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Complex IT Design using both Traditional QFD and Blitz QFD®

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Abstract:

Information Technology (IT) Systems and services are key, complex components of today's complex business operations. With increased levels of complexity it becomes increasingly difficult to maintain alignment with business needs. In extreme cases programmes can lose sight of the desired business benefits and hence fail to achieve the business case. The Quality Function Deployment (QFD) approaches discussed in this paper are powerful tools that can be used to de-risk the possibility of such a de-coupling.

The Blitz QFD® approach, the basis of Modern QFD, was developed as an accelerated method for determining key areas of customer value for software development compared with the traditional matrix based QFD approach. The authors will expand on how both traditional and Blitz QFD® approaches have been applied to ensure that IT Systems and Services are designed such that they align exactly to satisfy the customers' priority business needs and drivers. A key objective is to show the power of QFD approaches in analysing multi-stakeholder requirements and priorities, and how the QFD methods provide a robust way of maintaining coherence through-out the whole lifecycle of system design and service provision. The paper will also show how QFD provides a backbone for 'Lean Systems Design.

Further, this paper will illustrate the benefits of the different QFD approaches when applied to the design of a global customer relationship management system for a Financial Services organization. The significance of these methods in establishing approaches to companies adopting disruptive IT such as Cloud Computing and Service Oriented Architectures will also be touched upon.

Keywords:

Traditional QFD; Blitz QFD®; Modern QFD; IT Design; Lean System and Service Design; Requirements Engineering; Benefits Realisation; Customer Relationship Management; Cloud Computing.

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1. History of QFD – Why Modern & Blitz QFD®?

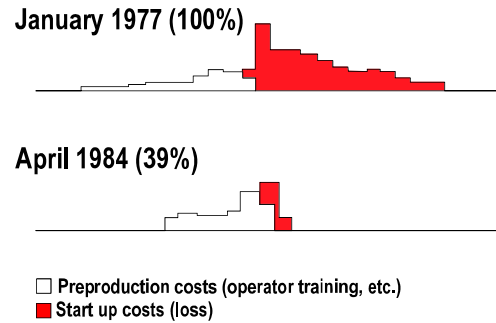
In the mid 1960s there was a growing recognition in Japan that the traditional product design and development process often resulted in products that failed to satisfy key customer requirements on quality and reliability and that business functional departments did not understand their contribution to overall quality. In the late 1960s Prof Yoji Akao had been working at Tokyo University on the development of a systematic process for translating and **deploying** customer needs, or **quality** expectations, into requirements for each of the business-**functions** in the product developer's organization. The results of his work, and that of other Japanese quality leaders such as Shigeru Mizuno, was the matrix based '**quality function deployment**' process, and this began to be adopted in Japan in the early 1970s.^[1]

The mid-20th century Japanese engineering community enjoyed the social guarantee of lifetime employment, long work hours, the abacus was a common desk top tool and customers were generally limited to the next step in the process. This resulted in product development teams having the time and

[1] Mizuno, Shigeru & Akao, Yoji, 'QFD – The Customer Driven Approach to Quality Planning & Development' Asian Productivity Organization, ISBN : 92-833-1121-1, 1994.

resources to do a comprehensive analysis of the quality requirements and work out how to satisfy them. While manufacturing was moving towards “lean,” the design side of the business was anything but lean. In response to this lag companies such as Toyota started to invest heavily in ways of improving the design side of the business, adopting techniques such as traditional QFD. The attention to detail was well repaid. Pull-through benefits from a thorough analysis of design issues helped Toyota Auto Body reduce start up costs by 61% from 1977 to 1984 (Figure 1). Akira Fukuhara, the quality assurance manager at that time, attributed the savings not only to the improvements resulting from repeated application of QFD technique to the product line, but also to the increased awareness of how all product quality issues drive customer satisfaction. As a result Toyota was able to understand the link between production processes and customer satisfaction and were able to minimise the cost of poor quality in their design and production environments.

Early deployments of Traditional QFD produced a hierarchy of a large number of inter-dependent matrices. As an example the Lite Ace mini-van project identified four major improvement opportunities in steering, rust prevention, sliding side door, and a moon roof. The rust study (actually a reliability deployment and not a QFD), deployed to 16 levels of matrices and took some two years to complete. This started with a matrix of 42 tertiary customer needs (needs translated from customer needs by the car companies and then translated to product needs for the supplier) and progressed through 16 levels of matrix finishing with a matrix that translated ‘operation standards’ into ‘work control conditions’ i.e. the comprehensive approach goes end-to-end from customer needs to manufacturing controls.



