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Statistical methods — Six Sigma — Basic criteria underlying benchmarking for Six Sigma in organisations

Méthodes statistiques — Six Sigma — Critères fondamentaux d'une évaluation comparative Six Sigma pour les organisations

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Foreword

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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).

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT), see the following URL: Foreword — Supplementary information.

The committee responsible for this document is ISO/TC 69, *Statistical methods*, Subcommittee SC 7, *Six Sigma*.

Introduction

Benchmarking is frequently used in various domains in connection with business activities. The Six Sigma methodology requires an evaluation step using a benchmarking process. In other words, a method for the comparison of levels of quality, performance, and productivity with the state-of-the-art is required. This International Standard establishes what to compare and develops a methodology to conduct a correct comparison between an organization's levels of quality, performance, and productivity. The numbers given by the benchmarking can be integrated into any improvement programme to quantify any progress. They can also be used by other assessment processes in the organization such as regulation compliancy or financial performance evaluation.

Benchmarking is the whole process of collecting and processing data and information and comparing the results. The benchmark is the reference point for comparison.

The main point of this benchmarking methodology, based on transparency and the universal principle of evaluation, is to give confidence to its calculating procedures and the results, so that comparisons between organizations are accepted by all parties.

Benchmark and Six Sigma's principles

The Sigma measure is a number ranging from, typically, near zero to 10 or more. The value six has traditionally been considered "world class" (that can be approximated by 3,4 defects per million opportunities — see ISO 13053-1 5.3) for mechanical and electronic industries. The criticality of defects within each industry typically defines the Sigma level required in order to be a "world class" benchmark quality level for that application. So, according to the different sectors and markets, the level of "world class" can be different.

The Sigma level is an estimate of the proportion of defects (typically expressed in defects per million). A "world class" Sigma level is the Sigma level that is considered essential to consistently deliver excellence of product and service.

This benchmarking method is applicable to all types of sectors, to all type of processes, to organizations of all sizes, and to all methodologies for improvement, in association with DMAIC, or issues relating to Design for Six Sigma (DFSS).

Criteria and defects

The Sigma level is based on the ratio of estimated (or observed or predicted) number of defects to the number of opportunities according to the specifications and the variability of the process (for example, one "defect" in a million deliveries).

A defect is something that a customer or a user cannot accept or it might have a negative impact on performance.

Two types of customer are identified:

— the end user or consumer (Business to Consumer) and

— the professional (Business to Business).

The consumer has some needs but these needs are often implicit. Product requirements that address these needs are not numerous and they can be summarized by the following:

a) to be safe in its intended usage (security, safety);

b) to do what it is supposed to do (functional, conformity);

c) to be available in the expected shape and not to break in its intended usage (availability, ease of use, reliability);

d) to not do any harm to persons (ethical) or environment (pollution control).

These four criteria cover most of the consumer's needs for all sectors and on all continents.

A customer will have other criteria but all of these are likely to be summarized by the four generic criteria described above.

Supply chain

A supply chain is the whole supplier/transformer link from the raw material to the final product or the service for the consumer. Each sector has its supply chain organization.

Examples:

— Petrol sector — from the offshore extracting (extractor) unit to the gasoline retailer for consumers.

— Food sector — from the fields and orchards (raw material) to the consumer.

— Automotive sector — from the steel and glass supplier to the car manufacturer.

— Cosmetic sector — from the molecule to the perfume or beauty cream.

The level of quality and performance delivered to the consumer is the "total" of all quality and performance levels of the different transformers along the supply chain.

This benchmarking methodology aims to give a comparison of levels between upstream and downstream transformers (chain efficiency benchmarking) or between transformers at the same step (competitive benchmarking).

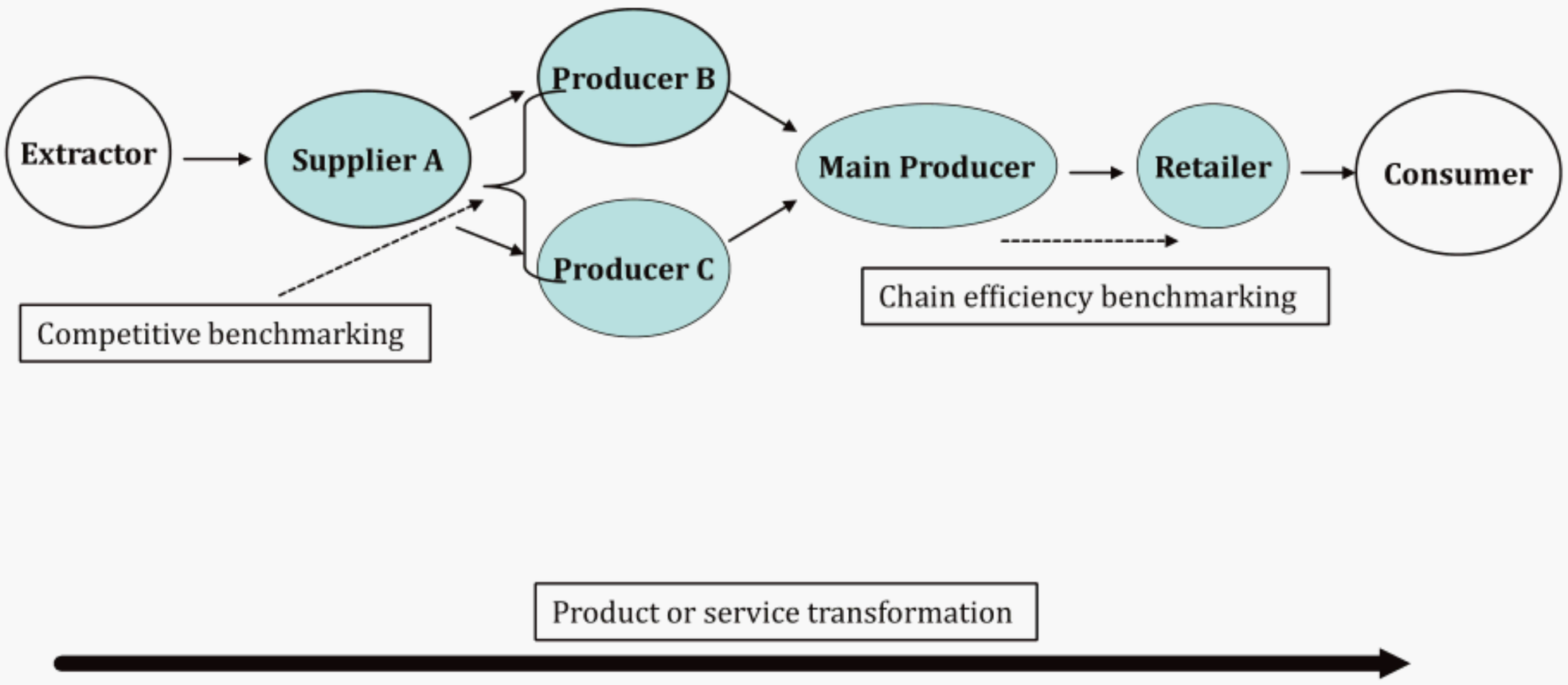

Figure 1 — Supply Chain Cycle

Statistical methods — Six Sigma — Basic criteria underlying benchmarking for Six Sigma in organisations

1 Scope

This International Standard describes a methodology for establishing the level of quality, performance, and productivity of processes, products, and services according to Six Sigma principles. It is applicable to all sectors (industries, services, administration, etc.) and to all types of organizations, whether it is already involved in an improvement programme such as Six Sigma, Lean, or not. In particular, it can be used to initiate a Six Sigma programme by providing a selection of improvement projects.

