Transactional TRIZ, Theory, Application, and Execution, Part II: The Contradiction Matrix

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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.

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.

The second article will present a case for a Transactional Triz matrix. The modification here will be much more than cosmetic. 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.

Basis for the Transactional Matrix

The first article concluded with: It is upon this basis that we can fulfill the first step of re-engineering the presentation of TRIZ that manufacturing has used so successfully. "The first step to intelligent re-engineering is to save all the pieces." In this case, we have to make sure what the pieces are. The contradiction, the problem statement, directional approach and a flexible multi-tier attack for different problem types are all elements that need to be retained to even hope to successfully claim a good translation to Transactional TRIZ.

Whether due to translation inconsistency, or a shortage of appropriate words in English, the terms invention, patent and solution are often used, somewhat, interchangeably in the literature. The author makes no effort to be more precise. Lev Shulyak in his translation of **And Suddenly the Inventor Appeared,** points out that Inventions are 'Author's Certificates" patents and not really patents as we understand them. But then they are used interchangeably in that book. So, forgiveness for a less precise utilization of the words is asked for in advance.

So, from that jumping off point, the problems with the manufacturing matrix that bother transactional and service based users need to be addressed. The first problem is that the original matrix set of solutions (The 40 inventive principles) are typically proposed in manufacturing terms. Most service people have a great deal of trouble thinking of ways to interpret mechanical terms such as Spheroidality, Mechanical Vibration, Pneumatic Constructions, Thermal expansions or Accelerated oxidation as a way to contribute to service dilemmas. Fortunately, several people have taken on the task of showing business examples for each of these inventive principles. These can be found

on the TRIZ.com website. It is not really necessary to re-define the terms to fit business specifically if one can contribute a Gestalt feel to the Principle by using examples. In fact, the Martin Slack Observation can be applied here. Martin was a student, who when being shown the TRIZ Contradiction Matrix, asked: "What is the difference between this and using a horoscope, or reading tea leaves or throwing the bones?" Upon reflection the author answered, "None, really." Koestler points out that creative solutions require some connection between two concepts. Altshuller requires us to define our contradiction (The first concept) and suggests, via his matrix a potential solution in the form of a set of principles. Our creative side is still required to play a role. Altshuller just makes the connection a lot more likely.

Martin's point is that if you were to come home from a hectic day, only then finding time to read the morning horoscope, and find that the day's prediction was: "You will have a bad day," upon reflection there would be plenty of evidence to support the claim. Yes, this person was an idiot and rude to you, these problems came cascading down, etc. Suddenly, you realize that this was not the prediction for your sign, but for an adjacent sign and yours actually read: "You will have a good day." You will also find evidence to support that as well. Yes, the rude idiot apologized and you got praised for solving all the problems that came your way. The beauty of these 'predictive' elements is often to create a paradigm of perspective that leads to a successful observation. And this is the best the Contradiction Matrix can hope for. The 40 Principles are not specific solutions, but generalized classes of solutions. It is still up to the user to connect the contradiction that they possess with a specific idea that will solve that contradiction. The Matrix merely reduces the search from a mind exhausting 40 principles to a handful. It was Altshuller's empirical observations that allowed him to filter the search for the rest of us to 'most likely' candidates. And there are some, like Darrell Mann (1), who has counted the most commonly used of the Principles. This could, without a Matrix, serve as a statistical filter in the search for a useful solution.

The author has facilitated sessions where 5 different groups were given identical contradictions to solve and each were asked to use 8 (Each group used different ones; Group One uses 1-8, Group Two uses 9-16, etc.) of the Principles to look for idea generators. As a result, each group ends up with a list of ideas, suggested by the contradiction. Oddly enough, it is not unusual to find the different groups coming up with identical solutions from different starting Principles.

Altshuller states in **The Innovation Algorithm**:

P.29 "Creativity here resides in the skill to state the problem correctly. P.60 "Brainstorming rejects control of the thought process, and this is its main defect. Brainstorming really helps in overcoming inertia- thought moves from a dead spot, gaining speed but often missing the point where it should stop." And p.199 "However, for all powerful solutions, the general thinking process style is distinctive: Directional thought. An absence of chaotic jumps, or restless tosses and turns...." The combination of these last two paragraphs suggests that the goal of the Matrix, which Altshuller wished to be directive in nature, and not random, works mostly because the contradiction is appropriate, not because the Principle necessarily is.

