

# LEAN MANUFACTURING and VALUE MANAGEMENT CONVERGENCE of DIVERGENT TOOLS

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## Biography



Dr. Bijay Nayak is Vice President, Manufacturing of SAVE International, USA. He has global professional experience in manufacturing industries in the USA, Canada, Australia, Thailand & India. He holds a Ph.D. degree in Mechanical & Manufacturing Engineering from Swinburne University of Technology, Melbourne, Australia. He has published and presented numerous chapters and technical papers in The Value Engineering Handbook (Published by Society of Japanese Value Engineers, Japan), Industrial Engineering Practice Users' Encyclopedia (Published by International Journal of Industrial Engineering, USA), International Conferences, and Journals in the USA, Canada, Australia, England, Japan & India. Recipient of Outstanding Professional Award for dedicated achievements in the field of Lean Manufacturing (USA), Distinguished Leadership Award for outstanding contributions to Lean Manufacturing (USA), and National MOHTA Award for the best Value Engineering Project (India).

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## Abstract

This paper begins with three fundamental questions :

1. Should there be a joint venture between Lean Manufacturing & Value Management to combat global cost competitive pressure ? The answer is unequivocally ***“Must”***.
2. Can there be a rational, meaningful & sensible partnership between two divergent tools – Lean Manufacturing & Value Management ? The answer is clearly ***“Yes”***.
3. Is manufacturing industry truly interested in and committed to such integration of Lean Manufacturing & Value Management ? The answer is quite ***“Mixed”***.

The paper highlights the history of Lean Manufacturing & Value Management and their development as two separate, and stand alone tools over past 5 decades for cost reduction & waste elimination. It focuses on the similarities & dissimilarities between Lean Manufacturing & Value Management and highlights the benefits of collaboration & alliance between these two tools. The paper introduces the integrated concept of “Lean Value Management (LVM)”. Lean Manufacturing & Value Management have a lot of synergy and the synergized concept (LVM) is much more powerful & useful in today's cut throat globally competitive manufacturing environment. The integrated Lean Manufacturing & Value Management, if properly utilized in the manufacturing industry, will significantly improve the bottom line profit, enhance value to the customers, and eliminate non-value added & wasteful functions, features, processes, operations & activities in any system. The attempt is made to show the “Value Gap” between customer perception of “Value” and manufacturer's offer of “Value”. Finally, the paper focuses on the challenges and key issues of integrating two independently powerful tools in North American manufacturing industry.

## **A. Introduction**

Lean Manufacturing and Value Management have their respective strengths and weaknesses. When applied in a planned and focused manner, the respective strengths and weaknesses of these methodologies are complimentary. For projects of any scope, large or small, careful and judicious application of a combination of these two disciplines will yield synergy, and corresponding beneficial results, beyond what application of only one discipline would otherwise yield. This paper explores the nature of the two approaches, the basis for collaborative synergy, and proposes a model for integration. Lean Manufacturing and Value Management are great disciplines. Too often, practitioners use only one of these approaches, where a combination of disciplines/tools would yield greater benefits. Too often, practitioners of one of these disciplines view other discipline as competitive methods, not complimentary methods that will greatly aid and facilitate use of the other methods. The methods can compliment each other on an ad hoc basis, but they work better as part of a cohesive model.

Lean Manufacturing and Value Management are both proven cost reduction and continuous improvement techniques used in the manufacturing business and industry. The well-established Lean Manufacturing technique is founded on elimination of waste and non-value added operations & activities, lean manufacturing mindset, knowledge and teamwork. Similarly the well-established Value Management is founded on system functionality, knowledge and teamwork.

As we look at each tool deeply, we can detect some fundamental similarities in strategies, and techniques as well as differences in the application, timing, participant roles and project focus. Each tool has its own strengths and weaknesses which when considered relative to the desired goals and outcomes of a given project, may help determine which tool is most appropriate.

No single tool or technique can be panacea for all improvements. Unfortunately, some opt for one methodology over others believing that one approach can provide everything they need in all areas such as cost, quality, delivery, savings, process improvements, etc. This raises a point worth considering that it can be advantageous for an organization to use Lean Manufacturing and Value Management concurrently or as complementary to one another to achieve the best & optimal results.

## **B. Lean Manufacturing & Value Management as Independent Tools**

Lean Manufacturing and Value Management are methods developed independently in time, with the intent to address different problems.

### **B.1. History of Lean Manufacturing**

Henry Ford is credited for the use of core principles and practices of Lean Manufacturing at Ford Rouge River manufacturing operation during 1917-1937. Henry Ford developed Lean Manufacturing concepts to improve production line flow. Ford later on abandoned lean strategy in favor of a “Process Village” model, and production suffered. Meanwhile, Toyota, under the leadership of Taiichi Ohno, continued to refine and develop Lean principles and practices they learned from Ford Motor Company. Japanese visitors saw Ford’s Rouge River plant in operation and applied the principles and practices of Ford Rouge River operations to their operations what they saw at Ford. They applied, refined, and expanded Ford’s operating methods & principles, eliminated wastes, improved quality and increased customer value relentlessly. Continued and focused application of Lean Manufacturing principles and practices is an inherent part of the Lean Organization Culture – the central component of Lean Model. Taiichi Ohno from Toyota is regarded as the father of Toyota Production System (TPS) which is widely described as Lean Production.

Eiji Toyoda and Taiichi Ohno pioneered the concept of Lean Manufacturing (i.e. Toyota Production System - TPS) at the Toyota Motor Company after World War II. Lean Manufacturing became the strength of the Japanese motor vehicle industry because it was able to eliminate waste of the resources, manufacturing space, investment tools, engineering hours, and new product development time by 50% than that of mass production. Lean Manufacturing caused Toyota to gain market share and revitalize the automotive industry. This revitalization and increased market share caused other automobile manufacturers around the world to become interested in Toyota Production System.

The International Motor Vehicle Program (IMVP) at Massachusetts Institute of Technology (MIT) was created in 1985 to learn Toyota’s techniques, and the research & learning of the fundamentals of Lean Manufacturing began.

John Krafcik, a factory specialist on the IMVP research team, coined the term “Lean” because it consumed less of everything and eliminated waste. Lean principles incorporate teamwork, communication, efficient use of resources, elimination of waste, and stressed the importance of continuous improvement. As the Lean principles were studied, the IMVP research team incorporated other value improving principles, such as Kaizen ( a continuous, incremental improvement process ) and Value Engineering (VE) technique to achieve Target Costing, Statistical Process Control (SPC), Total Quality Control (TQC), and Computer Aided Design (CAD). After years of collaborative research and learning, it was concluded that the fundamental ideas of Lean are universal and Lean Manufacturing can be applied equally to every industry where cost, quality, and resource allocation matter. Lean Manufacturing focuses on the pursuit of perfection, creating reliability, and eliminating anything that does not add value to meet or exceed customer expectations. It changes how people think and how people make choices.

### **B.1.1. Seven Types of Wastes in Lean Manufacturing**

Lean Manufacturing focuses on seven types of wastes which are explained in Figure-1 below.

