Perception Mapping and Contradiction Resolution of Voice of the Customer (VOC)

Problem Solving Custom Methodology Case Study

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Introduction

Our world, systems and processes are becoming ever more complex and interrelated. Focusing solely on quantitative analysis and modeling to understand and resolve problems is becoming difficult, if not impossible, due to the amount and variety of data that must be considered and the perils that lay along the analysis path. The perils can be manifested as incorrect problem focus, bad initial data, statistical validation challenges, data crunching mistakes and the possibility of errors in results interpretation. Therefore, it is crucial to have the capability of representing a large and diverse quantitative data set in a qualitative, or abstracted, manner so that very complex situations and systems can be modeled in such a way that the most pertinent and unifying issues are easily identified and then addressed in a holistic manner. This paper describes one such process.

After decades of innovation focused problem solving for technology and business systems I have developed the insight that the methods and procedures for both categories are very closely related. In fact, methodologies traditionally associated with either business or technology can often be used within the other regime. To make my point I will describe the merge of three disparate methodologies into a single solution engine. The first of these methodologies, Voice of the Customer [1] (VOC), was used to gather the input from the customer base that would be used as the foundation of the analyses' problem modeling. The second methodology, Perception Mapping [2] (PM), was employed to understand the qualitative interrelationships between the disparate set of concepts and ideas that was gathered from a variety of stakeholders and decision makers. And finally the third

methodology, the Theory of Inventive Problem Solving [3] (TRIZ), utilized both quantitative and qualitative techniques to model problems and solutions based on a direct analysis of the systems and processes at play. This paper will describe the blended use of these methodologies through a case study of a project I, along with an internal team of client business system experts, performed in late 2009 and early 2010 at Presbyterian Health Services of New Mexico.

Case Study Client and Project

Presbyterian Healthcare Services (PHS) is a not-for-profit system of hospitals, a health plan and a growing medical group. PHS is a vibrant organization with strong quality improvement and problem solving disciplines. Within the larger organization are groups dedicated to continuous improvement and solution generation. One of these teams was tasked with improving the utilization of their OR suites. The specific problem statement was; “PHS needs to increase utilization of available operating room hours”.

The project team used Six Sigma [1] statistical analysis to define their current situation in order to measure where they stood in relation to project goals. They then used VOC and Critical to Quality [4] (QTC) processes to help define what was important to their customers and what was critical to providing high quality services going forward. However, when they arrived at the solution generation portion of the project, the program leaders were not satisfied with the usual solution generation brainstorming methodology that is utilized within almost all “problem solving” processes. Having previously performed TRIZ based innovative problem solving within PHS I was contacted by the project leads to assist them with this new challenge. While the exact process steps I used are numerous, and too in-depth for a detailed explanation in this piece, an introductory discussion of the methods and their purposes will be provided.

Custom Solution Engine

The solution engine was created by combining aspects of several disparate methodologies, a somewhat unknown science and several analysis processes. VOC was used to determine what was important to the customer base. CTQ was

used to determine what was important to providing a quality outcome. PM was used as one method of modeling the problem. TRIZ was used to produce two additional problem models and to model and solve contradictions found throughout the entire problem modeling suite. Finally, QTC statements and other measurement criteria were use to slim down the extensive solution concept set and to determine to what extent each innovative idea would suffice the needs of the overall project.

Solution Engine Process Map

The fundamental behind problem solving is that a problem model is created from an initial problem statement which is then manipulated through some transformation tool, methodology or process into a solution model. More specifically a specific problem statement is changed into a general problem model which is then transformed through some engine or algorithm into a general solution model which is then converted into a specific solution statement. Ok, since that was a bit nebulous allow me to get more concrete. Think back to those lovely word problems your second grade math teacher use to bestow upon you. Consider the specific problem statement; “If Johnny has three apples and Suzy has two apples how many apples do they have together?” Now turn it into a specific problem model; “3+2=?”. Use a solution engine to solve (rules of addition in this case); 3+2=5 and you now have a general solution model, “5.” This general solution model can now be converted into a specific solution statement; “Johnny and Suzy have 5 apples between them.”