Counting which Principle suggested the idea, is a reverse engineering feat, perhaps not warranted in all cases. If both Separation and Spheroidity could suggest the same idea to a person, and Separation was looked at first, then the count is a self-fulfilling prophecy. This is not a major point of contention because even if it is less a

statistical certainty that any one Principle is more likely to be of help, it is a safe logical conclusion, with little harm.

However, adding, or subtracting Principles might not be as safe a deviation. Altshuller's list of Principles was a result of an Affinity Diagram-like work of putting like inventions (Solutions) together and to bunch those commonalities together. Thus they represent a comprehensive look at those sets of inventions. The supposition is that they also represent the same comprehensive look into the future. While it might not be accurate to say there are no new inventions, it would be safer to say there is less likely to be a new Principle. The second thing that one would hope for from a list, is that it also be mutually exclusive. Adding new Principles are likely going to violate that idea as shown by the observations above, that some of the different Principles are already suggesting the same idea. Adding more Principles is likely to present more conflict. In fact, some articles in the TRIZ website refer to Combined Principles. The logic of listing a Combined Principle is nice from a catalog concept, but it makes even more work for a user to search for a potential solution. In that way, it brings a less likely happy conclusion to the hunt.

The essence of the Matrix is that it is meant to help the user to successfully select an idea that is directed towards his specific contradiction. Fewer options make it more likely that the user will be able to find a useful idea in his mind.

So, if the somewhat mutually exclusive and comprehensive list of Principles need not be morphed to fit the Business user, what should be changed? The 39 engineering parameters serve a manufacturing world well. However, there are only a few: Speed, Waste of information, Speed of information, Reliability, Accuracy of measurement, Harmful factors acting on object, Harmful side effects, Convenience of use, Adaptability, Level of automation and Productivity, that can be easily used without modification by a typical business person. And, indeed, the resulting Matrix suggestions will often generate a very useful solution. However, the 2/3 or so of the Parameters, not immediately useful will often be interpreted. But problems with this approach begin immediately. So is 'Power' to be thought of as 'Manpower?' Or is it 'Amount of Cash to be thrown into a situation?' What is the difference between a moving and non-moving object in a transactional world? Is 'Tension' a condition or environmental concern of a work site? And with the reinterpretation of these Parameters two questions come to the fore: 1.) Is the list still comprehensive? 2.) Is the list still mutually exclusive? It is the author's contention that neither one is acceptably true.

So instead of redefining the 39 engineering parameters, it is proposed that transactional parameters be put forward. They would need to be comprehensive and as close to mutually exclusive as possible, but due to the user interpretation commonly found in translating the user's contradiction into a parameter based general contradiction, the need for mutually exclusiveness is not a fixed requirement.

Imai (2) attributes to a Toyota Motors manager, Shigeru Aoki, a quote that says: while to make profits is self-evident, "the next superordinate goal should be…quality, cost, and scheduling(QCS),…Therefore we should regard all other management functions as existing to serve the three super-ordinate goals of QCS" Marshall (3) suggests that trust is an important component of transactional business. While most manufactured goods have implied warranties, the service industry must rely often on trust as a fourth goal. Picture trying to pick a baby-sitter out of a phone book. You want a reliable

service, at a good price, on time, for the whole evening. But as importantly, you want to know (Trust) that all three; quality, cost and schedule, will meet your specifications, before the baby-sitting event takes place. The term 'Risk' is often used, and implied, to be the same thing, but the author chose to avoid the term because other meanings are often utilized for the term. In the strict business sense, risk equals the measure of balance of profit and loss. However, in execution, the term 'risk' often only refers to the negative loss side and by implication is something to be avoided. Other times, risk is implied to be positive as in 'The employee is willing to take risks when appropriate.' Most companies don't reward risk-takers, but reward those who successfully take risks and win profit. So the word is used inconsistently and will be avoided.

