"Generate Innovation" with the Value Methodology – A Case Study

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Abstract:

The real value of the Value Methodology is to use functions to inspire a change in the thought process of a cross-disciplinary team when evaluating how to improve the value for any given product, process or project. This is exactly what happened in the attached case study which allowed the value study team to not only think in innovative ways by using functions, but to also generate some innovative ideas which led to the submission of US patents. Due to the propriety of the client, I am not allowed to mention the specific company, however, the specific product which was evaluated in this workshop was automotive passenger and side airbags (not the whole system, just the physical airbag or cushion as it is often called). In this study, the SAVE International® six step Value Methodology job plan was followed with an effective cross-disciplinary team after the normal gathering of data required in the pre-workshop stage prior to the actual workshop. This technical paper will show each step of that job plan, and how following the Value Methodology process led to these innovative ideas and US patent submissions.

Introduction:

In the automotive business, airbags are not only required in the front driver and passenger seats of every vehicle manufactured in the USA by the federal government, they are an important factor in the survival rate of occupants in high speed crashes. Today, every manufacturer of airbag cushions globally makes them in very similar manners. They use various layers of different kinds of fabric, some with very high heat resistance, some with less heat resistance but with higher strength requirements, and other fabrics which have a specific amount of elasticity to cushion the impact to the occupant when the airbag is deployed. In every case, all of these various types of fabric are joined together with high strength thread on industrial type sewing machines (mostly manually) but in some operations, automatic machines may be utilized. This is the way airbags have been manufactured ever since the invention of airbags by a gentlemen named John W. Hetrick, a retired industrial engineering technician, when he applied for the first US Patent #2,649,311 in 1953 which he called, 'safety cushion assembly for automotive vehicles'. This patent was the first prototype for today's modern airbag. Although the technology has changed extensively over the years since then to keep up with the technology of the automobile, the method of assembling the fabric has remained fairly much the same with fabric being sewn together with thread, mostly hand fed into industrial sewing machines.

Pre-Workshop Activities:

Personally, I believe that half of the success for any given Value Methodology (VM) study starts with a well planned and executed pre-workshop meeting. If the right agenda, personnel, and data is not explained, gathered, and agreed upon by all team members prior to the workshop with a commitment from all cross-disciplinary value study team members that they will participate in all sections of the workshop all days, the value study is compromised from the start. I don't and won't accept all clients that come knocking on my door, because, quite honestly, not all of them are willing to 'play by my rules', and that is OK with me, because, I want to ensure every client of mine has an excellent first and following value study which utilizes all of the power of this methodology that guarantees maximum

results. I have been in this business too long, to allow it to get a bad name because of improper preparation or discipline of what is required upfront to ensure a successful outcome for that client. I can guarantee results when a client signs up with me because I am particular in my requirements for the value study and so far, in 23 years, I have never disappointed any client.

The preparation starts with a great agenda which allows sufficient time for each of the 6 phases of the Value Methodology workshop study highlighted in blue text per Figure 1 below. Although my agenda may vary slightly due to the client's capability and the subject matter to be studied, Figure 1 below shows a typical 3-day agenda (the shortest I offer) for a manufactured product or process study:

3-Day Workshop Agenda:				Airbag Passenger Cushion	
Workshop Location:				USA	
Workshop Dates:				2017	
Line #	Day	Start Time	End Time	Agenda Item or Description of Subject	Whose Involved or Responsible
1	1	8:00	8:10	Introduction by Engineering Director	Engr. Director
2	1	8:10	8:30	Compliance Discussion by company representative	Specialist
3	1	8:30	9:00	Objectives, Expectations, Introduction to VM	VM Facilitator
4	1	9:00	10:30	Information Phase - Marketing/Quality/Supplier Review	VM Study Team
5	1	10:30	10:45	Break	All
6	1	10:45	12:15	Actual Teardown of Competitive Products (Processes)	VM Study Team
7	1	12:15	12:45	Lunch	All
8	1	12:45	1:15	Function Phase: Function Analysis Training	VM Study Team
9	1	1:15	2:45	Identify Functions and Build FAST Diagram	Team
10	1	2:45	3:00	Break	All
11	1	3:00	3:15	Function Resource Matrix Worksheet Training	VM Study Team
12	1	3:15	5:15	Complete Function Resource Matrix Worksheet	VM Study Team
13	1	5:15	5:30	Day 1 Wrap-up and adjourn	All
14	2	8:00	8:30	Review of previous day's activities	All
15	2	8:30	9:00	Creativity Phase Training	VM Facilitator
16	2	9:00	10:30	Creativity by Function	VM Study Team
17	2	10:30	10:45	Break	All
18	2	10:45	12:00	Creativity by Function	VM Study Team
19	2	12:00	12:30	Lunch	All
20	2	12:30	1:15	Creativity by Function	VM Study Team
21	2	1:15	1:30	Evaluation Phase Training	VM Facilitator
22	2	1:30	3:30	Evaluation Phase using Cost Ranking Matrix	VM Study Team
23	2	3:30	3:45	Break	All
24	2	3:45	5:15	Prioritize Ranking of Ideas into Groupings	VM Study Team
25	2	5:15	5:30	Day 2 Wrap-up and adjourn	All
26	3	8:00	8:30	Review of previous day's activities	All
27	3	8:30	9:00	Development Phase Overview	Facilitator
28	3	9:00	10:30	Start Development of Business Cases (project plans)	VM Study Team
29	3	10:30	10:45	Break	All
30	3	10:45	12:30	Continue Development of Business Cases	VM Study Team
31	3	12:30	1:00	Lunch	All
32	3	1:00	3:30	Finish Development of Business Cases	VM Study Team
33	3	3:30	4:00	Break (Time to combine Business Cases for review)	All
34	3	4:00	5:15	Presentation Phase: Management Report-out Meeting	VM Study Team
35	3	5:15	5:30	Day 3 Wrap-up and adjourn	All