Source: Sullivan, Lawrence P 1986. Quality Function Deployment. *Quality Progress* 19 (6 June): 39-50.

Figure 1: Toyota reduces startup costs with

This study became one of the foundations of automotive supplier QFD in the U.S. and elsewhere, but its magnitude was hard for beginners to grasp. A Fuji-Xerox study that used just four matrices was adapted by American automotive suppliers to address common reliability concerns, and what became known as the “4-phase” model of QFD was born. The first of these phases, the House of Quality, has since become synonymous with QFD. Many of the early adopters in the US allowed these charts to grow to sizes that approached one million intersecting cells. On being shown one of these charts, Dr Akao avoided blessing the efforts of one automotive team by praising “how straight the lines were.” (Japanese charts were typically drawn by hand at that time and this was one of the first to be printed on a plotter.) The straight forward 4-Phase deployment of product requirements through the four phases to process controls is logical and easy to learn, and quickly became ‘The way to do QFD’ in nearly every country outside Japan.

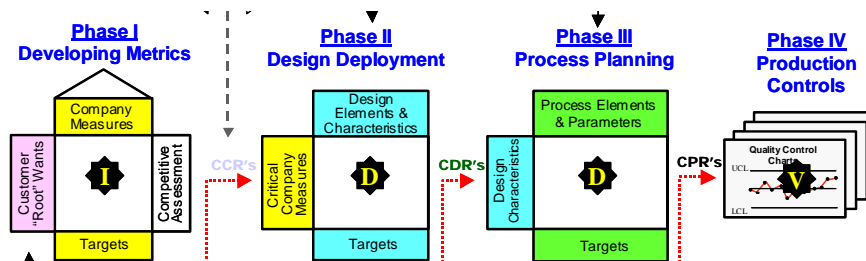


Figure 2: 4-Phase QFD model for auto part suppliers

However, not all companies using QFD are auto part suppliers building to product requirements and specifications from an OEM auto maker. Many companies using QFD design and manufacture end products, services, software, food products, etc. Even first and second tier auto part suppliers in today’s world have major design responsibility. In such cases, the 4-Phase QFD model may not cover all the necessary deployments, that is, it does not go end-to-end to assure quality.

A better approach, used in Blitz QFD® and Modern QFD, is to custom tailor a subset of the QFD matrices and other tools to improve the effective and efficient use of team members’ time.

Modernizing QFD

The Blitz QFD® approach developed by Richard Zultner^[2] in the mid-1990s, aimed to develop a faster approach to QFD for ‘time-to-market sensitive’ and fast-changing technology projects often found in IT and software development. Modern QFD was built on the foundations of Blitz QFD® which offers 4 significant improvements over traditional QFD for companies involved in the end-to-end design, development and deployment of products, processes, services and systems:

1. **Efficiency & speed of analysis:** Blitz QFD® offers a more efficient use of time by replacing most, sometimes all, matrices with more efficient tables that track only a small number of the most critical customer needs end-to-end through the analysis, design, development, and build phases, see Zultner on ‘Software QFD’^[3]. The use of Hierarchy diagrams has enabled the structure of needs to be established i.e. requirements at the same level of scope are considered rather than mixed levels. The traditional House of Quality matrix, on the other hand, is only the deployment of the requirements analysis phase into design (Figure 2, Phase 1). Additional matrices may be need at various stages of the end-to-end cycle to give a visual summary of key requirements.
2. **Establishing True Customer Needs and Values:** The problem with Traditional QFD was that suppliers, particularly automotive suppliers, were reliant on their OEM customer to understand their customers’ needs and priorities. Unfortunately, this was not always the case and so even suppliers with well developed components suffered if the finished vehicle did not sell well. Similarly IT System Suppliers often assume that their customers’ needs and priorities are properly understood and communicated to them at the start of projects. Thus, a structured front end analysis and prioritisations of the business and project goals, customer / market segments and value chains was added to the analysis phase in modern QFD in order to ensure a clearer articulation and understanding of critical customer needs and their priorities was established.

