TRANSACTIONS FROM
THE SYMPOSIUM ON QUALITY FUNCTION DEPLOYMENT

Keeping Up with Global Best Practice: ISO 16355 – Applications of statistical and related methods to new technology and product development process

Glenn H. Mazur, QFD Red Belt®
Executive Director, QFD Institute

Abstract: In 2009, the QFD Institute was asked to convene an ISO Working Group to write an international standard for QFD. The biggest concern was how to standardize a method that works best when custom-tailored to the new product development (NPD) process of an organization, as well as for its specific products and customers. The International Council for QFD liaised its members with others from Africa, the Americas, Asia, Europe, and India to form a group of experts to write the new ISO 16355 series standard for quality function deployment. In June 2016, the five QFD parts were approved for publication with the remaining three parts not far behind. This paper and presentation will outline the structure of the eight parts, how they build on older QFD models from the 1970s and 80s, and what is needed to become a leader and facilitator of this Modern QFD standard. In addition to its overall guidance on new product development, the eight parts of the standard cover the gamut from strategic hoshin planning, competitiveness, project management, on-site customer visits, survey design, prioritization, quality assurance, innovation, cost management, reliability, optimization, supplier management, make and build, commercialization, support, retirement, and flow to next generation products. ISO 16355 includes case studies and examples from product, service, information technology, and process industries from all over the world. The standard includes upgrades to both the classical House of Quality and well as the more streamlined Blitz QFD®. NPD professionals will want to master these global best practices so they can engage their organizations in surging ahead of their competitors in creating the truly great products their customers demand.

Key words: ISO 16355, QFD, Hoshin Kanri

1. History of ISO 16355

The development of this new international standard, primarily for quality function deployment (QFD), was started in 2009 by the International Standards Organization Technical Committee (TC) 69 (applications of statistical methods) Subcommittee (SC) 8. Its purpose is to standardize global best practices for QFD and robust design for applications beyond their initial use in the automobile components industry. This has become necessary to address applications in finished goods, services, software and information products, as well as internal business processes, in both business-to-business (B2B) and business-to-consumer (B2C) sectors. The standard also takes into account the time, people, and money constraints faced by modern businesses by including smaller, more efficient tools – good news for those turned off by the overwhelming classical House of Quality. Six Sigma professionals, including Design for Six Sigma, Lean Sigma, and Design for Lean Sigma will welcome the improved mathematics, the result of the statistical focus of TC69.

In creating a new ISO "product" for creating new products, it seemed obvious that SC8 should practice what it preaches and apply its own methods to its work, and so Working Group (WG) 2's convenor conducted a QFD study on likely users of the standard to discover what were their most important needs (Mazur, 2012). This study also help assemble the team of QFD experts to author the work, which included several members from the International Council for QFD (ICQFD) as well as additional QFD experts from Germany, Japan, the United Kingdom, and the United States. The standard is divided into eight parts, which reflect the application of QFD throughout the product life cycle, from project strategy through commercialization and even retirements of the product.

2. 8 Parts to Answer 10 Questions

To satisfy the needs of the ISO 16355 standard's users and their very diverse products, the full, comprehensive QFD process devised in Japan in the 1960s and 1970s had to be covered; the 4-Phase model truncated by build-to-print automobile component suppliers in the 1980s was insufficient. The standard consists of eight parts, including one technical report and is divided as follows:

Part 1. General principles and perspectives of the QFD method (ISO 16355-1:2015, 2015). This overview describes the general framework of QFD and suggests various methods and tools with relevant references and examples.

Part 2. Acquisition of VOC/VOS – non-quantitative approaches (ISO 16355-2:2017, 2017). This part details how to identify and acquire the voice of customers and stakeholders through visits, interviews, and inference.

Part 3. Acquisition of VOC/VOS – quantitative approaches (ISO/WD 16355-3). This part details how to identify and acquire the voice of customers and stakeholders through structured surveys and interpretation of statistical information.