Figure 1 (Typical 3-Day Agenda for a Manufacturing Product/Process VM Study)

Many times if the client is interested (and personally my recommended VM best study) is an agenda for a manufacturing or process related VM study that includes both a plant visit to the actual manufacturing site where the selected current or future product or process is to take place as well as an in-depth competitive analysis of the product or process that most closely aligns with the product or process being studied. This requires one additional day in the VM study per a 4-day VM agenda, however, this extra time is more than worth the extra cost and investment of the organization's personnel. Many times the eyes of the marketing, sales, manufacturing, and procurement personnel are really opened as I include my lean, design for lean, and Design for Manufacturing and Assembly (DFMA) background in the value study plus my 45 years of global product and manufacturing experience with many types of organizations.

The next topic which is critical for a successful VM study is to ensure the right cross-disciplinary team members are assigned to the value study team. Generally for a manufactured product or process and specifically, in this case study on the airbag cushion, the following team members were present for the value study per Figure 2 below:

Value Methodology Workshop Attendees				Workshop Location:	USA
				Workshop Dates:	2017
Area of Responsibility	**Name**	**Confirmed**	**TEAM ASSGNMENT**	**Team Member email**	**Team #**
Engineering (Prpject Leader)			Airbag Team		Cushion
Engineering Design			Airbag Team		Cushion
Manufacturing Engineering			Airbag Team		Cushion
Plant Operations			Airbag Team		Cushion
Finance / Target Costing			Airbag Team		Cushion
Quality Representative			Airbag Team		Cushion
Procurement Representative			Airbag Team		Cushion
Change Leader			Airbag Team		Cushion
VE/VA Manager for Airbags			Airbag Team		Cushion
Lean Specialist			Airbag Team		Cushion
Sales/Marketing Representative			Airbag Team		Cushion
VM Consultant and Facilitator	Jim Bolton		Bolton Value Consulting		

Figure 2 (Required Value Study Team Members for a Manufacturing/Process VM Study)

After the selection of the value study team members, the next important aspect of the pre-workshop activities is to conduct the VM Pre-workshop meeting. All of these team members shown in Figure 3 must also be present for the pre-workshop meeting because each of them will have assignments which will need to be completed prior to the actual VM workshop and I want to ensure each team member understands his or her responsibility in preparing the required data for the actual workshop. Besides preparing the data, these value study team members will present their data in the workshop. This pre-workshop meeting should be completed at least two weeks prior to the actual VM workshop to give each of the value study team members sufficient time to gather the required data per Figure 3 below:

Item #	Item Description	Decision or Action Required	Responsible Person	Target Date
1	Time and Dates for Workshop		Workshop Sponsor	
2	Location of Workshop (room reservations, lunch,etc.)		Workshop Sponsor	
3	Personnel Committed to attend	See attached list	Workshop Sponsor	
4	Logistics (flight and hotel reservations)	Each individual to confirm their own	All Team Members	
5	Support Required at Workshop (Admin. Name)			
	a. Computer projector secured fulltime for all days		Workshop Sponsor	
	b. Easel and flip chart paper available		Workshop Sponsor	
6	Target Costing and Quality Status and Objectives	Current and Objectives to be clearly defined		
	a. Target Cost vs. Current Cost for Product being studied	Cost Targets to be clearly established	Finance Representative	
	b. Quality Target vs.Current Status for Product evaluated	Quality Targets to be clearly established	Quality Representative	
7	Costed Bill of Material with material & processing infor.	See Product BOM Sample tab attached	Finance / Project Leader	
8	Process Operations including time and distance	See Process Review Sample tab attached	Manufacturing Engineer	
9	Supplier and in-house quality & warranty data or targets	input will be included in workbook	Quality/Purchasing Repr.	
10	Sample Components (assembled and unassembled)	need key parts compared to competitors	Product/Technical Leader	
11	Assembly and all Component Drawings	need in electronic format for reference	Product/Technical Leader	
12	Process Tool and Labor Routing Work Instructions	Need sent by target date	Manufacturing Engineer	
13	Tooling & Maintenance Reports (equipment up-time, etc.)	Need sent by target date	Manufacturing Engineer	
14	Process Flow Diagrams and Assembly Line Layout	Need sent by target date	Manufacturing Engineer	
15	Supplier Logistics (Manuf. Location of purchased parts)	See Supplier Logistics tab attached	Purchasing Representa.	
16	DFMEA	need in electronic format for reference	Product/Technical Leader	
17	PFMEA	need in electronic format for reference	Manufacturing Engineer	
18	Selection of Products for Competitive Analysis at event	Competitive Products needed at workshop	Sales / Marketing	
19	Competitive Alternative Process Opportunities	Gather ideas from associates at plant	Manufacturing Engineer	
20	Marketing Strategy and Competitive Situation	Final result should be customer needs		
	a. Marketing Report of competitors & future strategy	identified from all 3 Voice of Customers	Sales / Marketing	
	b. Trends and customer desires per Voice of Customer		Sales / Marketing	
	c. Completed QFD or House of Quality from VOC		Sales / Marketing	
21	Time and Date for Management Review			
	a. E-mail invitation to management members		Workshop Sponsor	
	b. Establish Video-Phone Conf. call for this meeting		Workshop Sponsor	
	c. Distribute management report-out meeting notice		Workshop Sponsor	
22	No cell phones, pagers, no laptop computers (email etc.)		All team members	

