

How test programs and methods evolve and how to deal with that?

- an old technique in a new context -

Harry Roossien
the Netherlands



66th CEEES Meeting & ASTELAB 2016



Contents

1. Intro and growth
2. Customers and QFD
3. Tailored testing and example
4. Conclusions

CV

- Senior Reliability Systems Engineer (1990)
 - Ericsson, SonyEricsson, Tonalite, Plantronics, Dopple
 - 2008 R2R reliability support
- President PLOT (2005)
 - Platform for Environmental Sciences
 - Past CEEES president
- M.Sc. (1986, 2010)
 - mechanical engineering (beta)
 - business studies: psychology and marketing (alpha)



1. Growing

- Why are testplans growing?
- Will it continue?
- How to handle this?

a. Growth for the application = evolution



+ (over)load

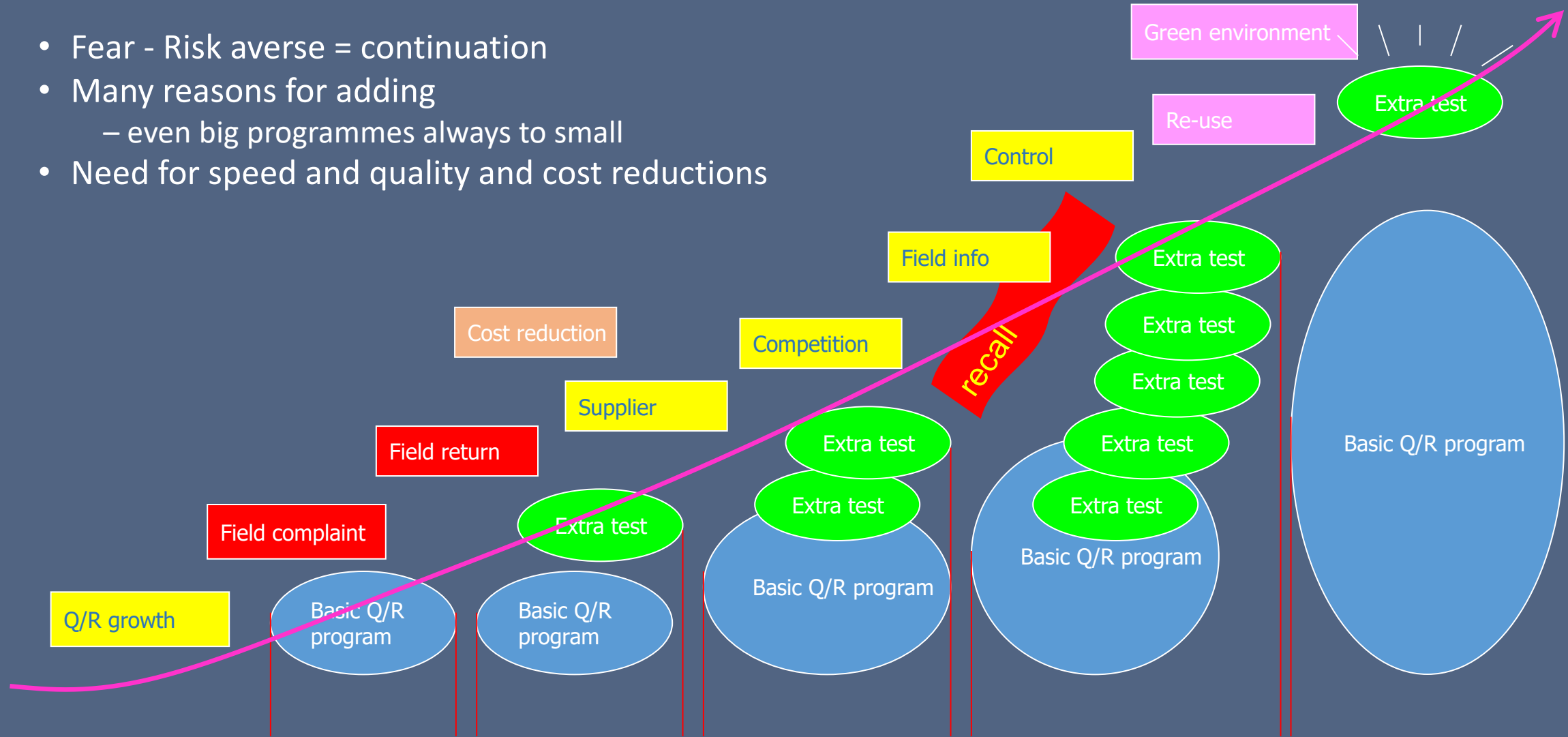


+ social media



b. Growth for the test programs = revolution

- Fear - Risk averse = continuation
- Many reasons for adding
 - even big programmes always to small
- Need for speed and quality and cost reductions



