Managing the challenges of product development in the Internet age using the new ISO 16355 standard for QFD

International Conference on INDUSTRY 4.0 Using Quality Function Deployment, Mladá Boleslav, Na Karmeli, 31.5.2016

Prof. Dr. Georg Herzwurm
QFD has to celebrate the following milestones

- 50 years since the first QFD publication by Bridgestone Tire (1966)
- 20th anniversary of the Akao Prize®
- 20th anniversary of the QFD Institut Deutschland e. V.
- Finalization of the ISO 16355 standard for QFD
Agenda

- Challenges of product development in the Internet age
- History of QFD standardization
- Overview on ISO 16355
- Outlook and next steps
Definition of QFD according to ISO 16355-1

• 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.
We should try to live as we teach

QFD is the solution!

What is the problem?
Changing problems since QFD was introduced

- Customers: New requirements
- Staff: Generation Y
- Market: Dynamic Business Ecosystems
- Technology: Industry 4.0

Today’s Product Development Challenges
Changing problems since QFD was introduced

- Staff: Generation Y
- Market: Dynamic Business Ecosystems
- Customers: New requirements
- Technology: Industry 4.0

Today’s Product Development Challenges
Quality requirements 1966: zero-defects
Quality requirements 2015: innovation/coolness
Changing problems since QFD was introduced

- **Customers:** New requirements
- **Staff:** Generation Y
- **Market:** Dynamic Business Ecosystems
- **Technology:** Industry 4.0

Today’s Product Development Challenges
Generation Y is coming up..

Who are Generation Y and Where Do They Fit in the Workforce?

- ambitious
- competitive
- connected
- mobile
- waiting for employers to impress them
- hard-working

Generation Y engineers

Most important brand characteristics for Generation Y

1. Has its own style 35%
2. Makes me feel happy 31%
3. Is up-to-date 128%
4. Has a clean reputation 27%
5. Is real/authentic 27%
6. Is unique 27%
7. Is something I can identify with 27%
8. Is clear and simple 24%

Generation Y customers
QFD has to become a „cool“ method

“This standard 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. “
Changing problems since QFD was introduced

- Staff: Generation Y
- Market: Dynamic Business Ecosystems
- Customers: New requirements
- Technology: Industry 4.0

Today’s Product Development Challenges
Business Eco-Systems?!
Roles in an Automotive Software Eco-System

Customers & Users

Platform providers

Comple-mentors

Quelle: Mautsch (2014)
Changing problems since QFD was introduced

- **Customers:** New requirements
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- Today's Product Development Challenges
SWOT Analysis of Industry 4.0

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<tr>
<th>Internal Perspective</th>
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<tr>
<td><strong>Strengths</strong></td>
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<tr>
<td>• Process efficiency leading to High Precision and Quality</td>
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<tr>
<td>• Security</td>
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<tr>
<td>• Less Human Intervention</td>
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<tr>
<td>• Customized</td>
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<tr>
<td>• Reduced Usage of Energy</td>
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<tr>
<td>• Lean Processes &amp; Easy Monitoring</td>
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<tr>
<td><strong>Weaknesses</strong></td>
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<tr>
<td>• Data security in a cloud</td>
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<tr>
<td>• Complex &amp; Costlier to implement / maintain</td>
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<tr>
<td>• Not applicable for all businesses (SME, some sectors)</td>
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<tr>
<td>• Less manual labor needed (Role of government critical at Zalando!)</td>
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<tr>
<td>• Fear of technology leads to non-implementation</td>
</tr>
<tr>
<td>• Industry 4.0 in the beginning – fear of “baby” mistakes</td>
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<table>
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<tr>
<th>External Perspective</th>
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<tr>
<td><strong>Opportunities</strong></td>
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<tr>
<td>• Competitive advantage due to process efficiency (For Germany &amp; its Industries: First mover advantage)</td>
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<tr>
<td>• Knowledge based industry and Hub</td>
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<tr>
<td>• Flexibility remains a key factor for the manufacturing work in Germany</td>
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<tr>
<td><strong>Threats</strong></td>
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<tr>
<td>• Low acceptance level from workers</td>
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<td>• Competition: non—trust from competitors to share datasets</td>
</tr>
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<td>• Outsourcing threat</td>
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<tr>
<td>• E-commerce “return rate” as a risk for environment</td>
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Source: http://de.slideshare.net/sarathygurushankarl/shaping-towards-a-connected-world-of-supply-chain-industrie-40
The need for change