Figure 3 (Pre-Workshop Required Data for a Manufacturing/Process VM Study)

Information Phase:

The purpose of the information phase is to get all of the cross-disciplinary team members on the same page with all of the information that each one of them have collected from the above list. Overall my experience in manufacturing based companies, even though many of them say they have a 'team' approach to the design and development of their products and processes, in reality, they may meet together, but each department has their own individual goals which may or may not end up resulting in the final customer achieving the best value for those products or processes. The representative from procurement may have the goal of achieving the lowest purchase order (PO) price on a certain commodity, however, that low PO price may end up causing quality issues on the assembly line, or delivery issues to the manufacturing plant, or warranty issues in the field which in the end, does not give the organization or the final customer the best value. Unfortunately, this is many times the case. Since the same information listed in Figure 4 is presented by the cross-disciplinary value study team member that gathered that information during the actual VM study, I will not repeat it again in this technical paper as it is a lot of proprietary data which I am not allowed to publish.

Function Phase:

This is my favorite phase, as this is where the 'magic' happens. The whole purpose of the function phase is to help the cross-disciplinary team understand the product or process or project in terms of functions and not in terms of materials, components, subassemblies, processes, or systems. Most students at colleges and universities globally are not taught how to think of what the final customer wants in terms of functions. Although some universities teach the Value Methodology, and some others even teach the use of Quality Function Deployment (and when taught properly, it actually uses functions as we know them in the VM world), the percentage of schools that do this is too low due based upon the power of this methodology. Ultimately, every final customer for any given product, process or project, really wants something in terms of functions, whether he or she understands anything about function. There has never been a desire or need of a customer, that I have not be able to turn into a function or even multiple functions, because in reality, all of us buy functions every day whether we know it or not.

The first step in the function phase is to identify random functions for the product, process, or project under study. The cross-disciplinary team developed random functions for the passenger and side airbag (PAB and SAB respectively) cushions per Figure 4 below:

Random Function Identification Worksheet

Subject: Passenger Airbag & Side Airbag Cushions

System or Component	Function	
	Action Verb	Measureable Noun
CUSHION SUBSYSTEM	MAINTAIN	INTEGRITY
	CREATE	SHAPE
	FILL	GAP
	CONTAIN	GAS
MAIN PANEL	CREATE	SHAPE
PROTECTION FLAP	MAINTAIN	FOLD
	COMMUNICATE	INFORMATION
INTERFACE	RESIST	HEAT
	MAINTAIN	INTEGRITY
	MAINTAIN	POSITION
	PREVENT	LEAK
SAFETY VENT	DIRECT	FLOW
	RELEASE	PRESSURE
BAR CODE LABEL	COMMUNICATE	INFORMATION
TAKT STITCHES	MAINTAIN	SHAPE
STITCHES	CONNECT	MATERIAL

Figure 4 (Random Function Identification Worksheet for PAB and SAB Cushions)

The next step in the function phase is use all of the unique functions identified in Figure 4 above to develop a Function Analysis System Technique (FAST) Diagram. The purpose of the FAST Diagram is to ensure the value study team thinks of all customer and performance requirements. The cross-disciplinary team, with my guidance, developed the following FAST Diagram per Figure 5 below:

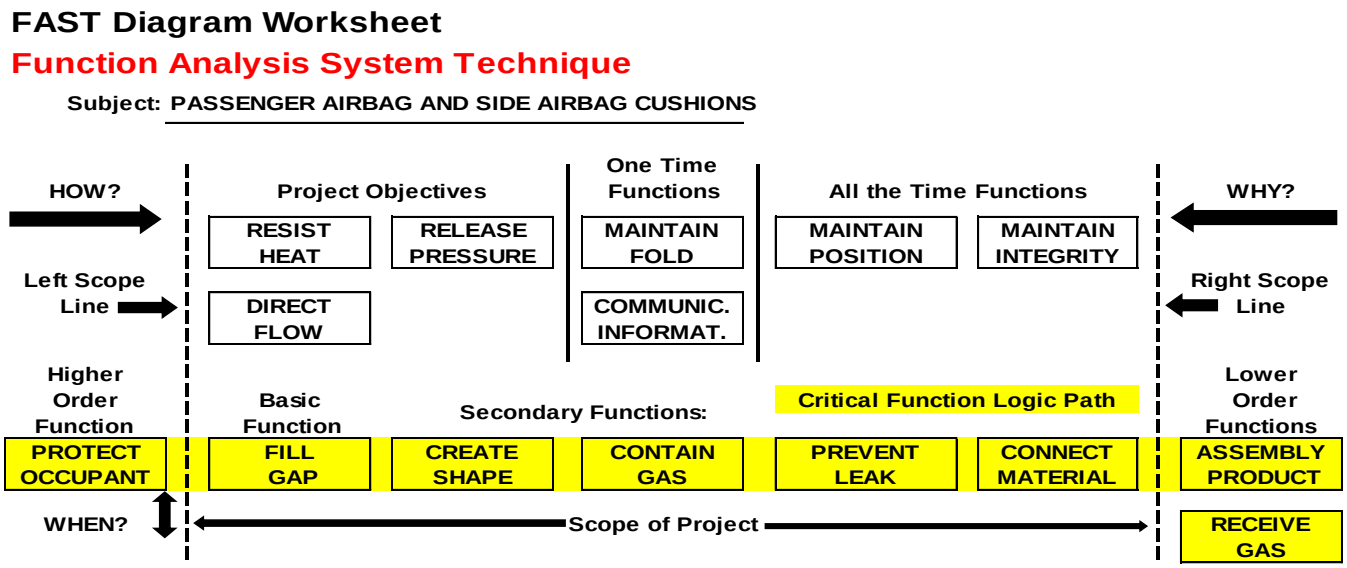


Figure 5 (FAST Diagram for Passenger and Side Airbag Cushions)

After developing the FAST Diagram, it is important to find a way to prioritize the functions for the Creativity Phase of the VM Workshop, since some functions may not be as important as others in optimizing value for the client or customer. Due to the fact that the VM Workshop time with the complete cross-disciplinary team is limited, it is important to ensure the best value propositions can be developed with the functions which have the most value contribution. Although there are many ways to do this, I have found for manufacturing product and process workshops, that the Function Resource Matrix Worksheet (FRMW) works really well as it requires the value study team to determine which functions contribute the most amount of cost for any given product or process. However, before we develop this FRMW, I have developed a Bill of Material entry worksheet which when completed properly, will automatically download the data into the FRMW via various macros I have entered into the Excel spreadsheet. This Bill of Material entry worksheet also includes assembly labor as that is a real cost in the manufacturing of any given product per Figure 6 below:

Component, Process, or Operation	Cost	Cumulative %
CUT PART, SAFETY VENT, RH	1.2893	2.4%
LABEL, AIAG, BLANK, BAR CODE	0.4182	0.8%
THREAD, POLYAMIDE, 69 SPOOL PURPLE	0.0394	0.1%
THREAD, POLYAMIDE, Nylon, 70 Tex	0.034	0.1%
SUBASSEMBLY, CUT COMPONENTS, T	45.0699	82.3%
TEX MATERIAL, THREAD, CUSHION,	0.1082	0.2%
THREAD, POLYAMIDE, SPOOL, 138	1.3316	2.4%
THREAD, SPOOL, 92	0.4672	0.9%
ASSEMBLY LABOR FOR CUSHION	6.0001	11.0%
Total Item Cost Evaluated:	54.76	
Total Item Cost:	55.00	
Percentage of Total Item Cost Evaluated:	99.6%	

Figure 6 (Bill of Material and Labor Entry Worksheet for Passenger and Side Airbag Cushions)

In many VM Workshops, the FRMW is a real eye opening event for many of the value study team members, as they never thought that certain functions contributed that much cost to the customer for that given product or process per Figure 7 below:

Function Resource Matrix Worksheet

TEAM: Airbag Cushions
PROJECT: PAB & SAB
DATE:
FACILITATOR: Jim Bolton

			FUNCTION (ACTIVE VERB / MEASUREABLE NOUN)											
PART or OPERATION:	Cost	Check sum	CREATE SHAPE	CONTAIN GAS	PREVENT LEAK	CONNECT MATERIAL	RESIST HEAT	DIRECT FLOW	RELEASE PRESSURE	MAINTAIN FOLD	COMMUN. INFO	ASSEMBLE PRODUCT	MAINTAIN INTEGRITY	MAINTAIN POSITION
CUT PART, SAFETY VENT, RH	1.29	1.00	0.06 5%	-	-	-	-	0.52 40%	0.52 40%	-			0.19 15%	
LABEL, AIAG, BLANK, BAR CODE	0.42	1.00	-	-	-	-	-	-	-	-	0.42 100%	-	-	-
THREAD, POLYAMIDE, 69 SPOOL PURPLE	0.04	1.00	-	-	-	0.02 40%	-	-	-	0.02 50%	-	-	-	0.004 10%
THREAD, POLYAMIDE, Nylon, 70 Tex	0.03	1.00	-	-	-	0.01 40%	-	-	-	0.02 50%	-	-	-	0.003 10%
SUBASSEMBLY, CUT COMPONENTS, T	45.07	1.00	4.51 10%	9.01 20%	9.01 20%	2.25 5%	13.52 30%	-	-	-			6.76 15%	
TEX MATERIAL, THREAD, CUSHION,	0.11	1.00	-	-	-	0.04 40%	-	-	0.02 20%	-	-	-	0.04 40%	-
THREAD, POLYAMIDE, SPOOL, 138	1.33	1.00	0.27 20%	0.27 20%	0.27 20%	0.13 10%	-	-	-	-			0.266 20%	0.133 10%
THREAD, SPOOL, 92	0.47	1.00	0.09 20%	0.09 20%	0.09 20%	0.05 10%	-	-	-	-			0.093 20%	0.047 10%
ASSEMBLY LABOR FOR CUSHION	6.00	1.00	-	-	-	-	-	-	-	-	-	6.00 100%	-	-
FUNCTIONAL TOTAL	54.76		4.93	9.37	9.37	2.51	13.52	0.52	0.54	0.04	0.42	6.00	7.36	0.19
FUNCTIONAL RANKING: Sort Ranking			6	2	2	7	1	9	8	12	10	5	4	11
			CREATE SHAPE	CONTAIN GAS	PREVENT LEAK	CONNECT MATERIAL	RESIST HEAT	DIRECT FLOW	RELEASE PRESSURE	MAINTAIN FOLD	COMMUN. INFO	ASSEMBLE PRODUCT	MAINTAIN INTEGRITY	MAINTAIN POSITION