Now let’s go back to a more abstract characterization of the process used in this case study. I first developed a model of the problem by creating a PM of the customer concerns, issues and desires. Secondly, I indentified pertinent relationships and characteristics for further analysis by scoring the PM. The resulting focus areas were used as the basis for concentrating the problem solving onto the most pertinent issues and represents the specific problem statement. Next, analysis contradictions were distilled to perform as the general problem statements. Then TRIZ based systematic innovation techniques were used to develop innovative solutions to the focus areas previously identified. These

solutions began as general solution models but were then transformed into specific solution models by integrating them into to the environment they were created for. And finally, various measurement criteria, including QTC statements, were used to identify the most effective solution concepts which are in turn combined into final solution sets.

What is Voice of the Customer (VOC)?

VOC is a term used in business and information technology to describe the process of capturing a customer's requirements. In this case study the VOC was in association with a Six Sigma analysis. The project VOC was the qualitative input data for another tool used within the analysis; Perception Mapping?

What is Perception Mapping (PM)?

PM is a graphical representation of perception interrelationships that is used when manifold perceptions about a situation or problem exist within various inter-related teams or groups. The perceptions can come from a wide range of valuable contributors ranging from line operators to upper management or from customers to suppliers. While all of the perceptions are valid they are often quite diverse due to the various vantage points from which each contributing group views the problem. The diversity of the perceptions is both a blessing and a curse. The blessing is that a diverse set of perceptions about an issue provides a very broad and encompassing look at a problem. The curse is that on the surface a broad set of perceptions can seem marginally, if at all, related to one other. At a first level of analysis it can seem impossible to meld the diverse concepts into a single model. The advantage of PM is that it focuses me on the most unifying perceptions in the set, helps to identify perceptions that contradict each other and reveals logical loops that need to be enforced or destroyed depending on what their contributions are to the situation being addresses. Perceptions can be gathered directly by survey or distilled from VOC and/or CTQ summaries. What is even more powerful about this process is that it can be used with any set of perceptions about any topic or issue gathered in any number of ways. For instance, following a competitor's Twitter ^{TM} account could yield a host of

customer perceptions that could be analyzed for the purpose of understanding the target organization's weaknesses.

What is TRIZ?

TRIZ is the Science of Inventive Problem Solving which was developed by Genrich Altshuller (Soviet engineer working in the Soviet Naval Patent Office) beginning in 1946. The initial discoveries of TRIZ were based on the analysis of over 30,000 patents which lead Altshuller to conclude that inventing is based on understanding and resolving contradictions and that every method used to solve contradictions can be summarized into a set of 40 Inventive Principles.[5]

What are the 40 Inventive Principles?

When Altshuller began researching innovation he came to the realization that not only did all innovative advances serve to resolve some contradiction within the system being analyzed, but that all contradictions were resolved by one or more of a limited number of methods, or principles. When his initial research was concluded Altshuller had compiled a list of 40 principles which encompassed every method observed to address all contradictions he had studied. This list of 40 principles, known as the 40 Inventive Principles [6], still stands today as the entire set of all utilized methods of resolving contradictory requirements within a system or process. As an example, Inventive Principle 1 (Segmentation) states that you should divide and object into independent parts, make and object easy to disassemble or increase the degree of fragmentation of an object. An example of this principle as applied to the OR utilization challenge might be to divide an OR into two sections separated by a sterile barrier or curtain so that as one side is being utilized the other side could be cleaned and prepared for the next scheduled event.

What is Contradiction Modeling?

Contradiction Modeling [7] (CM) is rudimentary to TRIZ and is key because almost all programs, projects, or efforts are put in motion to address contradictions. More specifically, contradictions are situations where existing conditions make a

desired result difficult or impossible. The real beauty of CM is that once a contradiction is accurately understood it is fairly easy to find ways to resolve, or more precisely, transcend it. In other words, TRIZ does not seek to find the perfect balance between the competing requirements of a contradiction but rather it seeks to render the contradiction irrelevant and move the system into a whole new operating space and therefore level of performance.