So now, for management, a strategic contradiction matrix can be assembled using these terms:

- **Cost**-what it takes to run the business
- **Quality**-a. Got to have features -customer will be dis-satisfied if missing;
  b. Delighters; and value-adders -things that satisfy-more is better
- **Schedule**-delivering to the customer's timeline
- **Trust**-belief by the customer that the company will perform, before the customer buys

Note that Quality got split up into dis-satisfiers and satisfiers (& delighters), per the Kano model. This was done due to their asymmetrical nature. A dis-satisfier has only downside risk. A delighter has only an upside, whereas the typical satisfier has the ability to be worth more, the more plentiful it is. The resulting table (Figure 1) gives a look at how a manager might deploy his/her resources to solve problems. Several of the suggestions include "Reverse trades." This implies that, perhaps, an earlier decision was made to install a new quality or feature that as it got better, a dis-satisfier was uncovered. So one solution might entail a step back and re-evaluate the wisdom of the earlier decision. The advantage of this chart is merely to present a decision matrix that might have some value at the Champion or Manager level that offers a process improvement team a general direction, or class of improvements without getting into immediate solutions. That should be reserved for the people who actually analyze the details of the current and to-be processes. But this way, both the manager and the improvement team will have input.

Figure 1: Table of Transactional Dilemmas and Solutions-Strategic Level

		Features that get worse				
		Cost	**Quality (Dis-satisfier)**	**Quality (Satisfier)**	**Schedule**	**Trust**
Features That Better Features	**Cost**	X	Reverse cost-cutting	Look for economic features to add to the Value/Cost ratio	Find Ways to reduce NVA waits and queues	Find ways to promote VA Features (Advertise)
	Quality (Dis-satisfier)	Find COPQ to offset	X	Look for economic features to add to the Value/Cost ratio	Lean application to reduce loss in value stream time	Advertise that the company offers reliability
	Quality (Satisfier)	Raise price; look for waste	Find offset; reverse trades	X	Circumvent leadtime; Sell earlier (pre-sell); sell in segments	Advertise that the company is a good deal
	Schedule	Look for NVA wastes	Find offset; reverse trades	Poke-yoke; 6-Sigma defect reduction	X	Advertise the speed of service
	Trust	Raise price	Find offset; reverse trades	Contradiction in terms! Fix or lose customer; 6-Sigma tools	Fix or lose customer; Lean out the flow	X

This is not to imply that this table is anything as comprehensive as Altschuller's, and certainly not as useful. But it uses the 'Sage' face from Moser-Wellman's "The Five Faces of Genius."(4) It is in that mode, where one "Begins with the end in mind." This will help start the project with a specific direction.

But more is certainly needed. As a result, the major goals of business were further refined and redefined to create a list of 21 transactional parameters as follows:

Operational Definitions-Costs

Labor-wages and benefits of company and supplier employees
Equipment-rental and purchased equipment and materials
Setup-one time charges to setup a process
Packaged costs-charges due to mixtures of categories. Example: outsourced printing or other services
Rate of return-amount of growth in customer accounts

Operational Definitions-Quality

Safety-actual chance of poor performance
Versatility-flexibility, adaptability
Proximity-physical location of services to customer
Information flow-accuracy, reproducibility, or retrievability of customer data
Ease of use-clarity of customer perception to use product or service
Privacy-ability to keep customer secrets

