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Applications of statistical and related methods to new technology and product development process —

Part 7: Guidelines for developing digitalized products and services — General principles and perspectives of the QFD method

Application des méthodes statistiques et des méthodes liées aux nouvelles technologies et de développement de produit —

Partie 7: Ligne directrices pour le développement de produits et services numérisés — Principes généraux et perspectives de la méthode de déploiement de la fonction qualité (QFD)

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ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 69, *Applications of statistical methods*, Subcommittee SC 8, *Application of statistical and related methodology for new technology and product development*.

A list of all parts in the ISO 16355 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html..

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Introduction

Quality function deployment (QFD) is a method to assure customer or stakeholder satisfaction and value with new and existing products by designing in, from different levels and different perspectives, the requirements that are most important to the customer or stakeholder. These requirements are well understood through the use of quantitative and non-quantitative tools and methods to improve confidence of the design and development phases that they are working on the right things. In addition to satisfaction with the product, QFD improves the process by which new products are developed.

Reported results of using QFD include improved customer satisfaction with products at time of launch, improved cross-functional communication, systematic and traceable design decisions, efficient use of resources, reduced rework, reduced time-to-market, lower life cycle cost, improved reputation of the organization among its customers or stakeholders.

The current ISO 16355 series describes methods and tools of QFD independent of industry because the principles of applying statistical methods for product and technology development are similar for all types of products. However, when applying the standard for the development of fully or partially digitized products, specific characteristics of digital goods in product development (such as measurability, immateriality, etc.) should be taken into account. Digital goods such as software are specific in economies of scale and network effects and thus require specific strategies and concepts for design, development and marketing. Due to the progress of digitalization in almost any market, the observed phenomena and measures gain relevance and importance in business and academia. Hence the emerging convergences in industries, suppliers, businesses and products cause a game change in markets for digital or digitized goods.

Therefore, this document describes guidelines for developing digitalized products and services. It aims at adapting the (QFD) process, its purpose, users, and tools as they are described in the ISO 16355 series with respect to the specific characteristics of digitalized products and services. All companies affected by the digitization of their products and services are intended users of this document.

The methods and tools shown and described represent decades of improvements to QFD; the list is neither exhaustive nor exclusive. Users should consider the applicable methods and tools as suggestions, not requirements. As the other parts of the ISO 16355 series, this document is descriptive and discusses current best practice; it is not prescriptive by requiring specific tools and methods.

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Applications of statistical and related methods to new technology and product development process —

Part 7: Guidelines for developing digitalized products and services — General principles and perspectives of the QFD method

1 Scope

The current ISO 16355 series is written intentionally independent of industry because the principles of applying statistical methods for product and technology development are similar for all types of products. However, when applying the standard for the development of fully or partially digitized products in practice, specific characteristics of digital goods in product development (such as measurability, immateriality, economies of scale effects, etc.) are taken into account.

This document gives guidelines for adapting the quality function deployment (QFD) process, its purpose, users, and tools as they are described in the ISO 16355 series that consider these specific characteristics for developing digitalized products and services. Table 1 illustrates the scope of this document by stating examples of the types of products the standard focuses on.

Users of this document include all organization functions necessary to assure customer satisfaction, including business planning, marketing, sales, research and development (R&D), engineering, information technology (IT), manufacturing, procurement, quality, production, service, packaging and logistics, support, testing, regulatory, and other phases in hardware, software, service, and system organizations.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 16355-1, *Application of statistical and related methods to new technology and product development process — Part 1: General principles and perspectives of quality function deployment (QFD)*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 16355-1 apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

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3.1
digitalized products and services
works that incorporate components consisting of operable objects from digital information and communication technology

Note 1 to entry: In this document, the terms digital, digitized and digitalized are used synonymously. A digitalized good is an intangible software enabled product or service that can be sold and distributed repeatedly online without the need to replenish inventory. Digitalization may cause services to have a stronger product character.

Note 2 to entry: In this document, software product development means the development of digitalized products and software parts of software-intensive products, i.e. systems or services.

Note 3 to entry: Software parts of software-intensive systems that are not marketed and priced as separate entities are called embedded software.

Note 4 to entry: Software-intensive systems can be products from all industries such as automobiles, airplanes, smartphones etc.

Note 5 to entry: Software-intensive services, often delivered as cloud services, can also be products from all industries like financial, insurance, gaming, social software, or human services based on software support.

Note 6 to entry: This document will generally use the term “software products” instead of explicitly referring to software-intensive products.

Note 7 to entry: When other parts of ISO 16355 series or ISO 9000 series standards are referenced in this document, note they may not differentiate explicitly between products and services.

3.2
quality function deployment
QFD
managing of all organizational functions and activities to assure product quality

Note 1 to entry: The organization is responsible for product quality and strives for it via defining, testing, building, commercializing, and supporting the product.

Note 2 to entry: Literal definition is that the “quality function” is “deployed” to all other business functions and departments who play a role in assuring quality and customer satisfaction.

Note 3 to entry: In most cases, the interests of an organization are commercial, but there are exceptions, as is sometimes seen in open source-based products or in the public sector.