How to Develop a PM from VOC

In order to develop a PM from VOC statements I first distilled the VOC statements down to a set of independent concepts (see Table 1 – Perception List).

Perception Mapping (PM)	
Identifier	**Perceptions**
A	Dedicated rooms help patient access for on-call issues
B	Dedicated rooms have a negative impact on utilization
C	Schedulers are critical to the current process
D	Block scheduling reduces communication requirements
E	Communication boards improve information access and flow
F	It is important to have flexibility
G	Meeting planned times is important to planning process
H	Quality and quantity of staff and equip impacts schedule performance
I	Load leveling & sequencing and case matching helps with resource planning
J	Need access outside block time
K	Multiple scheduling access methods would be helpful
L	Scheduling rules need to be applied consistently
M	Drs should want to bring patients to the OR
N	Surgeons and anesthesiologists need to accept 24/7
O	Surgeon preference overrides patient preference
P	TOT needs to be 30 minutes or less
Q	Flip rooms are convenient for surgeons
R	Shift change can effect TOT efficiency
S	Anesthesiology variability is an issue
T	Universal rooms would help utilization
U	Layout improvements would help utilization

Table 1 – Perception List

For each of the concepts on the list I then asked, “Which other concept on the list does this concept lead to?” For example, perception “B” (Rooms dedicated to

specific usage models [i.e., brain surgery] have a negative impact on utilization) mostly leads to perception "T" (Rooms outfitted for any and all procedures [i.e., universal rooms] would help utilization). This analysis created the "leads-to" inter-relationships found in column three of Table 2 - Perception List with "leads to" and "conflicts with" Analysis, and thus the PM shown in Figure 1 – Perception Map. Next, for each perception on the list I asked if it contradicted any other perception(s) on the list. As an example, perception "D" (Block scheduling [the process of permanently reserving blocks of time for particular surgeons] reduces communication requirements) conflicts with perception "J" (Surgeons need access outside of block time). This analysis created the "conflicts with" inter-relationships found in column four of Table 2, and thus the four sets of color coded perception pairs found in Figure 2 - Perception Map with Conflicting Perceptions Identified.

Perception Mapping (PM)			
Identifier	Perceptions	leads to	conflicts with
A	Dedicated rooms help patient access for on-call issues	J	
B	Dedicated rooms have a negative impact on utilization	T	
C	Schedulers are critical to the current process	L	K
D	Block scheduling reduces communication requirements	O	J
E	Communication boards improve information access and flow	K	
F	It is important to have flexibility	T	L
G	Meeting planned times is important to planning process	H	
H	Quality and quantity of staff and equip impacts schedule performance	I	
I	Load leveling & sequencing and case matching helps with resource planning	C	
J	Need access outside block time	C	
K	Multiple scheduling access methods would be helpful	L	
L	Scheduling rules need to be applied consistently	J	
M	Drs should want to bring patients to the OR	F	
N	Surgeons and anesthesiologists need to accept 24/7	J	
O	Surgeon preference overrides patient preference	J	
P	TOT needs to be 30 minutes or less	H	R
Q	Flip rooms are convenient for surgeons	P	
R	Shift change can effect TOT efficiency	H	
S	Anesthesiology variability is an issue	P	
T	Universal rooms would help utilization	F	
U	Layout improvements would help utilization	P	