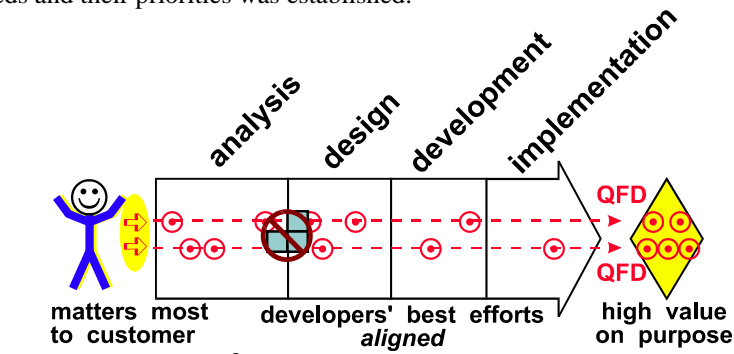


Figure 3 Blitz QFD® and why House of Quality alone is insufficient

3. **Relative / Proportional values of priority:** Traditional QFD, as it developed in 1960s Japan in the pre-calculator age, was done by hand. A simple five rating point scale was adopted that could be calculated with an abacus. Although it resembles the five-point market research Likert Scale, the QFD scale is used to determine importance and correlation, not agreement with a statement. Because the five-point scale is an ordered scale, that is the interval between 1 and 2 is not necessarily equidistant to the interval between 4 and 5, statistical analyses are limited to mode and median calculations. This means that many of the math operations in traditional QFD violate this limitation and the results have questionable meaning and the best that can be achieved is a rank order prioritisation. The better approach, used in modern QFD, is to develop ratio scale priorities using the Analytic Hierarchy Process (AHP)^[4] which ensures they are relative e.g. a project goal contributing 50% to meeting a business goal is twice as important as a 25% goal.

[2] Zultner, Richard E. “Project QFD Managing Software Development Projects,” Transactions of the 9th Symposium on QFD. QFD Institute. ISBN1-889477-09-5, 1997

[3] Zultner, Richard, ‘Software QFD – A Silver Bullet for Software Development’, Transactions from the 12th Symposium on QFD. QFD Institute ISBN 1-889477-12-5, 2000

[4] Saaty, T. L., (1990), Multicriteria Decision Making: The Analytic Hierarchy Process, RWS Publications, 4922 Ellsworth Avenue, Pittsburgh, PA.

4. **Lean design – effort focused on critical customer business goals and requirements.** Since the 1960s, “right-sizing” has lead most organizations to cut staff to the leanest possible levels. Add to this the pressures of global competitors, multi-tasking across projects, compressed time-to-market and the demands of rapidly advancing/disruptive technologies such as Cloud Computing, then new product design and development teams are hard pressed to find time to do all the QFD they should. Modern QFD has included Blitz QFD® as a matrix-free/ light approach to first deploy only the most important needs of the customer, end-to-end throughout all the quality assurance phases, see Figure 3. In the Toyota rust study, for example, Blitz QFD® would include only the critical few concerns of all 16 matrices.

2. Challenges in Complex IT Systems Design

2.1 General Challenges to IT Systems Design

Developing new IT Systems is a complex process and often either does not realize the desired business benefits or fails to identify and communicate them. An ISACA, the global Information Systems Audit and Control Association, survey in 2009 of 1217 IT Professionals found that of the respondents,

‘...two-thirds accepted they were failing to measure IT in ways that provide a full account of its benefits.’

Despite this, on average, 43% of an organization’s Capital Expenditure is on IT^[5]. The IT challenge for many organizations is in developing Strategies and Solutions that align with and further the business goals by delivering their full potential for business benefits.

That said, IT systems are central enabling components in most technological systems in the world today, whether it is the government tax system, an earth telemetry system or an automotive brake management system. They are themselves complex systems composed of a number of major interacting and interdependent components such as:

- Enterprise/ System Architectures
- Information and Data Models and Data Storage and Management Systems
- Application Software
- IT Infrastructure – Input/ Output Devices, Computing Devices, Laptops, Storage, Comms. Networks
- Service Management and Support Systems
- Access Management, Governance and Security systems etc., etc.