Figure 7 (Function Resource Matrix Worksheet for Passenger and Side Airbag Cushions)

When developing the Function Resource Worksheet Matrix, it is critical to include all of the functions from the FAST Diagram for the product or process being studied. Otherwise, you may miss some performance or customer requirements that are critical to the product or process being evaluated. In addition, I like to color code the functional ranking with orange highlighting the functions which have the largest cost contribution, followed by yellow with those that have medium cost contribution, and then green with those functions which have the lowest cost contribution as shown on Figure 7 above.

Creativity Phase:

Creativity Phase starts with a story I tell the value study team members to help them get out of their comfort zone. Now the magic really starts when the team is trained to brainstorm ideas in terms of functions instead of their normal way of brainstorming by materials, components, subassemblies, processes, or systems. We start with the highest cost functions first, but seek to brainstorm as many of the functions as possible with the time allotted. Actually, in this workshop, we only had twelve different functions to brainstorm per those prioritized in Figure 7 above which allowed us sufficient time to brainstorm most of the functions. In fact, in this case study, the innovative ideas which resulted in multiple patents being submitted, came from the function 'Connect Material' which was only $2.51 of the total $54.76 (4.4%) airbag cushion manufacturing cost as shown in Figure 7 above. As the team really engaged with brainstorming functions, they started to ask themselves, what other industry does similar things to what we are doing in the airbag cushion industry for these particular functions. Someone commented, that the fabric industry also has to 'Connect Material' when they join shirt sleeves to torso components, etc. Then I mentioned, how do most of the raincoats manufactured today 'Connect Material'? We discussed this for a while and then I mentioned that most of them are made without threads (due to potential leak paths) but instead are bonded together with the base material itself. Then the lights of the value study team members when on and several ideas (26-38) on the attached Brainstorming Form (truncated to fit this presentation) started to emerge per Figure 8 below:

