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The Lean Perspective

"The Decision Making Process in the Value Chain"

(The third in a 9 part series on Lean Enterprise, and the tools and techniques employed to affect change) by **Patrick Lucansky** and **Lee Ducharme.**

Decision making is the process of choice between multiple courses of action for the purpose of achieving a desired objective. While this is a discussion of the process of choosing between compensatory and competing solutions, the decision making process in the Value Chain is defined by the following characteristics:

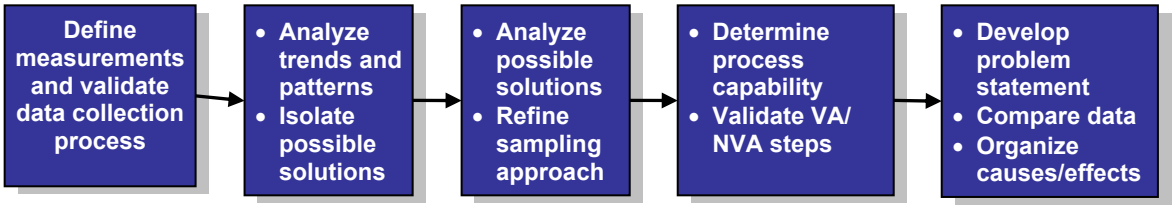
1. Assessing pros and cons of selected alternatives.
2. Applying set criteria for selection.
3. Choosing of preferred courses of action.
4. Assessing progress and modifying direction.
5. Implementing a preferred course of action.
6. Auditing the results against agreed benchmarks.

In the business community, Lean practitioners work in environments that are varied and complex, data are inaccurate or unavailable, objectives are unclear, and root causes are not identified. Under these circumstances, the decision making process must be robust and possess a distinctive methodology in order to be effective and useful. The decision making methodology can be structured in a number of phases, however, for the purpose of this discussion, we describe the methodology in three phases. The main body of the methodology consists of the following phases; the Knowledge Phase, the Design Phase, and the Implementation/Auditing Phase. *(See FIGURE 1 for a graphical representation).* As we describe the different phases, we will provide some definition regarding the application of the above mentioned characteristics

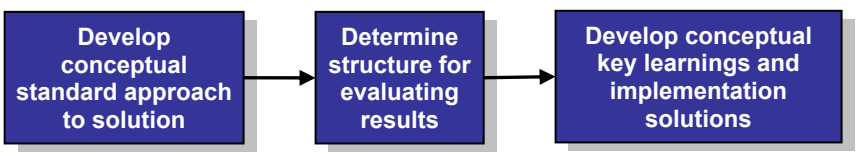
FIGURE 1: Decision Making Structures

A. Knowledge Phase

B. Design Phase



C. Implementation/Auditing Phase



The steps outlined in (Figure 1) were designed along with specific tools to provide a foundation for progressing analytically through the process. If the progression is successful, reaching logical and beneficial solutions is likely, however, when the progression is interrupted or tools are misused, jumping back steps in each of the phases is recommended.

The goal of the Knowledge Phase is to define the project scope and objectives, identify areas of analysis, customer needs, and collect cause and effect data. The scope of analysis can be as narrowly defined as an inspection process or widely defined as the entire supply chain. The size and scope of the analysis is directly related to resources and management commitment. Objectives are usually tied to customer needs. Lean project objectives are directly centered around customer driven requirements. Customers can be located anywhere along the value chain – nonetheless, each process or functional area has a supplier and a customer. Internal customers are usually the functional department waiting for a product or service to complete a sub-process step. External customers are found where the final product is delivered (i.e., clients, regulatory bodies and other outside entities). Voice of the Customer is the most effective technique in determining customer requirements.. Conversely, the tools used for collecting cause and effect data are fishbone diagrams; scatter plots diagrams, histograms, run charts, brainstorming, and value maps. At this stage, converting tribal knowledge (what "Lean practitioners" consider the most basic knowledge) and the effective use of tools are the basis for understanding, analyzing, and screening relevant data in support of this phase of the Decision Making process. *(See FIGURE 2 for an overview of the tools and their applicability to the 3 phases)*

FIGURE 2:

