

Linking customer needs to operational process

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Statistical process control and quality function deployment can be used to match the needs of customers and production processes.

The quality revolution has spawned numerous techniques that have contributed significant improvements in the quality of manufacturing and service. Two significant techniques are statistical process control (SPC) and quality function deployment (QFD). Together SPC and QFD form a process that links the customer to the production process. This process allows the producer to focus on projects that are directly traceable to customer needs, break down barriers between sales and production, provide incentive for projects that previously have been viewed as "extra work," and provide guidance in the selection of problems for SPC teams. It has provided the vehicle that created common goals and efficient channels of communication to enable the rapid identification of customer needs and eliminate obstacles to satisfying those needs.

The process begins with specific identification of customer needs using Garvin's Dimensions of Quality: performance, features, reliability, conformance, durability, serviceability, aesthetics, and perception. Precise application of these dimensions eliminates ambiguity normally associated with marketing requests. Next, the process requires identification of the relative importance of each dimension and the company's relative perceived position with competitors. This can be accomplished using procedures outlined by the Strategic Planning Institute or other market research experts. This information is then fed through the Quality Function Deployment model developed by Mitsubishi and used in many domestic organizations. It is especially applicable to the paper industry, primarily in conversion operations that supply primary manufacturing. The QFD process links the customer's needs to operational and staff processes in a meaningful and concrete fashion.

Linking SPC to the "real world"

Most who have attempted implementation of SPC systems have heard companies stress customer satisfaction. All agree that, like apple pie, it's hard to go wrong with a good helping of each. Questions begin to arise, however,

when the themes and examples in SPC classes are all manufacturing related. Tools like control charting make perfect sense to use for caliper or basis weight control, but this "stuff" can't work in the sales or customer satisfaction world, can it? What do we do with this program?

In order to link processes to customers and control operations to satisfy buyers, we must begin with an operational definition of quality. Quality should be viewed as pertinent to all aspects of the buyer's decision except price. The definition should regard the many aspects of quality any product or service might possess.

In 1987, David Garvin published a milestone article entitled "Competing in the eight dimensions of quality."* These dimensions can be used to develop a functioning definition of quality. Garvin recognized that one definition could not fit all applications. However, by relating critical dimensions, he has given us the ability to use a well-thought-out structure conducive to operational application. The dimensions that are to be considered for development of definitions are:

1. Performance—Fitness for use of the product or service for its intended application
2. Features—The options or "bells and whistles" that make the product more attractive to a wider market
3. Reliability—The likelihood of failure within a given period of time
4. Conformance—Conformance to customer requirements or blueprint specifications is necessary but not sufficient to gain and hold market share. Zero Defects is the starting point.
5. Durability—The operating life expectancy of the product
6. Serviceability—The time required for and simplicity of repair
7. Aesthetics—The appearance of a product and the finished product that is manufactured from it
8. Perceived quality—The way in which customers rate all aspects of a product or service in comparison to the competition.

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*Garvin, David, Harvard Business Review 65(6): 101(1987).

1. Customer requirements planning matrix

CUSTOMER REQUIREMENT	Product Characteristics				Market Evaluation	
	Smooth surface	Absorbs glue	...	Correct size	Customer importance	Competitive evaluation
	0	0	...	+	6	A
	-	Relationship Matrix			4	C
	...				...	
	...	+	-	...	0	9
Probability						

Fits printer

Sticks together

...

Prints

0 = no effect

- = negative effect

+ = positive effect

Competitors

A

B

C

2. Final product characteristic deployment matrix

PRODUCT CHARACTERISTICS	CRITICAL COMPONENTS					
	Calender pressure	Viscosity (glue)	Glue roll pressure		Trimmer setting	Overall effect
Surface	+	0	+		+	+
Glue	-	+	+		0	+
...	...	...	...		...	
Size	-	0	-		+	-
Over effect	-	+	+		+	

3. Critical components performance matrix

MEASURABLE CONTROL VARIABLE						
	Roll speed	Roll height	Glue temp.		Speed diff.	Consistency pulp
Caliber pressure	+	-	0	...	+	+
Viscosity glue	0	0	+	...	0	0
Roll press. glue	-	-	+	...	0	+
...						
Trimmer setting	-	-	0		+	+
Total effect	-	-	+		+	+
Goal	?	?	?	?	?	?