c. Growth continuation – 3 trends

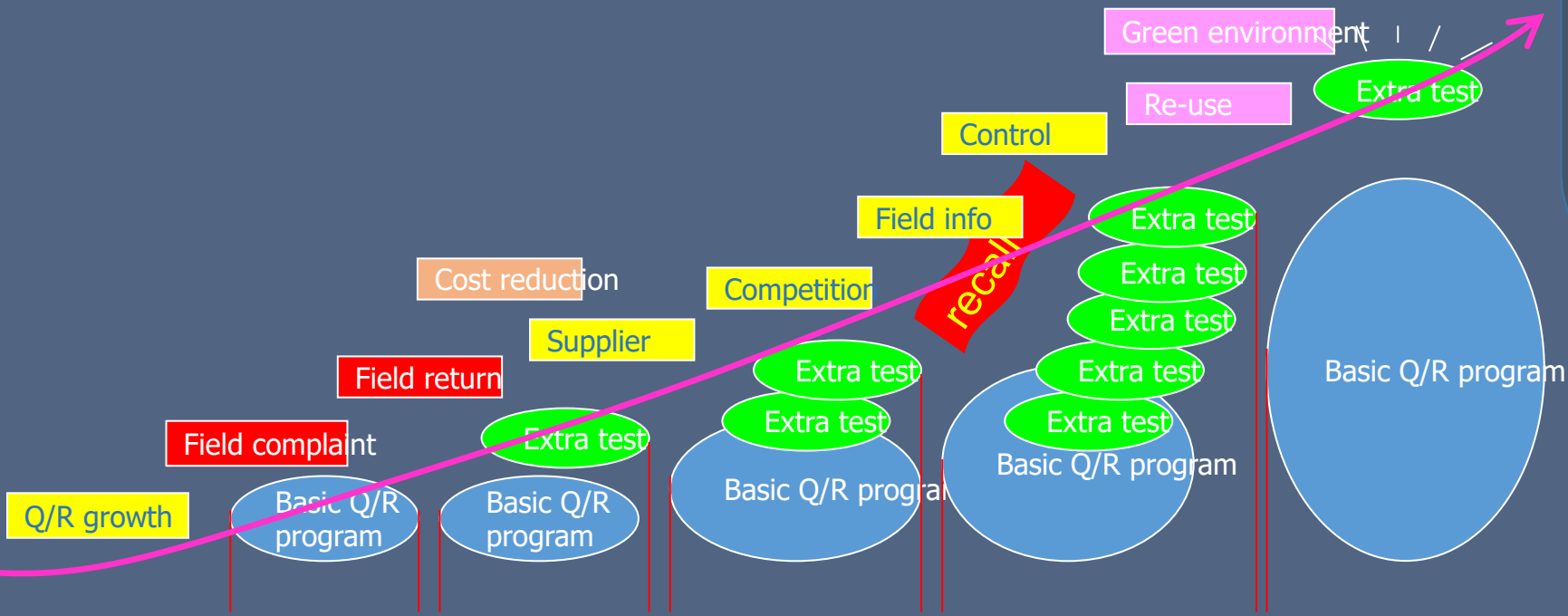
1. Big data



2. New tests/
methods



3. Exposure



Contents

1. Intro and growth
2. Customers and QFD
3. Tailored testing and example
4. Conclusions

Customers and QFD

- Why are customers so difficult?
- How do we get a handshake?
- What means Quality Function Deployment?

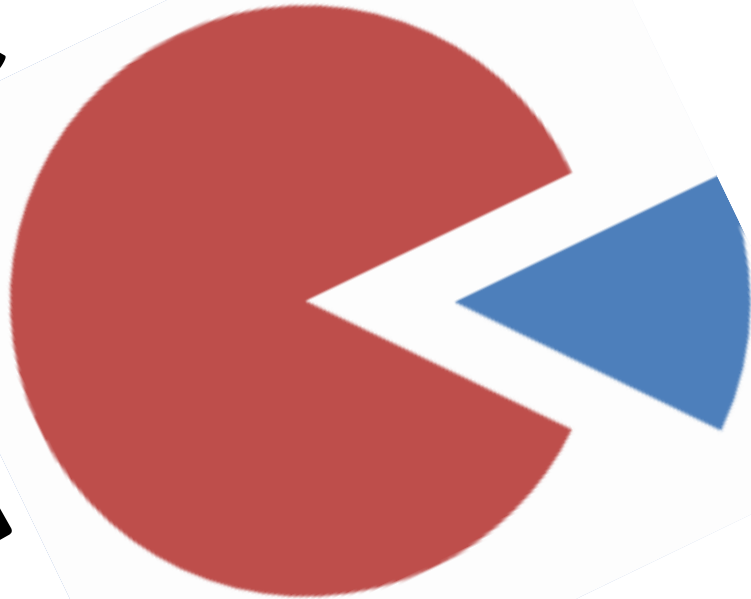
Exposure

Tailored Testing
for the customer



Exposure... because it can

Emotional



Rational

DOMO

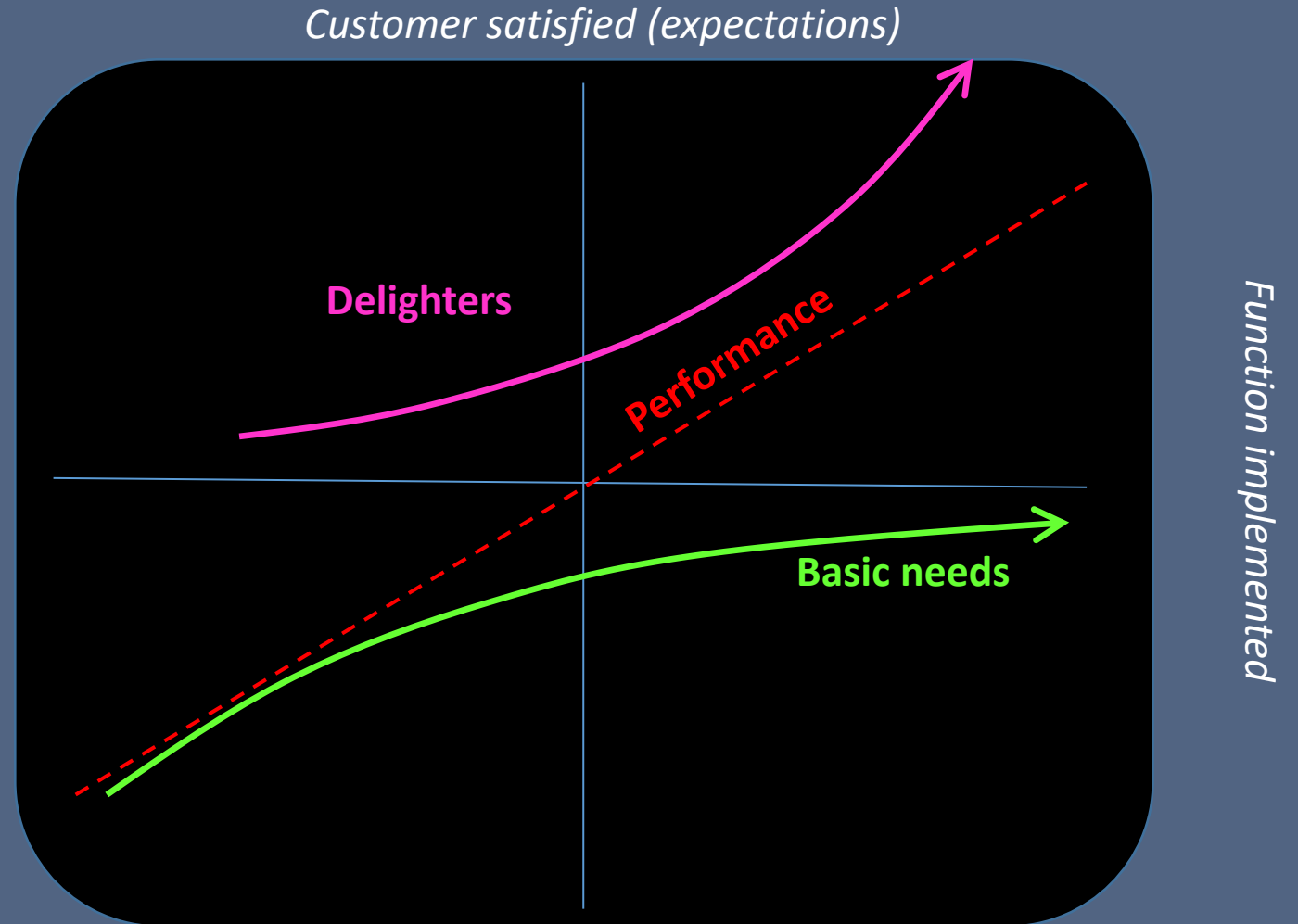
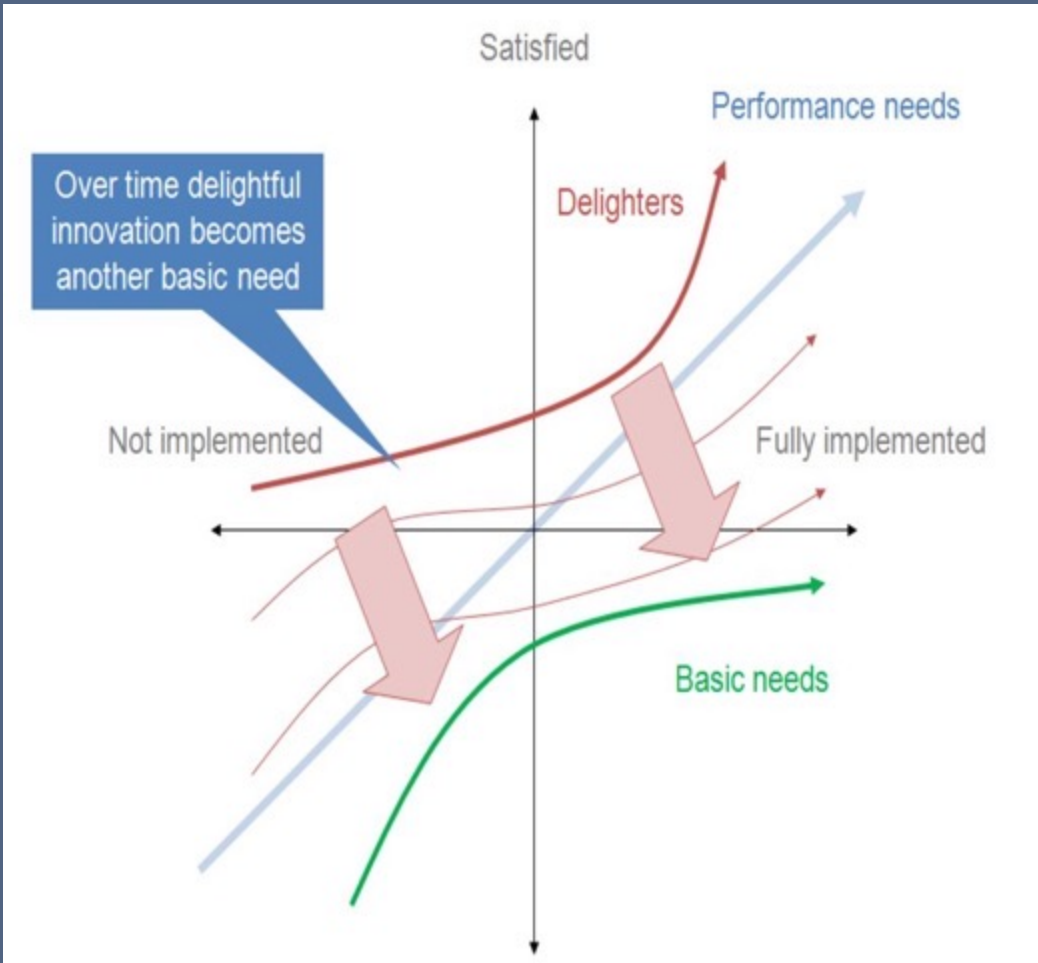
Data Never Sleeps 11.0