Table 2 – Perception List with "leads to" and "conflicts with" Analysis

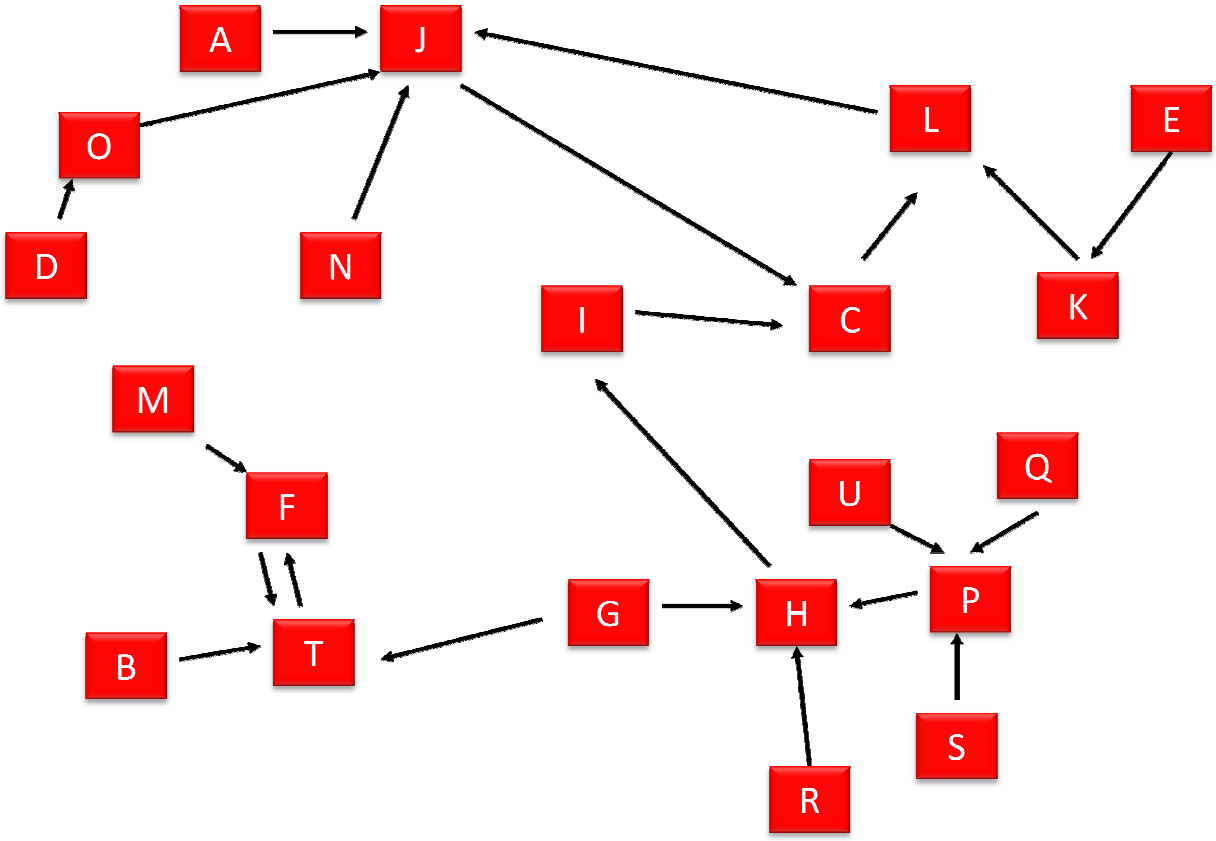

Figure 1 – Perception Map

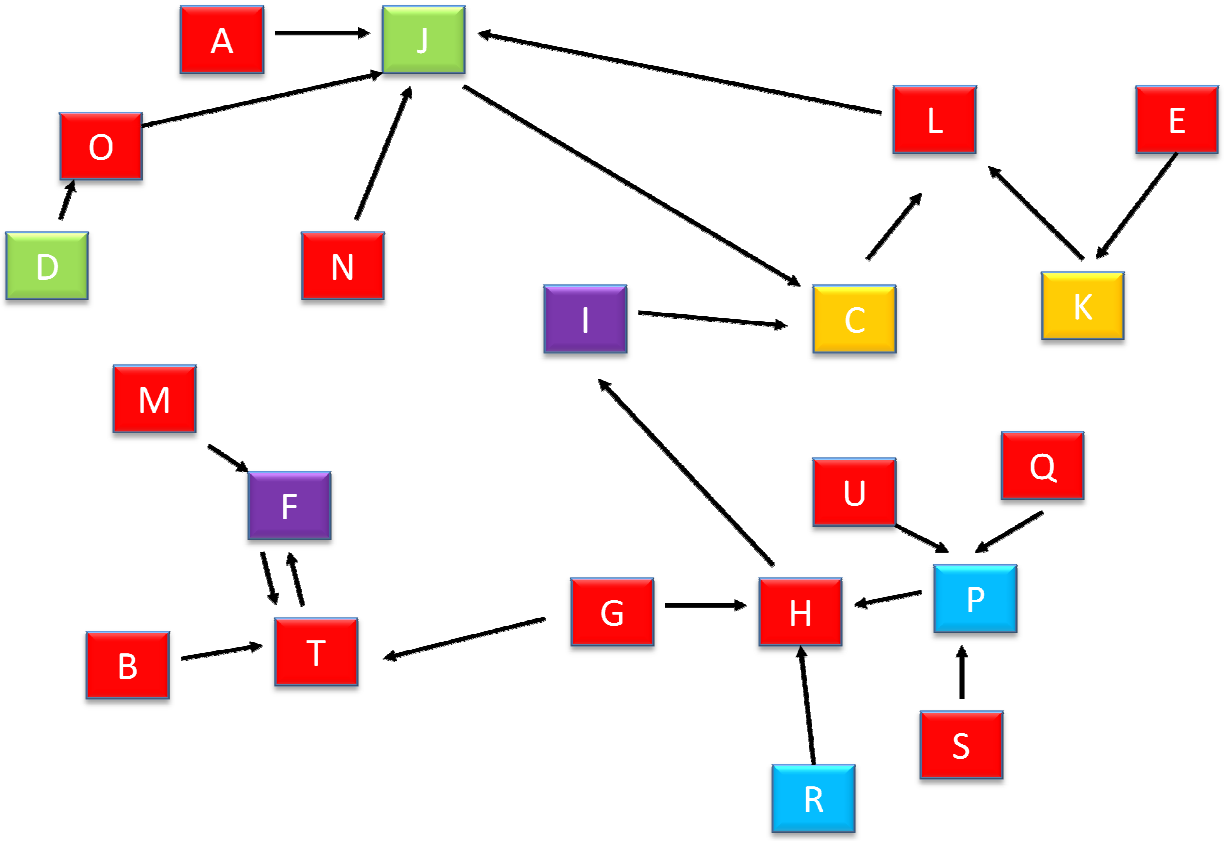

Figure 2 – Perception Map with Conflicting Perceptions Identified

Scoring the Map

Scoring the map is how the significant perceptions, loops and conflicts are identified within the map. First, I gave every perception that was in a loop four points (see red arrows in Figure 3 for one of the loop examples). Next, I gave every perception that was in a conflict chain three points (see blue arrows in Figure 3 for one of the conflict chain examples). Finally, I assigned every perception that was a collector (more than one other perceptions leads to it) "n-1" points where "n" is the total number of perceptions pointing to the perception being scored (see purple arrows in Figure 3 - Loops, Conflict Chains and Collector Node Scoring Examples, for one of the collector point examples). I continued scoring each perception box for inclusion in loops, conflict chains and as collectors until each perception box had been scored. As an example, perception "J" is in a

loop which scores 4 points, is part of a chain which scores 3 points, and is a collector which scores 3 points (n - 1 or 4 - 1 = 3). Therefore, the total score for perception "J" is 4 + 3 + 3 = 10 (see Table 3 – Perception List Scoring). Perception "J" happens to be the highest scoring perception on the map and is therefore the one perception, which if addressed, will have the largest impact on the entire set of perceptions and therefore will do the most to make all contributors to the perception set satisfied.

