BS ISO 16355-2:2017

BSI Standards Publication

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

Part 2: Non-quantitative approaches for the acquisition of voice of customer and voice of stakeholder

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National foreword

This British Standard is the UK implementation of ISO 16355-2:2017.

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INTERNATIONAL STANDARD

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

Part 2: Non-quantitative approaches for the acquisition of voice of customer and voice of stakeholder

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

Partie 2: Acquisition non quantitative du retour client (Voice of Customer) ou du retour des parties prenantes (Voice of stakholders)

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Contents

Page

Foreword ..... **iv**
Introduction ..... **v**
1 Scope **1**
2 Normative references **1**
3 Terms and definitions **1**
4 Basic concepts of QFD **1**
5 Integration of non-quantitative voice of customer (VOC) and voice of stakeholder (VOS) acquisition with customer research methods **2**
5.1 VOC and VOS acquisition support for market research methods for product development 2
5.2 Voice of customer and voice of stakeholder acquisition outline 2
6 Types of new technology and product development project for which VOC and VOS can be acquired **2**
7 VOC and VOS acquisition team membership **3**
7.1 QFD uses cross-functional teams 3
7.2 Core team membership 3
7.3 Subject matter experts 3
7.4 VOC and VOS acquisition team leadership 3
8 Tools for VOC and VOS acquisition and analysis **3**
8.1 General 3
8.2 Seven management and planning tools 3
9 New technology and product development voices **4**
9.1 Voice of business 4
9.1.1 General 4
9.1.2 Strategic planning 5
9.1.3 Business goals for projects 18
9.1.4 Identify project constraints 20
9.1.5 Project scope 20
9.2 Voice of customer (VOC) or stakeholder (VOS) (non-quantitative) 22
9.2.1 Identify customers or stakeholders 22
9.2.2 Marketing perspective and engineering perspective of customers and their activities 24
9.2.3 Prioritize customers or stakeholders 27
9.2.4 What is contained in the voice of customer (VOC) or voice of stakeholder (VOS) 29
9.2.5 Sources of VOC or VOS 29
Bibliography **39**

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Document Sharing Hub
Full document details: BS ISO 16355-2:2017

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).

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 on 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 the following URL: www.iso.org/iso/foreword.html.

This document was prepared by 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.

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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 should be 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 lifecycle cost, and improved reputation of the organization among its customers or stakeholders.

This document demonstrates the dynamic nature of a customer-driven approach. Since its inception in 1966, QFD has broadened and deepened its methods and tools to respond to the changing business conditions of QFD users, their management, their customers, and their products. Those who have used older QFD models find these improvements make QFD easier and faster to use. The methods and tools shown and referenced in the standard 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.

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 2: Non-quantitative approaches for the acquisition of voice of customer and voice of stakeholder

1 Scope

This document describes the non-quantitative approaches in the acquisition of voice of customer (VOC) and voice of stakeholder (VOS) and its purpose, and provides recommendations on the use of the applicable tools and methods. It is not a management system standard.

NOTE It does not provide requirements or guidelines for organizations to develop and systematically manage their policies, processes, and procedures in order to achieve specific objectives.

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 terminological databases for use in standardization at the following addresses:

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

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

4 Basic concepts of QFD

The basic concepts of QFD are described in ISO 16355-1:2015, Clause 4.

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5 Integration of non-quantitative voice of customer (VOC) and voice of stakeholder (VOS) acquisition with customer research methods

5.1 VOC and VOS acquisition support for market research methods for product development

Integration of non-quantitative VOC and VOS acquisition with customer research methods is both desirable and possible. Successful integration has been accomplished with market research, focus groups, ethnographies, use case, agile development, and other methods. This integration should be guided by an expert familiar with these methods.

NOTE 1 QFD can be integrated with other customer research methods.

NOTE 2 QFD can integrate tools and methods from different new product development processes. Conversely, different new product development processes can utilize QFD tools and methods.