Tools	Understand	Design	Implement /Audit
• Value maps	X		X
• Affinity diagrams	X		
• Brainstorming	X		
• Run chart	X		
• Pareto chart		X	X
• Fishbone		X	
• Histogram	X	X	
• Scatter plots	X		
• Critical to quality	X	X	
• Control charts		X	X
• Cause and effect diagram		X	X
• FMEA		X	X
• Design of experiment		X	X
• Time series plots		X	
• Prioritization chart		X	X
• Voice of Customer	X	X	X
• Hypothesis test		X	
• Regression chart		X	

Before going much further…in the pursuit of collecting information, it is important to recognize that roadblocks frequently occur early on and even show up in ALL of the phases. As they occur, they should be addressed immediately and either eliminated or minimized. Difficult roadblocks are often related to poorly structured teams, project scope, lack of time, lack of ownership, resource constraints, weak-leadership, or ineffective support from management.

The Knowledge phase is predominately a cerebral exercise where the collection of data is related to causes, trends, effects, and customer needs. The focus on customer needs and data gathering leads to a critical exercise – identifying waste. Eliminating waste is the driving factor underlying the "Lean Philosophy" and is best dramatized in the development of value maps and value analysis matrices (See FIGURE 3).

Waste and non-value-added activities are directly linked. ***Value-added*** is identified as activity customers are willing to pay for, physically changes the product, and is done right the first time. Conversely, ***non-value-added*** is activity that is not essential to produce output. A reference to Value or the elimination of waste should be included in the project scope and a significant aspect of the intended course of action as the progression to the next phase takes place.

A quick checklist for the Knowledge Phase includes:

1. Value maps.
2. List of customer needs.
3. Baseline data formatted in (Figure 2) tools.
4. Analysis scope and objectives.
5. Priority list of critical inputs/outputs.
6. List of possible solutions.

FIGURE 3: Sample Value Analysis Matrix

Process Step	1	2	3	4	5	6	7	8	9	10	Total	%Total
Time (Hours)	12	10	1	10	20	6	10	1	10	20	100	100%
Value-Added			X					X			10	10%
Non-value added												
Hand offs									X		20	30%
Paperwork												
Inspection						X					10	40%
Rework	X				X					X	50	90%
Handling		X		X			X				10	100%
TOTAL											100	100%

The start of the Design Phase covers the development and validation of possible solutions. The goal is to demonstrate, with data, that solutions lead to improvement and satisfy the objectives set out in the Knowledge Phase. The tools used in the development and validation approach are mathematically driven (i.e., linear program, game theories, and design analysis). Tools such as FMEA, Design of Experiments, and SPC control charts are most effective. The bridge between causes and effects begins to construct and take shape. Obviously, the gap between cause and effect is dependent on the complexity of relevant attributes. As an assist in the sorting and ranking outcomes, comparison charts can be employed to simplify the process. This cursory analysis allows for the rank ordering of alternatives and signals the start of the Selection Process. (See FIGURE 4).

FIGURE 4

	Solution	Pros	Cons	Cost	Availability	Duration
Solution 1						
Solution 2						
Solution 3						
Solution 4						
Solution 5						
Solution 6						

Prior to designing an implementation plan of recommended solutions, if there is no clear choice, assessing risks is an essential ingredient in the Decision Making Process. Therefore, a risk assessment is performed in support of an implementation plan.

Inset 1

The principle of choice assesses the acceptability of a solution with respect to risk using two sub-principles of Normative Choice and Sub-optimization.

Normative- implies that the chosen alternative is demonstrably the best possible solution which requires proof that the selection is optimal. The proof is provided by a process called ***optimization*** which is generally achieved by (a) getting the highest level of goal attainment form a given set of resources, (b) finding the alternative with the highest ratio (*maximization)* of goal attainment to cost or (c) finding the alternative with the lowest cost that will fulfill a required level of goals (*minimization)*. Normative Decision Theory is based on three assumptions 1) humans are economic beings whose objectives are to maximize the attainment of goals (rational decision making) 2) in a given situation, all viable alternative courses of action and their consequences are known and 3) decision makers have an order of preference that enables them to rank the desirability of all consequences.
Suboptimization- requires the decision maker to consider the impact of each alternative course of action on the organization in order to lessen the effects in other areas. Here we use a points system to review the overall impact of the decision across the organization. Organizationally, this makes the system deployed complicated, expensive, and often quite time consuming. To solve these issues we use a closed system with narrow boundaries, hence sub-optimization. The downside of this approach is that when we select a solution which is optimal in one area of the organization it may not be optimal elsewhere and quite often is detrimental. This approach however, has its benefits in that analysis of a portion of the system allows some tentative conclusions to be made without becoming too cumbersome on the organization. Once a solution is proposed, its potential effects on the other areas can be assessed. If no significant negative effects are uncovered, the solution can be considered for implementation.