BRAINSTORMING Form for CREATIVITY PHASE of Value Methodology Workshop

Date:
Team: AIRBAG CUSHION
Facilitator: JIM BOLTON

Bolton Value Consulting

Line #	Ran	FUNCTION	Explanation of Idea in Detail	Team
1		ASSEMBLE PRODUCT	MOVE TOOLING HOLES INSIDE CUSHION WHEN IT IS POSSIBLE	Cushion
2		RESIST HEAT	USE NON FLAMABLE THREAD	Cushion
4		PREVENT LEAK	ELIMINATE 1 STITCH OPERATION BY STITCHING 2 LAYERS OF SEAM PROTECTION TAPE AT THE SAME TIME SAB	Cushion
10		MAINTAIN INTEGRITY	CHANGE MAIN TETHER FROM 2 PIECE TO ONE PIECE IN PAB	Cushion
11		MAINTAIN INTEGRITY	ELIMINATE CIRCLE STITCH IN THROAT AREA ON FLAP IN PAB	Cushion
17		ASSEMBLE PRODUCT	ELIMINATE FOLDING OF THE TETHERS	Cushion
19		CREATE SHAPE	REDUCE LENGTH OF THIGHT MATRIX REINFORCEMENT FOR SAB	Cushion
20		CREATE SHAPE	REDUCE LENGTH OF FLAT FABRIC REINFORCEMENT FOR SAB	Cushion
21		RESIST HEAT	USE METAL MESH FABRIC FOR HEAT SHIELD	Cushion
26		CONNECT MATERIAL	USE MELTED MATERIAL BY VIBRATION WELDING INSTEAD OF STITCHING	Cushion
27		CONNECT MATERIAL	USE MELTED MATERIAL BY SONIC WELDING INSTEAD OF STITCHING	Cushion
29		CONNECT MATERIAL	USE MELTED MATERIAL BY HOT PLATEN WELDING INSTEAD OF STITCHING	Cushion
30		CONNECT MATERIAL	USE MELTED MATERIAL BY CHEMICAL WELDING INSTEAD OF STITCHING	Cushion
33		CONNECT MATERIAL	USE MELTED MATERIAL BY VIBRATION WELDING INSTEAD OF SEAM PROTECTION TAPE	Cushion
34		CONNECT MATERIAL	USE MELTED MATERIAL BY SONIC WELDING INSTEAD OF SEAM PROTECTION TAPE	Cushion
35		CONNECT MATERIAL	USE MELTED MATERIAL BY HOT PLATEN WELDING INSTEAD OF SEAM PROTECTION TAPE	Cushion
36		CONNECT MATERIAL	USE MELTED MATERIAL BY CHEMICAL WELDING INSTEAD OF SEAM PROTECTION TAPE	Cushion
37		CONNECT MATERIAL	USE MELTED MATERIAL BY VIBRATION WELDING INSTEAD OF SEAM PROTECTION TAPE AND STITCHING	Cushion
38		CONNECT MATERIAL	USE MELTED MATERIAL BY SONIC WELDING INSTEAD OF SEAM PROTECTION TAPE AND STITCHING	Cushion
39		RESIST HEAT	STEEL WOOL IN FRONT OF HEAT SHIELD	Cushion
40		PREVENT LEAK	USE MELTED MATERIAL BY HOT PLATEN WELDING INSTEAD OF SEAM PROTECTION TAPE AND STITCHING	Cushion
41		PREVENT LEAK	USE MELTED MATERIAL BY CHEMICAL WELDING INSTEAD OF SEAM PROTECTION TAPE AND STITCHING	Cushion
47		RESIST HEAT	USE KOVENEX FABRIC FOR HEAT SHIELD	Cushion
48		RESIST HEAT	USE TEFLON FABRIC ON HEAT SHIELD	Cushion
49		RESIST HEAT	USE OILED FABRIC ON HEATSHIELD	Cushion
50		ASSEMBLE PRODUCT	ADD AN END STOP (THROUGH GLASS) STITCHING MACHINE TO IMPROVE STITCH LOCATION	Cushion
51		ASSEMBLE PRODUCT	ADD SENSORS TO FABRIC DETECTION AND NO DETECTION	Cushion
52		MAINTAIN INTEGRITY	REDUCE ON PAB FROM 2 STITCHES TO ONE STITCH FOR LABEL	Cushion
65		MAINTAIN INTEGRITY	MOVE LABEL TO END OF FLAP AREA TO TAKE ADVANTAGE OF EXISTING STITCHES	Cushion
66		MAINTAIN INTEGRITY	ATTACH FLAP WITH CROWN STITCH INSTEAD OF SEPARATE STITCH	Cushion

Figure 8 (Brainstorming by Function form [truncated] for Passenger and Side Airbag Cushions)

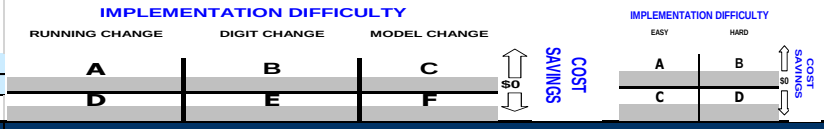
Evaluation Phase:

Figure 9 below shows the Evaluation Form which was used in the next phase of the workshop called, the