Domo has been keeping tabs on the world's data usage—in a minute—for over a decade now. What the numbers consistently show is that how we use data is always evolving—and that data isn't slowing down. We're also seeing some big changes. The rise of Artificial Intelligence (AI) is reshaping the way we communicate, work, and create. Digital payments continue to replace traditional transactions. Taylor Swift streams in countless headphones. And a rash of cybercrime grows alongside these digital experiences.

In Domo's 11th edition of Data Never Sleeps, we take the pulse of our digital age, where every click, swipe, and stream fuels an ever-expanding digital universe. These are not just numbers; they are the heartbeat of a world where data reigns supreme.

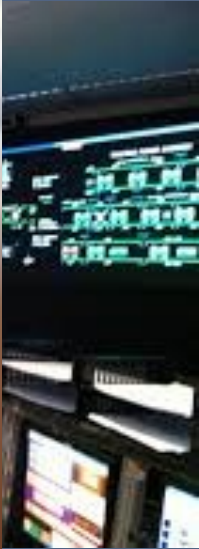


Customers ... (Kano-model)



... and technicians

- Rational
- Quantification
- Control
- Reliability
- Predictability



Why are customers so difficult?

Not difficult – it is all about **BRIDGING THE GAP**
Emotional – Rational; Customer - Technician

- uncontrolled
- uncontrollable
- “mis-use” ???