If people are changing, our products and the way how we develop products have to change as well.
Agenda

• Challenges of product development in the Internet age

• History of QFD standardization

• Overview on ISO 16355

• Outlook and next steps
History of QFD standardisation

• First idea was presented in 1995 at ISQFD‘95 Tokyo, Japan by JUSE-QFD committee but rejected by other countries, e. g. USA and Germany

• Japan decided to develop a national QFD standard: “Guidelines for Quality Function Deployment” were included into JIS Q9025, published in 2003

• In 2008 Prof. Dr. Hiroe Tsubaki, The Institute of Statistical Mathematics, Tokyo, Japan supposed ISO a standard in statistics that included QFD as one important method

• In 2009 Georg Herzwurm, Glenn Mazur and other international QFD experts from ICQFD have been asked to join the committee
ISO customer voice analysis

Goal: To make an ISO QFD standard more useful.

- Standards easy to use. (L: 0.244 G: 0.244)
  - Easy to apply. (L: 0.525 G: 0.128)
    - Minimal effort to be successful. (L: 0.088 G: 0.011)
    - Scope of standard is easy to apply. (L: 0.066 G: 0.008)
    - Easy for my vendors to follow the standard. (L: 0.216 G: 0.028)
    - I can meet the standard using methods I already know. (L: 0.058 G: 0.007)
  - Easy to understand data type (attributes) for different QFD Stages & Fields (L: 0.272 G: 0.035)
  - Guides users in application of QFD to new designs (L: 0.300 G: 0.038)

- Anybody can understand (L: 0.065 G: 0.016)
- Easy to find (L: 0.319 G: 0.078)
- Always up-to-date (L: 0.091 G: 0.022)

- Standard helps us improve. (L: 0.176 G: 0.176)
- Supports other standards I must follow. (L: 0.444 G: 0.444)
  - Clarifies other standards and specifications. (L: 0.169 G: 0.075)
  - Helps me meet other standards. (L: 0.831 G: 0.369)

- Standard is widely accepted (L: 0.043 G: 0.016)
- Supports requirements traceability. (L: 0.078 G: 0.029)
- Standard helps me meet regulatory requirements. (L: 0.278 G: 0.103)
- Standard helps my products get certified. (L: 0.363 G: 0.134)
- Standard helps my processes get certified. (L: 0.149 G: 0.055)
- Standard helps us pass audits. (L: 0.090 G: 0.033)

- I can do the best QFD possible. (L: 0.135 G: 0.135)
Agenda

- Challenges of product development in the Internet age
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- Outlook and next steps
1: General Principles and Perspectives of the QFD Method

2: Acquisition of Voice of Customer/Voice of Stakeholder – non-quantitative approaches

3: Acquisition of Voice of Customer/Voice of Stakeholder – quantitative approaches

4: Analysis of non-quantitative and quantitative Voice of Customer/Voice of Stakeholder

5: Strategy and Translation of VOC into engineering solutions and cost planning

6: Optimization – parameter design for robust products

7: Optimization – tolerance design and output to manufacturing

8: Guidelines for commercialization and life cycle

Applications of statistical and related methods to new technology and product development process
ISO 16355-1 Structure

24. Flow to Next Generation Development

23. Product End-of-Life Disposal, Recycle, Reuse

22. Customer Satisfaction

21. Customer Support

20. Packaging Design, Logistics, Channel Management, Consumer Information, and Operating Instruction

19. Build

18. Build Startup

17. Build Planning

16. Prototyping, Testing, and Validation

15. Design Optimization

14. Solution Concept Engineering

13. Transfer of Prioritization and Quantification from One Information Set into Another

4. Basic Concepts of QFD

5. Integration of QFD and Other Product Development Methods

6. Types of QFD Projects

7. QFD Team Membership

8. QFD Voices

9. Structuring Information Sets

10. Prioritization

11. Quantification

12. Translation of One Information Set into Another

Theory and principles of QFD
QFD use of the word of function
Spirit of QFD
Display of information

Core team membership
Subject matter experts
QFD team leadership

Voice of business
Voice of customer or stakeholder
QFD Flow Chart

**QFD Project**
- 6 Type of QFD project
- 7 QFD Team
- 8.1 Voice of business

**Customers**
- 8.2.1 Identity customers
- 8.2.5 Prioritize customers
- 8.2.7 Voice of customer
- 8.2.10 Customer needs
- 10 Prioritize customer needs
- 11 Quantify customer needs