NOTE 3 The applicable tools listed are not exhaustive. They are meant to illustrate tools that have been effectively used in QFD. Other tools can also be useful according to the project. Which tools and in what sequence can be custom-tailored to the organization and product.

5.2 Voice of customer and voice of stakeholder acquisition outline

Figure 1 describes the VOC and VOC acquisitions outline, where the numbers refer to the relevant clauses in this document.

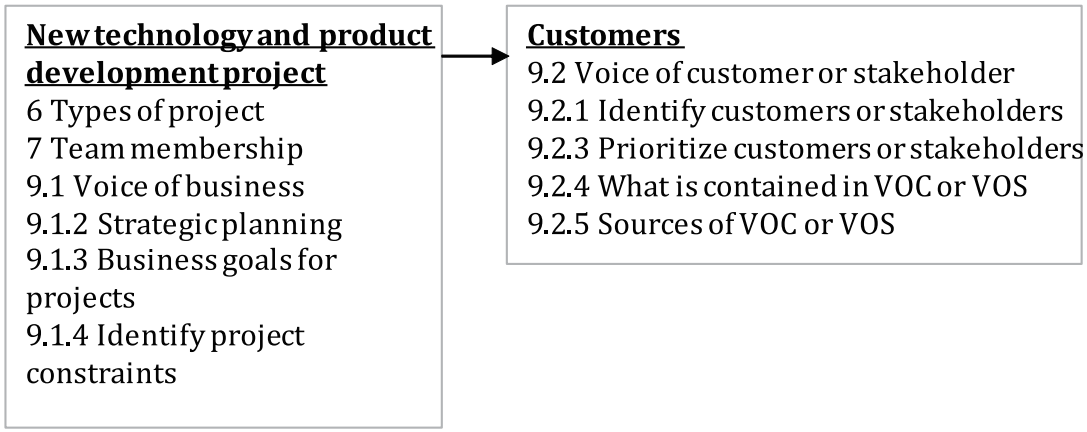

Figure 1 — VOC and VOS acquisition outline

6 Types of new technology and product development project for which VOC and VOS can be acquired

QFD projects can encompass new developments as well as generational improvements to existing products. The types of QFD projects are referenced in ISO 16355-1:2015, Clause 6.

NOTE 1 The VOC and VOS acquisition approaches and their sequence can be scaled to the type of project.

NOTE 2 The VOC and VOS acquisition approaches and sequence can be adapted to the management structure and culture, market research, and problems of each organization to improve participation, integration, and long-term utilization of the method. VOC and VOS acquisition can be integrated with existing research activities.

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NOTE 3 QFD is not a method to design a product or process — it is an infrastructure to ensure the product or process satisfies customers.

7 VOC and VOS acquisition team membership

7.1 QFD uses cross-functional teams

Cross-functional teams are referenced in ISO 16355-1:2015, 7.1.

7.2 Core team membership

Core team membership is referenced in ISO 16355-1:2015, 7.2.

7.3 Subject matter experts

Subject matter experts involvement are referenced in ISO 16355-1:2015, 7.3.

7.4 VOC and VOS acquisition team leadership

VOC and VOS acquisition teams can be led by members of business functions such as sales, marketing, market research, customer service, customer support, and others with first-hand knowledge or contact with customers and stakeholders.

8 Tools for VOC and VOS acquisition and analysis

8.1 General

The basic tools for quality control are sufficient for analysis of quantitative data that can be collected from current operations. However, in new product development, quantitative data is not always available until engineering and build operations have begun. Therefore, a new set of quality tools were arranged to acquire, organize, and analyse the qualitative and often verbal information more common in business and product planning as well as voice of customer and voice of stakeholder studies. These are called the seven new quality tools or the seven management and planning tools[3][20][23]. These tools are helpful in acquisition and analysis of the voice of the customer and voice of the stakeholder which is detailed in ISO 16355-4. VOC and VOS analysis are a critical element in QFD to capture and prioritize both language and behaviour of the customers which drive the product development process. See Figure 2.