**Figure-1: Seven Types of Wastes in Lean Manufacturing**

Type of Waste	Definition
Waiting	Time spent waiting for items required to complete a task (i.e. information, material, supplies, instruction etc.)
Unnecessary Motion	Any motion that does not add value to a product or service
Overprocessing	Effort and time spent on processing material which doesn't add value
Excess Inventory	Material that is waiting for processing or not required per customer demand
Unnecessary Handling	Unnecessary transportation of material by conveyor, forklift, or foot travel
Overproduction	Producing more products than the ultimate customer requires
Rework or Defects	Time spent on reworking or repairing defective products

### **B.1.2. Value Stream Mapping (VSM)**

Value Stream Mapping (VSM) is a powerful tool used in Lean Manufacturing study. Value Stream Mapping is the simple process of directly observing the “flow of information and material” as they occur and summarizing them visually. It is a tool to analyze process flows from a systems perspective and to document the performance of the process. A Value Stream involves all of the steps, both value added and non-value added, required to bring a product or service through the process steps. Value Stream Mapping is a visual tool used to help see the hidden waste – and sources of waste – in the value stream. A Current State Map (CSM) is drawn by a cross-functional, multi-disciplined team to document how things actually operate (this is the “as-is” process). Then a Future State Map (FSM) is developed to design a lean process flow through the elimination of the root causes of wastes & non-value added activities and through process improvements (this is the “as it should be” process) – all leading to an Implementation Plan that details the action steps needed to support the objectives (the What, Who, and When).

As with the theories of waste identification & elimination, Lean Manufacturing principles, Value Stream Mapping has its roots in Toyota Production System (TPS). Toyota Production System focuses on three flows, such as material, information and people & process. Value Stream Mapping covers the first two flows (material & Information) and is based on the materials & information flow in Toyota Production System.

During the 1990's the driving force behind the use of Value Stream Mapping emerged as Lean Manufacturing which was pioneered by Dr. James Womack, author of The Machine That Changed the World (1990) and Lean Thinking (1996). Just as Function Analysis is part of Value Management, Value Stream Mapping is part of Lean Manufacturing.

A Value Stream is defined as all of the actions (both value added and non-value added) required to complete a product or service from beginning to end. Value Stream is all about “flow”, whether it is process flow from raw materials to the customer (Manufacturing Value Stream) or a design flow from concept to product launch (Engineering Value Stream). The Value Stream often involves many processes and crosses numerous functions. Therefore, it is vital to have all of the operators, users and customers of the Value Stream involved in the improvement activity.

Value Stream Mapping is a technique that establishes a common language to document processes and provides a blueprint for improvement by identifying wastes and non-value added activities. It enables team members to visualize the process, point to problems, and focus direction for future lean efforts. Value Stream Mapping starts with engaging right people, a multi-disciplined cross-functional team of people responsible for implementing new ideas.

Value Stream Map (VSM), a Lean Manufacturing tool, is a powerful tool for seeing waste, and providing the basis for moving forward eliminating waste, and identifying areas requiring improvements. A good Value Stream Map will include customers who will establish the “business case”, i.e. they will tell what they want, they will give the criteria to establish when we are effective. They will also tell where there is waste in the processes/products. Suppliers also have role in developing the Value Stream Map.

#### **B.1.2.1. Value Stream Map (VSM) identifies:**

1. Customer requirements
2. Process waste
3. Areas generating poor quality
4. Processes lacking inter-organizational coordination
5. Labor cost
6. Material cost
7. Inventory cost
8. Maintenance cost

Typically a Value Stream Map developed in a session is attended by representatives from all organizations involved in the product flow. Value Management methodology includes creating /using Process Flow Charts and comparable tools, but it doesn't offer a mechanism quite like a Value Stream Map in Lean Manufacturing.

Deliverables from a Value Stream Map include detailed description of the current process. For each step in a value stream, the map will detail flow time, cycle time, number of people involved, raw materials/work in process/finished stock inventory, change over time, yield, and other relevant information. The Value Stream Map will identify areas in the value stream with quality problems, inventory problems, highest levels of wastes, identification of the areas offering the greatest potential for improvement in efficiency, effectiveness and reduction in the lead time.

#### **B.1.2.2. Key Elements in Value Stream Mapping :**

The key elements in a Value Stream Map are documented in the following established sequence:

1. The Customer (and the customer's requirements)
2. Main Process Steps (in order, including undocumented work)
3. Process Metrics (Process Time, Wait Time, Change Over Time, First Time Quality, Work-in-Process Inventory)
4. Supplier with Material Flows (using a value stream walk-through)
5. Information and Physical Flows (how each process prioritizes work)
6. Overall Performance of the Value Stream

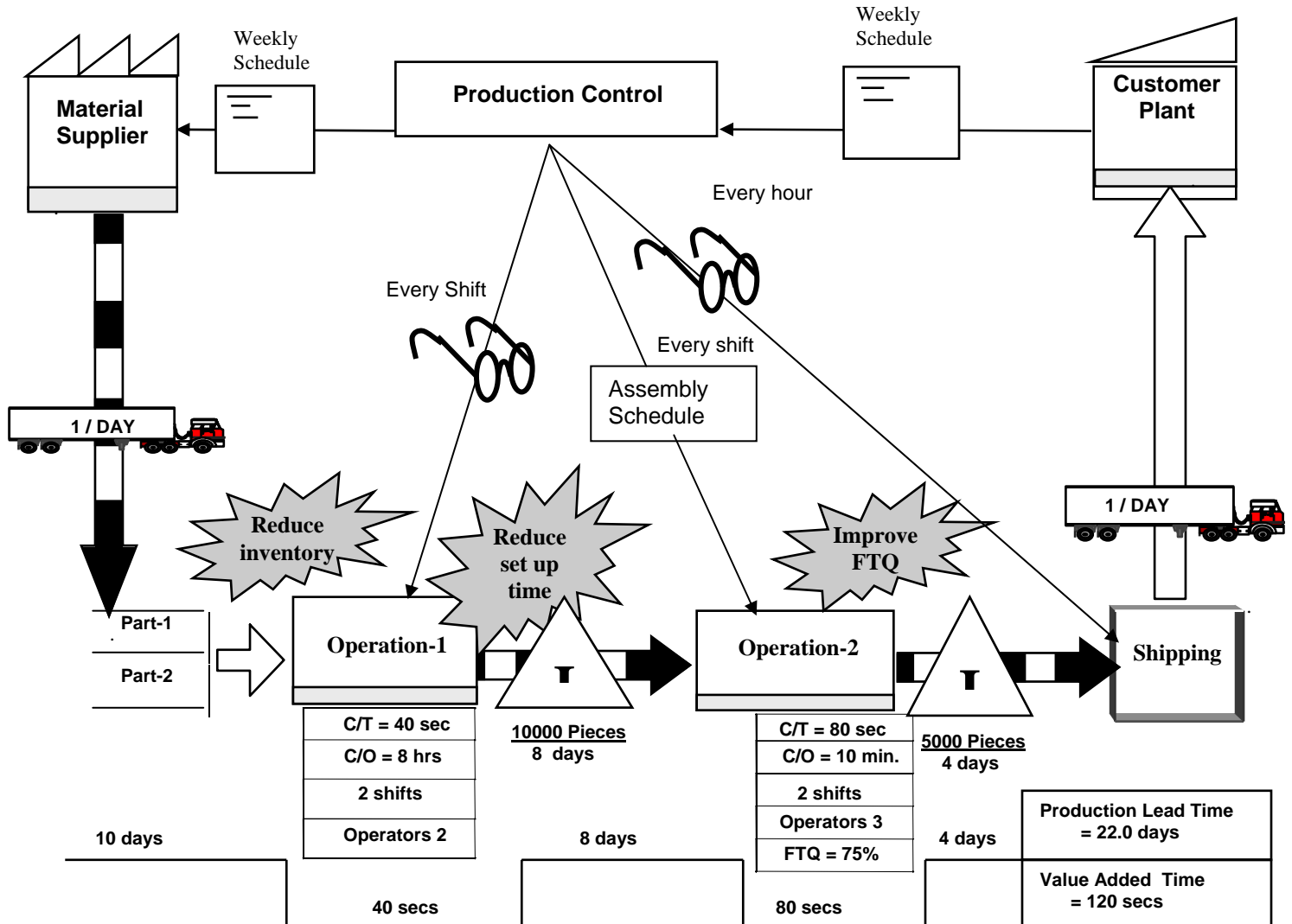
#### **B.1.2.3. Steps in Value Stream Mapping process involves following steps:**

