Transactional TRIZ, Theory, Application, and Execution, Part III: The Full System

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This series of articles will make the case for a version of TRIZ that applies for transactional, service or business applications. The first article addressed the relationship between intelligent problem analysis, creativity and components of creative problem solving. This analysis is appropriate for all philosophies of TRIZ. The second article presented a case for a Transactional TRIZ matrix.

However, beyond philosophy, many non-manufacturing people often have a difficult time with the nomenclature associated with manufacturing techniques. And with that, they believe the tools and examples are not relevant to their workplace. The author has found this true in both Six Sigma and Lean training events. But when the material is changed ever so slightly to be put in terms of the business environment in which they serve, the users are quite adept at utilizing the same tools and examples with which they formerly had issues.

And the third article will offer a relatively cosmetic modification of ARIZ to convert the language to be more accessible to people who solve transactional problems. Along with the modification, a comparison of theoretical creative concepts (Five faces of Genius) and applied directional protocol will show that the Altshuller approach is sound in theory as well as in practice.

The Five Faces of Genius

Moser-Wellman, in her book, The Five Faces of Genius, lays out a case for the theoretical approach to solving problems. She describes her five approaches like this:

1.) Seers visualize the future: They create a 'Why not' scenario
Three Characteristics mark them:
- a.) Pay attention to images in mind's eye
- b.) Allow themselves to visualize in great detail
- c.) Manipulate images to discover great ideas

Similar to TRIZ Ideal Final Result (IFR)

Keys: Image future; mission maker; visualize unmet needs; see stepping stones

2.) Observers see the present
Four characteristics they demonstrate:
- a.) In awe of World around them
- b.) Notice & cherish detail
- c.) Driven by curiosity
- d.) Use beauty as inspiration

Similar to process mapping; five whys; Lean maps

Keys: Always wonder why; Pay attention to whispers; Connect the detail dots; Appreciate beauty in work

3.) Alchemists Cross-functional leverage; see similarities in divergent processes
Three characteristics found in them:
- a.) Borrow ideas
- b.) Broad range of interests drive ideas
- c.) Find insight in connections

Similar to team approaches; Benchmarking; some TRIZ techniques

Keys: Study other industries; Stitch together work & play; Find inspiration in conversation; Use analogies as bridges to ideas

4.) Fools Harvesting chance; ask 'What happened here'
Three characteristics for them:

a.) Excel at inversion
b.) Use absurdity to break through
C.) Unending perseverance

Similar to hypothesis tests; control charts; FMEA; Defect detection & identification; TRIZ supra & subsystem analysis

Keys: Invert conventional wisdom; explore absurd solutions; Don't give up too soon; Explore weakness & redeem failure

5.) Sages Reduce problems to essence
Two Characteristics are used:

a.) Use simplicity as path to ideas
b.) Access history for inspiration

Similar to CTQs (Critical to Quality) from VOC (Voice of the Customer); Lean; Hoshin; MBF (Management by Fact); Project Management; TRIZ inherent contradictions; Goldratt's Theory of Constraints

Keys: Focus like a laser on core issues; Strip away the unessentials; look forward-look back; Identify & spread stories of positive change

What the Five Faces do is to serve as a method of breaking down the inertia of previous thought. In doing so, there will come an opening for creative solutions to find a path. It has been the author's observation that most everyone will normally use at least two of the five faces as a matter of course in their problem solving, but almost no one uses all five. As a result, any methodology that forces the problem solver to use all five approaches will be effective. In a later section, an ARIZ (61, for this example) will be translated over to transactional terminology and an interpretation of which of the Five Faces is being called into play will be annotated.

Levels of Innovation

Altshuller in his book, The Innovation Algorithm, pointed out that some innovations can be made at a simple level, but more work is needed as the innovation requirement is more complex. For this reason, he argues that successful techniques such as brainstorming, which are successful for level I complexity, are not likely to be as useful at higher levels. The five levels and some of the appropriate tools are shown in figure 1.

Let's take an example of a problem a bank might identify:

The bank would like to migrate all service transactions out of the banking centers, but move all sales into the banking centers. The challenge is that few people ever come to the bank for sales (other than opening a checking account)....currently, it is primarily service and then an attempt to offer key products to them is made.

Let's describe this as a level III process change because it will require at least a moderate change in the way business is currently run.