NOTE The focus of this methodology is on criteria, measures, measurement process, and comparison process. The results can then be used to identify good practices of benchmarking.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 13053-1, *Quantitative methods in process improvement — Six Sigma — Part 1: DMAIC methodology*

3 Terms and definitions

3.1
benchmark
reference point against which comparisons can be made

3.2
benchmarking
activity of comparing objects or practices of interest to each other or against a benchmark to evaluate criteria (or characteristic)

3.3
benchmarking method
logical sequence of general steps to describe the process of quantitatively comparing one or more attributes against a reference attribute with respect to a specified scale

4 Symbols and abbreviations

A	measure of total “space”
A_{lost}	measure of total lost “space”
C	number (count)
C_{air}	number of breaches of threshold of air pollution in a specified time
C_{input}	input defects level
C_{output}	output defects level
C_{process}	process or activity defects level

C_{water}	number of breaches of threshold of water pollution in a specified time
E	category of user — experienced
F	category of user — first time
k	organization index
N	total number
N_E	number of experienced users
N_F	number of first time users
t	duration of time of study
t_1	duration of time during which a product is returned
t_{lost}	measure of lost time
t_{start}	measure of time required for starting or understanding a product
X	measure (continuous scale)

5 General considerations on benchmarking

Benchmarking is the method for collecting and analysing the data, and from these results, for comparing the quality, performance, and productivity level between two or more organizations.

5.1 Objectives and framework

The following paragraphs describe what an organization is recommended to do in order to deploy benchmarking and to obtain benchmark results.

5.1.1 Objective

The organization should decide upon the objective of the benchmarking before starting any measurement or comparison activities.

NOTE Examples of objectives are to improve processes, to compare to competition, to evaluate the gap for performance improvement.

5.1.2 Framework

The framework encompasses parts that are interrelated. This methodology is built with two main parts:

— benchmark;

— benchmarking.

In the objective's description of benchmarking, an organization should detail these two parts.

6 Benchmark

This clause describes the overview and requirements to determine some reference points for comparison (see 3.1.1 and 3.1.2). The points to be detailed are

— the criteria and

— measures of the criteria.

6.1 Overview and requirements for the criteria

Benchmarking is required to be applied to the criteria. This methodology defines 10 main criteria. If one of the criteria is irrelevant, the organization will explicitly give an explanation for excluding it from benchmarking. Two optional criteria are proposed, making a total of 12. This International Standard focuses on 10 main and two optional criteria clustered into three types. The main criteria are also named generic criteria.

6.1.1 Types and description of criteria

To have a universal benchmark, 10 main criteria are defined and they are clustered into two types. A third type is for optional criteria (see Table 1).

Table 1 — Benchmarking criteria

Number	Type	Title
1	Type 1: generic quality	Compliance
2		Ethical behaviour
3		Security/Safety
4		Returns (customer listening)
5		Availability
6		One-time delivery
7		On-time to market
8	Type 2: generic efficiency	Productivity
9		Raw material efficiency
10		Energy efficiency
11	Type 3: Option	Ease of use
12		Pollution control

These main criteria are divided into sub-criteria. Annex B gives the list of the sub-criteria. The main criteria describe the basic requirement of the consumer such as security or on-time delivery. The sub-criteria give a practical way to obtain the measure. A main criterion can have from one to eight sub-criteria. In case of several sub-criteria, each one gives a measure and the main criteria can have up to eight resulting measures (8-uple).

EXAMPLE Compliance has four sub-criteria: regulation, functional, contractual, and company policies. A result of measures would be (100 %, 95 %, 82 %, and 95 %) and if the company has no policy, then it would be (100 %, 95 %, 82 %, and not applicable).

6.1.2 Requirements for criteria

The organization should describe its policy and implementation of the 10 generic criteria with all its sub-criteria (total of 30). Annex B gives the description of all main criteria and sub-criteria. If one of the sub-criteria has no practice (e.g. no ethical charter or no charity programme in the organization), it shall be explicitly mentioned and excluded from the benchmarking.

6.2 Overview and requirements for the measures

This sub-clause gives an overview and the requirements for the measures.

6.2.1 Scope of measures

The measures are performed on the main processes of the organization (see Introduction).

The inputs of the organization level process are the inputs of the organization. The outputs of the organization level process are the outputs (or deliveries) of the organization. The main process is a bundle of processes and each process is a set of activities. Each process can belong to a type of process such as functional process (e.g. purchasing, sales, finance), support process (IT process, HR), or management process (project management, accounting management).

For each benchmarking, the organization should describe which processes are in the scope.

6.2.2 Generic measures

This is a requirement to obtain measures for the generic criteria.

6.2.2.1 Measure for compliance

Compliance is related to the application of legal regulations, business commitments, and organizational policies. The organization will describe the regulations, the business agreements, and the policies it applies. The measure is described in Table 2.

Table 2 — Compliance

Information need	Compliance on regulation commitments and policies of an organization
Unit of measure	Count number (compliance requirements, compliance requirements not fulfilled)
Measurement method	Count total number of compliance requirements (N) Count number of compliance requirements not fulfilled (C)
Data type	Integer
Measure	(N, C, (N - C)/N) (%)
Function	Divide total number of requirements (N) minus number of requirements not fulfilled (C) by total number of requirements (N)

Note For example, counting the number of non-conformities and the total number of requirements of ISO 9001:2008 standard will give this measure.

Counting the number of security practices not fulfilled and the total number of security practices that are mandatory will also give another measure.

6.2.2.2 Measure for ethical behaviour

Ethical behaviour is related to all of the social responsibility activities of an organization. The organization should establish the list of its ethical "good practices" (GP). The measure is described in Table 3.

Table 3 — Ethical behaviour

Information need	Ethical good practices (GP)
Unit of measure	Count number (ethical good practices, ethical good practices not fulfilled)
Measurement method	Count total number of ethical GP to be applied (N) Count the number of ethical GP not fulfilled (C)
Data type	Integer
Measure	(N, C, (N - C)/N) (%)

Table 3 *(continued)*

Function	Divide the total number of ethical GP (N) to be applied minus the number of ethical GP not fulfilled (C) by the total number of ethical GP to be applied (N)

Note For example, do not throw your old computer but send it to a school or association.

6.2.2.3 Measure for security/safety

This measures what the consumer is expecting for its security (or safety). A breach of security (or safety) is an event that jeopardizes the vital functions of an organism or an organization. The measure is described in Table 4.

Table 4 — Security/Safety

Information need	Security (or safety) for an organism or an organization
Unit of measure	Count number (breaches of security or safety)
Measurement method	Count total number of breaches of security (or safety) (C) over a specified period of time t
Data type	Integer
Measure	(C, t, C/t)
Function	Number of breaches of security over a specified period of time (week, month, year, etc.)

6.2.2.4 Measure for returns

A return is an explicit action issued from a dissatisfied customer (problem report, complaint, product return, a request for return). The measure is described in Table 5.

Table 5 — Returns

Information need	Returns from consumers
Unit of measure	Count number identified returns (complaints, product return, report, withdrawal of goods, etc.)
Measurement method	Count number of returns (complaints, product return) (C) by specified period of time (t) Count number of units sold (U)
Data type	Integer
Measure	(C, t, U, C/U)
Function	Divide the total number of returns by specified period of time (week, month, year) by the number of units sold

6.2.2.5 Measure for availability

This International Standard records availability with two measures:

— proportion of time (i.e. useful time/total time);

— proportion of space (i.e. space where usable/total space).

The measure is described in Table 6.

Table 6 — Availability of time and space

Information need	Useful available time	Useful available space
Unit of measure	Time Lost time	Space Unavailable space
Measurement method	Measure total time (t) Measure lost time (t_{lost})	Measure total space (A) Measure lost space (A_{lost})
Data type	Continuous	Continuous
Measure	(t, t_{lost}, (t - t_{lost})/t) (%)	(A, A_{lost}, (A - A_{lost})/A) (%)
Function	Divide total time (t) minus "lost" time (t_{lost}) by total time (t)	Divide total space minus lost space by total space

6.2.2.6 Measure for on-time delivery

On-time delivery (OTD) gives the timeliness of deliveries to customers (see ISO 13053-1). The measure is described in Table 7.