To work successfully as a system the components have to work seamlessly together, must also integrate flawlessly with other systems they exchange data and information with, whilst interfacing effectively with the ‘physical’ processes conducted by the users. The IT System is therefore a component or sub-system of a broader enterprise system, and meets a sub-set of the overall outcomes that the enterprise has to meet i.e. the benefits, outcomes and critical business requirements are themselves part of a hierarchy.

The design is made more complex because it has to address the needs of a diverse set of stakeholders who often will have conflicting views on the priority of the functional (what the system does) and the performance / non-functional (how well it does it e.g. response time, usability, reliability, security) aspects of the solution.

In parallel, the technologies supporting functional and performance aspects of the components of the solution are changing rapidly as enhanced ways of meeting requirements are found. At the time of writing this paper the most disruptive ‘technological’ change facing the IT service industry today is the emergence of ‘Cloud Computing Services’ i.e. supply of Business Services/Applications/ Processes/ Functions via the

[5] Linthicum, David S, ‘Cloud Computing & SOA Convergence in Your Enterprise’, Addison-Wesley Professional, 5 Oct 2009

internet supported by the world-wide-web. The access on demand of these IT enabled Business Services radically changes the cost base and agility/responsiveness of IT. Blechar^[6] captured the complexity of the task when describing the challenge of establishing an 'agile' information architecture for Service Oriented Architecture (SOA) systems, see Figure 4. The need for methods to help suppliers quickly understand their customers' business drivers and align the most effective 'IT Solution' has never been greater.

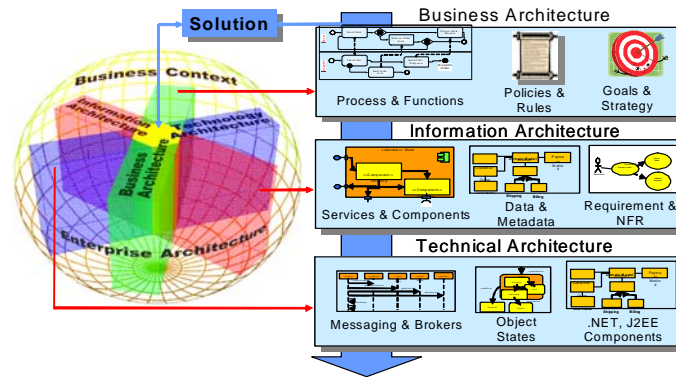


Figure 4: Complexity of Information Architecture for SOA Deployments (courtesy of Gartner)^[5]

The critical challenges facing Complex IT Systems Design

- Complexity of Stakeholders and structuring and prioritization of their needs
- Integration of new systems and services with the existing estate
- The rapid emergence of service delivery game changers such as Cloud Computing, Service Oriented Architectures, Software as a Service.
- **Alignment of IT Solution to Business Drivers**

It is the intention of this paper to illustrate how QFD approaches have helped ensure that IT solutions are aligned with and satisfy the business drivers. Modern QFD, an extension of Blitz QFD[®], supports alignment between business drivers and the whole of the system and service life-cycle, from scoping and design to end-of life replacement and disposal. The design questions addressed and design activities impacted are shown in Figure 5.

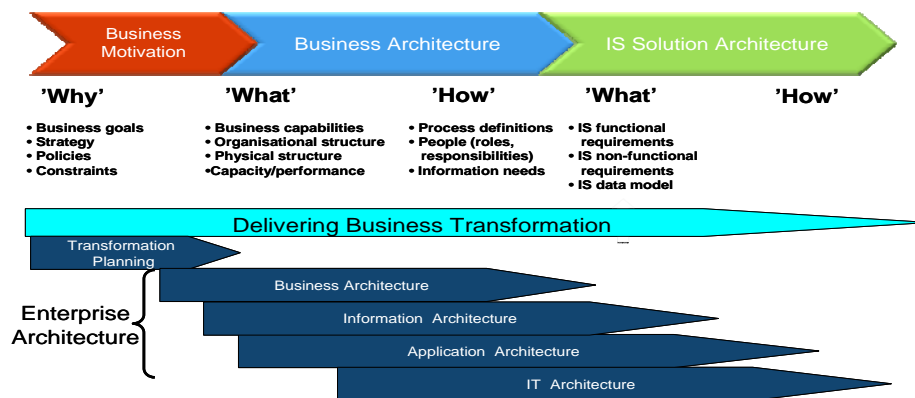


Figure 5: Flow of Business & Solution Requirements Using QFD

[6] Blechar, Michael, 'Yin and Yang of Process and Data: Establishing an Agile Information Architecture in an SOA', Gartner SOA & Application Development and Integration Summit, London, 25 -26 June 2008.