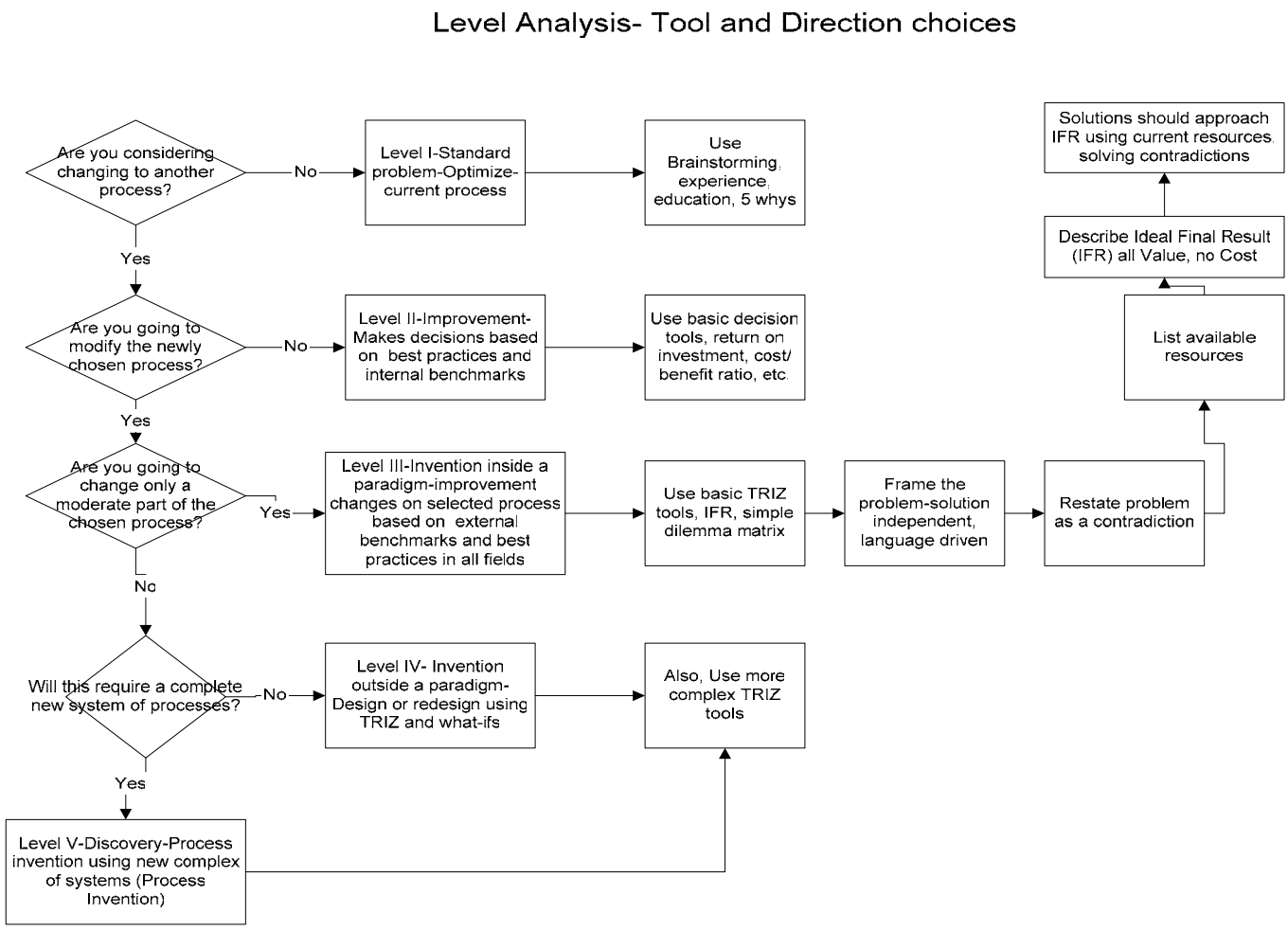


Figure 1: Altshuller's five levels and a tool suggestion guide

From Figure 1, the tools suggested are:

1. Identify the Customer
2. Identify the Value/Cost elements (aka: Ideal Final Result-IFR) from the customer perspective
3. List functions that affect the V/C elements
4. Use Matrix to suggest solution possibilities

So step one through three might yield:

- Customer 1: <u>Any Consumer</u>
  - Value: Growing wealth
  - Costs: No loss of time, No fees
- Customer 2: <u>Stockholders</u>
  - Values: More revenue & margin
  - Cost: No more marketing costs
- Contributing Functions
  - Offering products that grow wealth; Offering assurances of low risk; Prompt product offers; Timely product offers; Offering best fit options; Offering products only when the customer wishes; Using current resources to determine correct time to offer; Using current resources to make offers

Using the Transactional TRIZ Matrix, (For an explanation on its use, see last month's article, Transactional TRIZ II) the first contradiction in the above problem would be as the wealth (Rate of return) grows, the customer fears greater risks are being taken (Reliability). The other two contradictions follow along similar lines. The goal is to take this relatively complex problem and seek some solution suggestions that will fit all three contradictions simultaneously. The second contradiction has the customer being charged more fees in exchange for interest rate improvement. And the third contradiction describes better quality information, but a longer wait for it.
Based on values, costs and functions seen above, these dilemmas were chosen:

Dilemma 1 Improvement **5** Rate of return-amount of growth in customer accounts
Dilemma 1 Conflict **19** Reliability-Customer perception that future performances will perform to expectation

Dilemma 2 Improvement **5** Rate of return-amount of growth in customer accounts
Dilemma 2 Conflict **4** Packaged costs-charges due to mixtures of categories. Example: outsourced printing or other services

Dilemma 3 Improvement **9** Information flow-accuracy, reproducibility, or retrievability of customer data
Dilemma 3 Conflict **16** Timeliness of on-going use-how long the customer must wait for the output of an ongoing process or service. Example: how long for checks to clear, how long to wait in line

Putting these three contradictions into the Transactional TRIZ matrix suggests these common Solution Principles.