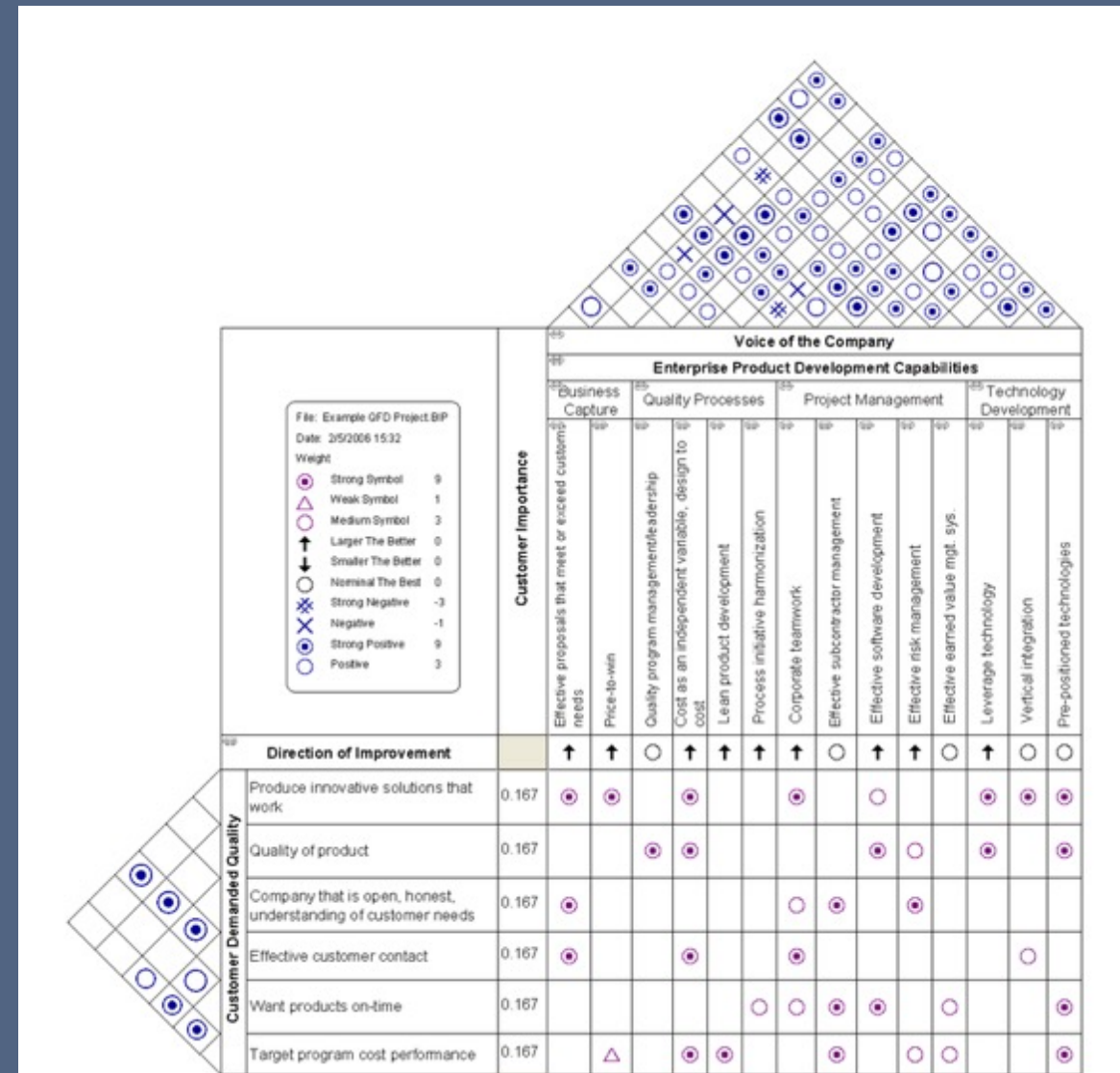


Field return, claimed sitting on it.....



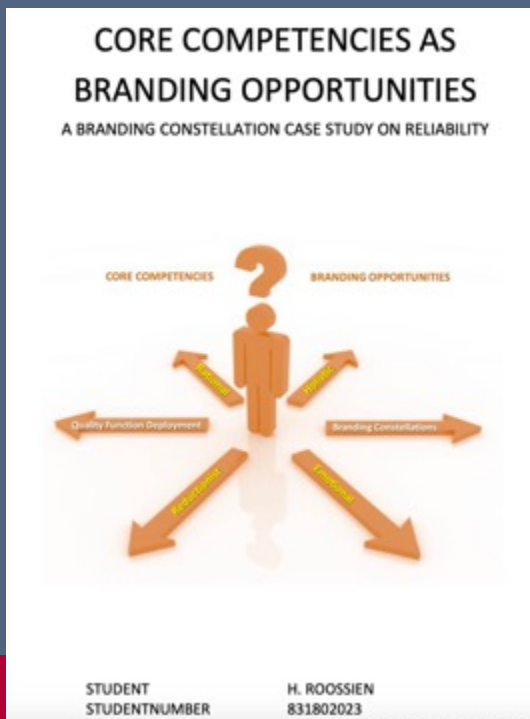
QFD

- Quality function deployment (QFD) is a method to help **transform customer needs (the voice of the customer [VOC]) into engineering characteristics** (and appropriate test methods) for a product or service. It helps create operational definitions of the requirements, which may be vague when first expressed. It prioritizes each product or service characteristic while simultaneously setting development targets for the product or service.
- As described by Dr. Yoji Akao, who originally developed QFD in Japan in 1966, it is a “method to transform qualitative user demands into quantitative parameters, to deploy the functions forming quality, and to deploy methods for achieving the design quality into subsystems and component parts, and ultimately to specific elements of the manufacturing process.”,[1] The author combined his work in quality assurance and quality control points with function deployment used in value engineering. (Wikipedia)



Modifications to standard QFD

1. Simplify interaction matrix
2. Optimize quantification by numbers
(iso relations, indicating the strength of the relation)
3. Add reliability risks for customer function as input for later test tailoring



Implications

Theoretical implications for the Branding Theme are:

1. The high reliability of the branding constellations conducted in this case study means that the findings of this case study can be used with high confidence for theoretical and practical conclusions and recommendations
2. The high stacking reliability means that the trustworthiness of the Branding Theme reliability findings have become stronger
3. The improved reliability measurements enable a more reliable comparison for future studies within the Branding Theme, standardisation of the consensus development reliability measurements, and a framework with detailed Theme findings that improves the stacking
4. The differences between the core competencies findings deduced by a QFD analysis and those revealed by branding constellations, might not only indicate that the branding constellations are moderately unreliable; rather they might indicate that branding constellations have additional value to QFD regarding the identification of core competencies; especially, as the brand team members had more confidence in the core competencies revealed by the branding constellations than in the ones deduced by QFD; furthermore, this new QFD measurement might lead to a new standardised reliability measurement within the Branding Theme: the *QFD triangulation reliability*, which compares the findings revealed by branding constellations with those deduced by QFD; in addition, the litmus test might be of great theoretical and practical value to discriminate competencies from core competencies; finally, the notion of identifying core competencies by both QFD and branding constellations to identify branding opportunities seems of great theoretical and practical value.

The handshake: QFD model



Developers and technicians

- rational behaviour -

- Ratio to test and predict
- Characterization
- Quantitative research possible

Customer and users

- emotional behaviour -

- Emotional behaviour and responses difficult to test
- Extensive market studies, long time, expensive, too late to steer development
- Qualitative research

and Reliability Engineers

Tools

FMECA, RRA, MTBF, QFD, testing etc.

Ratio – control/Feeling – experience

ADDING QUANTIFICATION

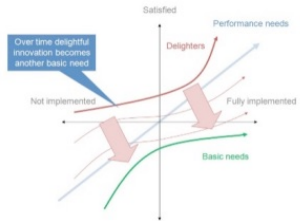
QUALITY FUNCTION DEPLOYMENT (QFD)

Project: [Redacted]
 Revisio: [Redacted]
 Date: 2 [Redacted]

Rational (technical)

Wow

“Emotional” (user)