The Choice step (*see inset 1, main principles of choice, Normative Choice and Sub-optimization*) can be best described as that of ***Rational Choice*** where we assess the future consequences of a solution as well as how well it will be received in the future. Even when employing rational choice, we rarely find the ultimate solution. More realistically, a decision maker should begin with an acceptable outcome and work back to a set of antecedent actions sufficient to produce that outcome. This derivative approach to rational choice is called "***satisficing*** *"and* its effect is to curtail the search for additional solutions as soon as a workable solution is found. However, the risk of satisficing is a failure to discover a superior solution. The benefit is that time and resources are not wasted in the discovery of what may only be a marginal improvement.

Selecting a preferred course of action is the result of having completed the previous steps; however, any action taken should be responsive to the circumstances and to desired outcomes. In order to evaluate and compare alternatives it is necessary to predict the future outcomes of each proposed alternative. Decision situations are classified on the basis of what the decision maker knows or believes about the forecasted results. This knowledge is classified in the following three ways:

1. Certainty – When decisions are made under certainty, it is assumed that complete information is available so that the decision maker knows what the outcome of each course of action will be. In addition, the decision can be made under certainty because there is only one outcome for each alternative.
2. Risk – When decisions are made under risk, the decision maker must consider several possible outcomes for each alternative, each with a given probability or occurrence. Additionally, it is assumed that the long-run probabilities of the occurrences of the given outcomes are known or can be estimated. Under these assumptions, the decision maker can assess the degree of risk assumed (also known as "***calculated risk***").

3. Uncertainty – When decisions are made under uncertainty, the decision maker considers situations in which several outcomes are possible for each course of action. There is a risk situation, in addition to the unknown probability of occurrence of the possible outcomes.

The final stages of verifying causes and effects, fundamental redesigns, and the development of solutions specifically targeted to meet project objectives should be completed. Drafting implementation plans and approaches to how solutions will be evaluated are the main themes of this phase. The outcome of the Design Phase regarding planned and tested activity should reduce the number of possible solutions and reduce the impact of risks. The quick checklists for this phase include:

1. Factors and attributes considered in the design of solutions.
2. Short list of solutions.
3. Criteria used in the selection of solutions.
4. Results of tests and experiments.
5. Plans for implementation of solutions.
6. Risk analysis summary.

The focus of the Implementation/Auditing Phase is to insure the solutions and related methodology are sustained and improve over time. Data are now used to evaluate solutions and their impact. The final phase is comprised of implementing the preferred course of action, assessing progress and modifying direction (if necessary) while auditing the results against agreed benchmarks. Control Charts, Critical to Quality Charts, Standardization, Future Value Maps are the basis for a solid monitoring system. Attributes and factors that fall outside of set parameters and control points are quickly identified resulting in corrective action. The monitoring process is made easier when interim targets and acceptable deviations are projected at the time of implementation. Benchmarks help set guideline and provide valuable information to decision makers regarding Best in Class parameters. Since complex business decisions rarely proceed as planned, managers need to monitor what happens and make modifications if necessary, including the possibility of retracting a decision. The monitoring process is made easier when interim targets and acceptable deviation limits are projected at the time of implementation. These guidelines can be valuable in alerting those carrying out the decision of a possible need for intervention and change. Moreover, guidelines can become invaluable when the task of monitoring is performed by someone other than the decision maker. *(see inset 2, decision making and cognitive theory)*

Inset 2

Decision making styles encompass cognitive theory.

Under the cognition theory of decision making, an individual resolves differences between an internalized view of the environment from that which actually exists in the same environment. It is, therefore, the ability to perceive and understand information.