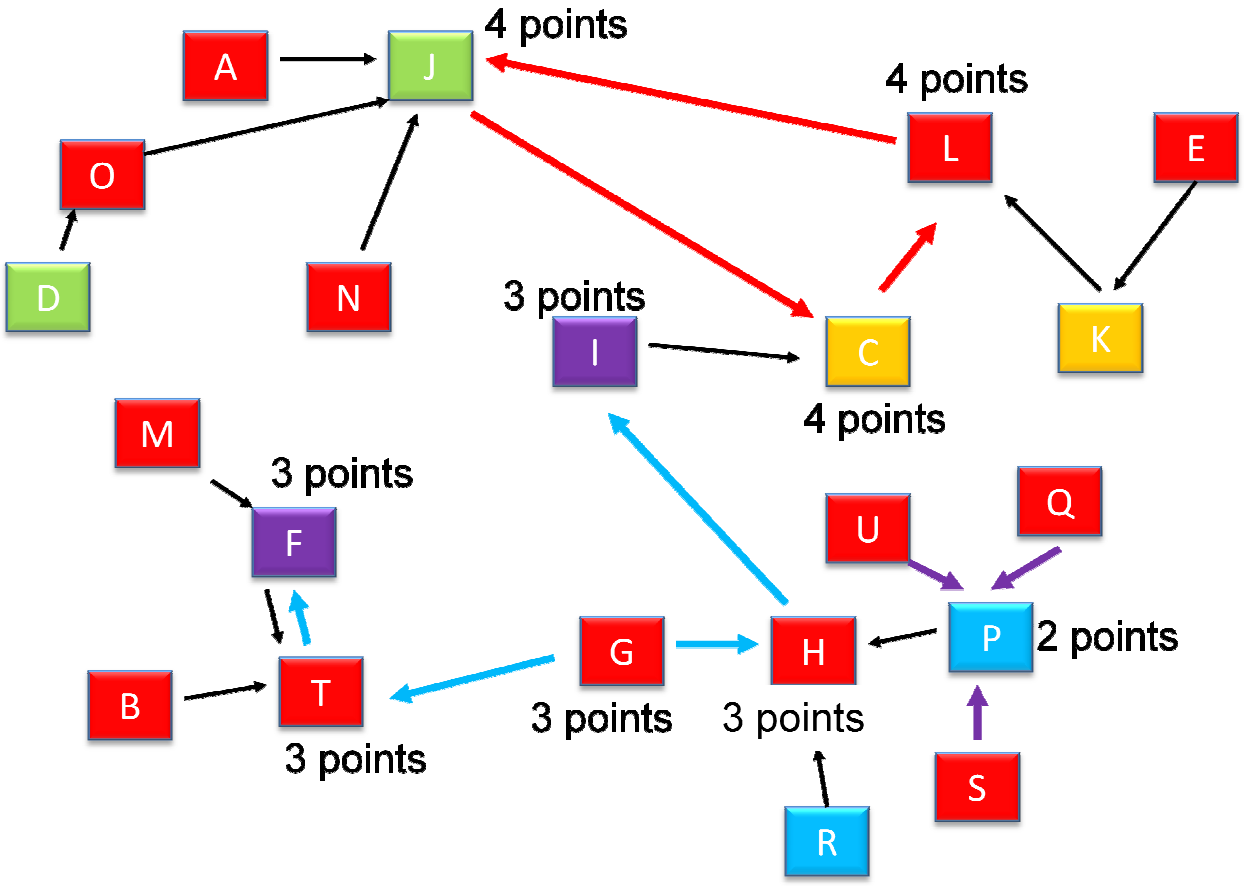

Figure 3 – Loops, Conflict Chains and Collector Node Scoring Examples

Perception Mapping (PM)		Scoring			
Identifier	Perceptions	Total Score	loop (4 points)	collector (n-1)	conflict chain (3 points)
A	Dedicated rooms help patient access for on-call issues	0			
B	Dedicated rooms have a negative impact on utilization	0			
C	Schedulers are critical to the current process	8	4	1	3
D	Block scheduling reduces communication requirements	3			3
E	Communication boards improve information access and flow	0			
F	It is important to have flexibility	8	4	1	3
G	Meeting planned times is important to planning process	3			3
H	Quality and quantity of staff and equip impacts schedule performance	8		2	6
I	Load leveling & sequencing and case matching helps with resource planning	3			3
J	Need access outside block time	10	4	3	3
K	Multiple scheduling access methods would be helpful	3			3
L	Scheduling rules need to be applied consistently	8	4	1	3
M	Drs should want to bring patients to the OR	0			
N	Surgeons and anesthesiologists need to accept 24/7	0			
O	Surgeon preference overrides patient preference	3			3
P	TOT needs to be 30 minutes or less	5		2	3
Q	Flip rooms are convenient for surgeons	0			
R	Shift change can effect TOT efficiency	3			3
S	Anesthesiology variability is an issue	0			
T	Universal rooms would help utilization	9	4	2	3
U	Layout improvements would help utilization	0			

Table 3 – Perception List Scoring

Contradiction Analysis

Previously we identified four sets of conflicting perceptions. Each of these contradictory pairs was converted into a general contradiction. Then, utilizing the Business Conflict Matrix [8], a tool specially developed to associate the 40 Inventive Principles with business process contradiction parameters, I modeled the general contradictions buy assigning an improving and worsening parameter to each pair of conflicting perceptions. For example, considering the contradiction between perception “D” (Block scheduling reduces communication requirements) and perception “J” (Need access outside of block time) I wrote the following general contradiction statement: “If I utilize a block scheduling system solely, then my communication requirements are reduced, but I have less flexibility in utilizing my operating room suite.” Next, I assigned an improving parameter (communication flow) and worsening parameters (adaptability/flexibility) from the Business Conflict Matrix, to my general contradiction statement. I then stated the equal but opposite contradiction; “If I schedule outside of assigned surgeon blocks, then I have more flexibility in utilizing my OR suite, but my communication requirements are increased.” This