Table 7 — On-time delivery (OTD)

Information need	Timeliness of deliveries to customers.
Unit of measure	Count number (product deliveries)
Measurement method	Count number of deliveries that are not on time to the customer specifications (C) over a specified period of time (t). Count total number of deliveries that are planned (N).
Data type	Integer
Measure	(N, C, (N - C)/N) (%)
Function	Total number of deliveries (N) minus number of deliveries not on time (C) divided by total number of deliveries (N) over a specified period of time (week, month, year)

6.2.2.7 Measure for on-time to market

On-time to market (OTM) gives the timeliness of new products to the market. The measure is described in Table 8.

Table 8 — On-time to market (OTM)

Information need	Timeliness of deliveries of new products to market
Unit of measure	Count number
Measurement method	Count numbers of new products delivered that are on time to the market specifications over a specified period of time (t).
Data type	Integer
Measure	(N, C, (N - C)/N) (%)
Function	Total number of deliveries of new products (N) minus number of not on time deliveries (C) divided by total number of new products deliveries over a specified period of time (week, month, year)

6.2.2.8 Measure for productivity

Productivity is the measure of the efficiency of the organization to meet the requirements of consumers. Productivity can be measured by the ratio between outputs and inputs (part of inputs are resources). The measure is described in Table 9.

Table 9 — Productivity

Information need	Productivity
Unit of measure	Count number (delivered product/service) Measure resources consumption (limited to workforce)
Measurement method	Count number of units delivered (product/ service) (C) per specified unit of time (t). Measure workforce resources consumption (w) involved in the process over the same period of time (t).
Data type	Integer, time, integer
Measure	(C, t, w, C/ (w*t))
Function	Number of delivered units (C) by specified unit of time (t) using (w) resources

As an alternative, Table 10 includes in this measure the recall of products or services that have non-conformities.

Table 10 — Productivity and recall

Information need	Productivity including recalled product
Unit of measure	Count number (delivered product) Measure resources consumption (limited to workforce)
Measurement method	Count number of units of delivered product (C) per specified unit of time (t) Count number of units of delivered product (C_t) that can be recalled in a specific period of time t_t Measure workforce resources consumption (w) involved in the process over the same period of time (t)
Data type	Integer, time, integer
Measure	(C, t, w, C/w*t, C_1, t_1)
Function	Number of produced units (C) by specified unit of time (t) with consumption of (w) resources and number (C_1) that can be recalled in time t_1

6.2.2.9 Measure for raw material efficiency

The raw material consumption efficiency is measured by the ratio of products/services delivered to the quantity of raw material needed. The organization will detail the main raw material being used in its production process. The measure is described in Table 11.

Table 11 — Raw material efficiency

Information need	Efficiency of raw material consumption
Units of measure	tonnes (raw material consumption) Count (produced products/services)

Table 11 *(continued)*

Measurement method	Measure the volume of consumed raw material (X) over a specified period of time (t) Count the number of produced units or services (N) over this same period of time *(t)*
Data type	Continuous, count
Measure	(N, X, N/X)
Function	Divide the number of produced units (N) by the quantity of raw material (X) used over the specified period of time (t)

6.2.2.10 Measure for energy efficiency

Energy efficiency is given by the ratio of products or services delivered to the quantity of energy needed. The measure is described in Table 12.

Table 12 — Energy efficiency

Information need	Efficiency of energy consumption
Units of measure	MWh (energy consumption) Count (produced products or services)
Measurement method	Measure the quantity of consumed energy (X) over a specified period of time (t) Count the number of produced units or services (N) over this same period of time
Data type	Continuous Count
Measure	(N, X, N/X)
Function	Divide the number of produced units (N) by the quantity of energy (X) used over the specified period of time (t)

6.2.3 Industry specific measures

The following criteria are industry specific. They are not mandatory and they can be used to complete the scope of the benchmarking.

6.2.3.1 Measure for ease of use

Product ease of use is measured by percentage time. It measures the time a user spends to get the product or service started or to understand how it functions. Two categories of measures: one for first time users and another for experienced users. The measure is described in Table 13.

Table 13 — Ease of use

Information need	Ease to use of a product or service
Unit of measure	Minutes (duration of use) Minutes (duration for starting or understanding) Categories (of users: first time, experienced user)
Measurement method	Measure the duration of usage (t) Measure the duration for starting or understanding how it works — while using it (t_{start}) Count the category of user (F or E)
Data type	Continuous, count
Measure	(N_F, N_E, t, t_{start}, $(t - t_{start})/t$) (%)

Table 13 *(continued)*

Function	Divide time of usage (t) minus time for starting or understanding (t_{start}) by time of usage (t) per category

Note Online services (banking, travel agency, booking, etc.) are deploying these measures in order to evaluate how easy it is to browse on the website. The number of clicks for reaching a specific page is another measure for "Ease of use".

6.2.3.2 Measure for pollution control

Pollution control is focused on air, water, and soil.

Air pollution control is measured by the regular agencies that collect and analyse air quality. Thresholds have been established from the national, regional, and international organizations.

The measure is described in Table 14.

Table 14 — Pollution control

Information need	Pollution of air and water of the product during usage and for the processes to manufacture it
Unit of measure	Count (number of breaches of threshold)
Measurement method	Air: count the number of breaches of threshold (C_{air}) indicated by monitoring agencies in a specified time period (t) Water: count the number of breaches of threshold (C_{water}) indicated by monitoring agencies in a specified time period (t)
Type of data	Integer
Measure	(C, t, C/t)
Function	Count number of breaches of thresholds (C) during a specified time period (t)

6.2.4 Summary of measures

The measure is described in Table 15.

Table 15 — Summary of measures

	Criteria	Opportunity	Scale
Main			
Table 2	Compliance	Requirement	%
Table 3	Ethical behaviour	Good practice	%
Table 4	Security/safety	Breach of security	Number of breaches per unit time
Table 5	Returns	Return or complaint	Number of returns or complaints per unit time
Table 6	Availability	Time and space	%
Table 7	On-time delivery	Delivered product	%
Table 8	On-time to market	New delivered product	%
Table 9	Productivity	Delivered product	Delivered products per unit time and per workforce
Table 11	Raw material efficiency	Volume	Volume per unit of production

Table 15 *(continued)*

	Criteria	Opportunity	Scale
Table 12	Energy efficiency	Energy consumption	Energy per unit of production
		Optional	
Table 13	Ease of use	Time taken	%
Table 14	Pollution control	Breaches of threshold	Number of breaches per unit time

7 Benchmarking

Benchmarking is the complete process with

— an objective establishment step,

— a measurement step (Clause 6),

— a controlling step for the level of quality of the measurement results, and

— a comparison step.

7.1 Objective establishment step

A person responsible for benchmarking should be appointed to ensure that

— the benchmarking policies have been validated by general management,

— the 10 criteria with their 30 sub-criteria of the benchmark results are managed, and

— traceability of the benchmarking is deployed in order to ensure reproducibility of the results.

7.2 Measurement step

The organization should describe its policy for data management (collecting, gathering, processing, and displaying the results) for its product or service and for its processes. Some of the measures described in Clause 6 can only be calculated if a proper data management policy has been established (e.g. using "big data" techniques).

There are three phases at this step.

7.2.1 Data collection

The organization should describe the method for gathering the data. The point of gathering the data is to measure the level of the 10 criteria with their 30 sub-criteria according to the measure's principles described in Clause 6.

This description shall include the following information:

— the sources (report, automatic collecting from sensors, administrative files, logs);

— the sampling or the filtering procedures if any;

— the statistical methods if any;

— the frequency of collection.

7.2.2 Data arrangement

After collecting the data, the method for arranging them (if any) should be described.

Note This step involves what is commonly described as “cleaning” or “homogenization” of the data.

7.2.3 Data quality validation

The organization should deploy a method for assessing the quality of the collected data. This method should also contain the source (7.2.1), the date of collection, and the person in charge of collecting them (appointed by the benchmarking responsible; see 7.1).