2.2. Case Study – CRM Design for Financial Services

Cole and Stansfield have previously applied Traditional and Blitz QFD[®] approaches on various customer sensitive IT System designs. Due to the sensitivity of these systems they cannot be discussed in this forum. To illustrate the particular benefits of the Blitz QFD[®] above and beyond the many benefits of the Traditional QFD approach we will illustrate key stages of the approach and typical outcomes for the design of a Customer Relationship Management (CRM) System for a Global Financial Services Organization. Although these outputs are generic, particular insight will be drawn from a customer project initiated at the point of writing this paper. These systems encompass the broad range of challenges faced in IT Design.

CRM systems are a major IT component that can help deliver the Business Intelligence (BI) Strategy for organizations, where Business Intelligence refers to the collation and analysis of sales and operational performance to support improved decision making ability by the management team. Historically BI Projects have struggled to overcome the following challenges:

- Data / source capability driven.
- Unclear business priorities, so try to do everything for everyone.
- “Build and they will come” mentality.
- IT focused, i.e. build what we have today with new technology.
- Loose or no linkage to business strategy.
- Big Bang rather than iterative “Bite-Sized” deliverables.

Which previously has resulted in:

- Delivery of operational style reporting perpetuating the “steady-state”
- Investment in new technology only delivers the same business performance capability.
- Over 50% of the development effort delivers no value.
- Increased ongoing maintenance costs.
- Poor system performance and
- Poor user take on.

The customer needed to improve its understanding of customer trends across its product lines for commercial and individual customers in the different countries and regions it operates within to improve the effectiveness of service management and development operations. They had developed their Corporate Business Intelligence Strategy, which to be deployed required the development of several major sub-systems to manage and supply consolidated customer and service performance information. A critical component consisted of the integration of multiple and non-interoperable CRM systems that historically had been acquired and managed independently by the product line business units. The lack of interoperability meant it was difficult and time-consuming to collate customer and service information at a line of business and corporate level, meaning the information could not be used in a timely manner to manage operations or plan sales campaigns on a broad front.

It was also recognized that the customers often felt that they were treated by the company as different people when applying for different products i.e. the legacy information was product-centric rather than customer-centric. Not only did this damage the customer’s experience of the company but it hampered its ability to increase ‘cross-selling’ (selling additional products to existing customers) and ‘up-selling’ (selling higher value services or additions).

At the same time it was believed that integration of the CRM capabilities would further enhance the efficiency of the sales and marketing functions by establishing shared processes and transferring best practices between businesses.

3. How does Traditional and Blitz QFD® address IT Design Challenges?

3.1 Overview

Many companies first attempt QFD in their product development process based on the decades old traditional models and find that this effort yields huge matrices which although giving valuable insight, are too often judged as too cumbersome to use. This has often led to 'loss of sight of the wood/ forest for the trees'. This has been driven by inexperienced staff failing to distinguish between the hierarchy of requirements, the structure flowing down from business 'Critical Success Factors' and 'Business Target Benefits' (Strategic Requirements) through the business solution requirements to the requirements of the technical components.

The QFD Institute, put forward that true QFD, either Blitz QFD® or traditional QFD, does not require the use of matrices - it is about driving quality throughout the whole process; with quality defined as providing usefulness to the customer. It is also about aligning the effort of every part of the organization to contribute to satisfying the customer needs. In fact, the Japanese translation of QFD means that quality (as defined by the customer) must be deployed across all relevant business functions. Thus, there can be no QFD without a customer focus.

The Traditional QFD approach started with an assumption that the stakeholders and their needs had been identified and prioritised, and used the House of Quality matrix to establish priority of the 'Solution Design Requirements'. Stansfield and Cole exploited a combination of Six Sigma analytical techniques to develop a robust scope, set of stakeholders, processes and critical to quality requirements and showed how these could be fed into the traditional QFD^[7]. The framework they used is shown in

Figure 6. A similar design for six sigma (DFSS) approach to SOA design was reported by Cardone and Danziger^[8].