Operational Definitions-Schedule

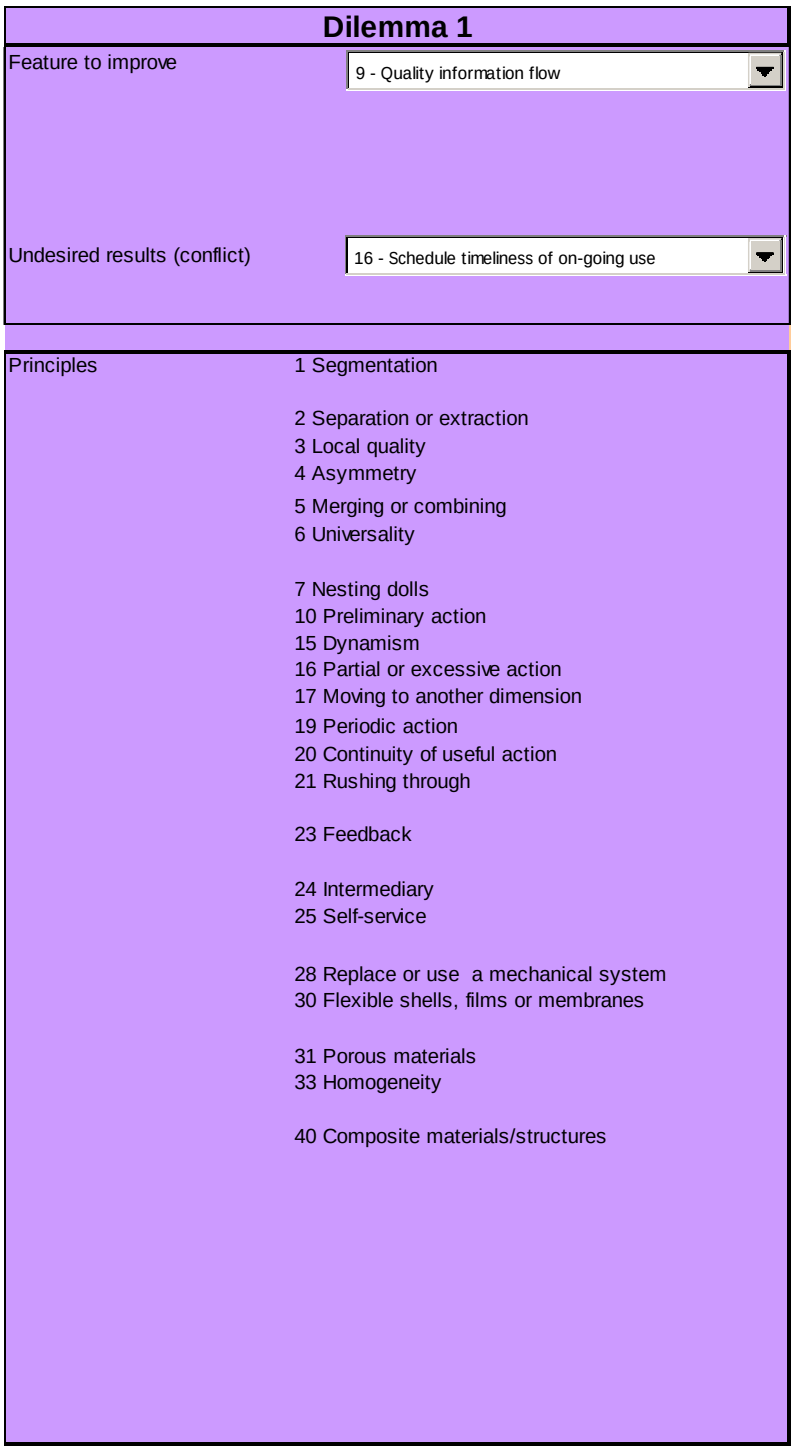
Leadtime-how long the customer typically must wait for full product or service. Example: how long for delivery of a credit card
Emergency leadtime-how long the customer must wait for product or service in its most accelerated manner
On-time promise(Accuracy)-performance of company to delivery to promise
Timeliness of first use-how long the customer must wait for the function of a product or service. Example: when they can use a credit line upon approval
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

Operational Definitions-Trust

Consistency-Customer perception that future performance will match past
Confidence-Customer perception that their assets will be safe
Reliability-Customer perception that future performances will perform to expectation
Friendliness-Customer perception that the company or company representative cares for the customer
Compliance-Provable adherence to regulatory and procedural functions

From these 21 Transactional Parameters a Transactional Contradiction Matrix was created. The grid, one quarter the size of Altshuller's original was populated by the author by likely solutions, based upon observations in several companies in aerospace, automotive, electronic, materials management, medical and financial institutions. Because it has about one fourth the number of contradictions, the resultant coverage of potential principles for each of the individual cells means about four times as many solutions will be offered. This is less than ideal as the user will need to stay engaged longer to find the best solution, and the user might become fatigued or intimidated by the task. An Excel automated matrix was created based upon the one created by Geoff Tenant for Altshuller's Matrix. (You can find his Excel Matrix on his website: www.sixsigmatriz.com.) The upper section uses Drop Down boxes to select one of 21 Transactional Parameters to get better or worse, and the lower section prints out which of Altshuller's 40 Inventive Principles might be appropriate. In this example (Figure 2) as the Quality of information flow gets better, the Schedule of timeliness of on-going use gets worse. This is a condition one might see when one has to wait for data to be verified before becoming available. 22 Inventive Principles are suggested as possible candidates for exploration. It will be left up to the reader to discover if they could come up with suitable examples.