The Value Stream Mapping process involves following steps:

**a. Current State Mapping (CSM) :**

The Current state Map shows how things really work, This is the “as-is” condition with all of the problems, inefficiencies, and flaws displayed for the entire team to see. The Current State Map should be an honest depiction of what is really happening. There must be thorough documentation of all non-value added activities. The mapping team should identify the wastes in the system and the root causes of those wastes. Waste is a symptom that points to the problem within the value stream or system. The identification of root causes of wastes leads to the elimination of problems and prevention of similar problems from reoccurring. Current State Map example is shown in Figure-2.

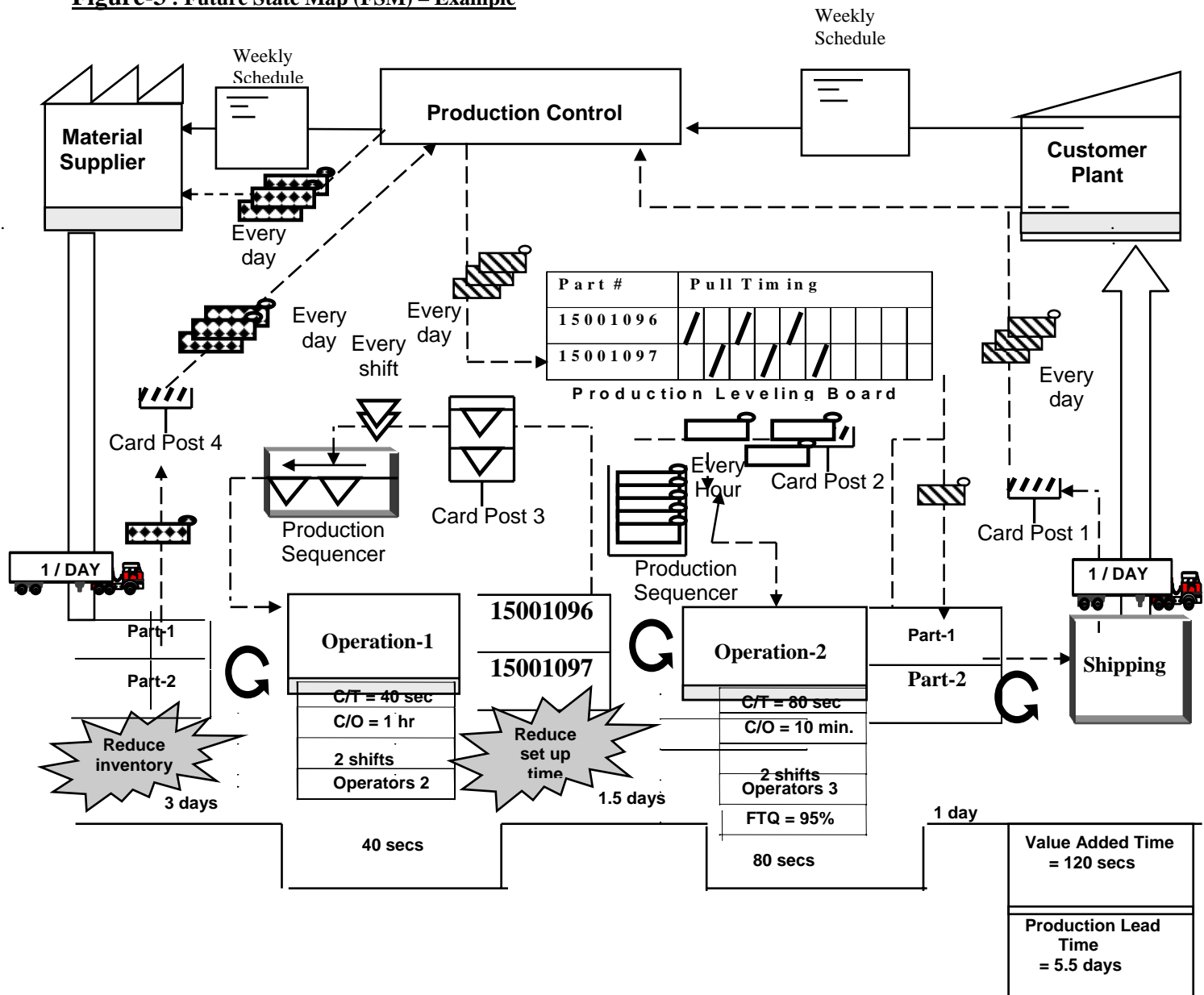
**Figure-2 : Current State Map (CSM) - Example**



**b. Future State Mapping (FSM) :**

Future State Map improves the flow and reduces waste in the value stream. This future state must meet the customer requirements and it includes necessary process improvements to achieve the Value Stream Vision. The mapping team revisits the initial business objectives and reviews the Current State Map to capture their initial ideas for changes. Key to improving the flow of the value stream is the elimination of the root causes of the wastes identified in the Current State. There is no single correct Future State. It depends on the business goals of the enterprise. Future State Map example is shown in Figure-3.

**Figure-3 : Future State Map (FSM) – Example**



### c. Implementation Plan :

Implementation Plan describes the necessary improvements which should be realized in the Future State. The mapping effort is simply a tool; implementing the plan is the key to success. A strong Implementation Plan must be achievable, and aggressive. It must include a Communication Plan with associated documents and established reviews to confirm the results. The Implementation Plan is critical to track, manage, and react to the progress of the implementation activities. By tying the Value Stream design to the organization's business objectives, the accompanying lean transformation will have a better chance of taking hold.

## B.2. History of Value Management

Value Analysis was founded by Lawrence D. Miles at General Electric after World War II mainly for substitution of materials which were in shortage due to war and to identify suitable substitute materials to reduce adverse impacts of shortage of some raw materials. They found that substitute materials often worked better, at lower cost. Value

Engineering was founded by Lawrence D. Miles in 1961 which has a proud 40 plus year history of success at reducing costs.

Value Management is also known as Value Engineering, Value Analysis, Value Control. Value Analysis / Value Engineering (VA/VE) is the process for getting more for less. In a hardware product it is getting more performance, better quality and improved customer satisfaction for less cost to produce. Applied to an organization or a service activity it is getting desired results faster with fewer resources. Value Analysis / Value Engineering (VA/VE) uses a value equation that says Value is equal to Function divided by Cost ( $\text{Value} = \text{Function} / \text{Cost}$ ). Value can be increased by increasing functionality & maintaining same costs or maintaining same functionality and reducing cost or increasing functionality & reducing cost. Either way, the result is more value for the customer.