TECHNICAL FUNCTIONS

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20						
VO CUSTOMER RATING																											
	Glue residues																										
	Foam sealing insufficient																										
	Cable sealing insufficient																										
	Insufficient glue curing																										
	Contact/glue relaxation																										
	Battery contacting/springs																										
	Battery terminals																										
	Battery empty (switch)																										
	Battery performance																										
	Headset/cable touching face																										
	Cable not straight, earpads turned																										
	Cable not clean, sticky																										
	Skuffing, wear, residues																										
	Poor lasermarking																										
	Gaps and scratches																										
	Cable socket																										
	Earpad defect @ replacement																										
	Component breakage																										
	Product not damaged (use, test)																										
	Discoloration, wearout, use traces																										
	Env. friendly appearance																										
	Chlorides in caps																										
	User friendly app																										
	Charge case design																										
	No shiny box (vs price)																										
	Poor smell																										
* agreed delighters (MS1)																											
Dissatisfiers in red - brand reputation	RS	RS	RS	RS	RS	TR	JG	HR	TS	EK	PS	PS	BT	RS	RS	TR	GS	RS	HR	HR	HR						
VOICE OF CUSTOMER	6																					RISKS					
Basic needs (Kano)																											
Good looking design*	6	5		3	8	6	6	8	7	4	4	6	6	4	5	7	4	6		8		vervorming kabel, plakkerigh					
OOB experience	4	4		2	7	6			4		4	6	2	3	2	7	4	6		4	6	vervormd uit doos					
Dead units/Dead on Arrival	7				8	6	6	8	8									6	6			Production, connect/disconn					
Pairing comfort	7					6	6	8	8									6	6			Interruptions when moving,					
Audio performance, good streaming	6				8		6		8								4	6	6			Android, antenna, sample de					
Delighters (Kano)																											
Fit & stability*	5								6	4	4	6					4			6		speaker breakage, glueing, m					
All day use*	6					6	6	8		4	4	6	6		6			6	6	7		volume level, contact resista					
Longer listening time*	7				8	6	6	8	6																		
Good idle wearing*	5								6	4	4	6	6		6												
Better switch between connections*	6																	6	6			nog te testen (beta test), mo					
Moist protection*	7		8	8		8	6	5		8					6				6			foam, nanocoating,					
Language voice prompts*	8																			8							
Improvement charge case*	6																			6		durability test (neckband/ca					
Click feeling																											
Performance																											
Reliability experience & return rate	5	5	8	6	3	6	6	4	8	7	4	4	6	6	4	6	7	2	6	6	6	4	status, compare BBGO2				
Production quality/output	6	4	6	4	4	6	6	4	8	6		7	8	8	7	6	7		6	6	6						
TECHNICAL RATING		5	7	6	3	7	6	5	8	7	4	4	6	6	5	5	7	4	6	6	6	6	4	8	##	##	##



Example

- How it works in practice
- Per product revision
 - 0.3 → 0.4 → 1.0

QUALITY FUNCTION DEPLOYMENT (QFD)

Project: M

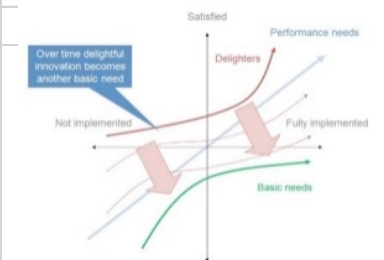
Revision: 0.3

Date: 11-11-2015

NULMETING (DRAFT)

Legend: 1 = poor 10 = excellent, current ratings presents opinion of design team

Rev. 0.3



* agreed delighters (MS1)

VOICE OF CUSTOMER

MISSION PROFILE

Basic needs (Kano)

Good looking design*

OOB experience

Dead units/Dead on Arrival

Pairing comfort

Audio performance, good streaming

Delighters (Kano)

Fit & stability*

All day use*

Longer listening time*

Good idle wearing*

Better switch between connections*

Moist protection*

Language voice prompts*

Improvement charge case*

Performance

Reliability experience & return rate

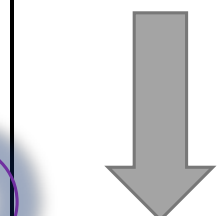
Production quality/output

Fit to customer
- need/expectations
- delighters/suprises

Not everything filled in, but will follow during

Fit to technical functions
- design
- reliability

		TECHNICAL FUNCTIONS																						
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21		
VO CUSTOMER RATING		Glue residues	Cable not straight	Poor lasermarking	Gaps and scratches	Cable not clean, sticky	No shiny box (vs price)	Sk r, residues	Po	En	Pr	appearance	damaged	Battery empty (switch)	Component breakage	Contact/glue relaxation	Chlorides in caps	Foam sealing insufficient	Cable sealing insufficient	Headset touching face	Battery con	User friendl	Charge case	Discoloratio
		RS	PS	RS						HR				RS	HR	RS	RS	EK	JG	BT				
MISSION PROFILE	4																							
Basic needs (Kano)																								
Good looking design*	5	5	4	3	3	4		6	8														8	
OOB experience	5		4			4	5	7	6	5	4				5								8	
Dead units/Dead on Arrival	5											7	5	3					3					
Pairing comfort	3														3				3					
Audio performance, good streaming	3														3				3					
Delighters (Kano)																								
Fit & stability*	5													5										
All day use*	5															6	6		3					
Longer listening time*	4															5	5		3					
Good idle wearing*	6																	6						
Better switch between connections*	5																				5			
Moist protection*	3																3	3						
Language voice prompts*	5																				5			
Improvement charge case*	4																			3		5		
Performance																								
Reliability experience & return rate	6							8	7		6	6	6	3		3	3		5				8	
Production quality/output	3											3	3	3										
TECHNICAL RATING		5	4	3	3	4	5	7	7	5	5	5	5	3	5	4	4	6	3	5	5	8	##	##



Many risks

RISKS

vervorming kabel, plakkerigheid, kabel contact
vervormd uit doos

Production, connect/disconnect, button activa

Android, antenna, sample dependend, interrup

speaker breakage, glueing, microclip, pouch, ea
volume level, contact resistance, gold plating b

nog te testen (beta test), monkey testing (2 kno
foam, nanocoating,

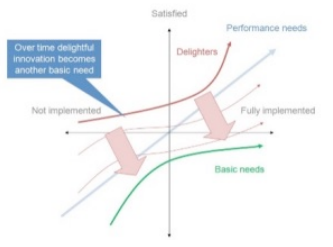
durability test (neckband/case will change)

QUALITY FUNCTION DEPLOYMENT (QFD)

Project: M
 Revision: 1.0
 Date: 17-12-2015

Colored cells means that this item is affected
 Legend: 1 = poor 10 = excellent, current ratings presents opinion of design team

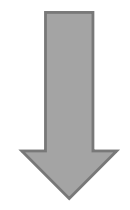
Rev. 1.0



* agreed delighters (MS1)