From here the SMEs (Subject matter experts) will brainstorm off these suggested tracks.

2 Separation or extraction
4 Asymmetry
5 Merging or combining
6 Universality
10 Preliminary action

- **Separation:**
  - Find and use clues that tell when the customer might need additional products, offer only then. Use tellers to ask follow-on questions to comments made and record a customer profile
- **Asymmetry:**
  - Offer products by customer profile; second checking to those with only one, upgraded credit card for those with an entry level card
- **Merging:**
  - Ask customers what product they would like in an ideal situation
- **Universality**
  - Make Tellers into Marketers to find best solutions that work for both customers and stockholders
- **Preliminary Action**
  - Inform customers using brochures, moving signage or fixed signage of what the Bank could offer. Publish and advertise success stories

In summary, for low levels of innovation (I-III) the TRIZ Problem Format works like this:

- Frame the problem-solution independent, language driven
- Restate problem as a contradiction
- List available resources
- Describe Ideal Final Result (IFR)
- Solutions should approach IFR using current resources, solving the contradiction

More Complex Problems

As problems become more complex (Levels IV & V), more TRIZ techniques will need to be used. From Rantanen and Domb's book, Simplified TRIZ, a list of patterns of evolution, and examples from the mechanical world are listed. We could then apply these patterns to the bank example to see if some insight results. The results follow.

Look for Patterns of Evolution of systems

- Uneven- pieces of system change faster than others
  Computer hardware evolved faster than software
- Transition to macrolevel- becoming part of larger system
  Sony "Beta" VCR failed to join larger system
- Transition to microlevel- using pieces instead of whole
  Using water to erode metal, have microbes produce drugs
- Increase of interactions- use more, less or modified items
  Post-it notes vs push pins; vacuum dust; oil to lube
- Expansion and convolution- combine systems, then trim waste
  Add tube to tire, combine, shrink to donut tire, eliminate entirely

Bank example of Evolutionary Patterns

- Uneven
  - Customers want instant gratification, but want stability as it represents safety of their assets
- Transition to Macro
  - Customers' lives are very busy and complex. We need to make allowances for that, perhaps offers services, linked to products, that accommodate that
- Transition to Micro
  - In a complex world, customers often can only deal with one issue at a time. By acknowledging this we might offer products in a suite that solve the micro issue, but do not violate their Macro needs
- Increase in Interactions
  - In a busy world, few issues can be dealt with in a long drawn-out affair. Large deals can be done with lots of small piecemeal efforts, linked together so the customer sees the gain. Visual representation of their portfolio, lots of graphs describing their improvements will reinforce the interactions
- Expansion and convolution
  - Based on portfolio changes, offer to change products that maximize the customer wealth- become Bankers who advise in a timely fashion

Figure 2 is a procedure map for how one goes about describing the problem and to break the problem into pieces that might lead to insights.

Describing the Problem-The Bank example

- The System can be described by An Actor(Tool) performing an action on an Object
  - A debit card serves to exchange money
  - A Teller reverses a penalty fee
- Moving the system up or down changes the relationship
  - A debit system serves to exchange resources
  - A document signals a reversal of a late charge

Next we look to do system analysis by putting the client in the present system and see what insights might emerge to continue our search for innovation. One potential analysis follows.

Looking for Description Via System Analysis

	Past	**Present**	**Future**
Macro-Level			
System		Client	
Micro-level			

	Past	**Present**	**Future**
Macro-Level	Plan for the future	Portfolio	Wealth Management Program
System	Potential Customer	Client	Retiree
Micro-level	Money	Account/ Product	Assets to manage