3.3
voice of customer
VOC
communications from the customer, user, and others

Note 1 to entry: The communications from the customer may be verbal, written, video, audio, animation, or other form and may be descriptive, behavioural, or ethnographic.

Note 2 to entry: Customer is defined in ISO 9000:2015, 3.2.4.

Note 3 to entry: For digitalized products and services, the voice may not come from the customer itself but from data or other artefacts relevant for quality.

Note 4 to entry: Customers may be not only human but also digitalized actors (digital agents).

3.4
customer need
potential benefit to a customer

Note 1 to entry: The benefit to a customer from having their problem solved, their opportunity enabled, their image (self or to others) enhanced, or being advanced to a more desirable state.

Note 2 to entry: The benefit is positively stated.

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Note 3 to entry: The benefit describes a single issue.

Note 4 to entry: The benefit is independent of the product or service performance, functional requirements, non-functional requirements, functions, features, or enabling technologies.

Note 5 to entry: A need may be explicit or latent.

Note 6 to entry: Customer is defined in ISO 9000:2015, 3.2.4.

Note 7 to entry: Requirements engineering for digitalized products and services defines customer needs differently than ISO 16355-1. Requirements engineering in focusing on product requirements may not deal with customer needs explicitly. Customer needs may be latent according to ISO 16355-1 which does not match the definition of requirements in ISO 9000 where needs must be stated explicitly. If the input to voice of customer is considered as customer needs in requirements engineering, the voice analysis yields stated requirements which may be interpreted as customer requirements as the complement to product requirements. Hence in requirements engineering the term customer requirements may be used synonymously to customer needs[2].

Note 8 to entry: The term demanded quality is also used in software QFD projects.

3.5
functional requirement
characteristic that a product or service is specified to possess

Note 1 to entry: The characteristic may be an inherent performance of the product or service or an action that the product or service may be able to accomplish. The manner in which the product accomplishes the action does not include specific mechanisms or internal procedures as part of the functional requirement.

Note 2 to entry: Product is defined in ISO 9000:2015, 3.7.6.

Note 3 to entry: Service is defined in ISO 9000:2015, 3.7.7.

Note 4 to entry: Common methods for the specification of requirements for digital products and services differentiate between functional and non-functional requirements, whereas functional requirements address actions a product may accomplish and non-functional requirements the inherent performance of a product. The terms quality requirement, and quality characteristics are also used in software QFD projects.

3.6
voice of stakeholder
VOS
communications from stakeholders

Note 1 to entry: Communications from stakeholders may be verbal, written, video, audio, animation, or other form and may be descriptive, behavioural, or ethnographic.

Note 2 to entry: Stakeholder is defined in ISO 9000:2015, 3.2.3.

Note 3 to entry: Stakeholders may be not only human but also digitalized decision-makers (digital agents).

Note 4 to entry: For digital goods, the stakeholder “solution developer” is particularly important because the product is often created incrementally in close cooperation with the customer.

3.7
customer gemba
location where true customer information is found

Note 1 to entry: Gemba is a Japanese word meaning the place where the truth is discovered. In Six Sigma, this usually refers to the shop floor where internal activities take place. In QFD for new product development, the new product does not exist yet, so the gemba changes to where the customer's activities or encounters take place.

Note 2 to entry: The gemba may be not limited to physical location. For digitalized products, digitalized spaces may exist where human actors directly may not explore (for example, cyberspace).

Note 3 to entry: Gemba visits help discover unknown or latent customer needs and requirements.

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3.8
hoshin kanri
method for management and deployment of strategic organizational policy

Note 1 to entry: English translations of the Japanese include policy management, policy deployment, management by policy, and strategy deployment.

4 Basic concepts of developing digitalized products and services

4.1 General

This standard describes guidelines for adapting the methods described in ISO 16355 series standards that consider the specific characteristics for developing digitalized products and services. See Table 1.

Table 1 — Digitalized products and services in scope of this document

	Degree of digitization		
Degree of servizitation	**Physical**	**Digitalized(hybrid)**	**Digital**
Product	Watch with mechanical movement	Smart watch	Watch App on smartphone or notebook
Hybrid product/ Hybrid service	Phone with contract	Intermodal mobility services	Onlince booking (with chipTAN)
Service	Car repair	Car navigation system (update performed by car garage)	Automatic download via web services

not focus of ISO 16355-7	focus of ISO 16355-7

4.2 Characteristics of digitalized products and services and their development

4.2.1 Specific characteristics of digitalized products and services

Digital products and services have specific characteristics that influence the applications of statistical and related methods to new technology and the product development process.

a) digital "voices" from customers and stakeholders;

b) availability of digital data from product usage;

c) easier product changes during development;

d) easier product changes after delivery;

e) cloud based product functions;

f) high rate of change due to requirements uncertainty and technology dynamics.

4.2.2 Effects of specific characteristics of digitalized products and services on the development process

These characteristics affect the development process of digitalized products and services.

a) agile development as widely used paradigm for developing software;

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