Dissatisfiers in red - brand reputation

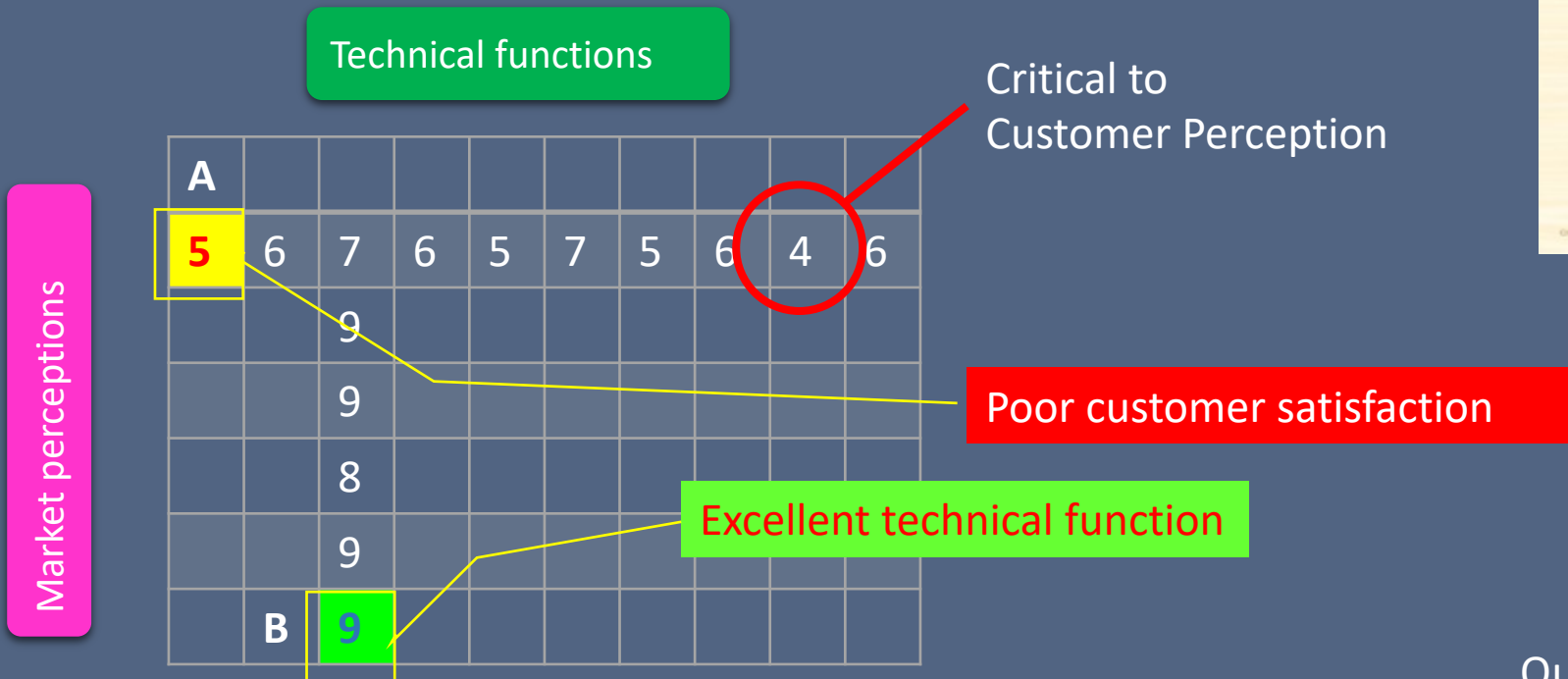
		TECHNICAL FUNCTIONS																															
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	
VOICE OF CUSTOMER	MISSION PROFILE	8																															
Basic needs (Kano)																																	
Good looking design*		8	8	8	8	8				8				7		8	7	8	7	8	7	6			8	7		7					
OOB experience		8		8	8									7		8	8	8			8			8		7		7	7	7	8		
Dead units/Dead on Arrival		7			7						7	8	7																				
Pairing comfort		8		8																								8				7	
Audio performance		8	8	9	9	8		7			8	8	9		6						8		6										
Delighters (Kano)																																	
Fit & stability*		7		8												7						7											
All day use*		9			9						8	8	9	9									9	9					7				
Longer listening time*		8			8						8	8	7	8									8	8					7				
Good idle wearing*		8												8	8	7	8					8	8										
Better switch between connections*		7	8																									8				6	
Moist protection*		6			6		6	6		6				6									8			6							
Language voice prompts*		8																										8				7	
Improvement charge case*		8									8	8	8																7				
Click feeling					8		8	8		8												8		8									
Performance																																	
Reliability experience & return rate		8	7	8	8	8	8	8	6	8	8	7	6	7	8	7	9	7	7	8	7	6	7	8	8	8	7		9		8	9	
Production quality/output		8	6	7	7	7	8	7	6	8	8	8	8	7	8	7	8	8	8	8	8	8	8	8	8	8	8					9	7
	TECHNICAL RATING	7	8	8	8	8	7	7	8	8	8	8	8	8	7	8	8	8	8	8	8	7	7	8	8	8	7	##	8	7	8	9	7



Gives insight, but major pitfall

By:

- Adding score/numbers



FACT

91% of unhappy customers will not willingly do business with you again.

THE BRIGHT SIDE

Resolve a complaint in the customer's favor and they will do business with you again 70% of the time.

Source: Lee Resources

CHAPTER 3 WHAT CUSTOMERS WANT

25

Quantification – product maturity for use

Simplified QFD is a helpful tool

Quality Function Deployment pro's

1. Focus and Insight

- VoC + delighters
- Transferfunction/Relation E & R

2. Quantification

- Score matrix
- Product maturity growth

3. Relationships clear

- One function more relations
- Strength of relation

Quality Function Deployment con's

1. VoC study

- Basic needs
- Delighters

2. Transfer to functional blocks/risks

- Language (technicians)

3. Stuck to standard programs

- Customer requirements w/o use case

Contents

1. Intro and growth
2. Customers and QFD
3. Tailored testing and example
4. Conclusions

Tailored testing

- How to incorporate testing in QFD?
- What are the basics for test tailoring?
- How does it work in practice?

The concept based on QFD

Voice of customer

- basic needs
- expectations
- surprises
(wow)

Adding technical functions (control)

Voice of technicians

- basic functions
- technical modules

Voice of customer

- basic needs
- expectations
- surprises (wow)

And reliability/testing?

Voice of customer

- basic needs
- expectations
- surprises (wow)

Voice of technicians

- basic functions
- technical modules

Reliability

Evaluation

- analysis
- testing

- Technical functions are
 - understood – (Physics of Failure)
 - testable
 - quantifiable

Example

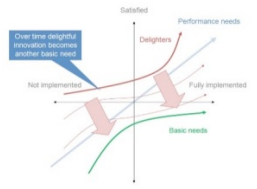
- How it works in practice

QUALITY FUNCTION DEPLOYMENT (QFD)

Project: M
Revision: 0.4
Date: 26-11-2015

Colored cells means that this item is affected
Legend: 1 = poor 10 = excellent, current ratings presents opinion of design team

Rev. 0.4



* agreed delighters (MS1)