8.2 Seven management and planning tools

The seven management and planning tools are the following.

a) Affinity diagram. This is used to organize a problem statement where there is uncertainty, often pertaining to future events or unknowns. Verbalized ideas, opinions, and facts are synthesized into a diagram using an anthropological technique known as the KJ™[1)] method named for its creator, Kawakita Jiro.

b) Relations diagram. This is used to unravel complicated issues by displaying the logical connections, cause-and-effect connections, or objectives and strategies. It is useful in planning activities to gain consensus from those with different perspectives.

c) Tree diagrams and hierarchies. These are used to systematically organize issues such as objectives and strategies and also to organize information into levels of abstraction and identify missing elements.

1) KJ™ is an example of a suitable product available commercially. This information is given for the convenience of users of this document and does not constitute an endorsement by ISO of this product.

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d) Matrix diagram. This is used to organize multi-dimensional problems so that intersecting relationships can be examined rapidly by those with knowledge and experience. Most common are the two-dimensional L-matrix; three-dimensional C-, T, and Y matrices; and the four dimensional X-matrix.

e) Arrow diagram. This is used for project management to show duration and sequence of critical tasks. It is often used with precedence diagrams, critical path method (CPM) and program and evaluation review technique (PERT).

f) Process decision program chart (PDPC). This is used to predict potential failures on plans and develop contingencies.

g) Matrix data analysis. This quantitative method relies on principle component analysis (PCA) to categorize and extract meaning from complex numerical data sets. Analytic hierarchy process (AHP) can also be used when combining objective and subjective information into a decision model.