Assessing the quality of data relies on several activities. One can focus on

— quality of estimation,

— quality of description of the collecting procedure, and

— crosscheck control.

7.3 Controlling the quality of the measurement results

The measurement methods described in Clause 6 apply to the measurements results. The quality of these results has to be fulfilled according to the following properties.

7.3.1 Precision

Precision is the measure of the ability to distinguish between nearly equal values (from ISO 2382).

The organization should describe how the precision of the benchmarking results is reached.

7.3.2 Consistency

Consistency is to obtain and to keep coherence between different types of data or information.

The organization should describe how consistency of the benchmarking results is obtained and maintained.

7.3.3 Up-to-date

To be up-to-date, the information or data have to be quickly processed after the collection phase.

The organization should describe the duration between the collecting step and the publication date of the data.

7.4 Comparison step

The results of the measurement steps have to be compared to a reference point. If a reference point does not exist, the organization should take the first result as a reference point. If some reference points exist, then compare them with the result for each of the 10 criteria.

A comparison table, with reference points and measurement results, should be established by the organization. Annex K gives an example of a comparison table.

7.5 Internal benchmarking

Internal benchmarking is benchmarking performed inside an organization. The 10 main criteria with their 30 sub-criteria are compared between different departments or services.

There are three specific types of internal benchmarking.

7.5.1 Historical benchmarking

This benchmarking is focused on comparing the same activities between two different time periods, typically from one year to the next or from one month to the next. This is to evaluate the improvement pace with regards to quality, performance, and productivity over time.

The organization should establish a historical benchmark and explicitly describe its results.

7.5.2 Functional benchmarking

This is benchmarking for a specific function in an organization.

NOTE Functions are human resource, sales, and marketing.

7.5.3 I/O benchmarking

This benchmarking is focused on comparing the quality level of the input with the quality level of the output. There are two steps:

— quality control for a supplier's delivery to the organization (input control);

— quality control for customer delivery (output control).

7.6 External benchmarking

These are comparisons between organizations on quality, performance, and productivity. They give competitive benchmarking. Any organization planning to perform an external benchmarking should previously have performed a historical benchmarking.

7.7 Supply chain benchmarking

Supply chain benchmarking introduces a new effect that will be measured and compared - the defects propagation from one activity to the next. Thus, this benchmarking gives a fourth result - the ability of the organization to evaluate the effect of defects propagation.

7.7.1 Benchmarking in an organization

The main process of the organization is decomposed into different processes such as purchasing, logistic, production, conditioning, delivery, and payment (see Table 16).

Table 16 — Organization processes and defects

Ordered processes	Purchasing	Logistics	Production	Conditioning	Delivery	Invoicing
Defects in ppm	225	7	45	12	3	56

The propagation effect will be measured by the propagation coefficient k according to the following rule (see Table 17):

Table 17 — Model of defect rate propagation

Defect rate	Input defects level	Process or activity defects level	Output defects level
Value	C_{input}	$C_{process}$	C_{output}

In the case of full defect propagation:

$$C_{\text{output}} = C_{\text{input}} + C_{\text{process}}$$

This is the worst case. Lowering the propagation effect introduces

$$C_{\text{output}} = k\left(C_{\text{input}} + C_{\text{process}}\right)$$

with $0 < k < 1$.

Benchmarking the propagation effect is evaluating k. It is named the k-organization index.

The k-organization index is to be compared for consistency with the rolled throughput yield (RTY), defined in ISO 13053-1.

An example of a propagation effect is given in Annex K.

7.7.2 Benchmarking in a supply chain

Different organizations are linked by a supply chain structure. As for the internal benchmarking, the supply chain benchmarking will be evaluating the propagation of defects between the different organizations, from upstream to downstream. The k of the supply chain has to be evaluated and is called the k-chain. See Figure 1.

7.8 Six Sigma project selection

For an organization, benchmarking with Six Sigma principles leads to measures about

— its level of quality, performance and productivity in comparison with the state-of-the-art,

— the reference points of comparison with other organizations, and

— any weak points that need to be improved.

With all of these results, an organization has guidelines to apply improvement programmes among which stand the two main Six Sigma methodologies: DMAIC and DFSS. Some Lean principles (flow management, productivity, OTD, and efficiency) can also be included in the scope.

8 Interface with other types of benchmarking

Organizations use different types of benchmarking in order to improve. Besides quality, productivity, and performance, the two other main areas of benchmarking are the following:

— "product performance" benchmarking — the functional performances of products are compared (e.g. motor car engines, computer raw power);

— "financial performance" benchmarking (i.e. cost benchmarking, value-added benchmarking, portfolio benchmarking).

The purpose of benchmarking for Six Sigma is to provide the results that can then be the inputs to other benchmarking activities, particularly financial performance benchmarking.

This benchmarking methodology achieves its objectives by delivering results on a re-usable scale such as a percentage (or ratio). Table B.1 gives a summary of the type of scale of the 10 main criteria and 30 sub-criteria.

An organization should describe the interface of this benchmarking with others using a table containing the criteria and the types of scale used.

An organization should also establish the traceability of all its results that are used in other benchmarking activities.

Annex A
(informative)

Three dimensions of benchmarking

Figure A.1 — Three dimensions of benchmarking: Productivity, quality, and cost

Annex B
(normative)

Table of criteria (generic)

The table for the generic criteria is given in Table B.1. The criteria are classified (01 to 10) according to their importance from the market point of view, with the rank 01 being the most important.

Table B.1 — Table of criteria (generic)

N°	Main criteria	Sub-criteria	Description
Generic quality criteria			
01	Compliance	Regulation	The product has to comply with regulation requirements.
		Functional	The product shall do what it is supposed to do.
		Contractual	The product has to comply with contractual agreements.
		Organization policies	The product and process have to comply to the internal policies of the organization.
02	Ethical behaviour	HR progress	Every person in the organization is involved in a yearly training programme.
		Fair trade	Good practices of fair trade are described in an ethical charter and applied.
		Local community	Local community is involved in manufacturing/delivering the product (% of local personnel in the organization personnel).
		Charity	The organization is involved in charity programmes.
03	Security/safety	Person active security and safety	During the manufacturing phase (workforce) or while being used (consumer), the product and the processes shall not endanger people's health or lives.
		Organization active security and safety	During the manufacturing phase (workforce) or while being used (consumer), the product and the processes shall not endanger the integrity of the organization.
		Person passive security and safety	During the manufacturing phase (workforce) or while being used (consumer), the product and the processes shall not attract events that might endanger people's health or lives.
		Organization passive security and safety	During the manufacturing phase (workforce) or while being used (consumer), the product and the processes shall not attract events that might endanger the integrity of the organization.
04	Returns	User complaint	In case of incidents or problems, the user/consumer of the product shall be able to easily send a complaint. These complaints are managed (e.g. a hot line).
		Product return	The customer returns a product because of dissatisfaction; the returned products are managed.
05	Availability	Direct availability	Product or service is available for usage at any time.
		Reliability	Product or service functions over a period of time without breaking down.
		Authenticity	Product origin is not altered (e.g. a breach of origin, counterfeit).
		Accessibility	Product or service is accessible for usage.
		Continuity	Product or service provides continuous service.
		Recovery	Product or service, after a breakdown, can quickly recover.
		Fault tolerance	Product or service continues to serve even with some flaws.
		Robustness	Product or service continues to serve in harsh conditions.