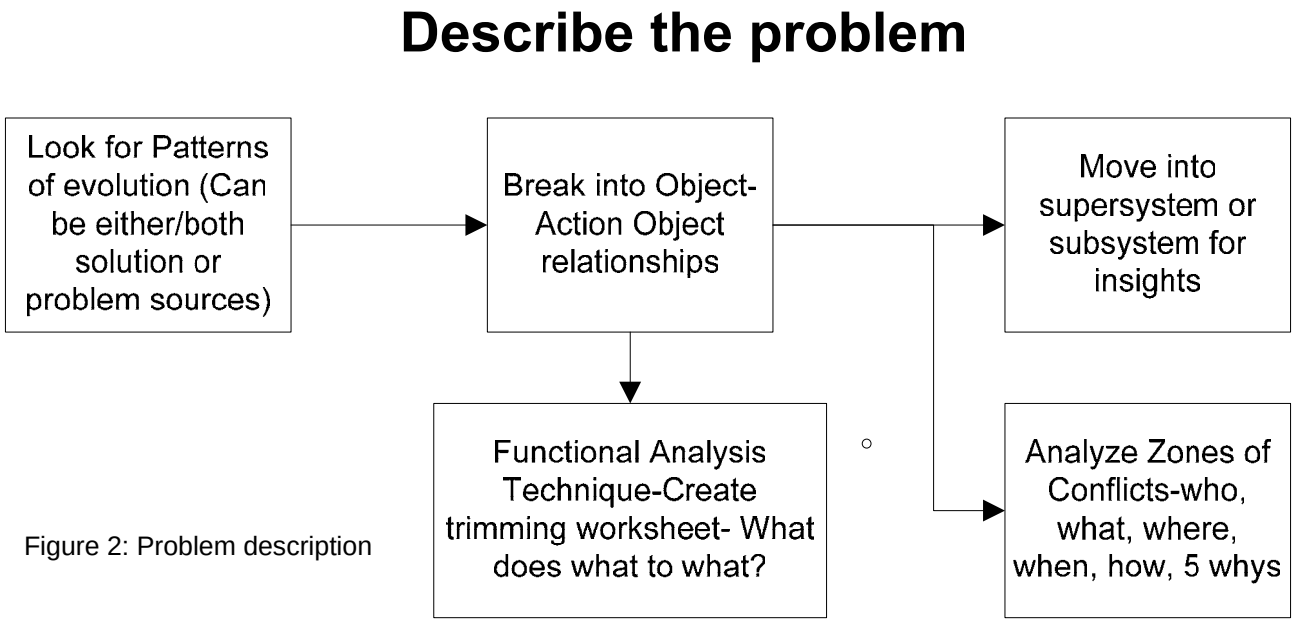


Figure 2: Problem description

So once the problem is broken into pieces and the system is described, then some insights might emerge that will lead the innovator to a new approach. Two legs are left to look at from Figure 2: Zones of conflict, which looks for causal agents and root causes to go beyond the up close approach that we might get trapped in. Figure 3 demonstrates how to approach the contradictions, which could tie into insights we receive from other tools, or could lead to insights that other tools could work upon. We will return to cover the Trimming technique shortly.

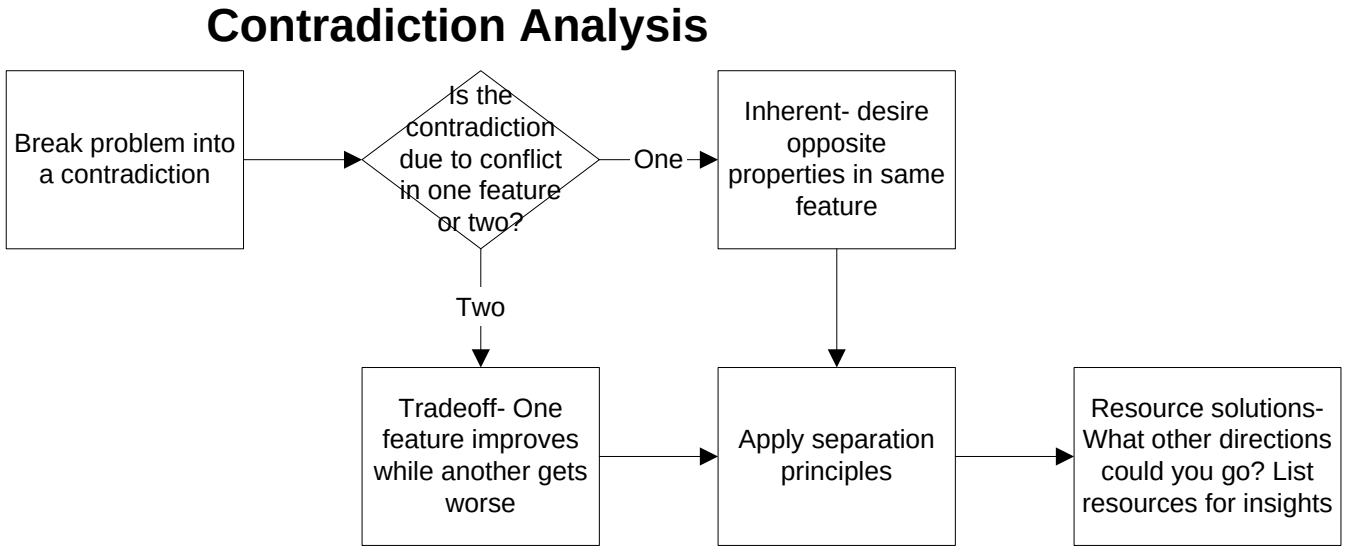


Figure 3. The Contradiction Analysis

The two types of contradictions in TRIZ and examples in our banking theme:

1. Inherent Contradiction-want something with opposite properties
    - Easy access to account (You), difficult access to account (Bad guys)
2. Tradeoff Contradiction-if something good happens so does something bad
    - Cost goes down, but delivery takes longer

Examples of how one might use the separation principles for the inherent contradiction in our banking theme:

Example: Easy access to account (You), difficult access to account (Bad guys)

- **Separation in Time**
    - Send Credit Card after sending the PIN #
- **Separation in Space**
    - Access allowed in some locations or formats and not others
- **Separation Between the Parts and the Whole**
    - Easy access for moving within own accounts, but not at removing assets
- **Separation upon Conditions**
    - Access to accounts requires Password

The next step is to look to available resource solutions. And ask "What other directions could we go?" A Cause and Effect diagram could be useful here. Figure 4 shows how that might be applied in our banking example to generate some ideas.

- Material-System elements, inexpensive materials, modified materials, waste, raw materials
- Time -parallel operations, pre/post work
- Information-methods, types
- Field/Energy-goodwill, momentum, branding,energy in system, energy in environment
- Space-empty space, another dimension, nesting
- Function-harmful functions, primary & secondary effects

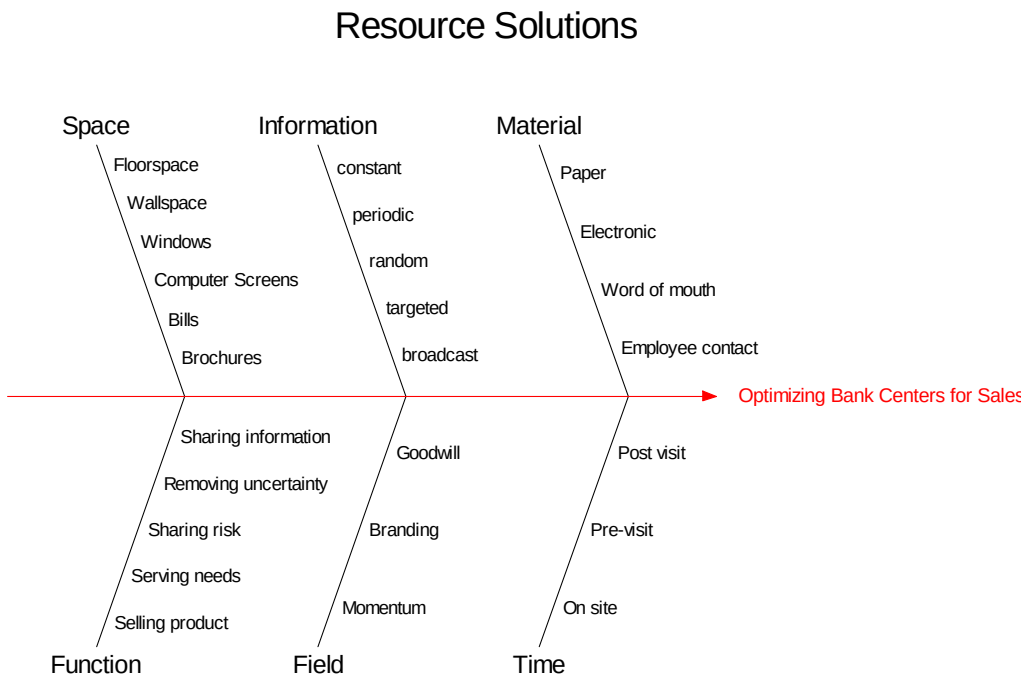
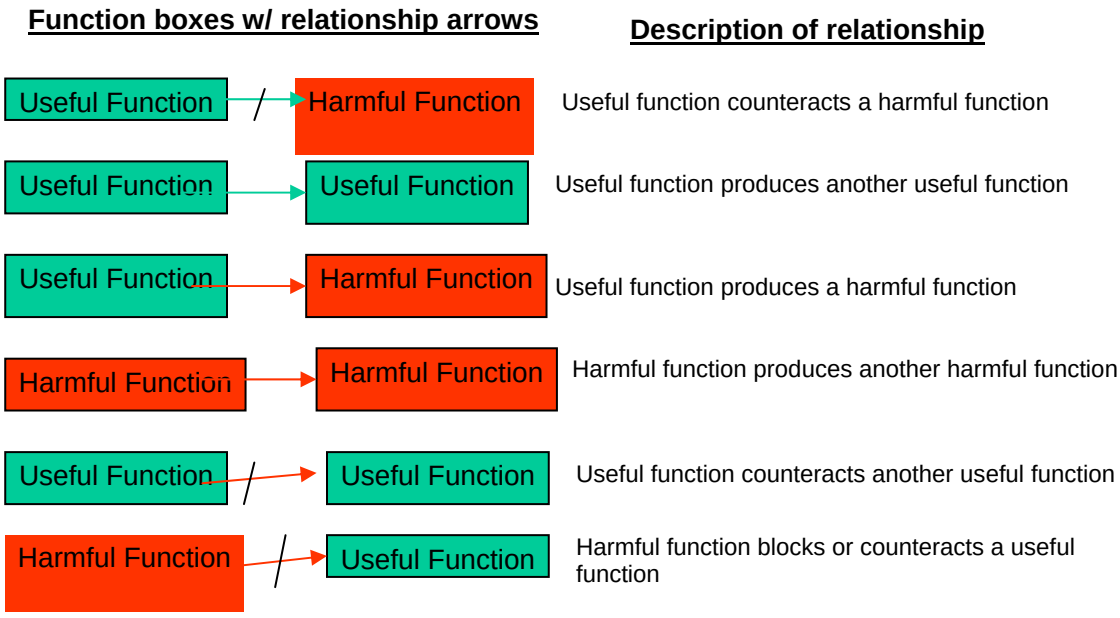


