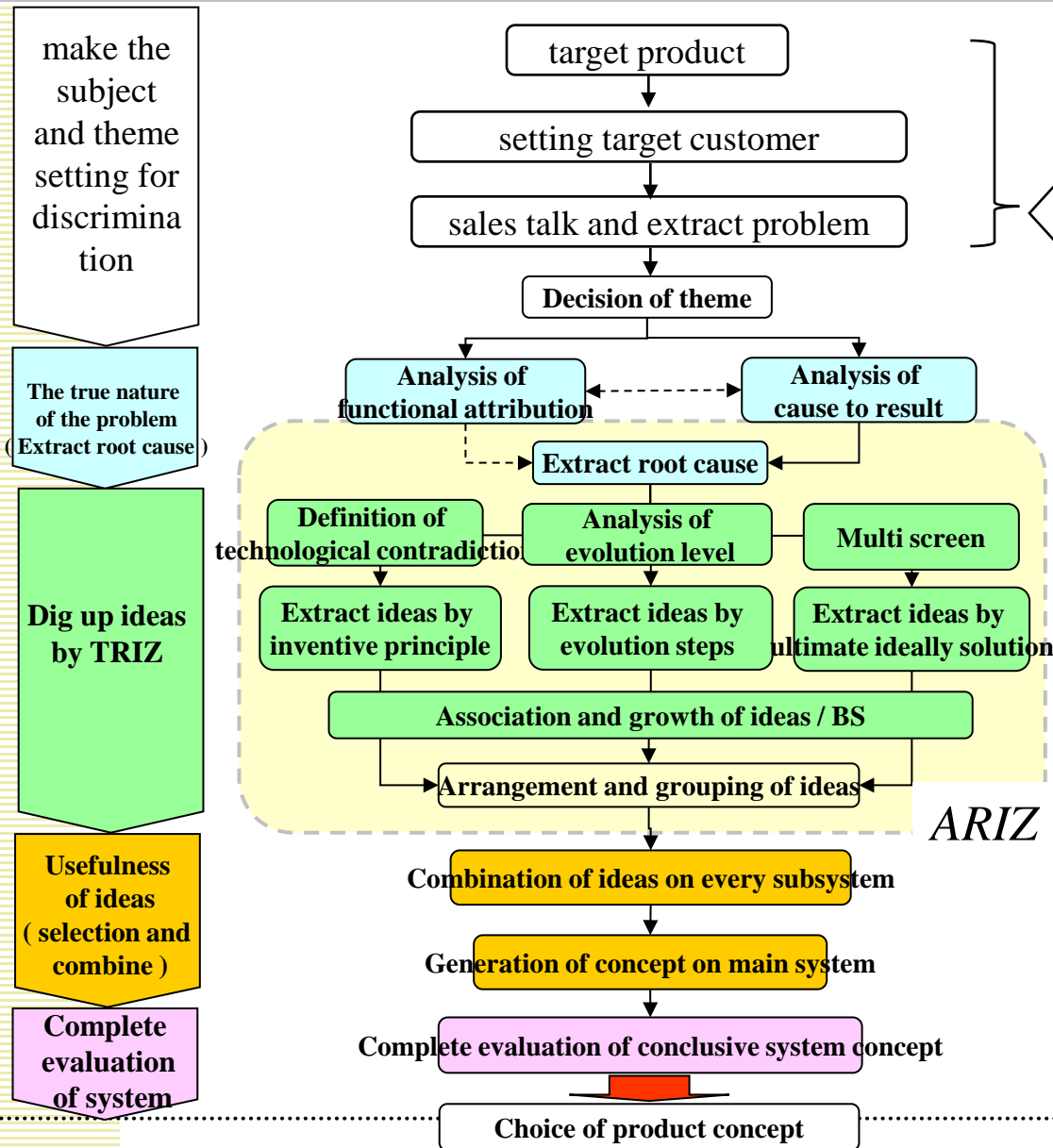
- the product on existing technology field which is not current design and unchanged product
- has not noticed until now , add new value then get strong competitive power

right then , how to add new value

- against conservative sense of value , easy to think about newly sales talk function by conception method to break down as parts area
- in many cases , discrimination by existing technology appeared idea even it's new technology on own company. it is not the first technology in the world that TRIZ can make solution



# propose pre-transaction of TRIZ



there is none technical evolution for pre-TRIZ “equalized products” create discrimination in sales talk for appeal TRIZ is waiting in next step, fix effective discrimination

for winning in technology also business, “standing point in contribute business management” it becomes to theme decision (TRIZ is useful for business)

# the end

## thanks for listening

none any subjects are operated with TRIZ  
none any products are operated with TRIZ  
emerge from sterile competition on function and cost ,  
make favorable competition on other stage

**create future with TRIZ**