Table B.1 *(continued)*

N°	Main criteria	Sub-criteria	Description
06	On-time delivery	Time to deliver	The current product reaches the user/consumer on the expected date.
		Reactivity	The manufacturing/logistic/delivery process can easily manage user/consumer modification of delivery date.
07	On-time to market	Time to market	The new product reaches the consumer's market in the expected period of time.
		Market reactivity	The organization can easily and quickly manage changes in market conditions.
Generic efficiency criteria			
08	Productivity	Productivity	Number of units of product produced per unit of time and per consumption of resource (workforce).
		Recall	The organization is able to withdraw an identified quantity of products in a very short time.
09	Raw material efficiency		The product (or service) uses the lowest quantity of raw material for the manufactured product.
10	Energy efficiency		The product (or service) uses the lowest quantity of energy for the manufactured product.
Industry specific criteria			
11	Ease of use	Ergonomic	Product has an easy-to-use interface (quick to use).
		Ease of starting	No need of any specific training to start it or restart it (no wasted time).
		Ease of understanding	No need of any specific training or expertise to use it or reuse it (no wasted time).
		Consumer information	Product information easily accessible (no wasted time).
		Maintainability	If a problem occurs, it can easily be repaired by the user (minimum time spent).
12	Pollution control	Air pollution control	Air thresholds indicated by monitoring agencies.
		Water pollution control	Water thresholds indicated by monitoring agencies.

NOTE The term "product" always refers to a product or a service.

Annex C
(informative)

Table of criteria with examples of results

The table for the criteria with examples is given in Table C.1.

Table C.1 — Criteria with examples

N°	Main criteria	Sub-criteria	Opportunity/ instance	Measure	Example of results
Generic quality criteria					
01	Compliance	Regulation Functional Contractual Organization policies	Requirement	$(N, C, (N - C)/N)$ (%)	(295, 7, 97,63 %)
02	Ethical behaviour	HR progress Fair trade Local community Charity	Good Practice	$(N, C, (N - C)/N)$ (%)	(30, 4, 86,77 %)
03	Security/safety	Person active security and safety Organization active security and safety Person passive security and safety Organization passive security and safety	Beach of security	$(C, t, C/t)$	(232 per year)
04	Returns	User complaint Product return	Complaint or return product	$(C, t, C/t)$	(1 234, year, 1 234 return/year)
05	Availability	Direct availability Reliability Authenticity Accessibility Continuity Recovering Fault tolerance Robustness	Time	$(t, t_{lost}, (t - t_{lost})/t)$ (%)	(5, 43 200, 99,99 %)
06	On-time delivery	Time to deliver Reactivity	Product delivered	$(N, C, (N - C)/N)$ (%)	(250,4, 98,40 %, year)
07	On-time to market	Time to Market Market reactivity	New product delivered	$(N, C, (N - C)/N)$ (%)	(25, 2, 92,0 %, year)
Generic efficiency criteria					
08	Productivity	Productivity Recall	Product delivered Product recall	$(C, t, w, C/w*t)$ $(C, t, w, C/w*t, C_1, t_1)$	(2M, 200, per year) (1M, 150, year, 2,500, 4 h)

Table C.1 *(continued)*

N°	Main criteria	Sub-criteria	Opportunity/ instance	Measure	Example of results
09	Raw material efficiency		Tonne	$(N, X, N/X)$	1 650 products per tonne in a week
10	Energy efficiency		MWh	$(N, X, N/X)$	1 650 products per MWh in a week
Specific industry criteria					
11	Ease of use	Ergonomic Ease of starting Ease of understanding Consumer information Maintainability	Time	$(N_F, N_E, t, t_{start}, (t - t_{start})/t)$ (%)	(4 h, 15 min, 93,75 %)
12	Pollution control	Air pollution control Water pollution control	Breach of threshold	$(C, t, C/t)$	25 breaches per year

NOTE The term "product" always refers to a product or a service.

Annex D
(normative)

Table of criteria for the food processing industry

The table for the food processing criteria is given in Table D.1.

Table D.1 — Table of criteria (food processing)

N°	Main criteria	Sub-criteria	Description
Generic quality criteria			
01	Compliance	Regulation	The product has to comply with regulation requirements (*food law*).
		Functional	The product/service shall do what it is supposed to do (*food nutritional value*).
		Contractual	The product has to comply with the contractual agreements.
		Company policies	The product and processes have to comply with the internal policies of the organization (*HACCP,* ISO 22000, *GAP, GMP, etc.*).
02	Ethical behaviour	HR progress	Every person of the organization is involved in a yearly training programme (*hygiene, quality, food safety, manufacturing practices*).
		Fair trade	Good practices of fair trade are described in an ethical chart and applied.
		Local community	Local community is involved in farming manufacturing, packaging and delivering the product (% of local personnel in the organization total).
		Charity	The organization is involved in charity programmes.
03	Security/safety	Person active security and safety	During the manufacturing phase (workforce) or while being used (consumer), the product and the processes shall not endanger people's health or life (*pathogen agent, chemical artefacts, glass breakages, radionuclide*).
		Organization active security and safety	During the manufacturing phase (workforce) or while being used (consumer), neither the product nor the processes shall endanger the integrity of the *organization* (*fire, explosion, pollution effects*).
		Person passive security and safety	During the manufacturing phase (workforce) or while being used (consumer), the product and the processes shall not attract events that might endanger people's health or life (*contamination, infection, disease weakness*).
		Organization passive security and safety	During the manufacturing phase (workforce) or while being used (consumer), neither the product nor the processes shall attract events that might endanger the integrity of the organization (*thunderstorm, earthquake*).
		Environment security	During the manufacturing phase or while being used, the product shall not damage the environment (*used water, smoke*).
04	Returns	User complaint	In case of incidents or problems, the user/consumer of the product shall be able to easily send a complaint. These complaints are managed (*hot line*).
		Product return	The customer returns the product because of dissatisfaction. The returned products are managed.

Table D.1 *(continued)*

N°	Main criteria	Sub-criteria	Description
05	Availability	Direct availability	Product is available at any time (*no long preparation like micro-wave*).
		Reliability	Edible over a period of time.
		Authenticity	Bio., organic, halal, "terroir".
		Accessibility	Product/service is accessible for easy usage.
		Integrity	No perishable components within the time limit.
		Continuity	Can be eaten at any time.
		Recovering	Process after a breakdown can quickly recover.
		Fault tolerance	Process can continue even with some flaws.
		Robustness	Product/service or process can continue in harsh conditions.
06	On-time delivery	Time to delivery	The current product reaches the user/consumer on the expected date.
		Reactivity	The manufacturing/logistic/delivery process can easily manage user/consumer modification of date.
07	On-time to market	Time to market	The new product reaches the consumer's market during the expected period.
		Market reactivity	
Generic efficiency criteria			
08	Productivity	Productivity	Number of units produced (product /service) per unit of time and per consumption of resource (workforce).
		Recall	All products are traced from the organization for potential recalls.
09	Raw material efficiency		The product (or service) uses the lowest quantity of raw material to be manufactured (*auxiliary, excipient*).
10	Energy efficiency		The product (or service) uses the lowest quantity of energy for manufacture.
Food processing industry specific criteria			
11	Ease of use	Ergonomic	Simple to use – practical.
		Ease of starting	No need of any specific training to start or to use it (no grand chef needed).
		Ease of understanding	Easy and understandable recipe.
		Consumer information	Understandable nutritional and good health information.
12	Pollution control	Air pollution control	Air thresholds indicated by monitoring agencies.
		Water pollution control	Water thresholds indicated by monitoring agencies.

NOTE The term "product" always refers to a product or a service.

Annex E
(normative)

Table of criteria for the automotive industry

The table for the automotive criteria is given in Table E.1.