### **B.2.1. Ten Principles of Evaluating a Product**

When Lawrence D. Miles, father of Value Analysis, began practicing the discipline of Value Analysis after World War II, he laid down following 10 principles for Purchasing department to use in evaluating a product.

1. Does the use contribute to value ?
2. Is it cost proportionate to its usefulness ?
3. Does it need all its features ?
4. Is there anything better for the intended use ?
5. Can a usable part be made by a lower cost method ?
6. Can a standard product be found that will be usable ?
7. Is it made on proper tooling – considering quantities made ?
8. Do materials, reasonable labor, and profit total its cost ?
9. Will another dependable supplier provide it for less ?
10. Is anyone buying it for less ?

### **B.2.2. Standard Questions in Value Analysis Studies**

1. What other material will do the job ?
2. Can we use a standard part ?
3. Can assembly be simplified ?
4. Is the part or process necessary ?
5. Can we combine parts & processes ?
6. Can we outsource these steps in manufacturing ?
7. Can delivery and storage of parts be made more efficient ?

Value Engineering has proven its ability to reduce costs by 30% to 50% or more without adverse effect on the product. In fact, in most cases the product or service is improved.

Value Engineering applications are rapidly increasing throughout the world. Over 25 countries recognize Value Engineering as an effective management tool and all areas of business, government and society are achieving its benefits. The potential effect of Value Engineering is not a reflection on past performance. It is the result of changing times, advancing technology, new attitudes and a host of new requirements.

Value Analysis (VA) was conceived and gestated entirely within a factory environment. At the time its conception it was an era of relative stability and large factory workforce, with concurrent long average working lives of employees with single employers. Particular features emanating from this and the era (1940's – 1960's) would include:

1. Large internal repository of knowledge concerning the factories products and manufacturing methods contained within the factory workforce, a substantial number of which would have a single employer for all their working life.
2. Information on costs, particularly internal costs available in-house.
3. Large workforce and less pressure on time making possible the freedom to take time out for activities such as Value Engineering.

### **B.2.3. Importance of Concept of Value**

Until Larry Miles it is reasonable to think that no one had seriously considered how value was made up in a product or project. What constitutes value ? How are the sediments of value laid down in a particular product ? Which bedrocks were they eroded from – materials, labor, function etc. ? Why is someone interested in buying the product ? Larry Miles introduced the product purchaser or customer the true judge of value. Miles postulated four components of value for a product as Use Value, Cost Value, Esteem Value and Exchange Value. Larry Miles defined the keenest value for a product as being the minimum cost necessary to create the appropriate use and esteem value components. The concept of value allowed a new esperanto to equivalence to materialize and dissolve hitherto artificial walls that separated products and their components. If use and esteem would be provided in some alternative way that was cheaper, then value was improved. Perhaps they could be improved for the same cost of manufacture, or even less cost. This new “freedom to dream” of alternatives organically meshed with the deliberate creative stage inserted into the Value Analysis Job Plan.

### **B.2.4. Value Analysis - Study of Function**

Function in Value Analysis permitted the consideration of what a product must do, sheared from how that function was currently provided. Again this opened a door to freely considering a new better or alternative ways of providing the function and through the development of function diagramming, investigation of whether some functions were really necessary in the context of appropriate value for a product. Function allows a way of breaking the impassive surround of an existing product into intelligible blocks that can be methodically thought about, when no other technique provides a magic key way of unraveling sufficiently what is tangible to think of new ideas that offer possible value improvements.

Value Analysis is about detailed study of functions.

1. Unnecessary features had crept into the design during the manufacturing stage.
2. A possible improvement had been left out of the design, or a less satisfactory one put in due to lack of right idea at the right time.
3. Temporary conditions of supply or tooling had forced the company to use a less desirable material or less efficient method of processing.
4. A design or production decision was the wrong one for the product.

### **B.2.5. Functional Analysis System Technique (FAST) Diagram**

Functional Analysis System Technique (FAST) is a diagramming technique which shows the relationships and interrelationships of all identified Functions within a specific project utilizing How-Why logic pattern based on intuitive logic. FAST is a “function-oriented” diagramming technique. It shows pictorially the relationships of the functions as a product does the work it was designed to do, i.e. what is actually happening now.

FAST Diagram is a powerful Value Analysis Technique which :

- a. Shows the specific relationships of all functions with respect to each other.
- b. Tests the validity ( How-Why logic) of the Functions under study.
- c. Deepens our understanding of the problem to be solved.

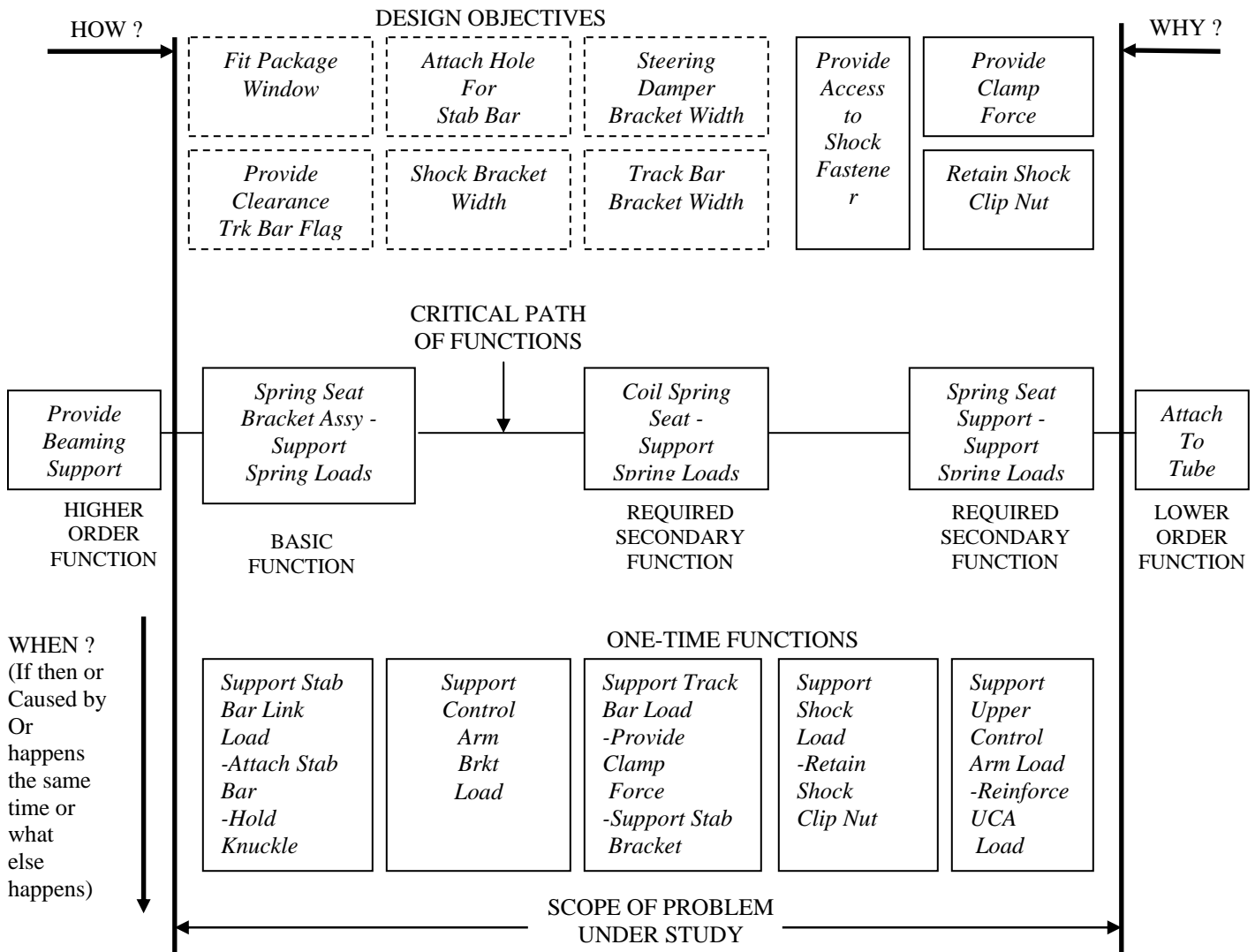
For small projects, Functional Evaluation (Verb & Noun) is relatively easy task. For complex Projects, Functional Evaluation becomes more involved and literally 100s of functions can be defined on this random basis. FAST diagramming was developed for these complex projects. FAST diagram is shown in Figure-4.