Figure 4. C&E diagram on potential resource solutions

Before we attack the Zones of Conflict piece, it would be helpful to use the Functional Analysis Technique as described below.

1. High level map elements of system on yellow stickies
2. What does the element do?
3. What does element act on?
4. Is it
    a. Useful?
    b. Harmful?
    c. Necessary?
    d. Adequate? Inadequate?
5. Create trimming worksheet

Functional Diagramming Suggested Format



Use these like process maps to graphically show problem areas
(Dotted arrows could be used to represent insufficient desired effect)

From there, we can using the **Trimming Worksheet Technique** in order to focus on the problem and possible solution better. It works by taking the functional diagram statements (There will likely be more than one.) and trying to apply the Fool approach, as you can see here:

- Function statement- "A does this to B"
- Trimming Question 1- "Can the system work without this function?"
- Trimming Question 2- "Can the object B perform the function itself?"
- Trimming Question 3- "Can any other part of the system perform the function? Could a resource perform the function

Now the attack plan would be to marry up the trimming worksheet results with the resource solutions work done earlier, for the **Zones of Conflict** analysis.

- Who has the problem?
- What resources are available?
- When does the problem occur?
- Where does the problem occur?
- How does the problem occur?
- Use the Five Whys

Somewhere in the process, the IFR should be stated. In Figure 1, it is suggested in two places, early on it helps focus on the essence of the solution set, which is a Sage technique. Later, it is a common sense approach to remind us to stay on task and not to bog down in details.

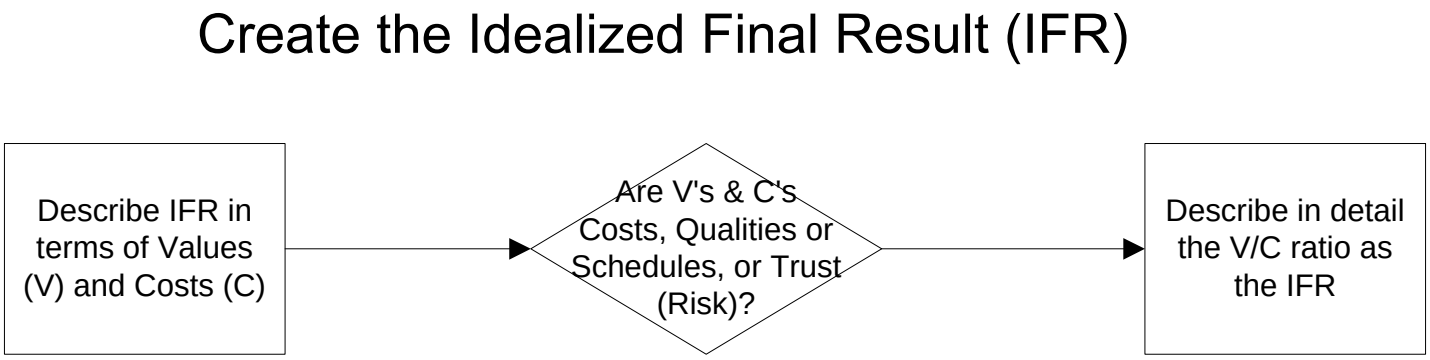


Figure 5. IFR in a Transactional format

Figure 5 shows how to translate from the mechanical terms of benefit and harm into the same elements that were used in the Transactional TRIZ matrix. From there we apply the **Problem Analysis Technique,** as described below**.**

- **Define the problem to be solved**

1. (Seer& Sage)Ideal Final Result (IFR): Maximizes the Value Engineering Ideality function-
    i. Ideality Function=Benefits/Costs+Harm
    ii. IFR=Benefits w/ no Cost or Harm
2. Test of 4 characteristics(Observer)
    i. Eliminates deficiencies of original system
    ii. Preserves the advantages of original system
    iii. Does not make the system more complicated(Uses free or available resources)
    iv. Does not introduce new disadvantages
3. Express IFR as "Problem takes care of itself" (Example: Data enters itself)(Fool)
4. Any barriers to IFR are potential root causes

For our final look at the banking example, an demonstration is offered of how the Value to Cost ratio is tackled using the Sage approach of IFR. From here it should be clear what needs to be measured to determine what direction the bank would like focus on. From this viewpoint, any solution will require a maximizing of the customer assets, safely, if the solution is going to approach the IFR.