opposite statement utilized the same set of parameters but the improving parameter (now adaptability/flexibility) and worsening parameter (now communication flow) assignments were switched. Since there were then two contradictory statements to choose from I made the choice based on identifying the contradiction where the perception with the highest score of the pair provided the desired positive effect. That may have also been a bit confusing to follow so here is an example. Since perception "J" (Need access outside of block time) scored higher at ten points than perception "D" (Block scheduling reduces communication requirements) scoring at three points (see Table 3), I chose the contradiction statement that favors scheduling outside of block time but increases my communication requirements. Therefore, using the contradicting improving parameter of adaptability/flexibility and worsening parameter of communication flow, I located this combination of parameters on the Business Conflict Matrix and identify the 40 Inventive Principles to be used in focused brainstorming of how to resolve that particular contradiction. According to the matrix one of the principles associated with this pair of parameters is Inventive Principle 25 (Self-Service). Self-Service states that an object should be made to serve its self by performing some actions that benefit the system instead of the customer, or target, of the system. An example of self-service in this analysis could be to utilize a centralized clock that in addition to informing the customers (surgeons) as to the time it also triggers and drives other events requiring coordination within the operation. I repeated this process for the remaining three contradictory pairs of perceptions previously identified.

High scoring stand-alone perceptions were also turned into contradictions in and of themselves and solved in the same manner. For example, perception "T" (Universal ORs would help the overall utilization of the facilities), scoring the second highest at 9 points, was converted into the contradictory statement, "If I have universal ORs then my utilization will be improved but the cost of developing the universal ORs will be very high." I assigned an improving parameter of flexibility/adaptability (again) and a worsening parameter of cost. Once again, utilizing the Business Conflict Matrix, I identified the 40 Inventive Principles associated with each pair of contradictory parameters and noted this information

for a subsequent focused brainstorming session aimed at resolving all of the contradictions contained within the perception map.