## **C. Similarities & Differences between Lean Manufacturing & Value Management**

The most prominent similarity between Lean Manufacturing and Value Management, and a reason for the perception is that one can choose one and leave other, is that both tools contribute to the same strategic goals within an organization which can include reducing costs, reducing wastes, improving quality & reliability, improving functionality & efficiency, etc. Additionally, similarity can be made between the steps of Lean Manufacturing “Elements” & and Value Management “Job Plan” . While the mechanics may vary, similarities can be noted in the



**Figure-4 : Functional Analysis System Technique (FAST) Diagram- Example (Stampings Assy.)**



logic. The similarities between Lean Manufacturing Elements and Value Management Job Plan are shown in Figure-5 & 6.

### C.1. Similarities between Lean Manufacturing & Value Management

1. The foundation of Lean Manufacturing Value Management is teamwork. The combined skills, knowledge, and effort of the project team is the motivation which drives the effort with Lean Manufacturing or Value Management professional acting as facilitator, directing the team.
2. Lean Manufacturing and Value Management start with and maintain a focus on the "customer" and getting the right people involved in a creative process.
3. Lean Manufacturing is about building "value" for the customer by eliminating waste and non-value added work. Value Management is about building value for the customer by improving performance or function while reducing life-cycle cost.
4. Lean Manufacturing works to strike a "balance" as well as uses a structured approach that bears a strikingly resemblance to Value Management. Value Management is very much about "balance" – in improving performance and function while reducing total costs while satisfying the customer. Value Management is a systematic team approach that follows a structured Job Plan.

**Figure-5: Similarities between Lean Manufacturing Elements and Value Management “Job Plans”**

Lean Manufacturing Elements	Value Management Job Plan	Purpose
Current State Map (CSM)	Information Phase / Functional Phase	a. Define problem to be solved, gather background material and data, establish system/process functions/characteristics. b. Identify inputs/outputs and relationship, identify sources of defects/cost drivers
Future State Map (FSM)	Speculation Phase / (Creative Phase) Evaluation Phase	a. Screen potential opportunity areas, Evaluate alternative opportunities
Future State Map (FSM)	Development Phase	a. Identify optimal designs/operating conditions from alternative opportunities
Implementation Plan	Implementation Phase	a. Implement process/design improvements, validate and document results

## C.2. Differences between Lean Manufacturing and Value Management

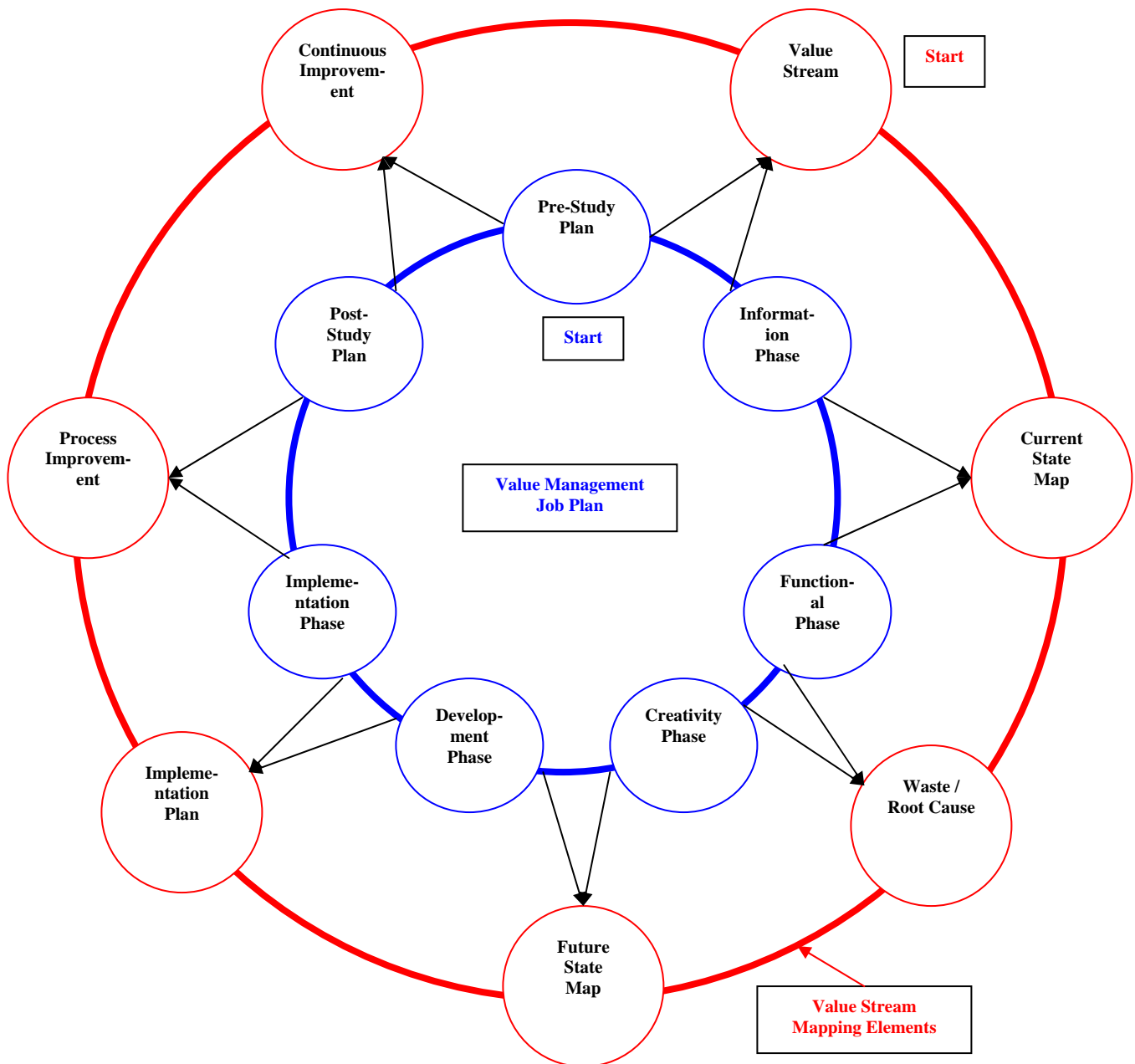
Now that we have established that Lean Manufacturing and Value Management have some similarities, let's examine the significant difference between the two. There are cases where one may have a distinct advantage over the other.