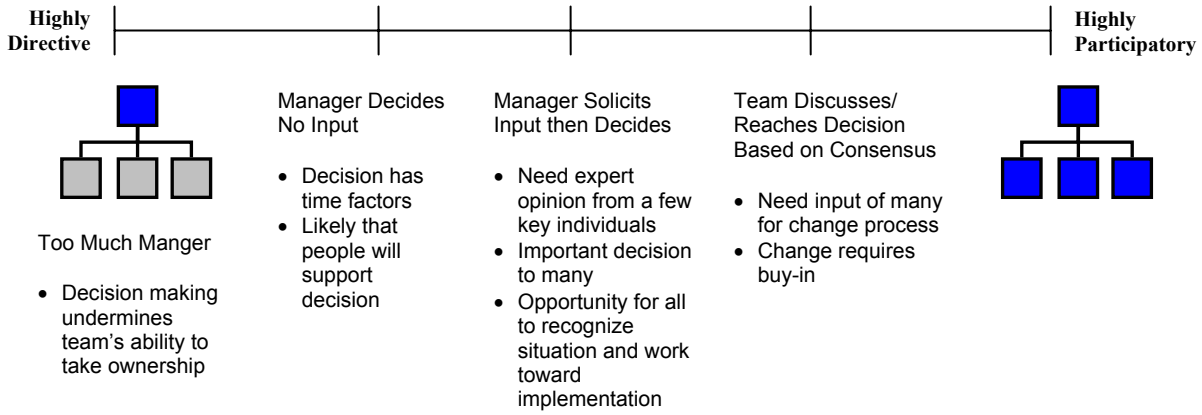
The cognitive style refers to the subjective process through which individuals perceive, organize and change information during the decision making process. Cognitive styles are important because they may determine one's preferences for human-machine interface. For example, should data be raw or aggregate, detailed or summarized, tabulated or presented in graphs? In addition, cognitive style impacts on preferences for qualitative versus quantitative analysis as well as on the preference for decision making aids.

Research on cognitive style is relevant to the design of management information systems. MIS and transaction processing systems tend to be designed by individuals who perceive the decision making process to be systematic. While systematic managers may be willing to use such systems, those same systems will not conform to the natural style of a heuristic decision maker. These types of individuals require a system which allows for the exploration of a wide range of alternatives, permits changes in priorities or in processing, allows the user to shift easily between levels of detail and permits some user control over the output form.

The effective use of control charts, future value maps, and standardization enchances stability and secures improvements from preferred solutions. The outputs from this phase include a monitoring system.

From a behavioral point of view, people attributes and an organizational's dynamics have an important effect in the decision making process. The analytical element provides a good place to start, but it is people collecting data and the organization that houses the interface between people. The factors related to the people approach consists of thinking, seeing, and doing. It is the combination of ALL that affect our ability to collect, sort, and analyze information. The visual and doing factors alter our ability to deal with data. Although the thinking approach is most effective during the Knowledge Phase, the visual approach introduces creativity and innovation during the Design Phase. The suggestion is that no decision making process can do without a combination of all three. These organizational dynamics are depicted below in FIGURE 5 and can have both a positive and negative impact.

FIGURE 5: Decision Making Approaches



The outputs expected from this final phase are a before and after solution analysis, monitoring systems, stakeholder analysis, and lessons learned. A quick checklist for this phase includes:

1. Data showing the effectiveness of preferred solutions.
2. Standards (methodology, process).
3. Documentation.
4. Improvement monitoring process.
5. Skills matrix.
6. Lessons Learned Log

In summary, a great deal affects the Decision Making Process. Most important is an organization's ability to integrate techniques in gathering, sorting, and validating information. The same is true when dealing with people and org anizations effecting the Decision Making Process. For an organization to be successful in finding the optimal solution across the value chain, the decision making process needs to be structured, robust and iterative. The Knowledge Phase provides us with who the customer is and the scope of the issue at hand while the Design Phase begins to shape or thoughts on solutions and the Implementation/Auditing Phase completes the process through solution installation and monitoring. While decision making has it roots in behavorial thought, a well-structured approach consisting of the three phases outlined in this article will provide organizations with a process all can follow and have success with.

Part 4 of the Lean series, **The Lean Supply Chain**. For question or comments relating to the article or lean tools and techniques, please email authors**.**

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