Figure 2. Excel based Transactional Contradiction Matrix



However, it was felt that this was too much to expect a regular user to use easily and since many transactional problems are more complex than a single dilemma, it would make sense to allow them to try to solve up to three contradictions simultaneously and to use the common possible solutions as a reduced list from which to choose.

Figure 3. Dilemma 2 and 3 examples

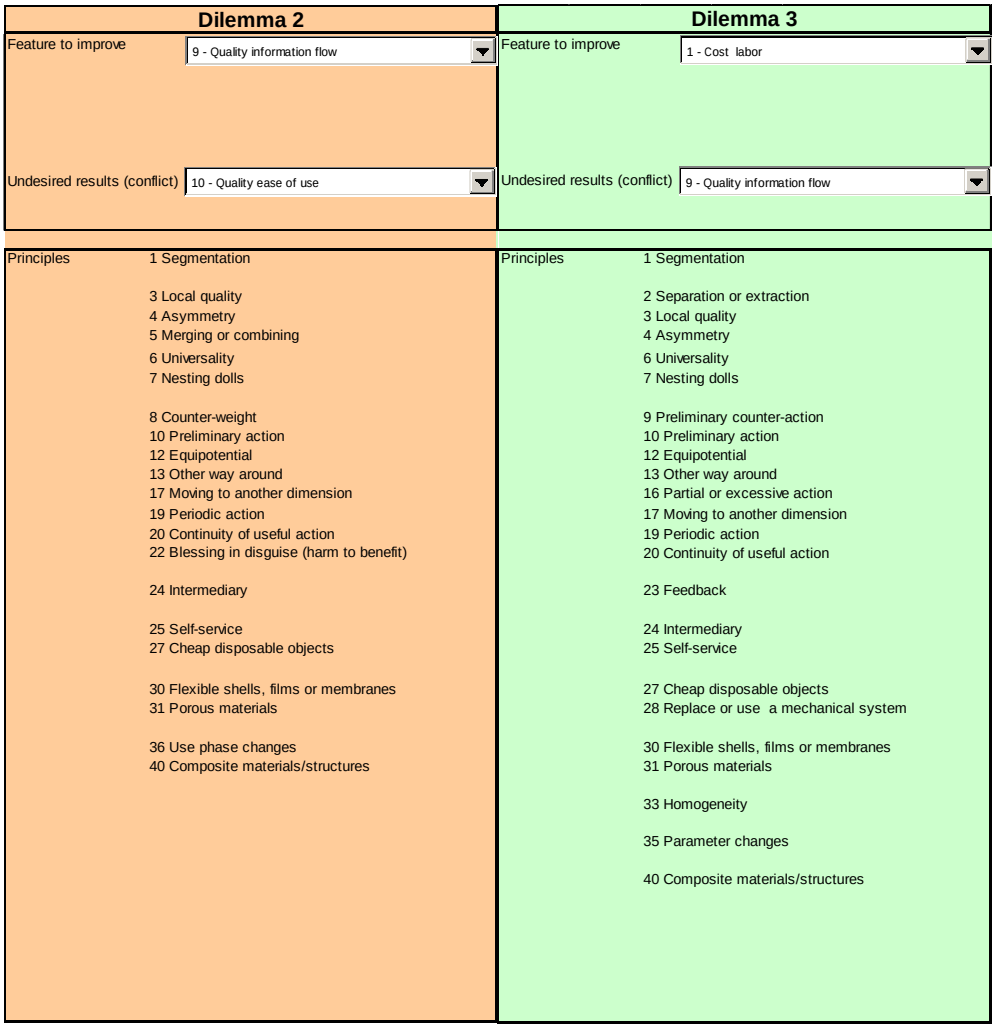


Figure 3 shows two other Contradictions populated in the Excel spreadsheet, and Figure 4 gives an example of another output of the spreadsheet that has the three selected contradictions assembled with the operational definition of each to provide clarity to the user's choice.