1. Lean Manufacturing is beneficial in elimination of wastes in a process or service. Value Management is beneficial in design analysis of non-manufactured objects, such as building construction, road and bridge construction, shipbuilding, spacecraft etc. Because of the very large scale and uniqueness of each of these types of projects, accurate and reliable data on all aspects rarely exists. Similarly, such data generally is not available on manufactured products at the early development stages. The knowledge based, team oriented Value Management is clearly beneficial for these applications.
2. Depending on the scope, the overall timeframe is often quite different between Lean Manufacturing and Value Management. From initial Lean Manufacturing project selection to conclusion of a workshop may generally be 2-3 weeks. Whereas a Value Management of a comparable scale may require 4-8 weeks at which point, the proposal should be ready to move forward to the implementation phase.
3. Lean Manufacturing focuses on elimination of wastes, non-value added activities, and lead time reduction. Whereas, Value Management focuses on functions, and non-value added product features, processes & systems.
4. Lean Manufacturing is not an analytical process in the sense that Value Management provides analytical tools. Lean Manufacturing is a collection of principles and attitudes, the application of which, over time, will reduce cost.
5. In Lean Manufacturing, Value Stream Mapping (VSM) is used as a tool to show flow of material & information, whereas in Value Management, Functional Analysis System Technique (FAST) is used as a tool to show inter-relationship of functions.

## D. Lean Manufacturing & Value Management – Strengths & Weaknesses

Based upon individual applications of Lean Manufacturing and Value Management, different strengths and weaknesses may be observed. The practitioners should be aware of the advantages or disadvantages of each of these approaches within the context of their own organization's products, processes & systems objectives. The appropriate strategy can lead to effective concurrent or complementary use of both techniques, if so desired. The comparison between Lean Manufacturing and Value Management tools and the effects of Lean Manufacturing and Value Management attributes are shown in Figure-7 & 8 respectively.

**Figure-6 : Relationship Between Value Management Job Plan and Value Stream Mapping Elements**



### D.1.1. Lean Manufacturing - Strengths

1. Value Creation is central concept in Lean Manufacturing to build robust, adaptive, flexible and responsive enterprise. Value Creation encompasses value identification, value proposition, and value delivery.
2. In Lean Manufacturing the team concept is very essential.

**Figure-7: Comparison of Lean Manufacturing and Value Management Tools**

<b>Lean Manufacturing Tool</b>	<b>Value Management Tool</b>	<b>Purpose</b>
VSM (Value Stream Mapping)	FAST (Function Analysis System Technique)	Details system functions/process steps and arranges them in dependent order/ Sequence to visualize correlation
Process / Step Listing	Function Listing	Lists all input & output functions/variables As well as categorizing them relative to one Another (e.g. Lean Manufacturing by “Processes”, and Value Management by “Basic” & “Secondary”
Cost Pareto	Cost Pareto	One-dimensional analytical method to identify opportunity areas based in one relation (e.g. “Cost by Waste” in Lean Manufacturing and “Cost by Component” in Value Management
Cost-Process Worksheet	Cost-Function Worksheet	Correlates system components/process steps to functions performed using an arithmetic weighting method to discern significant areas of opportunities/risks.

**Figure-8: Effects of Lean Manufacturing and Value Management Attributes**

<b>Attributes</b>	<b>Lean Manufacturing</b>	<b>Value Management</b>
Effectively Reduces Cost and Increases Value	High	High
Customer Focus	High	High
Workforce Participation	High	High
Visual Analytic Tools	High	High
Effective Process/Product Design	Low	High
Systematic Enterprise Approach	High	Low
Rigorous Analytic Tools	Low	High
Optional Tactical Use	Low	High
Effective Enterprise Transformation	High	-
Rigorous Creativity Tools	-	High
Low Cost Entry	-	High
Rigorous Risk Management	-	Low

### **D.1.2. Lean Manufacturing - Weaknesses**

1. History of Lean Manufacturing methods is not as succinct. Lean is not an analytical process in the sense that Value Management provide analytical tool. Lean is a collection of principles and practices (and attitudes), the application of which, over time, will reduce waste.

### **D.2.1. Value Management - Strengths**

1. It facilitates a comprehensive study of a relatively large system or project. The breadth of a Value Management study is helpful in visualizing and correlating various components of complex systems, understanding overall system functionality and costs and identifying improvement opportunity areas.
2. The broad study scope in conjunction with a focus on the Value Equation (  $\text{Value} = \text{Function} / \text{Cost}$  ), make Value Management particularly effective at improving functionality, and reducing material costs within a system. The Value Management tools 7 techniques are fashioned to orient the team's energies toward this objective by centering attention on functions and costs and their interrelationships, and systematically examining alternatives
3. The greatest strength of Value Management is its use and promotion of teamwork. Teams are particularly beneficial where tasks are too large or complex for one person or need to be done quicker than an individual can perform. In Value Management workshops, teamwork is very critical for success of the project. The knowledge and thoughts shared, and consensus built by a skilled team is invaluable to the quality of the results.
4. Value Management can be effective even where complete data is unclear or non-existent. This is particularly valuable in cases where Value Management is applied early in the development cycle of a new product (Value Engineering) or on construction or other projects where the design is unique. In these events, specific production data and field performance statistics simply don't exist. However, this is a critical time in the life of a system to affect design that drive cost and functionality. Rational, feasible conclusions can be reached and plans for further development made based on the educated input and directional estimates of the team.
5. There are three reasons why Value Management works :
  - a. Value Management has its core as functional analysis which leverages creativity.
  - b. Value Management is flexible. It can be used on simple problems, or on complex problems. It can be applied to a range of issues. It is relatively easy to learn, and application improves with experience.
  - c. Any systematic, reasonable, analytical process will improve operations but any such process will not work equally well in all situations. If challenged to solve a problem, a Value Management team will produce results that increase quality, reduce cost and increase overall value.

### **D.2.2. Value Management - Weaknesses**

1. The team-oriented, knowledge-based approach to Value Management can also fall prey to subjectivity and opinions. Occasionally, participants who hold their own irrational agendas or cling to honest wrong beliefs can jeopardize the results of a Value Management workshop. Depending on the role and influence of such participants, this behavior can be anything from an annoying, time-consuming distraction to seriously undermining the objectives of the rest of the team.
2. Value Management requires relatively high resource utilization. With development plans being compressed, staffs becoming difficult for teams to commit, all available resources for 3-5 days or more to conduct a Value Management workshop. In some cases, critical team members bow out or assign an unprepared substitute at the last minute, or the team requests an abbreviated workshop session given conditions.

## **E. Lean Manufacturing & Value Management Synergy**

In order to use Lean Manufacturing and Value Management in an effective manner, they need not be connected or interdependent. An organization can successfully use both tools concurrently by different practitioners for different applications. Each technique has its own strengths for which it is best suited. Using both simultaneously but separately, meets a broader range of continuous improvement requirements.