		TECHNICAL FUNCTIONS																									
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
VO CUSTOMER RATING		6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
		RS	RS	RS	RS	RS	TR	JG	HR	TS	EK	PS	PS	BT	RS	RS	TR	GS	RS	HR	HR	HR	HR	BT			
		Glue residues	Foam sealing insufficient	Cable sealing insufficient	Insufficient glue curing	Contact/glue relaxation	Battery contacting/springs	Battery terminals	Battery empty (switch)	Cable performance	Headset /cable touching face	Cable not straight, earpads turned	Cable not clean, sticky	Skuffing, wear, residues	Poor lasermarking	Gaps and scratches	Cable socket	Earpad defect @ replacement	Component breakage	Product not damaged (use, test)	Discoloration, wearout, use traces	Env. friendly appearance	Chlorides in caps	User friendly app	Charge case design	No shiny box (vs price)	Poor smell
VOICE OF CUSTOMER	MISSION PROFILE	6																									
Basic needs (Kano)																											
Good looking design*		6	5	3	3	6	6	8	7	4	4	6	6	4	5	7	4	6		8							
OOB experience		4	4	2	7	6				4		6	6	2	3	2	7	4	6		4	6					
Dead units/Dead on Arrival		7			8	6	6	8	8										6	6							
Pairing comfort		7				6	6	8	8										6	6							
Audio performance, good streaming		6				8	6		8									4	6	6							
Delighters (Kano)																											
Fit & stability*		5								6	4	4	6				4			6							
All day use*		6					6	6	8		4	4	6	6		6			6	6	7						
Longer listening time*		7				8	6	6	8	6																	
Good idle wearing*		5								6	4	4	6	6		6											
Better switch between connections*		6																	6	6							
Moist protection*		7	8	8	8	6	5		8						6					6							
Language voice prompts*		8																						8			
Improvement charge case*		6																			6						
Click feeling																											
Performance																											
Reliability experience & return rate		5	5	8	6	3	6	6	4	8	7	4	4	6	6	4	6	7	2	6	6	6		4			
Production quality/output		6	4	6	4	4	6	6	4	8	6		7	8	8	7	6	7		6	6	6					

Expected for this phase

Risks become less

Averaged out

No test

		TECHNICAL RATING																									
		5	7	6	3	7	6	5	8	7	4	4	6	6	5	5	7	4	6	6	6	6	4	8	##	##	##
TEST RESULTS																											
FAIL	9																										
FAIL	7																										
loopt	7																										
	7																										
PASS	2																										
PASS	2																										
3 dec. (exp. FAIL)	5																										
3 dagen OK	3																										
3-dec	1																										
Vervalt, want tumble goed	1																										
4-dec	3																										
		2	3	3	0	4	4	1	3	0	0	4	6	4	1	2	4	0	2	2	0	1	1	0	2	1	0

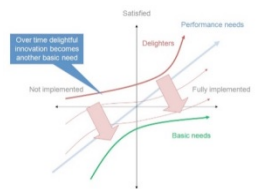
EVALUATION/TEST	CONDITIONS	
Visual inspection		1
Packaging inspection		2
Durability pouch test	2400 x	3
Cable/bend relief rob.		4
Tumbling test	1 m	5
Moisture test	IPx2, IPx4	6
Salt mist test	24 hrs	7
Sweat test	5 + 60 min	8
Halogen test	Cl	9
Vibration/shock test	6-hr	10
Thermal shock		

QUALITY FUNCTION DEPLOYMENT (QFD)

Project: M
Revision: 1.0
Date: 17-12-2015

Colored cells means that this item is affected
Legend: 1 = poor 10 = excellent, current ratings presents opinion of design team

Rev. 1.0



* agreed delighters (MS1)

Dissatisfiers in red - brand reputation

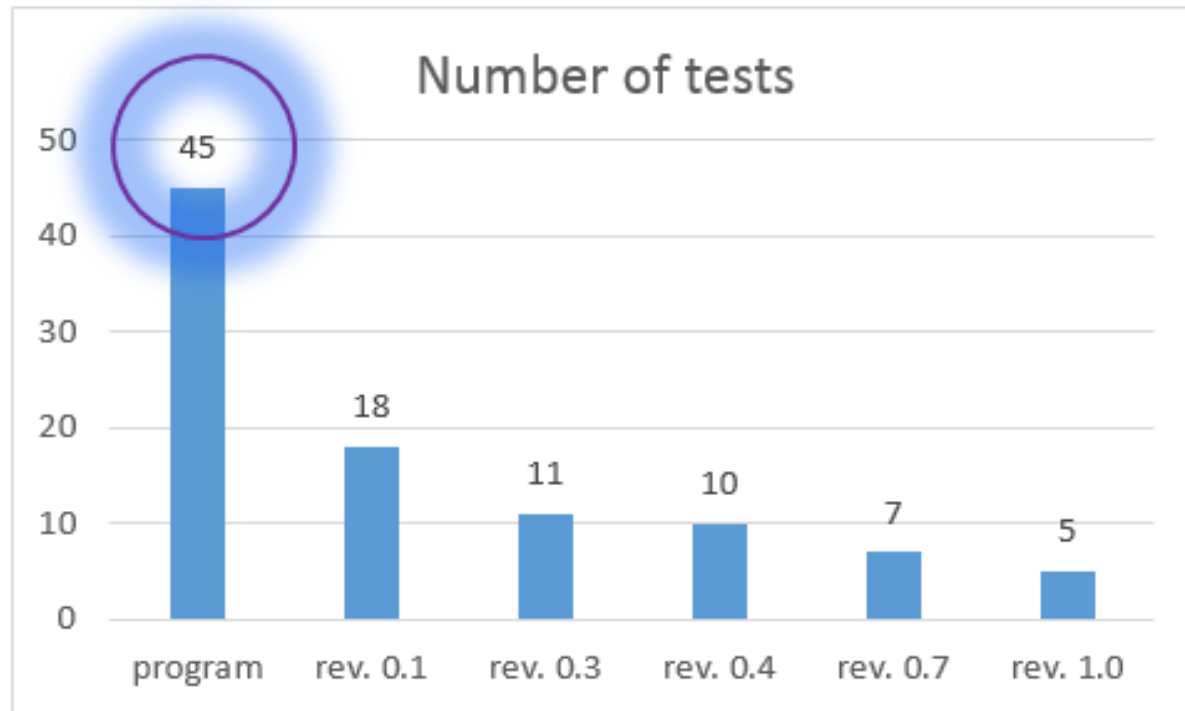
		TECHNICAL FUNCTIONS																																
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31		
VO CUSTOMER RATING		Antenna performance	Audio performance	Speaker housing fixation (glue)	Contact issues	Glue residues	Foam sealing insufficient	Cable sealing insufficient	Insufficient glue curing	Contact/glue relaxation	Battery contacting/springs	Battery terminals	Battery empty (switch, DOA)	Cable performance	Headset /cable touching face	Cable not straight, earpads turned	Cable not clean, sticky	Skuffing, wear, residues	Poor lasermarking	Gaps and scratches	Cable socket appearance & cracks	Earpad defect @ replacement	Component breakage	Product not damaged (use, test)	Discoloration, wearout, use traces	Env. friendly appearance	Chlorides in caps + RoHS/REACH	User friendly app	Charge case design	No shiny box (vs price)	Poor smell	Voice guided pairing		
		JW	GS	RS		RS	RS	RS	RS	RS	TR	JG	HR	TS	EK	PS	PS	BT	RS	RS	TR	GS	RS	HR	HR	HR	HR	BT	RK	HR	HR	BT		
VOICE OF CUSTOMER	MISSION PROFILE	8																																RISKS
Basic needs (Kano)																																		
	Good looking design*	8	8	8	8	8				8				7		8	7	8	7	8	7	6			8	7		7						
	OOB experience	8		8	8									7		8	8	8		8				8		7		7	7	7	8			
	Dead units/Dead on Arrival	7				7					7	8	7																					
	Pairing comfort	8		8																								8					7	
	Audio performance	8	8	9	9	8		7			8	8	9		6					8		6												
Delighters (Kano)																																		
	Fit & stability*	7		8												7						7												
	All day use*	9			9						8	8	9	9									9	9							7			
	Longer listening time*	8			8						8	8	7	8									8	8							7			
	Good idle wearing*	8												8	8	7	8			8	8													
	Better switch between connections*	7	8																									8						6
	Moist protection*	6			6		6	6		6				6									8			6								
	Language voice prompts*	8																										8						7
	Improvement charge case*	8																																
	Click feeling				8		8	8		8											8			8										
Performance																																		
	Reliability experience & return rate	8	7	8	8	8	8	8	6	8	8	7	6	7	8	7	9	7	7	8	7	6	7	8	8	8	7		9		8	9		
	Production quality/output	8	8	7	7	7	8	7	6	8	8	8	7	8	7	7	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	9	
	TECHNICAL RATING	7	8	8	8	8	7	7	8	8	8	8	8	8	7	8	8	8	8	8	7	7	8	8	8	7	##	8	7	8	9	7		