IFR-V/C Principles

- **Value/Cost** > 1 (Or we are a charity)= V/C > 1
- **Value in the Bank (Customer view)** = security of assets and/or growth of wealth
- **Cost in the Bank (Customer View)** = reduction of assets = fees + interest retained (One is observed, the other assumed)

- **Value to the Bank (Stockholder view)** = reduction of customer assets given to us
- **Cost to Bank** = reduction of Bank assets

- **Perception** = Observation of cost, quality or schedule performances + belief in those (trust) Perceived Value equals observed Value plus trust in Value Vp=Vo+Vt
- Perception is effectively = reality

- **Perceived Value (Vp) – Perceived Cost (Cp) = 1/R** This R is Risk. People who are risk adverse require a risk ratio to help them interpret the relative nature of the risk.
- **Vp-Cp/Cp= Risk ratio** This formula illustrates that as Cp goes up a bigger Vp-Cp will be needed
- **Value** may be immediate or eventual.

ARIZ-04t

This last section is merely a translation of ARIZ 61 to use the more commonly used transactional terminology. ARIZ 61 was picked show that the methodology should be effective in areas other than manufacturing. Another ARIZ could have been utilized as well. The applicable Faces of Genius are annotated to show the thoroughness of the protocol toward approaching a problem from as many angles as possible.

High Level Process Map for ARIZ 04T

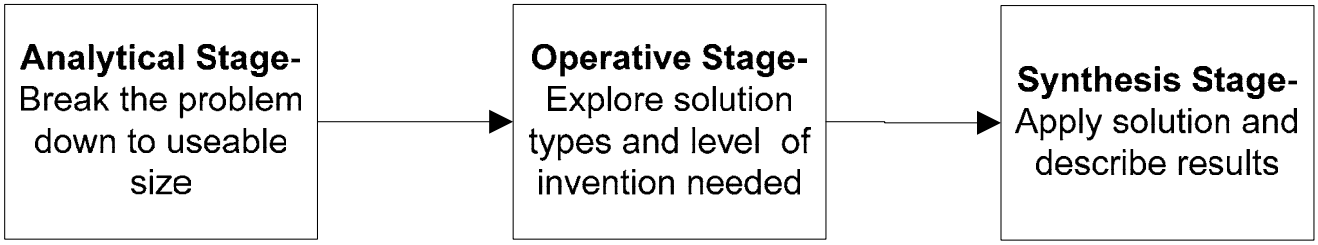


Figure 6. 3 main steps of ARIZ

From Figure 6, the high level view, we start with the Analytical stage, Figure 7. Then we continue with the Operative stage, as shown in Figure 8. And we end with the Synthesis stage in Figure 9.

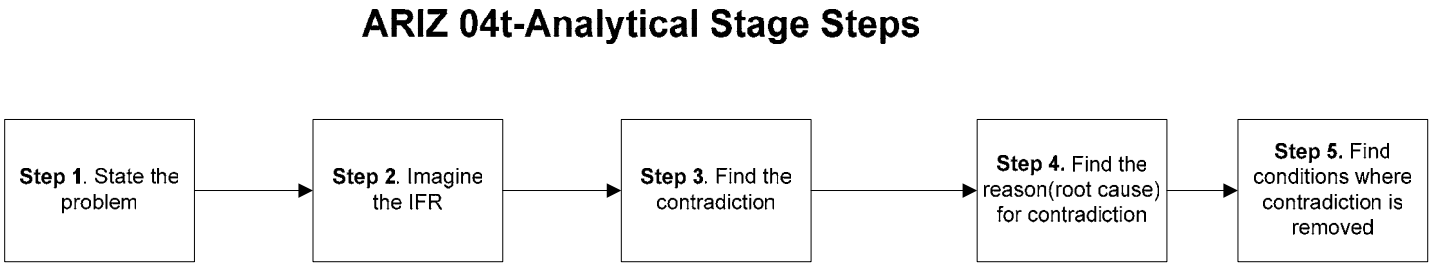


Figure 7. Analytical stage.