Table E.1 — Table of criteria (automotive)

N°	Main criteria	Sub-criteria	Description
Generic quality criteria			
01	Compliance	Regulation	The product has to comply with regulation requirements (*gas emission, safety*).
		Functional	The product shall do what it is supposed to do (*transport, carrying, travelling, motion*).
		Contractual	The product has to comply with the contractual agreement.
		Organization policies	The product and processes have to comply with the internal policies of the organization.
02	Ethical behaviour	HR progress	Every person of the organization is involved in a yearly training programme.
		Fair trade	Good practices of fair trade are described in an ethical chart and applied.
		Local community	Local community is involved in manufacturing/ delivering the product (% of local personnel in the organization personnel).
		Charity	The organization is involved in charity programmes.
03	Security/safety	Person active security and safety	During the manufacturing phase (workforce) or while being used (consumer), neither the product nor the processes shall endanger people's health or life (*crash test, car safety, safety belt*).
		Organization active security and safety	During the manufacturing phase (workforce) or while being used (consumer), neither the product nor the processes shall endanger the integrity of the organization.
		Person passive security and safety	During the manufacturing phase (workforce) or while being used (consumer), neither the product nor the processes shall attract events that might endanger people's health or life (*alarm control, identification, counterfeit spare part*).
		Organization passive security and safety	During the manufacturing phase (workforce) or while being used (consumer), neither the product nor the processes shall attract events that might endanger the integrity of the organization.
		Environment security	During the manufacturing phase, or while being used, neither the product nor the processes shall damage the environment (*pollution emission, car refurbish, battery recycling, chemical discharge*).
04	Returns	User complaint	In case of incidents or problems, the user/ consumer of the product shall be able to easily send a complaint. These complaints are managed (*hot line*).
		Product return	The customer returns the product because of dissatisfaction. The returned products are managed.

Table E.1 *(continued)*

N°	Main criteria	Sub-criteria	Description
05	Availability	Direct availability	Product is available for usage at any time (*the vehicle is ready to start when needed, no battery problem, no oil leak problem*).
		Reliability	Product functions over a period of time without breaking down (*motor*).
		Authenticity	Product origin is not altered (breach of origin) (*no counterfeit of spare parts*).
		Continuity	Product or processes offer continuous service (*warning for maintenance, easily repair*).
		Fault tolerance	Product or processes continue to serve even with some flaws.
		Robustness	Product or processes continue to serve in harsh conditions (*track, lane, country road, stormy conditions*).
06	On-time delivery	Time do deliver	The current product reaches the user/consumer on the expected date.
		Reactivity	The manufacturing/logistic/delivery process can easily manage user/consumer modification of date.
07	On-time to market		The new product reaches the consumer's market at the expected period.
Generic efficiency criteria			
08	Productivity	Productivity	Number of conforming/acceptable units produced per unit of time and per consumption of resource (workforce).
		Recall	The manufacturing/logistic processes are able to withdraw all identified products.
09	Raw material efficiency		The product is uses the lowest quantity of raw material for manufacturing.
10	Energy efficiency		The product is using the lowest quantity of energy for manufacture.
Automotive industry specific criteria			
11	Ease of use	Ergonomic	Product has an easy going interface (quick to use).
		Ease of starting	No need of any specific training to start or restart it (*easy driving instructions, easy GPS instruction*).
		Ease of understanding	No need of any specific training or expertise to use it or reuse it (*no idle time spent to understand tire pressure, defrosting, breaking limits*).
		Consumer information	Product information easily accessible (*no wasted time*).
		Maintainability	If a problem occurs, it can easily be repaired by the user (*minimum time spent on battery, oil condition, cooling system*).
12	Pollution control		Manufacturing and logistics of vehicle (*no pollution, no noise, and no* smell). Vehicle (*no pollution and no noise*).

NOTE The term "product" always refers to a product or a service.

Annex F
(normative)

Table of criteria for the retail banking industry

The table for the retail banking criteria is given in Table F.1.

Table F.1 — Table of criteria (retail banking)

N°	Main criteria	Sub-criteria	Description
Legal and security criteria			
01	Compliance	Regulation	The banking service shall comply with regulations (*risk assessment, solvency*).
		Functional	The banking service or financial product shall do what it is supposed to do.
		Contractual	The banking service, the financial product and the processes have to comply with the contractual compliance (*interest rate, profit return*).
		Organization policies	The banking service and the processes shall comply with the internal policies (*audit, internal control, inspection, due diligences*).
02	Ethical behaviour	HR progress	Employees are involved in a yearly training programme.
		Fair trade	Good practices of fair trade are described in an ethical chart and applied (*bribery, money laundry*).
		Local community	Local community is involved in delivering the banking service or financial product.
		Charity	Banking service or financial product involved in charity programmes.
03	Security/safety	Person active security and safety	During the processing phase of the banking service (workforce) or while being used (consumer of loan), neither the banking service nor its processes endanger people legal integrity.
		Organization active security and safety	During the processing phase of the banking service (workforce) or while being used (consumer), neither the banking service nor its processes shall endanger the legal integrity of the organization (*money laundering*).
		Person passive security and safety	During the processing phase of the banking service (workforce) or while being used (consumer), neither the product nor its processes shall attract events that might endanger people legal integrity (*money laundering*).
		Organization passive security and safety	During the processing phase of the banking service (workforce) or while being used (consumer of loan), neither the product nor its processes shall attract events that might endanger the integrity of the organization (*money laundering*).

Table F.1 *(continued)*

N°	Main criteria	Sub-criteria	Description
04	Returns	User complaint	In case of incidents or problems, the user/consumer of the banking service shall be able to easily send a complaint. These complaints are managed (*hot line*).
		Banking service return	The customer returns its banking service for a changed condition or cancellation because of dissatisfaction. The changed or cancel banking services are managed.
05	Availability	Direct availability	The banking service is available when needed.
		Reliability	The banking service has no breakdown during a period of time.
		Authenticity	No counterfeiting components on the banking service or financial product.
		Accessibility	Banking service is accessible for all persons conditions.
		Continuity	No component with uncertainties (*unknown risk*) with the banking service or financial product.
			The banking service can be used at any time.
		Recovering	Processes after a breakdown can quickly recover. The banking service can easily be restored.
		Fault tolerance	Processes continue to operate even with some flaws. The banking service can be used even with defects.
		Robustness	The banking service or processes continue to serve in harsh conditions (*network flaw, computer breakdown*).
06	On-time delivery	Time do deliver	The current banking service or financial product reaches the user/consumer on the expected date.
		Reactivity	The banking service processes can easily manage user/consumer modification.
07	On-time to market	Time to Market	The new banking service or financial product reaches the consumer/consumer at the expected time period.
		Market reactivity	The banking service processes can easily manage market condition modification.
Generic efficiency criteria			
08	Productivity	Productivity	Number of units produced (*banking service or financial product*) per unit of time and per consumption of resource (workforce)
		Recall	The delivered banking service to customers can quickly be identified and traced.
09	Raw material efficiency		The banking service is uses the lowest quantity of raw material (*paper, plastic, buildings*).
10	Energy efficiency		The banking service is uses the lowest quantity of energy (*electricity*).
Banking service specific criteria			
11	Ease of use	Ergonomic	Simple using – practical of the banking service.
		Ease of starting	No need of any specific training to start or to use the banking service or financial product.
		Ease of understanding	The banking service commands are easy to use.
		Consumer information	The banking service or financial product information are easily accessible and understandable.

Table F.1 *(continued)*

N°	Main criteria	Sub-criteria	Description
		Maintainability	If problems occur with the banking service or financial product, it can easily be restored.
12	Pollution control	Air pollution control	Air thresholds indicated by monitoring agencies.

NOTE The term "product" always refers to a product or a service.

Annex G
(normative)

Table of criteria for clothing and leather industry

The table for the clothing and leather criteria is given in Table G.1.