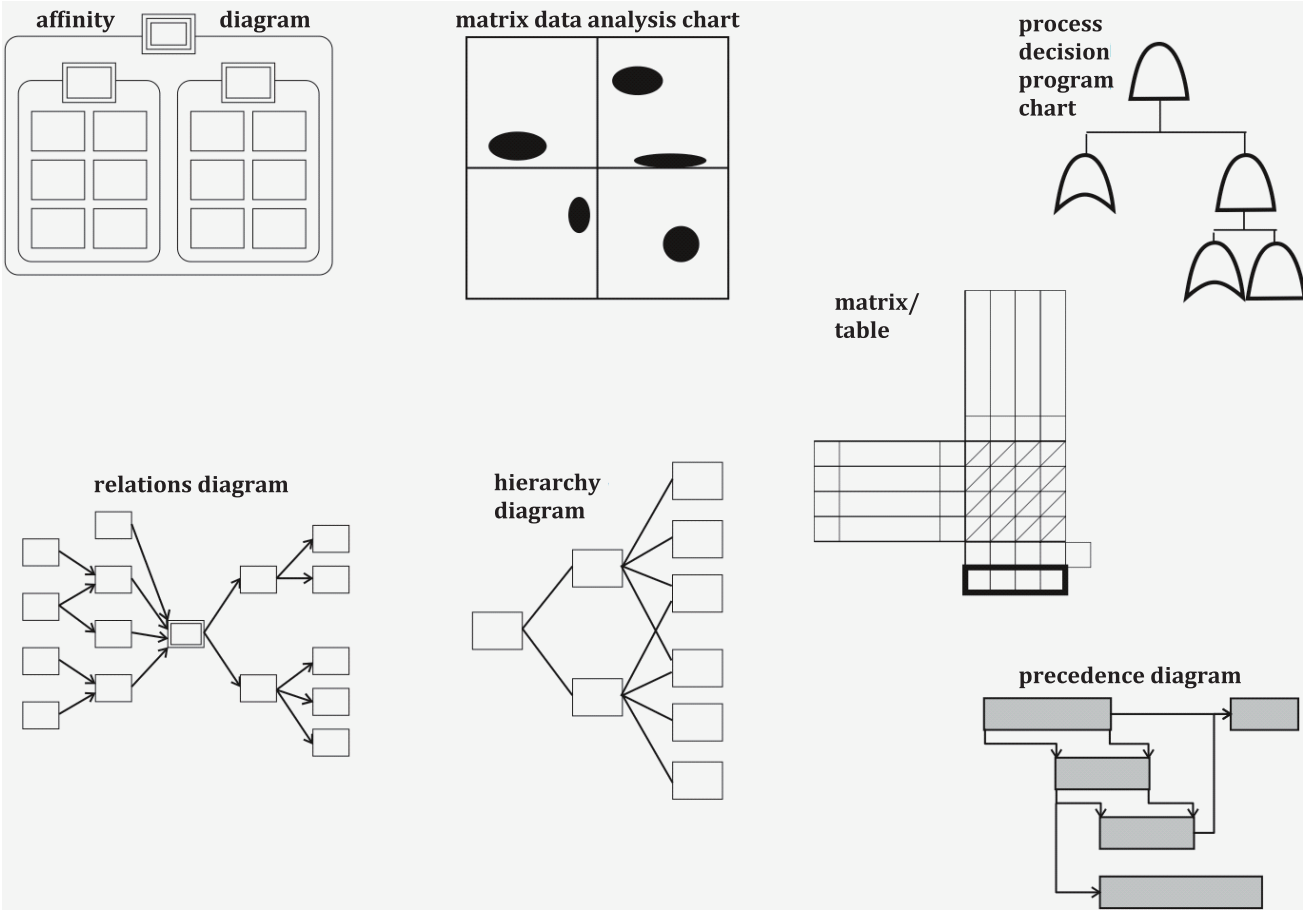

Figure 2 — Seven management and planning tools

9 New technology and product development voices

9.1 Voice of business

9.1.1 General

To keep an organization competitive, it is helpful to seek a deeper understanding of the value that drives customer needs during the early stages of product and process development. QFD enables product and process managers, designers, and developers to comprehend, prioritize, and merge both organizational and project-specific goals with the needs of the customer. QFD helps clarify project direction so that

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it remains fluid and responsive to change; if priorities are challenged, the model should be used to recalibrate the design focus. QFD helps improve the process by which these products and processes are developed.

9.1.2 Strategic planning

9.1.2.1 General

When QFD is applied to projects that contribute to strategically important objectives and goals for the organization, projects priorities, design focus, resources, and planning should be fully calibrated with those objectives and goals. The strategic objectives and goals are the main building blocks of the organizational vision, mission, and the core value. Constraints can also exist.

NOTE Not all QFD projects have strategic purpose, so capturing the voice of the business is optional.

9.1.2.2 Hoshin kanri (policy management and deployment)

9.1.2.2.1 Basics of hoshin kanri

Hoshin kanri emerged in Japan in 1964 as a method for management and deployment of strategic organizational policies. It was developed by many of the same people who created QFD who saw it as a way "to link total quality management (TQM) activities for fulfilment of all critical management objectives" and for which QFD was "the powerful tool needed. In quality assurance system flow charts, it is typically the starting point for QFD"[21].

Hoshin not only captures strategic intent, but also applies quality measurement and improvement activities to both targets and the means to achieve them. Hoshin can be used prior to QFD to form organizational strategies and identify projects, for which QFD can be implemented to assure the strategies are achieved. Hoshin can be used following a QFD study that captures market changes and suggests a new policy strategy[1][14][36].

9.1.2.2.2 Inputs to hoshin kanri

The hoshin kanri method considers the following inputs:

a) Strategic analysis and agreement by senior management and other individuals involved with corporate governance of

   1) Vision — what the organization wants to become,

   EXAMPLE 1 Big-U bookstores will become the leading university bookstore in the US by 2020 as measured by relationships with 75 % of two- and four-year college campuses.

   2) Mission — what activities the organization engages to achieve the vision,

   EXAMPLE 2 Buy equity in existing university bookstores and rebrand as Big-U.

   EXAMPLE 3 Develop online ordering under Big-U brand.

