One Method for Expanding TRIZ Application

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

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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
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.

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)
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.

- **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**

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.
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
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

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

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

- 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
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

Sales talk for casting surface

+ competitiveness
  + adoption by working machine manufacture
  + production quantity
  + cost
  + market share

Leading company was not leading since beginning

Circulate chart for success by trigger with sales talk

Current circulate chart as pricing competition

R

+ own competition ability
  + foreign parts and production
  + competitor's competition ability
  + own product cost
  + competing cost
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

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

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 is the target customer?

Next process, customer?

At the engine manufacturer's R&D section, planning to correspond many usage for the consumer to satisfy. But, OEM customer is working machine manufacturer's responsible decider person.
Necessity, it is target customer's agreement

- 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

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.

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

- future: to be a prince in the company and require against engine manufacture
- now: having skill to select the best engine
- past: just watching nearly own jobs but none relations on engine
- comprehend explanation by engine manufacture according to engine knowledge and comprehension
- to make right own judgment against engine manufacture's explanation

The top of mountain: the start point
The fifth stage
The third stage
The seventh stage
from "core of object" to "core of action"

<current sample of product planning>

- planning staff
- (market)
- product
- operating environment
- customer
- environment in broad sense
- consumers around market
- object first

<newly proposal>

- (multi scene with scenario)
- main cast (target customer)
- DO needs
- DO needs
- DO needs
- scene 1
- scene 2
- scene 3
- instrument (product)
- co-star (consumers around market)
- Playwright (planning staff)
- action first
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

consumer's value of substitution character

key needs method

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

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
extract ideas from fault listing method

<table>
<thead>
<tr>
<th>parts</th>
<th>fault</th>
<th>improving idea</th>
<th>sales talk</th>
<th>cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>cylinder head</td>
<td>too many number of cooling fins</td>
<td>eliminate fins at rocker arm moving space</td>
<td>should not only simply reduce fins</td>
<td></td>
</tr>
<tr>
<td></td>
<td>cooling fins locate only side surface</td>
<td>add fins on lengthways</td>
<td>if develop smaller and lighter</td>
<td>?</td>
</tr>
<tr>
<td></td>
<td>rocker arm moving space is wider</td>
<td>long term subjects as springs, ports and so on</td>
<td>if develop smaller, lighter and other design</td>
<td>?</td>
</tr>
<tr>
<td></td>
<td>intake and exhaust port passage bend right angle</td>
<td>insert insulator in intake passage</td>
<td>if obviously increase horse power</td>
<td>×</td>
</tr>
<tr>
<td></td>
<td>exhaust pipe is needed due to exhaust outlet locate side way</td>
<td>change direction to upward</td>
<td>but cannot get cost effect</td>
<td></td>
</tr>
<tr>
<td>parts</td>
<td>hypothesis</td>
<td>opposite setting</td>
<td>problem</td>
<td>idea for solution</td>
</tr>
<tr>
<td>---------------------------</td>
<td>-------------------------------------------------</td>
<td>-------------------------------------------------------</td>
<td>--------------------------------------------------</td>
<td>----------------------------------------</td>
</tr>
<tr>
<td>cylinder head</td>
<td>locate cooling fins</td>
<td>none cooling fins or less fins</td>
<td>happen seize or deform</td>
<td>make shorter fin and thicker fin</td>
</tr>
<tr>
<td></td>
<td>locate intake and exhaust port</td>
<td>none port passages</td>
<td>cannot pass gas flow</td>
<td>extend exhaust pipe and insulator</td>
</tr>
<tr>
<td></td>
<td>fasten bolt on cylinder</td>
<td>remove all fasten bolts or reduce bolts</td>
<td>cannot seal</td>
<td>liquid sealant</td>
</tr>
<tr>
<td></td>
<td>intake and exhaust port has constant diameter</td>
<td>vary sectional area</td>
<td>unknown mechanism</td>
<td>not available this moment</td>
</tr>
<tr>
<td></td>
<td>made by aluminum die casting</td>
<td>other than aluminum other than die casting</td>
<td>cooling , weight , strength</td>
<td>sheet metal , plastic and etc. long term subject</td>
</tr>
</tbody>
</table>
extract ideas from focusing method

<table>
<thead>
<tr>
<th>parts</th>
<th>convenience store's character • factor</th>
<th>utilize character</th>
<th>improved idea</th>
<th>sales talk</th>
<th>cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>bright lighting</td>
<td>good viewing</td>
<td>widen air ventilation</td>
<td>×</td>
<td></td>
<td></td>
</tr>
<tr>
<td>single floor construction</td>
<td>lower roof</td>
<td>wedge shape combustion chamber</td>
<td>if it is able to increase power</td>
<td>○</td>
<td></td>
</tr>
<tr>
<td>seems same drawing layout</td>
<td>shape, layout</td>
<td>port passage sectional area</td>
<td>if it is able to increase power</td>
<td>○</td>
<td></td>
</tr>
<tr>
<td>locate on busy street</td>
<td>many stores</td>
<td>add oil cooling system and reduce fins</td>
<td>if it is able to downsize</td>
<td>×</td>
<td></td>
</tr>
<tr>
<td>many products turn</td>
<td>changing</td>
<td>thin wall thickness of rocker arm space</td>
<td>×</td>
<td></td>
<td></td>
</tr>
<tr>
<td>part time workers in store</td>
<td>concurrent job</td>
<td>unify push rod case and rocker arm cover</td>
<td>×</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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
⑯ trimming

19 evolution pattern applicability
( precedent engineering possibility )

<table>
<thead>
<tr>
<th>idea for sales talk</th>
<th>effect</th>
<th>evolution pattern</th>
</tr>
</thead>
<tbody>
<tr>
<td>shorten / reduce cooling fins</td>
<td>○</td>
<td>⑯ trimming</td>
</tr>
<tr>
<td>wedge shape combustion chamber</td>
<td>△</td>
<td>—</td>
</tr>
<tr>
<td>variable intake port sectional area</td>
<td>⊗</td>
<td>⑪ variability adjustment</td>
</tr>
<tr>
<td>port passage sectional area</td>
<td>△</td>
<td>—</td>
</tr>
<tr>
<td>reference ) Mating surface of cylinder head against cylinder where is casting surface</td>
<td>○</td>
<td>—</td>
</tr>
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</table>
materialize variable intake passage area's idea

- 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

<table>
<thead>
<tr>
<th>new market</th>
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<tbody>
<tr>
<td>existing technology</td>
<td>new technology</td>
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<tr>
<td>new technology</td>
<td>new technology</td>
</tr>
</tbody>
</table>

- 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

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
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