Quantitative Data Analysis for Quality Control in Strategic Management

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INTRODUCTION

Today's leaders need to use data effectively in order to act strategically. Considering all the data available about organizations, one might think that data-driven decision-making would be easy. However, several steps are involved in data analytics: identifying the study's objective, determining the relevant data to collect, choosing the appropriate instruments to collect those data, analyzing that data, recommending appropriate actions, implementing them, and evaluating the implementation.

One of the main sticking points in such data procedures appears to be the analysis itself. How do leaders make sense of the data? What do the story behind the data tell? While accurately representing the data is a good first step, explaining the data and making inferences about the findings is necessary in order to make logical, feasible recommendations for action.

Several factors may account for this phenomenon: management's lack of statistical background, statistician's lack of organizational and management knowledge, lack of technical or statistical personnel, differing status between management and technical (e.g., statistician) personnel, perceived disconnect between data and management practices, perceived lack of available time, perceived poor ROI (return on investment) of data analytics, poor data quality, lack of integration of data with existing infrastructure, insufficient systems to process data efficiently, perceived lack of data analytics tools (or lack of knowledge about such products), other higher-priority management demands (Finos, 2015; Henschen, 2014). Because of these identified needs, quantitative data analytics practices are detailed in this chapter, focusing on quality control. Libraries constitute the organizational context.

THEORETICAL FRAMEWORK

Quality Philosophy and Strategic Leadership

For leaders to optimize data analytics, they should apply organzational systems theory. Kühl (2013) explained organizations as dynamic systems with interdependent parts. Inputs include available resources, both human and material. Input can also include the clientele that might access the organization. Internal workers then act with these resources, providing services and products. The output focuses on the clientele's uses of the organization's resources and services, with the outcome being the clientele's own success and satistfaction. Leaders need to examine each of the aspect of the system, identify those parts that need improvement, and spearhead those changes.

For indeed, one of the main thrusts of leadership is organizational improvement. It was only in the late 19th century that a more systematic approach to improvement was considered. Frederick Taylor introduced "scientific mangement" principles, whereby work was divided into smaller units that were

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accomplished more efficiently. This approach led to more standardization and assembly work; product quality was also impacted, and the concept of standards came into play. Frank Gilbreth later extended these principles to work design.

The term "quality" needs to be defined into order to discuss it meaningfully. A siple definition is "fitness for use." Garvin (1987, pp. 2-3) delineated eight dimensions of quality, which illustrates the complexity of quality.

- **Features:** What does the product do?
- **Conformance to Standards**: Is the product made exact as the designer intended?
- **Aesthetics:** What does the product look like?
- **Performance:** Does the product do the intended job?
- **Reliability:** How often does the product fail?
- **Durability:** How long does the product last?
- **Serviceability:** How easy is it to repair the product?
- **Perceived Quality:** What is the product's or organization's reputation?

Because stakeholders want to have consistently good services and products, quality is inversely proportional to variability (Montgomery, 2005). Variable data are usually measurable, so statistics can be applied to determining quality. Typically, managers determine a target value for a quality criteria, such as ninety percent reference fill rate. Such targets are usually bounded by a range of acceptable – and feasible – values, which reflect the relative tolerance of difference that are unlikely to impact the product or service significantly. The upper specification limit for the above reference fill rate might be 95 percent, and the lower specification limit might be 85 percent. Such determinations should be made by prior observation and bnechmarking with other comparable organizations. When the value falls below the lower specification limit, then it is nonconforming, or defective, and needs to be examined and improved.

Statistical methods were applied to quality control less than a hundred years ago (Montgomery, 2005). In 1924 William Shewhart of Bell Labs introduced statistical quality control through a control-chart concept. However, World War II greatly advanced statistical approaches because large-scale quality control and product quality improvement were needed. By the 1960s, product and process improvement was key in design experiement within the chemical industry. Widespread adoption of statistical data analysis by 1980, which helped the U.S. regain its top position in industry.

For such data analysis to be effective, it must be couched within the organizational system. As such, leaders must be involved in quality planning, quality assurance, and quality control and improvement (Montgomery, 2005). Quality planning is a strategic activity that involves identifying clientele and their needs. Quality assurance ensures that the quality of products and services is maintained through policies, procedures, and documentation. Quality control and improvement seeks to ensure that products and services consistently meet or exceed requirements or standards.

Behind the statistical method of quality control lie strategic management philosophies (Montgomery, 2005). Engineer expert W. Edwards Deming served as a consultant to Japanese industry, and showed them the power of statistical methods for quality control and improvement. He believed in continous improvement that involved the entire work force, especially in terms of statistically based problem solving, with the leader as insprirer and coordinator. His philosophy was the basis for Total Quality Management (TQM): a strategy for organization wide quality improvement implementation and management.

Another quality control program, which uses statistical data analysis as its fulcrum, is Six Sigma. Bill Smith, a reliability engineer for Motorola, conceptualized Six Sigma. As he saw systems become

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