Part 4. Analysis of non-quantitative and quantitative VOC/VOS (ISO 16355-4:2017, 2017). This part takes the acquired voices and translates them into customer needs which are then prioritized and competitively benchmarked to determine satisfaction targets.

Part 5. Strategy and Translation of VOC into engineering solutions and cost planning (ISO 16355-5:2017, 2017). This parts translates the customer needs into engineering requirements in order to develop a solution strategy that accounts for quality, new technology, reliability, and cost concerns.

Part 6. Optimization – robust parameter design (ISO/WD 16355-6). This part, first independently published as ISO 16336, addresses design phase optimization of nominal value parameters based on robustness of function.

Part 7. Optimization – tolerance design (ISO/WD 16355-7). This part addresses when to tighten tolerances to improve overall product quality and performance.

Part 8. Guidelines for commercialization and life cycle (ISO/TR 16355-8:2017, 2017). This technical report will address quality issues related to post-design test, build, package, commercialize, support, service, and retire from market phases.

Each part helps product developers answer many questions.

1. Which customer voices are critical to hear? (ISO 16355-2)
2. Which activities of those customers most concern them? (ISO 16355-2)
3. What is the customer saying, doing, and thinking during these activities? (ISO 16355-2)
4. What problems (undesired negatives), opportunities (unfulfilled positives), and image (look good and feel good) issues are the customers facing? (ISO 16355-4)
5. Which of these are most important for us to address first? (ISO 16355-3 and 4)
6. What competitive alternatives does the customer have? (ISO 16355-4)
7. What must our new product, service, software, or process be or do in order to solve the customer's most important problems, opportunities, or image issues? (ISO 16355-5)
8. What are the optimal targets of function and performance must the new product, service, software, or process achieve to sufficiently solve and be robust to the most important problems, opportunities or image issues? (ISO 16355-6 and -7)
9. What activities are essential to delivering these function and performance targets to the customer? (ISO 16355-8)
10. How can we assure these activities are carried out with sufficient quality and carried into the next generation product? (ISO 16355-8)

3. 5 Key Upgrades Every QFD Practitioner Should Know

The ISO 16355 standard is a "descriptive" standard that recommends the use of QFD and its methods as a framework for product development. It is not "prescriptive" in requiring any specific sequence or set of tools. Those familiar with the classical 4-Phase QFD approach will find this standard liberates them from trying to fit their organization's development process into a one-size-fits-all model and encourages letting the voice of their business and the voice of their customers guide their analysis. Nonetheless, the standard does provide guidelines and examples to help maximize the results with the minimum amount of effort. Among these are:

1. Start with Voice of Business, not Voice of Customer. The easiest way to satisfy customers is to give your product away for free! Needless to say, this does not make for long-term success. For customers to be truly satisfied, the business must also be healthy and satisfy its internal drivers and strategy. It is no coincidence that the

Japanese quality experts who created QFD also created Hoshin Kanri (Policy Deployment). The methods share the same tool set and are organically linked – Hoshin sets the new product strategy and QFD assures quality and customer satisfaction.

2. Go to *gemba*. Gemba is the Japanese word for the "crime scene" where the evidence is collected and the truth learned. In Six Sigma and other quality initiatives, the gemba is where you work – the factory floor, the back office, etc. This attends to problem-solving and customer complaints about your product. While necessary to address, is too late – customers are already displeased. True customer satisfaction comes from problem-solving the customer's business or life issues, and this requires "boots-on-the-ground" detail that can only be acquired in the customer's gemba – where they do their work and live their lives. The standard describes and gives examples of how to plan, conduct, and analyze customer gemba visits to uncover both spoken and unspoken needs.

3. Focus your best efforts where they matter most to the customer. Comprehensive QFD studies from the 1960s to the 1980s used as many as 30 different matrices and charts to address all aspects of product quality. Modern organizations, having neither the time nor money to improve everything, must prioritize their efforts where they get the biggest bang for the buck. The ISO 16355 standard explains how to use the Maximum Value table to combine the key elements of all QFD matrices into one chart by focusing only on the top 3-5 customer needs. The guideline is that if you do not have unlimited resources, don't spread them too thinly on customer needs that are already good enough.