Table G.1 — Table of criteria (clothing and leather)

N°	Main criteria	Sub-criteria	Description
Generic quality criteria			
01	Compliance	Regulation	The clothes and leather products shall comply with regulations (*chemical components, children's security, allergens*).
		Functional	The clothes and leather products shall do what they are supposed to do.
		Contractual	The clothes, leather products and the processes have to comply to the contractual agreements.
		Organization policies	The product and processes have to comply with the internal policies of the organization.
02	Ethical behaviour	HR progress	Employees are involved in a yearly training programme.
		Fair trade	Good practices of fair trade are described in an ethical chart and applied.
		Local community	Local community is involved in field production/ manufacturing/delivering the clothes or leather products.
		Charity	The organization producing the clothes or leather products is involved in charity programmes.
03	Security/safety	Person active security and safety	During the manufacturing phase (workforce) or while being used (consumer), neither the product nor its processes shall endanger people's health or life.
		Organization active security and safety	During the manufacturing phase (workforce) or while being used (consumer), neither the product nor its processes shall endanger the integrity of the organization.
		Person passive security and safety	During the manufacturing phase (workforce) or while being used (consumer), neither the product nor its processes shall attract events that might endanger people's health or life.
		Organization passive security and safety	During the manufacturing phase (workforce) or while being used (consumer), neither the product nor its processes shall attract events that might endanger the integrity of the organization.
		Environment security	During the manufacturing phase or while being used, the product shall not damage the environment.
04	Returns	User complaint	In case of incidents or problems, the user/consumer of the clothes or leather products shall be able to easily send a complaint.
		Product return	The manufacturing/logistic processes are able to return or withdraw all the clothes or leather products.

Table G.1 *(continued)*

N°	Main criteria	Sub-criteria	Description
05	Availability	Direct availability	The clothes or leather products are available when needed.
		Reliability	The clothes and leather products have no weaknesses during a period of time.
		Authenticity	No counterfeiting components on the clothes and leather products.
		Accessibility	The clothes or leather products are accessible for all consumers (*price*, *availability*).
		Continuity	No component with uncertainties (*unknown risk*) on the clothes and leather products.
			The clothes or leather products can be used at any time.
		Recovering	Processes after a breakdown can quickly recover. The clothes or leather products can easily be repaired.
		Fault tolerance	Processes continue to operate even with some flaws. The clothes and leather products can be used even with defects.
		Robustness	The clothes or leather products or processes continue to operate in harsh conditions (*wind, rain*).
06	On-time delivery	Time do deliver	The clothes and leather products reach the user/consumer on the expected date.
		Reactivity	The manufacturing/logistic/delivery processes can easily manage user/consumer modification.
07	On-time to market	Time to market	New clothes and leather products reach the consumer at the expected period.
		Market reactivity	The manufacturing/logistic/delivery processes can easily manage market conditions modification.
Generic efficiency criteria			
08	Productivity	Productivity	Number of units produced (*clothes or leather products*) per unit of time and per consumption of resource (workforce).
		Recall	The organization is able to withdraw an identified quantity of products in a very short time.
09	Raw material efficiency		The product uses the lowest quantity of raw material in manufacture.
10	Energy efficiency		The product uses the lowest quantity of energy in order to be manufactured.
Clothes and leader products specific criteria			
11	Ease of use	Ergonomic	Simple to use – practical.
		Ease of starting	No need of any specific training to start or to use the clothes or leather products.
		Ease of understanding	The clothes or leather products are easy to use.
		Consumer information	The clothes or leather products' information are easily accessible.
		Maintainability	If problems occur on the clothes or leather products, they can easily be restored. Identical for all processes.
12	Pollution control	Air pollution control	Air thresholds indicated by monitoring agencies.
		Water pollution control	Water thresholds indicated by monitoring agencies.

NOTE The term "product" always refers to a product or a service.

Annex H
(normative)

Table of criteria for the telecoms industry

The table for the telecoms criteria is given in Table H.1.

Table H.1 — Table of criteria (telecoms)

N°	Main criteria	Sub-criteria	Description
Generic quality criteria			
01	Compliance	Regulation	The telecom service or product, and all its manufacturing and logistic processes, shall comply with regulations.
		Functional	The telecom service or product shall do what it is supposed to do.
		Contractual	The telecom service or product and its processes have to comply with contractual agreements.
		Organization policies	The product and processes have to comply with the internal policies of the organization.
02	Ethical behaviour	HR progress	Employees are involved in a yearly training programme.
		Fair trade	Good practices of fair trade are described in an ethical chart and applied.
		Local community	Local community is involved in field production/manufacturing/delivering the telecom service or product.
		Charity	The organization is involved in charity programmes.
03	Security/safety	Person active security and safety	During the manufacturing phase (workforce) or while being used (consumer), neither the product nor its processes shall endanger people's health or life.
		Organization active security and safety	During the manufacturing phase (workforce) or while being used (consumer), neither the product nor its processes shall endanger the integrity of the organization.
		Person passive security and safety	During the manufacturing phase (workforce) or while being used (consumer), neither the product nor its processes shall attract events that might endanger people's health or life.
		Organization passive security and safety	During the manufacturing phase (workforce) or while being used (consumer), neither the product nor its processes shall attract events that might endanger the integrity of the organization.
04	Returns	User complaint	In case of incidents or problems, the user/consumer of the telecom service or product shall be able to easily send a complaint.
		Product return	The manufacturing/logistic processes are able to return or withdraw all telecom service or product.

Table H.1 *(continued)*

N°	Main criteria	Sub-criteria	Description
05	Availability	Direct availability	The telecom service or product is available when needed.
		Reliability	The telecom service or product does not breakdown during a period of time.
		Authenticity	No counterfeiting components on the telecom service or product.
		Accessibility	Telecom service is accessible for easy usage.
		Integrity	No component with uncertainties (*unknown risk*) with the telecom service or product.
		Continuity	The telecom service can be used at any time.
		Recovering	Processes after a breakdown can quickly recover. The telecom service or product can easily be repaired.
		Fault tolerance	Processes continue to operate even with some flaws. The telecom service can be used even with defects.
		Robustness	The telecom service or processes continue to serve in harsh conditions (*network flaw, computer breakdown*).
06	On-time delivery	Time do deliver	The current telecom service or product reaches the user/consumer on the expected date.
		Reactivity	The manufacturing/logistic/delivery processes can easily manage user/consumer modification.
07	On-time to market	Time to market	
		Market reactivity	
Generic efficiency criteria			
08	Productivity	Productivity	Number of units produced (the telecom service or product) per unit of time and per consumption of resource (workforce).
		Recall	
09	Raw material efficiency		The product and telecom service use the lowest quantity of raw material in manufacture.
10	Energy efficiency		The product and telecom service use the lowest quantity of energy in manufacture.
Telecoms specific criteria			
11	Ease of use	Ergonomic	Simple to use – practical for every day calls.
		Ease of starting	No need of any specific training to start or to use the telecom service or product.
		Ease of understanding	The telecom service commands are easy to use.
		Consumer information	The telecom service or product information is easily accessible (*price, option, modification*).
		Maintainability	If problems occur on the telecom service or product, it can easily be restored. Identical for all processes.
12	Pollution control	Air pollution	Air thresholds indicated by monitoring agencies from telecom manufacturing and operating centres.
		Water pollution	Water thresholds indicated by monitoring agencies from telecom manufacturing and operating centres.

Annex I
(normative)

Table of criteria for the hotel business

The table for the hotel business criteria is given in Table I.1.

Table I.1 — Table of criteria (hotel business)

N°	Main criteria	Sub-criteria	Description
Generic quality criteria			
01	Compliance	Regulation	The hotel building and the hotel service have to comply with regulations.
		Functional	The hotel service shall do what it is supposed to do.
		Contractual	The hotel service has to comply with contractual agreements.
		Organization policies	The hotel service has to comply with internal policies.
02	Ethical behaviour	HR progress	Employees of the hotel service are involved in a yearly training programme.
		Fair trade	Good practices of fair trade are described in an ethical chart and applied.
		Local community	Local community is involved in building the hotel infrastructure and delivering the hotel service.
		Charity	The hotel organization is involved in charity programmes.
03	Security/safety	Person active security and safety	During the manufacturing phase (workforce for the hotel infrastructure) or while being used (consumer of the hotel service), neither the hotel service nor its processes of the hotel building shall endanger people's health or life.
		Organization active security and safety	During the manufacturing phase (workforce) or while being used (consumer), neither the hotel service nor its processes for building shall endanger the integrity of the organization.
		Person passive security and safety	During the manufacturing phase (workforce) or while being used (consumer), neither the hotel service nor its processes for building shall attract events that might endanger people's health or life.
		Organization passive security and safety	During the manufacturing phase (workforce) or while being used (consumer), neither the hotel service nor its processes for building shall attract events that might endanger the integrity of the organization.
04	Returns	User complaint	In case of incidents or problems, the user/consumer of the hotel service shall be able to easily send a complaint.
		Return/withdrawal	The building/logistic processes are able to return or withdraw all hotel services.