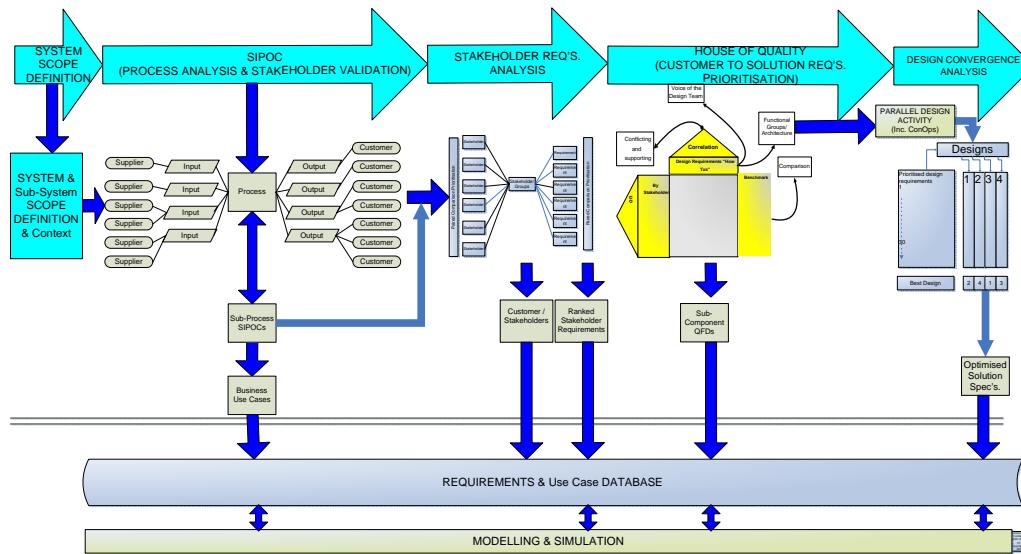


Figure 6: Six Sigma Framework For Traditional QFD Applied to IT^[7]

[7] Stansfield, Kim & Cole, Jeff, 'Use of QFD and Technology Road Mapping to Develop a Mobile Data Collection System', 20th Symposium on QFD, QFD Institute, ISBN 1-889477-20-6, 2008

[8] Cardone, Robert and Danziger, Russell, 'DFSS as an Enabler of Service-Oriented Architecture', iSixSigma Insights - June 18, 2007 - Vol. 8, #46 - ISSN: 1530-7603

What the Blitz QFD® process^[9] shown in Figure 7 does is to channel efforts to focus on a small number of the most important customer needs and see that they are applied throughout the entire development process until the customer is satisfied with a delivered product and after sales service. The philosophy is that by boosting the focus on the most critical customer needs and letting the others be taken care of “as usual,” customer value and satisfaction will improve, leading to a greater willingness to purchase/ use the product.

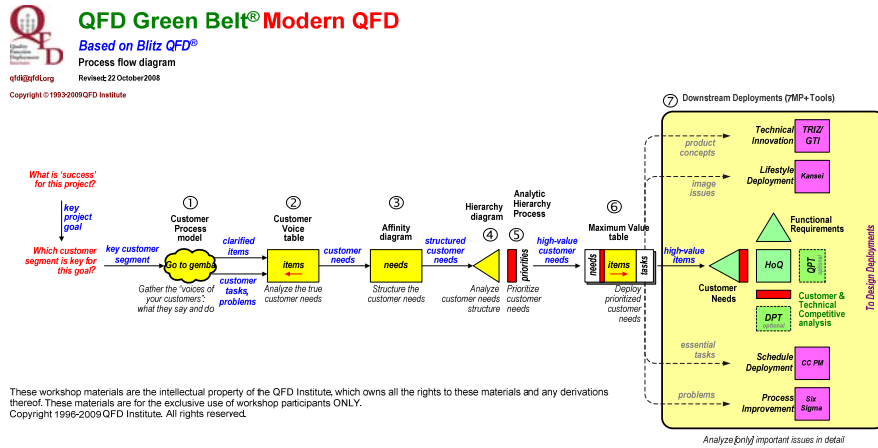


Figure 7: The Blitz QFD® Process Framework^[9]

So in summary, Traditional QFD originally was about keeping track of all customer needs throughout all the processes, and because it was comprehensive, it required greater effort. Work has been done to supplement Traditional QFD to bring more focus on critical requirements using Six Sigma techniques. Traditional QFD has the potential to boost customer satisfaction even more than Blitz QFD® but not every organization has the resources to pursue such an effort. Starting with Blitz QFD® is a sensible way for today’s companies to learn what it means to align their efforts around customer focus.