   3) Values — what principles guide the activities the organization engage in or not,

   EXAMPLE 4 Create a flexible workplace for student employees.

b) Setting of business goals by senior management and other individuals involved with corporate governance can be done for different time periods;

   1) Long-term (3- to 5-year) goals and how to measure them,

   EXAMPLE 5 Achieve 3 750 relationships by 2020.

   2) Medium-term (2- to 3-year) goals and how to measure them,

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EXAMPLE 6 Achieve 2 500 relationships by 2018.

3) Short-term or annual (1-year) goals and how to measure them.

EXAMPLE 7 Achieve 1 800 relationships by 2016.

EXAMPLE 8 Supply 95 % of required textbooks (used and new) by start of semester.

NOTE Business goals can have fixed durations or can be re-examined each year into rolling plans.

9.1.2.2.3 Process of hoshin kanri

The hoshin kanri method employs the following process.

a) Negotiations between all levels of management and their direct reports:

1) division of management goals among direct reports,

2) annual performance targets for each direct report,

EXAMPLE 1 Figure 3 illustrates an example of deploying hoshin targets to direct reports for an internal business process improvement project[17]. The plant manager has set a target of reducing plant-attributed claims to 63/year or less. This target is deployed to two direct reports: the general manager of production is responsible for reducing production related claims to 58/year and the general manager of purchasing is responsible for reducing defective parts-related claims to 5/year; these sum to 63/year. The general manager of production then deploys the target of 58/year to two direct reports: the section manager of manufacturing who is responsible for reducing manufacturing-attributed claims to 53/year and the section manager of inspection who is responsible for reducing audit error–attributed claims to 5/year; these sum to 58/year. The figure illustrates other targets and deployments.