Table I.1 *(continued)*

N°	Main criteria	Sub-criteria	Description
05	Availability	Direct availability	The hotel service is available when needed.
		Reliability	The hotel service has no breakdown (*water supply, electricity supply*) during a period of time.
		Accessibility	Hotel service is accessible for easy use and for all levels of revenue.
		Integrity	No component with uncertainties (*unknown risk*) on the hotel service.
		Continuity	The hotel service can be used at any time.
		Recovering	The building processes after a breakdown can quickly recover. The hotel service can easily be repaired.
		Fault tolerance	Processes continue to operate even with some flaws. The hotel service can be used even with some weaknesses.
		Robustness	The hotel service or building processes continue to serve in harsh conditions (*wind, storm, strikes*)
06	On-time delivery	Time do deliver	The current hotel service is ready when expected.
		Reactivity	The hotel service can easily manage user/customer modification.
			The building processes of the hotel infrastructure can easily manage client modification.
07	On-time to market	Time to market	The new hotel service reaches the consumer/consumer at the expected period.
		Market reactivity	The hotel service can easily manage user/customer modification on new service.
			The building processes of the hotel infrastructure can easily manage market condition modification.
Generic efficiency criteria			
08	Productivity	Productivity	Number of units produced (*hotel night*) per unit of time and per consumption of resource (workforce).
09	Raw material efficiency		The building of the infrastructure uses the lowest quantity of raw material. The hotel service uses the lowest quantity of raw material.
10	Energy efficiency		The building of the infrastructure uses the lowest quantity of energy. The hotel service uses the lowest quantity of energy.
Hotel business specific criteria			
11	Ease of use	Ergonomic	Simple to use – practical (*for room service*).
		Ease of starting	No need of any specific training to start or to use.
		Ease of understanding	The hotel service commands are easy to use.
		Consumer information	The hotel service information are easily accessible.
		Maintainability	If problems occur with the hotel service, it can easily be restored. Identical for the processes.
12	Pollution control	Air pollution control	Air thresholds indicated by monitoring agencies during building and hotel service.
		Water pollution control	Water thresholds indicated by monitoring agencies during building and hotel service.

Annex J
(normative)

Table of criteria for the retail business

The table for the retail criteria is given in Table J.1.

Table J.1 — Table of criteria (retail)

N°	Main criteria	Sub-criteria	Description
Generic quality criteria			
01	Compliance	Regulation	The retail service or distributed products have to comply with regulations.
		Functional	The retail service or distributed products shall do what it is supposed to do.
		Contractual	The retail service or distributed products have to comply with the contractual agreement (*choice, price, delivery*).
		Organization policies	The retail service or distributed products have to comply with the organization policies.
02	Ethical behaviour	HR progress	Employees of the organization are involved in a yearly training programme.
		Fair trade	Good practices of fair trade are described in an ethical chart and applied.
		Local community	Local community is involved in the retail service (*% of local personnel in the organization personnel*).
		Charity	The retail organization is involved in charity programmes.
03	Security/safety	Person active security and safety	The retail service or distributed products shall not endanger people's health or life.
		Organization active security and safety	The retail service or distributed products shall not endanger the integrity of the organization.
		Person passive security and safety	The retail service or distributed products shall not attract events that might endanger people's health or life.
		Organization passive security and safety	The retail service or distributed products shall not attract events that might endanger the integrity of the organization.
04	Returns	User complaint	In case of incidents or problems, the user/consumer of the retail service or distributed product shall be able to easily send a complaint.
		Product return	The retail service is able to return or withdraw all distributed products.

Table J.1 *(continued)*

N°	Main criteria	Sub-criteria	Description
05	Availability	Direct availability	The retail service or distributed product is available when needed.
		Reliability	The retail service or distributed product has no break-down during a period of time.
		Authenticity	No counterfeiting components on the distributed product.
		Accessibility	The retail service or distributed product is accessible for easy use.
		Integrity	No component with uncertainties (*unknown risk*) on the distributed product.
		Continuity	The distribution service or distributed product can be used at any time.
		Recovering	The retail service after a breakdown can quickly recover. The distributed product can easily be repaired.
		Fault tolerance	The retail service continues to operate even with some flaws.
		Robustness	The retail service continues to operate in harsh conditions (*network flaw, storm, strikes*).
06	On-time delivery	Time do deliver	The current retail service or distributed products is available for the user/consumer on the expected date.
		Reactivity	The current retail service or distributed products can easily be managed according to customer modification.
07	On-time to market	Time to market	A new retail service or distributed products is available for the consumer/consumer at the expected period.
		Market reactivity	A new retail service or distributed products can be easily managed according to changing market conditions.
General efficiency criteria			
08	Productivity	Productivity	Number of units produced (*the distribution service points or distributed product*) per unit of time and per consumption of resource (workforce).
		Recall	The retail service is able to withdraw specific quantities of delivered products within a short time.
09	Raw material efficiency		The retail service uses the lowest quantity of raw material for operations.
10	Energy efficiency		The retail service uses the lowest quantity of energy for operations.
Retail business specific criteria			
11	Ease of use	Ergonomic	Practical access to go to the retail service (*web service of the retailer*).
		Ease of starting	No need of any specific training to start it or to use the retail service.
		Ease of understanding	The retail service is easy to understand (*grocery range, product localization, shelf time*).
		Consumer information	The retail service gives the right product information and is easily accessible.
12	Pollution control	Air pollution control	Air thresholds indicated by monitoring agencies during retail service.
		Water pollution control	Water thresholds indicated by monitoring agencies during retail service.

Annex K
(informative)

Example from the poultry industry

Process of production and transformation:

Hatching – Farming – Slaughtering – Processing – Packaging – Retailing

The main criteria of the channel are the following:

— Compliance/regulation

The production shall comply to the sanitary regulations (HACCP method, internal audit, food law, etc.).

Measure: 100 % of regulation practices shall be applied (e.g.: HACCP has 235 essential practices categorized in 7 principles)

— Compliance/functional

The delivered product (chicken fillet, roasted chicken, etc.) shall contain the required level of protein, vitamins, and oligos.

Measure: 100 % of the quantity of the concerned product (protein, vitamin, oligo) shall be in the range of tolerance of the nominal quantity

— Safety to do what it is supposed to do (functional, conformity)

The delivered product shall not contain poison, antibio, or bacteria/virus that could endanger consumer health.

Measure: 100 % of the product's poison, antibio, or bacteria/virus shall be under a ppm threshold (regulation threshold)

— Availability

The delivered product shall be on the retail shelves when the consumer is on its purchasing day.

Measure: 100 % of availability on shelves (no stock outage)

— On-Time Delivery

Time delivery shall be controlled in order to keep up the "best before" date.

Measure: 100 % OTD (percentage of time lost)

— Productivity

Breeding, growing, and slaughtering/processing operations have to keep the highest percentage of edible product.

Measure: yield of production

— Channel effect

If one operator of the channel is missing a criteria threshold, then the other operators are impacted. This is the propagation effect of defects (see Table K.1).

Table K.1 — Example of benchmarking results for Poultry channel

Criteria	Process					
	Hatching	Farming	Slaughtering	Processing	Packaging	Retailing
Productivity	77 %	74 %	71 %	67 %	66 %	64 %
Safety (threshold of 25 ppm)	2	6	13	1	0	0
Availability	99,9 %	98 %	97 %	97 %	95 %	91 %

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