Application of these key dimensions requires considerable thought and time. It can best be accomplished by proven team participation techniques used by a combination of manufacturing and sales personnel and customers, if possible. All dimensions will not be equally applicable. Don't be overly concerned if any single dimension does not seem to fit. Work on those that best describe the desired customer attributes.

The precise application of these dimensions eliminates the ambiguity normally associated with sales and marketing requests. To enhance later application, one should identify the relative importance of each characteristic and the company's relative perceived position. This can be accomplished by using procedures outlined by market research groups.

Linking customers to the manufacturing process

Using Garvin's Dimensions, customer wishes can be specified but not, as yet, tied to the tweaking of knobs and turning of dials. To achieve this relationship, we must define the product type variables that satisfy the customer demand characteristics. Again, teams of manufacturing, engineering, and other technical experts can best attack measurable variables to these customer desires. The customer's voice drives all activities. The executives and engineers must be the interpreters. This approach, which has been called project or quality function deployment, benefits the user in the following ways:

- Translation from market to process does not become blurred.

- Misinterpretation is minimized between functional areas.
- Important support and production controls are highlighted at planning stages to allow for better implementation.
- Efficiency is achieved because objectives, strategy, and control points are interactively planned, thus minimizing the need for change.

A deployment model developed by Mitsubishi has proven successful in achieving these benefits. It is based on four key elements: a customer requirement planning matrix, a final product characteristic deployment matrix, process plan and quality control charts, and process certification procedures.

Customer requirement planning matrix

The customer requirement planning matrix, illustrated in **Fig. 1**, concentrates on control characteristics. It draws from the market and specifies final product control characteristics.

Within this matrix, the relationship of each product characteristic to each customer requirement should be estimated and verified through research where possible. A market evaluation should be completed to begin a focusing procedure aimed at the final process and its relationship to meeting specific customer needs. This matrix can be expanded to view control characteristics, relative costs, and other factors in order to fit specific needs.

Final product characteristic deployment

The final product characteristic deployment matrix shown in **Fig. 2** translates the output of the planning matrix to the critical components. The steps are very similar to the first matrix. The objective is to illustrate the strength and interrelationship of the various critical components.

This matrix continues the focusing of limited resources. This practice allows the use of experience, again employing team problem-solving techniques, to direct effort toward the critical component that positively affects the most critical product characteristics.

Process plan and quality control charts

The process plan and quality control charts define product and/or process parameters and control points. The matrix shown in **Fig. 3** links the critical components to the measurements that explain how well a component performs.

Again, this focusing effort further refines the areas that operators will target. The matrix indicates that consistency is important across the board. But roll speed has a mixed effect. Goals are based on the variability of each product control variable. Goal setting must be accomplished through experimentation and data analysis. Purely educated guesses will not suffice at this point. SPC techniques and design of experiments play a critical role in identifying and defining significant relationships.

Operating instructions

"Finally, the rubber meets the road." Until now, the effort has been to focus and link the processes that most affect the customer. To achieve this, a procedure referred to as process certification is effective. Certification is a procedure to outline a process using process charts; identify specifications or goals from previous matrices; calculate operational capability; and write operational standard operating procedures (SOPs). These SOPs must be written by the operators using group problem-solving techniques and statistical tools to measure and verify the effect of the sequential steps that a process dictates. The process and the tests used in this rigorous operational certification process are well documented and available for implementation by trained, experienced evaluators. This certification will focus team efforts to make processes capable and/or yield baseline data that will act as the beginning point for a continuing improvement process. It will be the tool to measure success by reduction of variability, movement of average, and reduction of duplicate services, or some combination of the three. In short, process certification is the procedure that ultimately illustrates what is affecting the customer.

Conclusion

Few operators would argue that customer needs should be recognized, and few salespeople, representing the customer, would argue against the efficiency goals of the operator. Most feel, however, that these goals conflict. The process just described focuses and communicates why and how the various critical steps interact with each other and affect the customer. Experience has shown that the teamwork directed by these steps anticipates many problems, measures actual results (thus eliminating conflict over interpretation), and highlights why emphasis is being targeted on certain operations, as well as how these targets affect the customer.

This is a rigorous process that requires the use of employee participation, statistical tools, and involvement by many functional groups. Perhaps the success that has been experienced by implementation of this model derives from the fact that more people are involved, decisions are fact-based, and the science of statistics is employed. The result is focus, teamwork, communication, and customer satisfaction through efficient time, money, and resource allocation. □

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