There are variety of ways in which Lean Manufacturing and Value Management can be used in a complementary fashion to make them more effective. Lean Manufacturing tools & techniques may be used to enhance Value Management studies and vice-versa. Additionally, it may be beneficial for an organization to conduct a Value Management study on certain aspects of their Lean Manufacturing procedure.

Lean Manufacturing is not enough to turn the situation around to ward off global competition, and to achieve lower costs. Lean Manufacturing alone can not provide the cost reductions necessary to keep North American manufacturers globally competitive. Lean Manufacturing is usually employed to solve existing problems that may have been plaguing the company for years. At the end, it is all about cost. In more and more industries, excellent quality, on-time delivery, and supplier customer service are simply requirements to play. Companies should and will always try to use these factors to set themselves apart from lower cost competitors, but quality, delivery, and service will only go so far in offsetting higher prices.

Typically in auto industry, the breakdown of manufacturing cost : material cost = 50-55%, labor cost = 10-15% , and overhead (fixed & variable) cost = 30-40%. Therefore, we have to focus where the cost is. Design features drive material costs, a comprehensive cost reduction effort must attack the material cost embedded in the product design. Value Engineering is a powerful and effective tool for attacking material cost embedded in a product's design as well as helping reduce variable overhead costs. Moreover, it is proactive in nature and it can be employed in the design phase of products and processes that will aid in avoiding serious problems later in production.

Lean Manufacturing addresses the labor and variable overhead segments of the cost structure, but have little or no impact on material cost which is about 50-55%. For the most part, design features of the product drive material costs, and the Lean Manufacturing methodology offers little in the way of a tool kit for paring these costs. Purchasing & Supply Chain department will reduce price and material cost to a degree, but these efforts will always be limited by the underlying characteristics of the product design.

Value Management, by its very nature, is an intensive, interdisciplinary problem-solving activity that focuses on improving the value of the functions that are required to accomplish the goal or objective of any product, process, service, or organization. Value Management's goal is the systematic application of recognized techniques that identify the "functions" of the product or service, establish the "worth" of those "functions", and provide only the necessary "functions" to meet the required "performance" at the "lowest overall cost". Value Management's focus on accomplishing the required "functions" at the "lowest overall cost" differentiates it from the Lean Manufacturing methodology. Value Management eliminates or minimizes wasted material, time, and product cost, which improves "value" to the customer.

Lean Manufacturing views the cause of "poor performance" as wasteful activity. Lean is a time-based strategy and uses a narrow definition of waste (non-value-adding work) as any task or activity that does not produce value from the perspective of the end customer. Increased competitive advantage comes from assuring every task is focused on rapid transformation of raw materials into finished product.

Both Value Management and Lean Manufacturing rely extensively on transforming operations into alternative forms of visual information. In Lean Manufacturing, a Kaizen or Continuous Improvement team will consider using a variety of visual analytical tools to identify waste. Spaghetti diagrams, flow diagrams, bar charts, standard work sheets, and production control boards, are part of Lean Manufacturing tool. Value Management uses function analysis, Function Analysis System Technique (FAST) diagramming to describe the functional relationship of the product, process, or service and identify functions where the team should focus on improving value.

Value Management relies on a rigorous interdisciplinary approach to problem solving. It uses a systematic approach to problem identification and solution. It is function oriented and promotes a "clean-sheet" approach that supports innovative solutions. Creativity is a key component to the Value Management problem solving activities that promotes "breakthrough thinking". It also uses a structured "job plan" that promotes consistency in application and helps assure results. Increased competitive advantage comes from the identification of innovative ways to accomplish key functions at a lower cost with improved quality and reliability. The FAST promotes a synergistic approach to problem solving that develops solutions far beyond that which only an individual could produce. These attributes combine to produce some superior advantages to problem solving when Value Management is employed.

Creating Value is the core of Lean Manufacturing, and creating Value is at the core of Value Management. Lean Manufacturing and Value Management use different approaches to accomplish the same objective. Assuming no one approach is superior in every respect to other approaches, there may be concepts, approaches, and tools in each approach that could help the other.

Lean Manufacturing and Value Management were not developed with the intention they be compatible. To manage them so they are compatible takes knowledge and insight. To manage them so they are complimentary takes

experience, skill, judgement, and determination. It is not easy getting an organization to use one approach with any degree of effectiveness – getting an organization to use two methods in concert takes a bit of doing.

Synergy between Lean Manufacturing and Value Management is increasingly recognized. Although Lean Manufacturing is commonly used in production areas, whereas Value Management is most commonly used in design. Increasingly, Lean Manufacturing and Value Management are used outside their traditional areas, and opportunities for synergy are increasing.

Lean Manufacturing and Value Management can work effectively, independent of the other method, but they work better together, particularly in a process where a team can take advantage of respective strengths and avoid respective weaknesses.

**One ideal integrated Lean Manufacturing and Value Management process is as under:**

1. Select processes/item improvement opportunity. Tie it to larger organization, mission/goals, problem areas, and high cost areas.
2. Conduct enterprise level Value Stream Mapping. Include customers, suppliers and other organizations.
  - a. Document current state and draw Current State Map.
  - b. Develop Future State Map after identifying & eliminating wastes in the current state.
  - c. Create Future State Achievement Plan to include:
    - i. “Do It” actions and fixes that require little coordination.
    - ii. Action targeting use of Lean Manufacturing, and Value Management methods.
    - iii. Actions requiring policy changes, information system changes, and similar activities.
    - iv. Possible additional upstream and downstream Continuous Improvement / Value Stream Map events.

Selection of method (Lean Manufacturing or Value Management) can be done tactically or as part of a larger strategy. Both approaches emphasize the importance of the Customer.

The synergy between Lean Manufacturing and Value Management enters the process at “Action targeting use of Lean Manufacturing, and Value Management methods” step. After identifying areas of waste and high cost in the value stream, the team can choose the most relevant tool, either Lean Manufacturing or Value Management.

The Lean Manufacturing programs have the same essential ingredients as are necessary for an effective Value Management program. Initiation of a Lean Manufacturing program requires the appointment of a Sensei, i.e. a personal teacher with a mastery of Lean thinking and techniques. Similarly Value Management program requires the appointment of a Certified Value Specialist (CVS) who has the knowledge and mastery of Value Methodology.

## **E.1. Necessary for an Effective Lean Manufacturing & Value Management Program**

Three ingredients of an effective Value Management Program are: Executive Involvement, Substantive Investment, and Systematic Effort

Lean Manufacturing & Value Management Program requires a climate conducive to Identifying Wastes, Challenging Tradition, Suggesting Change, Individual Growth, and Rewarding Results

## **E.2. Levels of Value Creation in Lean Manufacturing and Value Management**

**E.2.1. Per Lean Manufacturing research in MIT, the development of Value Creation is for three levels of enterprise:**

1. Program Level : This usually revolves around one product or program at a time.
2. Multi-Program Level : This revolves around multiple products and programs at the same time.
3. Enterprises Level : This focuses on the enterprise system at a very high level.

Even though the levels are referred to separately, the programs are usually embedded in one or more larger, multi-program enterprises which are embedded in a yet larger national structure that imposes policies, constraints, and expectations.