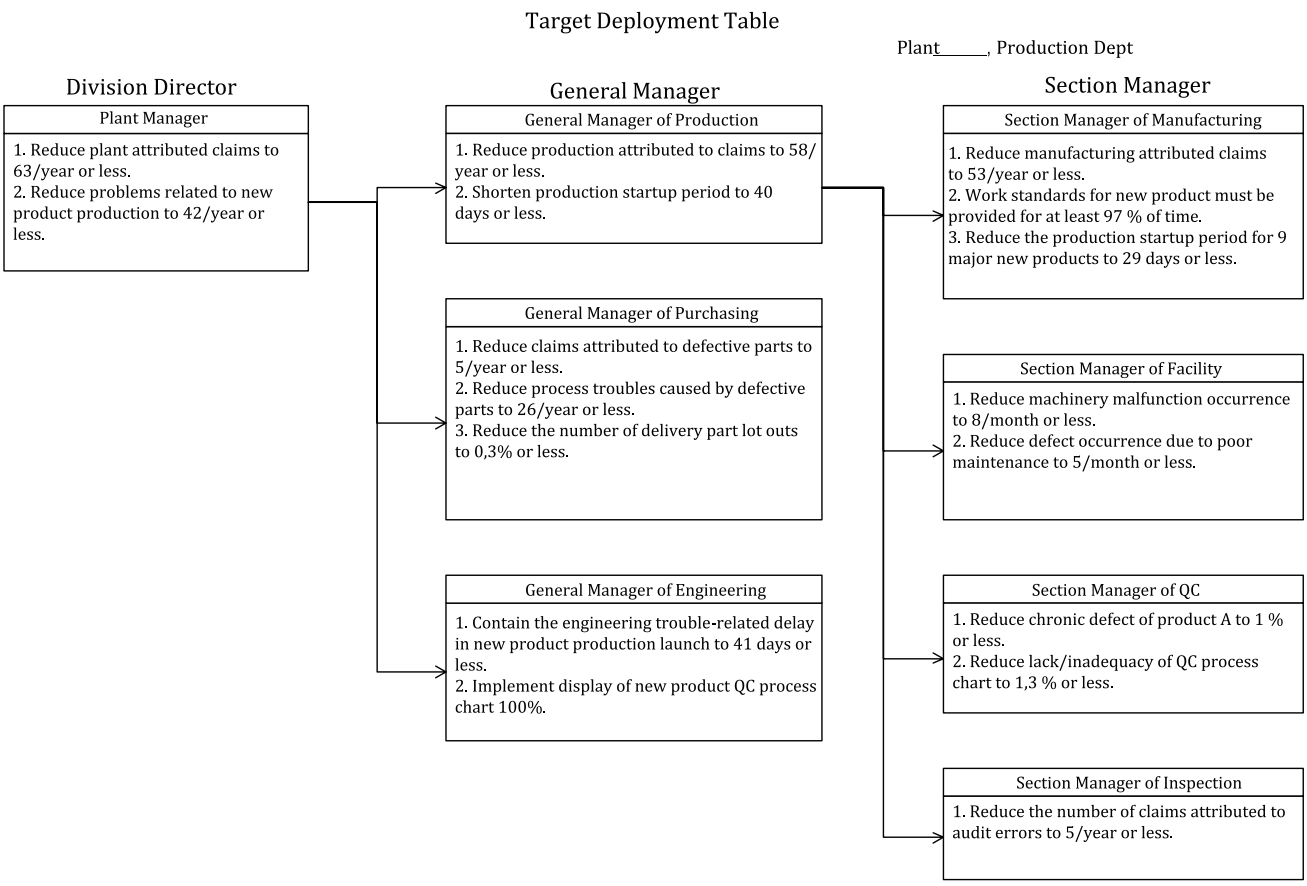

Figure 3 — Example of hoshin target deployment in a plant

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It is recommended that managers assign performance targets and not negotiate them with direct reports. Performance targets of the direct reports sum to the management goal.

NOTE 2 Some management goals are not assignable to direct reports because the authority to achieve them is the responsibility of the plant manager, as in this example.

3) means to achieve the targets should be negotiated with managers and coordinated with peer-level direct reports. These multiple relationships are to be clarified. Means can also include performance targets by which the direct report should monitor their own activities.

EXAMPLE 2 Figure 4 illustrates an example of deploying hoshin means among direct reports[17]. The plant manager commits to improving the thoroughness of finding and preventing causes of claims. The direct reports negotiate the means to achieve this: the production manager implements process defect recurrence prevention and a system to prevent process-attributed defects from being passed to the market, the purchasing manager reviews parts suppliers' standards and provide them with quality control assistance, and the engineering manager implements prototype reliability testing.

Means Deployment Table

Plant __, Production Dept. Date:

Division Director	Relationship line	General Manager	Relationship line	Section Manager
Means of Plant Manager 1. Thoroughness of finding causes of claims and preventing recurrence. 2. Completeness of preparation of new product receiving.		Means of Production Manager 1. Process defect recurrence prevention 2. Create a system that does not allow passing of defective products into market 3. Reduce production startup period Means of Purchasing Manager 1. Review of part supplier standards 2. QC assistance to part suppliers Means of Engineering Manager 1. Implement prototype reliability testing 2. Improve production prototype engineering		Means of Production Section Manager 1. Implement fool-proofing. 2. Follow through on Process Work Standards. 3. Improve process capability index for 7 high-priority products. 4. Provide training on use of control graphs. Means of Equipment Section Manager 1. Review the Machine Maintenance Standards. 2. Develop multi-functional production lines. Means of QC Section Manager 1. Early preparation of QC process charts. 2. Build new product accident history database. 3. Solve chronic defects of product A. Means of Inspection Section Manager 1. Improve reliability of final inspection. 2. Early creation of new product inspection system.

Figure 4 — Example of hoshin means deployment of a plant manager

b) The various targets and means for the organization can be illustrated in matrices at each organizational level to check for completeness and contradictions, such as the A3-X matrix shown in Table 1[10].

NOTE Many of the charts are formatted to fit the A-3 size of paper and have thus earned this nickname.