EVALUATION Forms for EVALUATION PHASE of Value Methodology Workshop

Bolton Value Consulting

Date:
Team: PASSENGER & SIDE AIRBAG CUSHIONS
Facilitator: Jim Bolton



A
B
C
D
E
F
X - Dupl
Observ

Line #	Ran	Idea #	Timi	BC Gr	FUNCTION	Explanation of Idea in Detail	Team
1	A	A1	6	2	ASSEMBLE PRODUCT	MOVE TOOLING HOLES INSIDE CUSHION WHEN IT IS POSSIBLE	Cushion
2	B	B28	12	8	RESIST HEAT	USE NON FLAMABLE THREAD	Cushion
4	B	B31	9	7	PREVENT LEAK	ELIMINATE 1 STITCH OPERATION BY STITCHING 2 LAYERS OF SEAM PROTECTION TAPE AT THE SAME TIME SAB	Cushion
10	B	B37	6	3	MAINTAIN INTEGRITY	CHANGE MAIN TETHER FROM 2 PIECE TO ONE PIECE IN PAB	Cushion
17	B	B44	6	3	ASSEMBLE PRODUCT	ELIMINATE FOLDING OF THE TETHERS	Cushion
19	B	B47	9	6	CREATE SHAPE	REDUCE LENGTH OF THIGHT MATRIX REINFORCEMENT FOR SAB	Cushion
20	B	B48	9	6	CREATE SHAPE	REDUCE LENGTH OF FLAT FABRIC REINFORCEMENT FOR SAB	Cushion
21	C	C13	24	9	RESIST HEAT	USE METAL MESH FABRIC FOR HEAT SHIELD	Cushion
26	C	C18	18	10	CONNECT MATERIAL	USE MELTED MATERIAL BY VIBRATION WELDING INSTEAD OF STITCHING	Cushion
27	C	C19	18	10	CONNECT MATERIAL	USE MELTED MATERIAL BY SONIC WELDING INSTEAD OF STITCHING	Cushion
29	C	C20	18	10	CONNECT MATERIAL	USE MELTED MATERIAL BY HOT PLATEN WELDING INSTEAD OF STITCHING	Cushion
30	C	C21	18	10	CONNECT MATERIAL	USE MELTED MATERIAL BY CHEMICAL WELDING INSTEAD OF STITCHING	Cushion
33	C	C24	18	10	CONNECT MATERIAL	USE MELTED MATERIAL BY VIBRATION WELDING INSTEAD OF SEAM PROTECTION TAPE	Cushion
34	C	C25	18	10	CONNECT MATERIAL	USE MELTED MATERIAL BY SONIC WELDING INSTEAD OF SEAM PROTECTION TAPE	Cushion
35	C	C26	18	10	CONNECT MATERIAL	USE MELTED MATERIAL BY HOT PLATEN WELDING INSTEAD OF SEAM PROTECTION TAPE	Cushion
36	C	C27	18	10	CONNECT MATERIAL	USE MELTED MATERIAL BY CHEMICAL WELDING INSTEAD OF SEAM PROTECTION TAPE	Cushion
37	C	C28	18	10	CONNECT MATERIAL	USE MELTED MATERIAL BY VIBRATION WELDING INSTEAD OF SEAM PROTECTION TAPE AND STITCHING	Cushion
38	C	C29	18	10	CONNECT MATERIAL	USE MELTED MATERIAL BY SONIC WELDING INSTEAD OF SEAM PROTECTION TAPE AND STITCHING	Cushion
40	C	C30	18	10	CONNECT MATERIAL	USE MELTED MATERIAL BY HOT PLATEN WELDING INSTEAD OF SEAM PROTECTION TAPE AND STITCHING	Cushion
41	C	C31	18	10	CONNECT MATERIAL	USE MELTED MATERIAL BY CHEMICAL WELDING INSTEAD OF SEAM PROTECTION TAPE AND STITCHING	Cushion
52	D	D2	6	2	MAINTAIN INTEGRITY	REDUCE ON PAB FROM 2 STITCHES TO ONE STITCH FOR LABEL	Cushion
55	D	D5	6	2	ASSEMBLE PRODUCT	LASER CUT CORNERS RADIUS INSTEAD OF 90°	Cushion
65	E	E8	6	3	MAINTAIN INTEGRITY	MOVE LABEL TO END OF FLAP AREA TO TAKE ADVANTAGE OF EXISTING STITCHES	Cushion
66	E	E9	6	3	MAINTAIN INTEGRITY	ATTACH FLAP WITH CROWN STITCH INSTEAD OF SEPARATE STITCH	Cushion

Figure 9 (Evaluation Form for Passenger and Side Airbag Cushion)

Evaluation Phase. Now that the ideas have been generated, they need to be evaluated with respect to feasibility, timing, and overall performance that would still meet both customer and performance requirements. Although there are two forms I generally use for manufacturing type value studies, due to the fact that these were existing products currently in production, we chose to use the ABCDEF Evaluation Matrix per Figure 9 where a Running Change means any ideas that can be done internally without customer or service community notification, a Digit Change would need the customer and/or service community to be notified, and a Model Change would indicate that added value or performance, or visual change would be required and thus a new model would have to be or should be developed for those ideas to ensure the customer was aware of the change in value proposition:

Development Phase:

In this phase the best ideas are developed into actual project plans which I call business cases where non-conflicting ideas with similar timing and similar risk are combined into one business case per Figure 10 below:

Business Case (BC)

I. GENERAL INFORMATION

				Program Status Risks		Conf. Level (tech+cost+timing)
Person Presenting:		Project Leader:		Technical	Y	
Ideas Considered	C18-C31	Module Set:	Cushions	Time	Y	50%
Brands		Platform:	All Sewing Operations	Cost	Y	

II. PROJECT DESCRIPTION

Project Name	INNOVATE CUSHION CONSTRUCTION
Current Design / Process	SEWING PROCESS USING THREAD
Proposed Design/ Process	EVALUATE NEW METHODS OF JOINING FABRICS

III. Business CASE SUMMARY

Currency	USD	Unit Savings	$ 2	Material Annual Savings	$ 14,977,600			Conversion / Quality / MPV Savings	$ 394,500
Start of Production Date	Q2-2018	Total Investment & Validation	$ 15,000,000	Payback Months (total Volume)	11.7	Total Annual Savings	$ 15,372,100	Risk Weighted Annual Savings	$ 7,686,050

Advantages (+'s)	Challenges	Tooling Costs	Validation Tests	
THREAD ELIMINATION	PROCURE 500 NEW MACHINES @ $30,000	15000000	PV Test	
	Total CAPET & Validation	$ 15,000,000	Validation Costs	$ -

IV. ANNUAL CONVERSION (Labor or returnable packaging), QUALITY, and MPV SAVINGS SUMMARY

Other Savings	Description	total
CONVERSION	10% improvement in cycle time for 500 sewing operators	$42,000
QUALITY	Scrap reduction of 75% with more reliable sewing process (less potential for operator error)	$217,500
CONVERSION	75% improvement in repair due to no needles and more reliable equipment	$135,000
	Total Other Savings	$ 394,500