- Part One: **Analytical stage**
  - Step one-State the problem-What the customer wants and isn't getting (SAGE)
  - Step two-Imagine the IFR (Idealized Final Result)- All value, no cost (SEER)
  - Step three- Find the contradiction that shows what interferes w/ attaining the IFR(OBSERVER)
  - Step four –Find the reason for the contradiction(OBSERVER)
  - Step five- Find conditions during which the contradiction is removed(OBSERVER)

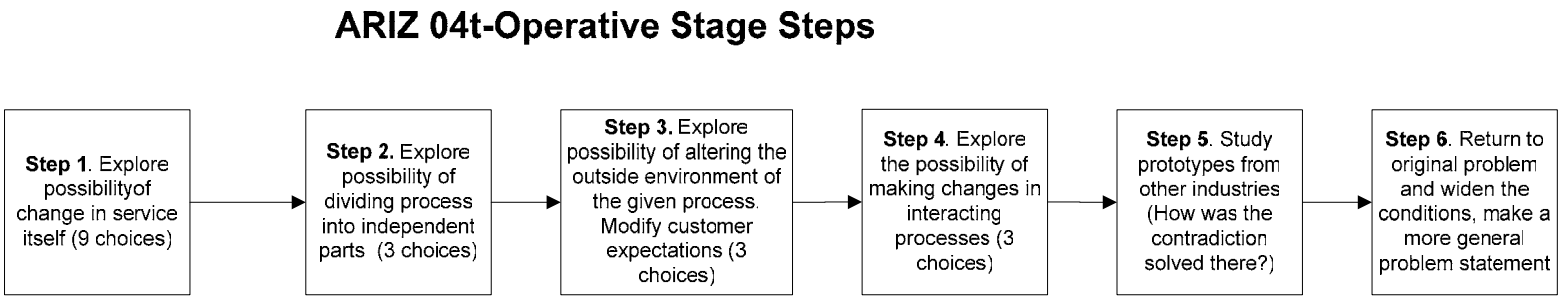


Figure 8. Operative stage

- Part Two: **Operative stage**
  - Step one- Explore possibility of making changes in the service itself.
    - Change(FOOL):
      1. Frequency; 2. segment served; 3. method of delivery; 4. cost of service; 5. quantity of service; 6. speed of service; 7. appearance; 8. relative position of service or reports; 9. working conditions of people with the purpose of optimizing their workload
  - Step two- Explore possibility of dividing process into independent parts(FOOL):
    - 1. Isolate 'weak' process;2. Isolate 'necessary/adequate' part; 3. Separate process into identical parts
  - Step three- Explore possibility of altering the outside environment of the given process. Modify customer expectations(ALCHEMIST):
    - 1. Customize more or less; 2. move to electronic or paper; 3. give customer more choices; 4. optimize pathways
  - Step four- Explore the possibility of making changes in interacting processes(SAGE):
    - 1. Reduce overlap; 2. eliminate one process by transferring its function to another process; 3. level the workload, use capacity management
  - Step five- Study prototypes from other industries (How was the contradiction solved there?)(SAGE)
  - Step six- Return to original problem and widen the conditions, make a more general problem statement(ALCHEMIST)

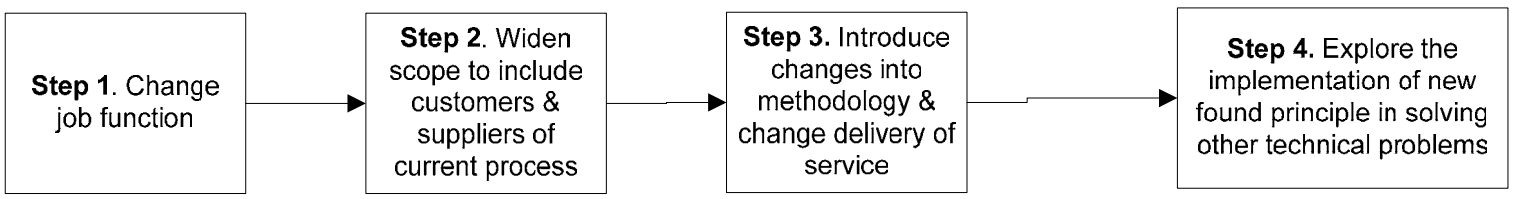


Figure 9. Synthesis stage.

- Part Three: **Synthetic stage**
  - Step one- Change job function (Examples: Xerox is document company; turn service center operators into Bankers)(ALCHEMIST)
  - Step two- Widen scope to include customers & suppliers of current process(ALCHEMIST)
  - Step three- Introduce changes into methodology & change delivery of service (ALCHEMIST)
  - Step four- Explore the implementation of new found principle in solving other technical problems (SAGE)(Leverage)

Summary

This series of three articles has attempted to tie together the Theory of Intelligence and Moser-Wellman's Five Faces of Genius and some theories of creativity. Then the second article proposed a contradiction matrix based upon transactional terminology, with an effort of maintaining Altshuller's intent of heuristic creativity. The third article laced together Transactional terminology and the theories of creativity with the full TRIZ approach.

The author hopes this effort does not offend the purist, but hopes that some of the good work that the manufacturing community has amassed in this field can be brought to bear on the transactional world also.

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Jack Stuart was introduced to TRIZ in a seminar offered by Ellen Domb in 2001 and has had, perhaps, an unhealthy obsession for the contradiction matrix ever since. He was curious whether a transactional version was available and when he was told it wasn't at the time, he set about trying to discover one. He has worked in Aerospace, Automotive, Educational and Financial institutions and served in both manufacturing and service sectors.