Solution Generation and Evaluation

After modeling the problem by way of the PM, and two additional methods not discussed in this paper, approximately 20 contradictions were analyzed and a handful of the 40 Inventive Principles were identified for each contradiction. The 40 Inventive Principles were utilized to generate 384 solution concepts. Keep in mind that those 384 solution concepts were all specifically focused on resolving the 20 contradictions established in the problem modeling exercises and therefore were all valid and would be effective if implemented. However, 384 solutions were a large number of ideas to continue analyzing therefore the solution concepts were pared down to those with the highest level of expected effectiveness. To do this the program team and I first scored the solutions against cost, implementation time and complexity which fundamentally rank ordered the entire list from short term to long term projects. It should not be inferred from the short, medium and long-term rankings that solutions valued as a complex, costly and long in implementation time were automatically classified as undesirable. On the contrary those longer term solutions could still have had a positive return on investment calculation. However, once ranked ordered we then divided the list into three sections categorized as short, medium and long term solution. The team pulled about 90 out of each term grouping and thus had 270 concepts to move forward with. We then scored those remaining 270 concepts against support of high scoring perceptions, support (or destruction) of loops and support of individual VOC statements. We then had a list of 90 short, medium and long-term solutions which were then scored against how well they suffice all the requirement of the entire analysis.

Final Solution Set Sample:

A sampling of the final solution developed for Presbyterian Hospital Services was:

- Short-term, Inexpensive, Easy:

1. Surgeon to maintain a back fill list of non-critical cases.
2. Document the cost of a delay or nonproductive time and provide visual indicator to the OR teams.
3. Fill block time from the end to the beginning, release early start for others if not filled (fill the block backwards).
4. Give surgeon an option for overbooking non-critical elective cases.

- Medium-term, Mid-range Cost and Complexity:

1. Concentrate high variability cases to one day or one room so other days/rooms are highly predictable.
2. Countdown on control/indicator board (visually demonstrate time remaining to on time start or on time close-delays). Can use color coding to signify delays, especially during room turnover.
3. E-paging to doctors for case time update.
4. Segmentation of schedule by case type so all similar cases are done on the same day or in the same room.

- Long-term, Expensive, Complex:

1. Patient navigator (concierge) - gets patient through the process from the time the decision is made for surgery until they are discharged home.
2. Completely separate scheduling systems by service lines.
3. Operating on one side of room and prepping on the other side (sterile barrier).
4. Absence of activity in an OR is an indication of schedule problems – install OR motions sensors.
5. Dynamic configurable rooms that can be arranged as needed.
6. Radio Frequency Identification tags on surgeons, patients, gurneys and equipment to signal location in the building.
7. Operate in patient's inpatient room.

The PHS OR utilization project is currently in final system design with phased implementation planned for the next several quarters. The project executed at PHS also used two other problem modeling tools in addition to Perception Mapping. These tools were Functional Modeling and Cause and Effect Analysis. You can learn more about these additional tool sets by visiting my web site,

InnomationLLC.com. Further, you can download the 40 Inventive Principles with business examples, the Innomation LLC 31 Business Parameters with definitions, and the Innomation LLC Business Contradiction Matrix (note: The Innomation LLC Business Contradiction Matrix utilizes a different set of parameters than the previously discussed Business Conflict Matrix utilizes).

Biography:

David Conley received his BS of Nuclear Engineering from Texas A&M University and his Masters of Finance from the University of New Mexico. As an Air Force Officer he performed plasma physics and space nuclear propulsion research and served at Los Alamos and Brookhaven National Laboratories and on NASA's Nuclear Safety Review Panel. His private sector experience includes Johnson and Johnson, Philips Semiconductor and Intel Corporation. At Intel since 1995, David has held a variety of engineering and management roles including a position in Competitive Intelligence. Certified by the St. Petersburg school of the International TRIZ Association as a Level 4 Specialist, David's contributions to the field of systematic innovation include: technical and business problem solving, methodology training, program integration and serving on the Board of the US based Altshuller Institute for TRIZ Studies. David has broad international business and engineering experience and currently lives in New Mexico, USA with his wife and three sons.

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