EXAMPLE Big-U bookstore has identified a number of tactical projects. Table 1 (reading clockwise from the left) shows how their strategy of increasing sales by 25 % by 2004 correlated strongly to a tactical QFD project to develop a mail order website. They expected to achieve a sales increase of 5 % by 2000 (year 1 of 5, so 5 %/year to achieve 25 % by 2004), which contributes to its annual revenue increase of $300 000 and profit of $173 000 per store.

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Table 1 — Hoshin kanri target-means x-matrix

Big-U Bookstore A3-X

strategies (vision) — tactics (means) — process (hoshin targets) — results

correlation: Increase sales by 25% over current level by 2004.	correlation: Increase used text book sales to 50% of total text sales by 2004.	correlation: Decrease costs as a percentage of sales by 1-2% per year by 2004.	tactics (means)	correlation / contribution: Increase sales by 5% in 2000.	correlation / contribution: Increase productivity by 5 inventory turns for textbooks, and 3 turns for non-textbooks by 2000.	correlation / contribution: Increase margins by increasing used text sales by 4.5% per year.	correlation / contribution: Decrease costs by 2% of sales in 2000.	accountability: General Manager	accountability: New Textbook Buyer	accountability: Used Textbook Buyer	accountability: Non-Textbook Buyer	accountability: Inventory Manager
◎	◎	-	Cash management of avg sale balance, bill pay,deposits.	-	◎	-	○	◎	-	◎	-	○
△	○	-	Better customer service- #1 in university newspaper.	◎	△	-	○	◎	○	○	○	△
○	◎	○	Decrease overtime - x% reduction YTD.	-	-	-	◎	○	-	◎	-	○
○			Advertising - 1,5% of gross sales.	○	◎	△	◎					
◎		○	Increase mail orders via website - 25/mo.	◎	△	-	△					

team members: General Manager, New Textbook Buyer, Used Textbook Buyer, Non-Textbook Buyer, Inventory Manager

correlation: Increase sales by 25% over current level by 2004.	correlation: Increase used text book sales to 50% of total text sales by 2004.	correlation: Decrease costs as a percentage of sales by 1-2% per year by 2004.	results		correlation / contribution: Increase sales by 5% in 2000.	correlation / contribution: Increase productivity by 5 inventory turns for textbooks, and 3 turns for non-textbooks by 2000.	correlation / contribution: Increase margins by increasing used text sales by 4.5% per year.	correlation / contribution: Decrease costs by 2% of sales in 2000.
◎	◎	-	Revenue	$300 000	◎	◎	△	-
-	○	○	Development costs	$50 000	○	-	○	○
○	◎	△	Material costs	$1 000	△	-	△	-
○	◎	○	Conversion costs	$70 000	○	○	◎	○
◎	◎	◎	Value stream profit	$179 000	◎	◎	○	○

Legend

Symbol		Meaning
◎	=	strong correlation or team leader
○	=	important correlation or core team member
△	=	w eak correlation or rotating team member

9.1.2.2.4 Outputs of hoshin kanri

The hoshin kanri method creates the following outputs.

a) Roll out of targets and means begins and results are monitored periodically to confirm means are being performed sufficiently and targets are being achieved.

b) Targets and means that are not within the forecast levels can become quality improvement projects to uncover the cause of their under- or over-performance so that corrective actions are taken in a timely manner.

c) End-of-year reviews can be conducted by managers and direct reports to review unmet targets for continuing activity as well as to improve the hoshin kanri process itself.

d) Hoshin that requires new products, services, information systems, or business processes can trigger a QFD project to execute the hoshin targets and means.

9.1.2.3 Porter five force competitive analysis

Strategic business environment intelligence is commonly used in determining which market forces support or threaten strategic plans. Porter five force analysis[27] has been used with QFD to give a high-level view of future markets, growth segments, value proposition competencies, and a road map with metrics. It helps create a single view of the environment, competitors, and the company position. This analysis can be led by the business environment or market research department to clarify the business environment in which the new QFD project must succeed. Figure 5 is an example of the five forces at a health insurance company[7].

a) Threat of new entrants.

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