V. Project Assumptions for Cost Analysis, Technical Feasibility, Cost/Tooling Estimates, Marketing, and so on

SAFETY IMPROVEMENT
Quality Improvement
DOWNTIME REDUCTION
Assumes a material SCRAP REDUCTION of 75% due to bags not sewn properly
EQUIPMENT OPTIMIZATION
Assumes a 10% improvement in cycle time and LABOR REDUCTION when protential new machines run 30 % faster
Assumes a 75% reduction in TECH SUPPPORT as a result of no needles and a more robust equipment

VI. MATERIAL SAVINGS

	Baseline or Existing			New or Proposed			Cost Saving Calculation			
#	Part Number	Cost/Unit	Qty/Product	Part Number	Cost/Unit	Qty/Product	Annual Volume	Unit Saving	Annual Saving	Part Description
1		1.8722	1		0	1	8000000	$ 1.87	$ 14,977,600	Thread elimination
							TOTAL	$ 1.87	$ 14,977,600	

VII. GENERAL PROJECT PLAN

Start of Production	Q3-2018

VIII. NEXT STEPS

Action	Responsible Person	Timng (in weeks)
RESEARCH FOR THE EQUIPMENT/SUPPLIER		12
REQUEST PROTOTYPE SAMPLES		3
VALIDATE TECHNOLOGY (SAMPLES)		52
ESTIMATE COST FOR EQUIPMENT		6
IMPLEMENTATION TIME (LAUNCH NEW TECHNOLOGY)		104

Figure 10 (Business Case for Innovative [patent pending] Airbag Cushion Joining Technology)

This business case above is for the new joining method to eliminate all thread from the plant to 'Connect Material'. In fact, one of the manufacturing engineering team members during the Development Phase, actually called one of his industrial sewing machine suppliers to see if they had experience with sonic welding, heat staking, hot platen welding, and vibration welding of fabric. They in fact, manufacture those types of machines already for the fabric industry and was willing to try some airbag cushion fabric to determine if the machines he produced, would be capable to connect that type of fabric. Although various alternatives are being evaluated, due to the high volume of cushions produced at this client's plant, the attached business case actually shows a one year payback based upon having to purchase new machines for the plant to eliminate the current sewing operations. This was just one of several business cases developed by the airbag cushion value study team.

Presentation Phase:

During this phase, we seek to obtain the support and approval from the management team for the business cases developed during the actual VM Workshop. Without their support and buy-in to assign human and provide financial resources for execution of the business cases, there will not be true value added to the client or for the customer, thus this phase is very important. I always ensure this phase is scheduled for the last 90 minutes of the actual workshop while the value study team is excited and the enthusiasm is still running high. Figure 11 below show all of the business cases that were presented to the management team:

Value Methodology Workshop Summary

Value Engineering Workshop Project: Passenger and Side Airbag Cushions

Date: | **Currency** USD | Business Cases presented at Management Mtg.

Business Case #	BUSINESS CASE SUMMARY DESCRPTION	QUALITY	CONVERSION	MPV	MARKETING	COST CHANGE	% Conf	Risk Weighted Annual Total Cost Savings	Estimated Annual Total Cost Savings	Estimated Investment	Payback (months)	Annual Material Cost Saving	Annual Conversion and Quality Costs Saving	UNIT SAVINGS
1	PROCESS CHANGE OPTIMIZATION	■	■				90%	$ 46,620	$ 51,800	$ 30,000	6.95	$ -	$ 51,800	$0.00
2	PAB Design and Process Changes		■	■	■	■	70%	$ 166,967	$ 238,524	$ 7,500	0.38	$ 141,024	$ 97,500	$0.35
4	Optimize seam tape/eliminate vent protector		■	■		■	60%	$ 35,985	$ 59,975	$ 1,000	0.20	$ 22,000	$ 37,975	$0.07
5	Replace seam tape with sacrificial seam		■	■		■	60%	$ 30,825	$ 51,375	$ 1,000	0.23	$ 33,000	$ 18,375	$0.10
6	PAB HEAT RESIST MATERIAL		■	■			60%	$ 163,324	$ 272,206	$ 6,000	0.26	$ 235,456	$ 36,750	$0.59
7	INNOVATE CUSHION CONSTRUCTION	■	■			■	50%	$7,686,050	$15,372,100	$ 15,000,000	11.71	$14,977,600	$ 394,500	$1.87
	Total Workshop Potential Savings							$8,129,770	$16,045,980	$ 15,046,000		$15,409,080	$ 636,900	$2.98

USD CURRENCY EXCHANGE		
IN USD	$8,129,770	$16,045,980

Figure 11 (Value Methodology Workshop Summary prepared for Presentation Phase [Management Report-out)]

Conclusion:

Even though a 4.4% cost item from a function ranking point of view may seem insignificant, it this particular case, it had the largest impact in this value study to not only the client but also to the final customer. In addition, this organization has the opportunity to protect this concept via its patent submission process and become truly innovative in this industry. This is what the Value Methodology is all about – coming up with innovative, patent pending ideas that will add real value to products, processes and projects globally. With the right training, the right cross-disciplinary value study team, the right strict attention to the Value Methodology process as defined by SAVE International's Body of Knowledge, and the right experienced CVS, tremendous possibilities are not only possible, but quite often normal. I was very honored to be asked to lead this study and help this organization in its Value Methodology journey.