4. Translate market requirements into product requirements and specifications. Market requirements are customer benefits and are independent of the product. Product requirements describe what the product is or does, and are technology-agnostic of how this is performed. ISO 16355 defines these terms and gives examples of how to do the translation using cause-to-effect and effect-to-cause diagrams.

5. Watch your math. When QFD was developed in Japan in the 1960s, the most common "calculator" was the abacus, a device divided into clusters of five beads. Early QFD math was based on ratings using a 1-5 ordinal scale (the U.S. later changed this to 1-9 ordinal). Ordinal scales do not contain sufficient information to support common math functions in QFD such as addition, subtraction, multiplication, and division (Stevens, 1946). The recommended approach is to change to ratio scale values in all QFD math, including project selection, customer importance and satisfaction, competitive benchmarking, House of Quality and other matrices, technology selection, FMEA, and elsewhere. ISO 16355 describes and gives examples of how to use the analytic hierarchy process (AHP) to develop these ratio scale values (Saaty & Peniwati, 2008).

4. Integration of ISO 16355 with Other Standards

Other standards, such as ISO 9001:2015, describe an overall system. ISO 16355 provides the details, examples, and guidelines to help quality professionals meet these. For example, at least two sections in ISO 9001:2015 discuss the opportunity "to attract

customers, develop new products and services." ISO 16355 will recommend methods and tools, with examples, on how to do this.

5. Conclusion

One of the hallmarks of the QFD process is to transfer customer priorities into technical priorities so that product developers can assure that the quality of their design, development, innovation, build, commercialization, and support efforts will deliver maximum customer satisfaction for minimum cost, time, and effort. The ISO 16355 standard explains methods and tools that can be used to achieve this result.

About the author

Glenn H. Mazur is convenor of the ISO TC69/SC8/WG2, the working group writing the ISO 16355 for QFD. He is also a member of TC176 responsible for ISO 9000:2015 and ISOP 9001:2015 standards. He is Executive Director of the QFD Institute and International Council for QFD, a retired adjunct lecturer on TQM at the University of Michigan College of Engineering, and is a senior member of the American Society for Quality (ASQ), and the Japanese Society for Quality Control (JSQC). He is a certified QFD Red Belt® (highest level), one of two in North America. He is a certified QFD-Architekt #A21907 by QFD Institut Deutschland and is honorary president of the Hong Kong QFD Association and the Asia QFD Association. He is an Academician and Secretary-Treasurer of the International Academy for Quality.

Bibliography

ISO 16355-1:2015. (2015). *Applications of statistical and related methods to new technology and product development process - Part 1: General principles and perspectives of Quality Function Deployment (QFD).* Geneva, Switzerland: International Standards Organization.

ISO 16355-2:2017. (2017). *Applications of statistical and related methods to new technology and product development process - Part 2: Acquisition of Non-quantitative Voice of Customer and Voice of Stakeholder.* Geneva, Switzerland: International Standards Organization.

ISO 16355-4:2017. (2017). *Applications of statistical and related methods to new technology and product development process - Part 4: Analysis of Non-Quantitative and Quantitative VOC/VOS.* Geneva Switzerland: International Standards Organization.

ISO 16355-5:2017. (2017). *Applications of statistical and related methods to new technology and product development process - Part 5: Solution Strategy.* Geneva Switzerland: International Standards Organization.

ISO/TR 16355-8:2017. (2017). *Applications of statistical and related methods to new technology and product development process - Part 8 Commercialization.* Geneva, Switzerland: International Standards Organization.

Mazur, G. H. (2012). Using Quality Function Deployment to Write an ISO Standard for QFD. *Quality Engineering , 24*, 436-443.

Saaty, T. L., & Peniwati, K. (2008). *Group Decision Making: Drawing Out and Reconciling Differences.* Pittsburgh: RWS Publications.

Stevens, S. S. (1946). On the Theory of Scales of Measurement. *Science , 103* (2684), pp. 677-680.