TEST RESULTS	1	0	3	3	1	3	3	3	3	3	1	1	0	3	0	1	2	2	0	1	1	1	2	0	1	2	0	0	0	0	0	1	0		
PASS	10		◆		◆			◆		◆				◆		◆	◆	◆		◆	◆														
PASS	11		◆		◆	◆	◆	◆	◆	◆	◆	◆					◆	◆								◆						◆			
PASS	4		◆	◆				◆															◆												
Copied from VOC	7				6		6	6		6				6									8			6									
Copied from VOC	7				6		6	6		6				6									8			6									
0																																			
0																																			
0																																			
0																																			

EVALUATION/TEST	CONDITIONS	
Visual inspection		1
Sweat test	5 + 60 min	2
Earpad replacement test	10x	3
Moisture test	IPx2, IPx4	4
Salt mist test	24 hrs	5

Tailored testing and test reduction



note: second product in product line.

Tailored testing can be driven from QFD

Tailored testing pro's

1. More value of test

- Effectiveness score
- "always pass" removed
- insight what you test (Tech.Funct.)

2. Less tests and prioritizing

- Only tests with value for function

3. Direct relation to customer

- Customer affected issues first
- Fast benefits from test

Tailored testing con's

1. Tailored testing competence

- Experience
- PoF

2. Outside confort zone

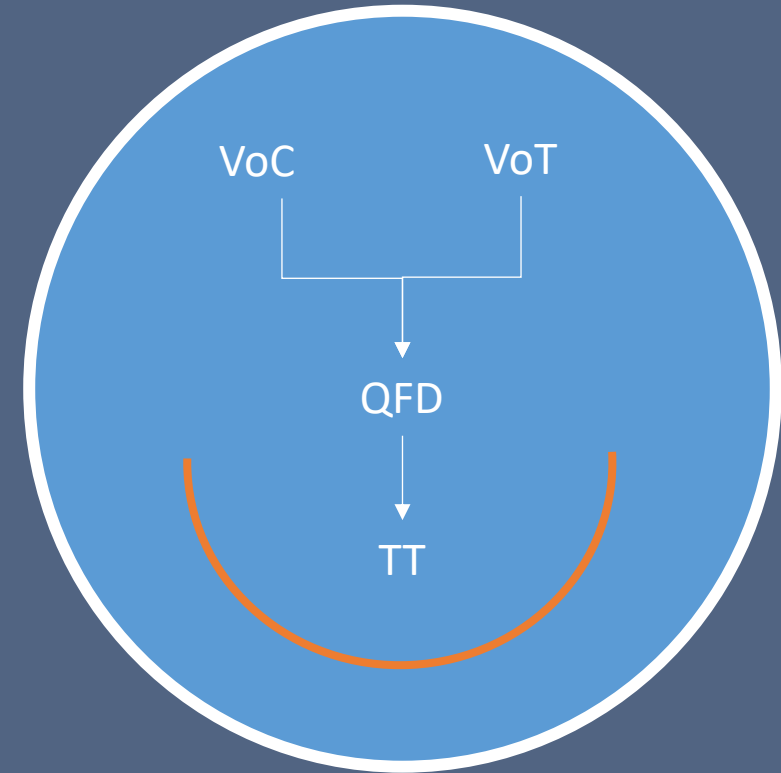
- Language (technicians)
- Insecure - fear

3. Extra work

- Next to standard programs
- Miss out benefits

Contents

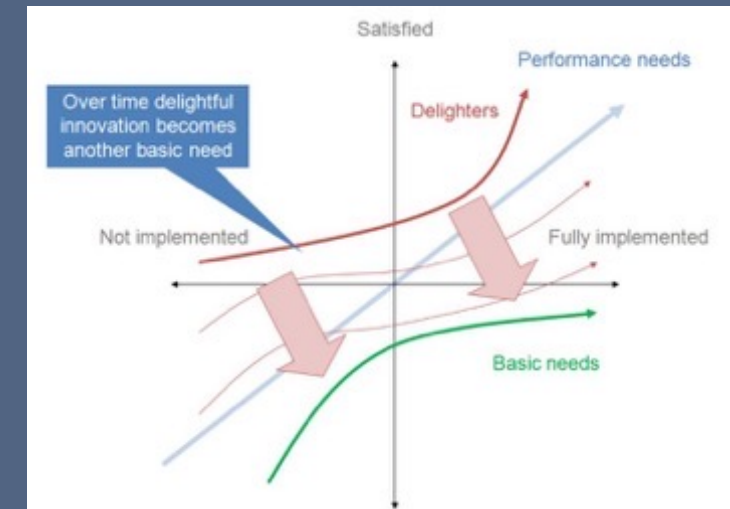
1. Intro and growth
2. Customers and QFD
3. Tailored testing and example
4. Conclusions



Conclusion

Test for the customer, not for the plan

- **Growth of data is given**, especially in big data and social data, but to control
 - customer power (social media)
 - customer is “strange.... “ (Kano, emotional) – bridge the gap
 - to control via simplified QFD model
- **QFD is helpfull tool**, not only for quality but as well for reliability and testing
 - to trigger customer expectations and give overview and insight
 - to rationalize in technical terms and baseline for test tailoring
 - to quantify how you perform, show status and progress
- **Test tailoring can help**, to keep effective and less testing
 - shows effectiveness of test (better 3x specific than general)
 - helps with prioritation
 - points you at black spots (no test for a function)



How test programs and methods evolve and how to deal with that?

- QFD as an old technique in a new context
- TT as addition to QFD
- ready for the future (youngsters)



Harry.Roossien@reliability-support.nl
www.plot.nl