**Product Development**
- 13 Quality deployment to transfer customer needs into product requirements
- 13.5.4 Technology deployment
- 13.5.6 Cost deployment
- 14.5.8 Reliability deployment
- 13.6.1 Function deployment
- 13.6.3 Parts deployment
- 13.6.5 Manufacturing deployment

**Product Design**
- 14 Solution concept engineering
- 15 Design optimization
- 16 Prototyping, testing, validation

**Operations**
- 17 Build planning
- 20 Packaging, information, logistics
- 21 Customer support
- 23 Product life cycle
Spirit of QFD according to ISO 16355-1

- A commitment among all critical departments to work together for the benefit of the customer or stakeholder. A personal connection to the customer should be established.

- **NOTE**
  - As a central principle, customer needs or requirements must be known or acquired, and understood adequately by all relevant stakeholders.
  - Must be validated if product requirements meet the needs of the customer or stakeholder.
## Appendix: QFD Tools (extract)

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<th>QFD and Related Tools and Methods</th>
<th>Operations</th>
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<td>7- and 8-D charts</td>
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<td>Management and Planning tools (Annex)</td>
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<td>Advanced quality product planning (APQP)</td>
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<td>Affinity diagram (Annex)</td>
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<td>Analytic Hierarchy Process - AHP (Annex)</td>
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<td>Analytic Network Process (ANP)</td>
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<td>Anticipatory Failure Determination</td>
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<td>Bill of materials</td>
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<td>Blue Ocean Strategy</td>
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<td>Cluster Analysis</td>
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<td>Conjoint Analysis</td>
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<td>Continuous QFD (Annex)</td>
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</table>

<table>
<thead>
<tr>
<th>QFD Project</th>
<th>Customers</th>
<th>Product Development</th>
<th>Product Design</th>
<th>Operations</th>
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<tbody>
<tr>
<td>6 Type of QFD project</td>
<td>8.1 Voice of business</td>
<td>8.2.1 Identify customers</td>
<td>8.2.5 Prioritize customer needs</td>
<td>8.2.10 Customer needs</td>
</tr>
<tr>
<td>QFD Team</td>
<td>8.2.7 Voice of customer</td>
<td>10 Prioritize customer needs</td>
<td>11 Customer needs</td>
<td>13 Quality deployment</td>
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Appendix: Comprehensive QFD Deployment Flow Diagram

- **House of Quality**
- **4-Phase QFD** for part suppliers
- **Quality**
- **New Technology**
- **Cost**
- **Reliability**
- **Function**
- **New Concept**
- **Parts**
- **Manufacturing**
- **Production**
- **Process Improvement**
Appendix: German QFD Institute Best Practice Flow Diagram
Reverse QFD for solution driven innovations

Figure 4 Solution-driven reverse QFD flow (Hines and Mazur 2007)
QFD in the Internet age

<table>
<thead>
<tr>
<th>Characteristics of fuzzy development tasks</th>
<th>Incremental planning &amp; implementation cycles</th>
<th>Employment of IT (QFD tools &amp; Internet)</th>
<th>Use of templates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Problems/Requirements</td>
<td>Simultaneous collection of CR &amp; PC</td>
<td>Simultaneous planning and development</td>
<td>Use of templates</td>
</tr>
<tr>
<td>Unclear CR/PC</td>
<td>Large number of short meetings</td>
<td>All matrices developed incrementally</td>
<td></td>
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<tr>
<td>Dynamic CR/PC</td>
<td>Gradually refined weighting</td>
<td>Simultaneous planning and development</td>
<td></td>
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<tr>
<td>Uncertain PC (feasibility)</td>
<td>Focus on most important CR/PC</td>
<td>Simultaneous planning and development</td>
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<td>Time pressure</td>
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Legend:
- CR = customer requirements
- PC = product characteristics

Herzwurm et al, 2003
Continuous QFD for dynamic and agile projects

Herzwurm et al, 2014
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The Next Steps

• ISO/FDIS 16355-2, 4, 5, and 8 to be published in 2016

• Finalizing ISO/CD 16355-3, 6, and 7

• Training and Dissemination of the ISO Standards

• Continuously further development in order to meet the product development challenges of the future
Summary

In order to survive QFD has to solve the problems from today, not the problems from the past!