### **E.2.2. There are three pillars of a Value Creation Program:**

1. Do the Right Job : This involves Product Capabilities or Requirements. Value Management with its “Function Analysis” is the perfect tool to use to ensure this happens.
2. Do the Job Right : This involves Program Implementation Strategy. This is where Lean Manufacturing focuses on the manufacturing process with the emphasis on flow and people techniques. Most of the Value Management applications have been concentrated in “Doing the Job Right”. Value Management needs to focus strongly on “Doing the Right Job”.
3. Enterprise Value Program : This is where Lean Manufacturing and Value Management are applied and spreaded in all areas of the enterprise.

Regardless of the type of enterprise, Value Identification occurs at all three levels though the focus becomes broader and less precise as the levels progress, Value Proposition also becomes less explicit and more complex, and Value Delivery shifts from narrow implementation activities to broad transformation initiatives.

### **F. Lean Value Management (LVM) Model**

Combining the methodologies of Lean Manufacturing and Value Management along with the eventual implementation of automation will provide the answer to the causes of poor performance and high costs in manufacturing industries. Separately, these tools only provide part of the answer to lower overall cost and improve quality. Together, they provide an extremely powerful suite of tools to improve productivity, lower cost, improve quality, and shorten the time-to-market. Value Management is a powerful design methodology that harnesses existing organizational creativity and knowledge resulting in superior innovative products with unique customer benefits. Together, Lean Manufacturing and Value Management increase customer value by optimizing costs, quality & delivery.

Lean Manufacturing hold its own as an effective improvement methodology that delivers meaningful results. Value Stream Mapping is the key tool to support the implementation of lean strategies in manufacturing as well as non manufacturing areas. When applied, it builds value for the customer and reduces waste. Value Stream Mapping helps teams see the flow and the source of waste in a process or system and it helps make decision about the flow apparent through the application of lean concepts & techniques. Lean Manufacturing has a natural synergy with Value Management, especially related to focus on the customer and as a systematic team approach.

Figure-9 shows a Lean Value Management (LVM) Model which is the convergence of Lean Manufacturing and Value Management.

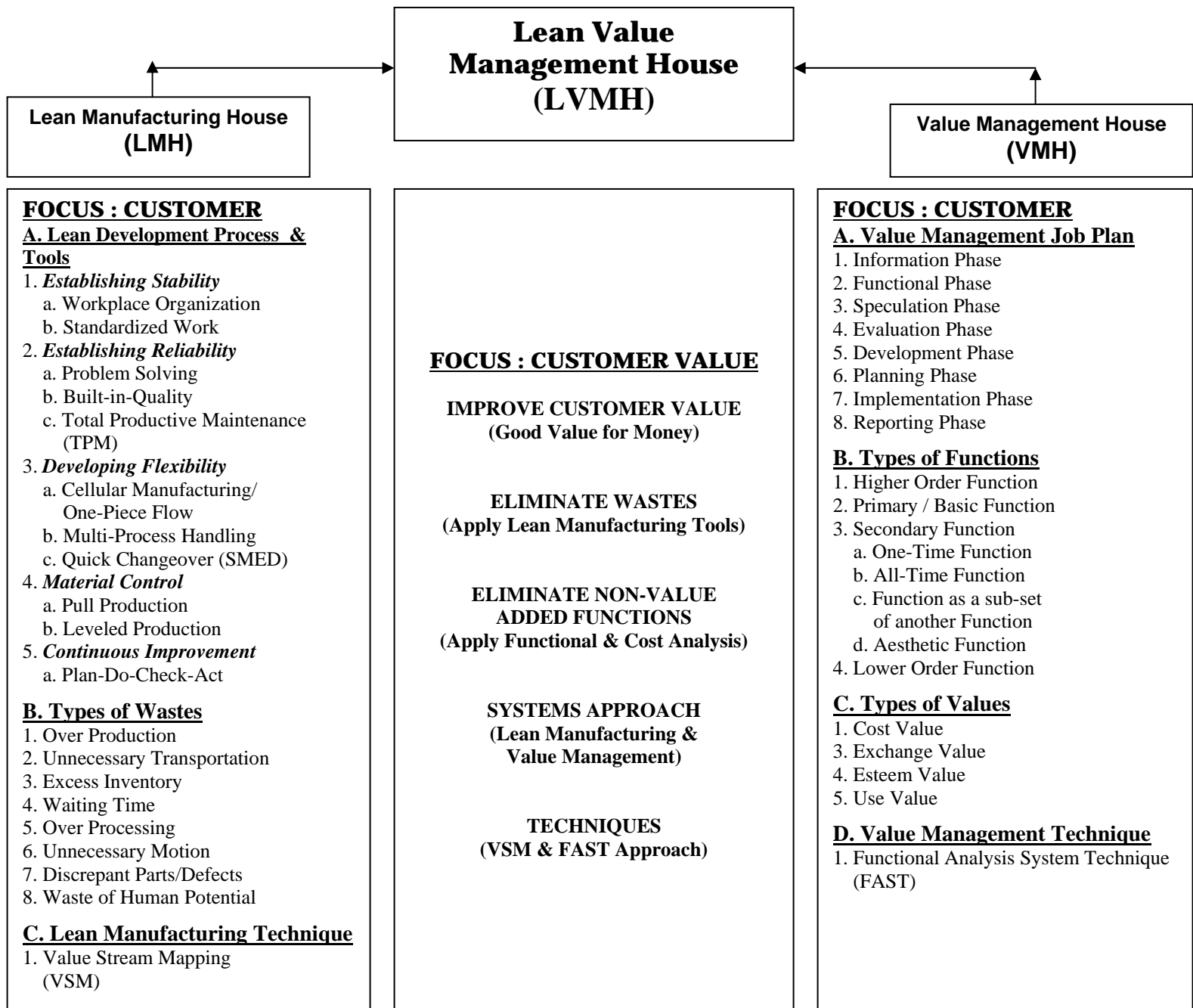
### **G. Conclusion**

Lean Manufacturing and Value Management are both well developed and established methodologies used in many areas of business and industry. The similarities in the strategies and certain techniques in the two disciplines can help in understanding and using these methods effectively. The difference in focus, applications and other aspects might be useful in meeting a broader range of needs within an organization. The strengths and weaknesses of each methodology should be carefully considered when examining a challenge and specially if an organization is contemplating foregoing one discipline for another. Trying to make Lean Manufacturing or Value Management broad and flexible enough to meet all system, design, business practice and manufacturing operation needs could result in a compromised, inefficient process. Similarly, allowing the limitations of a single discipline dictate what improvement opportunities can and can not be pursued is a poor situation as well.

The best solution, based on an organization’s needs and resources, is to adopt and practice both Lean Manufacturing and Value Management as key business strategies. Even if not used, interdependently, the increased capability and scope can be beneficial. If used in a complementary manner, the advantage of each method are compounded and amplified to enhance the overall effectiveness to the user. Along these same lines, training and use of both Lean Manufacturing and Value Management by the same individuals and functional groups within an organization can optimize their ability to lead continuous improvement efforts. The consultants and trainers could benefit from knowledge, practice and certification in both Lean Manufacturing and Value Management to meet a wider range of customer needs and desires



**Figure-9: Lean Value Management (LVM) Model**



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