Figure 4. Operational definitions of the chosen Contradictions.

Dilemma 1	Improvement	**2**	Equipment-rental and purchased equipment and materials
Dilemma 1	Conflict	**11**	Privacy-ability to keep customer secrets
Dilemma 2	Improvement	**9**	Information flow-accuracy, reproducibility, or retrievability of customer data
Dilemma 2	Conflict	**10**	Ease of use-clarity of customer perception to use product or service
Dilemma 3	Improvement	**1**	Labor-wages and benefits of company and supplier employees
Dilemma 3	Conflict	**9**	Information flow-accuracy, reproducibility, or retrievability of customer data

Once the choices are made, the user will be able to choose from Inventive principles that are derived from commonalities of 1&2, 1&3, 2&3 or all 3 contradictions. Figure 5 shows the output that would be presented to a user. Figure 6 is to help the user with the description and examples of a particular Inventive Principle.

It is hoped that the Transactional matrix will be useful to those needing it and not too offensive to any who might hope for a pure scientific approach. The author felt that the need for a user friendly, business based tool would help spread the use of Altshuller's ideas, only if it was expressed in terms they could easily assimilate. The author further tried to stay true to Altshuller's goal of a directed solution path. A copy of the Excel spreadsheet may be purchased from Transactionaltriz.com with the request that it not be resold or used for profit. In return, it would kind if the user would feed back any improvement suggestions or success examples.

This has been the second of three articles on Transactional TRIZ. 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. This final article will cover the approach of convert an ARIZ for transactional use and also deal with a common tendency to prefer simplicity over complexity in tool usage.

Output Only !		**You have chosen for:**					
Do not enter any data here!							
Choice 1	Feature to improve	2					
	Undesired results (conflict)	11					
Choice 2	Feature to improve	9					
	Undesired results (conflict)	10					
Choice 3	Feature to improve	1					
	Undesired results (conflict)	9					
		Common Solutions:					
All 3	**1 & 2**	**1 & 3**	**2 & 3**	**Instructions:** To find common			
		2 Separation or extraction	1 Segmentation	solutions for 2 or 3 dilemmas:			
3 Local quality	3 Local quality	3 Local quality	3 Local quality				
	5 Merging or combining		4 Asymmetry	Pick from the drop down menus			
6 Universality	6 Universality	6 Universality		in the Purple, Red & Green boxes			
7 Nesting dolls	7 Nesting dolls	7 Nesting dolls	6 Universality	to the far left			
10 Preliminary action	10 Preliminary action	10 Preliminary action	7 Nesting dolls	This box will populate automatically.			
17 Moving to another dimension	17 Moving to another dimension	17 Moving to another dimension		**Do not enter anything in this box!**			
19 Periodic action	19 Periodic action	19 Periodic action	10 Preliminary action				
20 Continuity of useful action	20 Continuity of useful action	20 Continuity of useful action	12 Equipotential				
25 Self-service	25 Self-service	25 Self-service	13 Other way around				
		28 Replace or use a mechanical system	17 Moving to another dimension				
		35 Parameter changes	19 Periodic action				
			20 Continuity of useful action	Your common solutions to your selected			
				dilemmas will appear in the box to the left			
			24 Intermediary				
			25 Self-service				
			27 Cheap disposable objects				
			30 Flexible shells, films or membranes				
			31 Porous materials				
			40 Composite materials/structures				

Figure 5(Above). Excel based output showing common solutions to the contradictions selected.

Figure 6. Box showing the description of the Inventive Principle and some examples.

Solution Descriptions and examples		
Type in solution number here:	2	Separation or extraction

Principle 2. Taking Out A) Separate an interfering part or property from an object or single out the necessary part 1. Eliminate targets 2. Separate the people from the problem 3. Just in time inventory management 4. Activity based costing instead of al

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Jack Stuart was introduced to TRIZ in a seminar offered by Ellen Domb in 2001 and has had a, perhaps, 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.