Section 3.2 provides descriptions of the individual steps of the Blitz QFD® applied to the CRM project. These sections will also raise how methods previously used with Traditional QFD have been applied in these areas. As an aide to navigation the major steps and questions addressed for the QFD approach are shown in Figure 8. This also shows the scope of this paper, starting at ‘1. Project Scope and Boundary’.

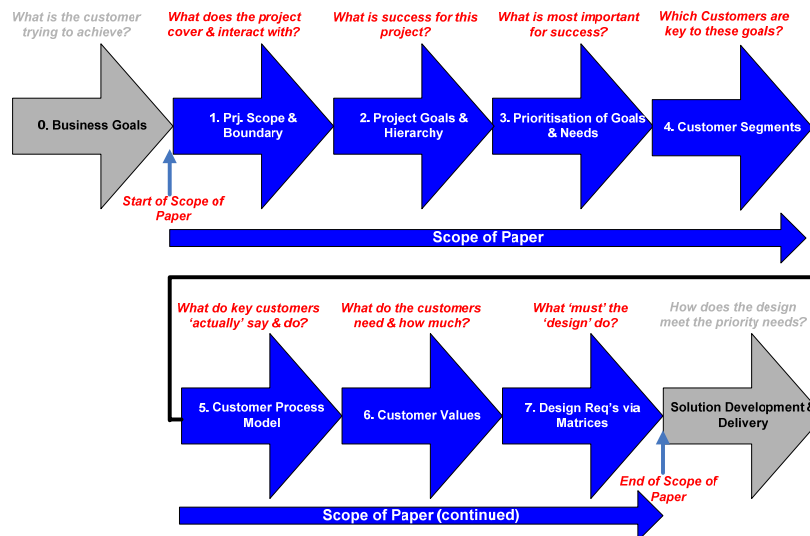
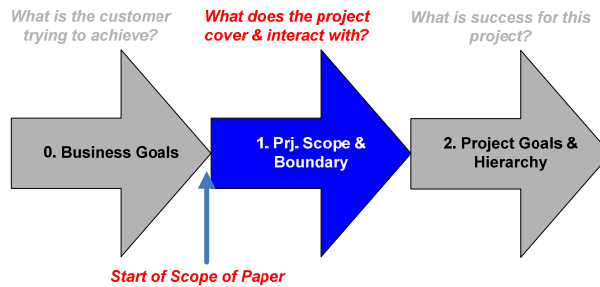


Figure 8: Major Steps and Questions for the QFD Approach

^[9] Copyright QFD Institute 1993 – 2009, ‘QFD Green Belt® Modern QFD – Based on Blitz QFD®, Process Flow Diagram’, Revised 22 October 2008.

3.2.1 Scoping The Project



The first Question addressed within Modern QFD is:

‘What is the customer trying to achieve?’

This step, although outside the scope of this paper, results in a set of prioritised business goals and is the precursor to the first question asked by Blitz QFD® ‘What Is Success For This Project?’ In many IT programs there is often a lack of clarity of which Business Goals and Processes are ‘In-Scope’. To address this and avoid analysing out-of-scope Project Goals, Stansfield and Cole^[7] have introduced a systems engineering step, Scope/ Boundary Analysis, using the simple ‘In the Frame/ Out of Frame’ approach at the launch of IT projects, shown as the first step in

Figure 6.

This answers the question:

‘What does the project cover and interact with?’

At the launch stage of IT projects such as the CRM project ‘scoping workshops’ are run with lead stakeholders from the customer and supplier teams where ideas for in-scope items are written on ‘Post-Its’ and placed on a chart in the appropriate sector (In Scope, In/Out of Scope, Out of Scope, Dependency on Project, Dependency for the Project) and where the final location had to be agreed. The items on the chart are then grouped by the customer using the KJ™ Affinity Diagram method to establish the hierarchy of items from a customer perspective. Extracts from the output for the CRM project are shown in Figure 9. For IT design projects this is used in conjunction with the ‘context diagramming’ to establish clarity of the boundaries, interfaces, dependencies and responsibilities for the customer and supplier.

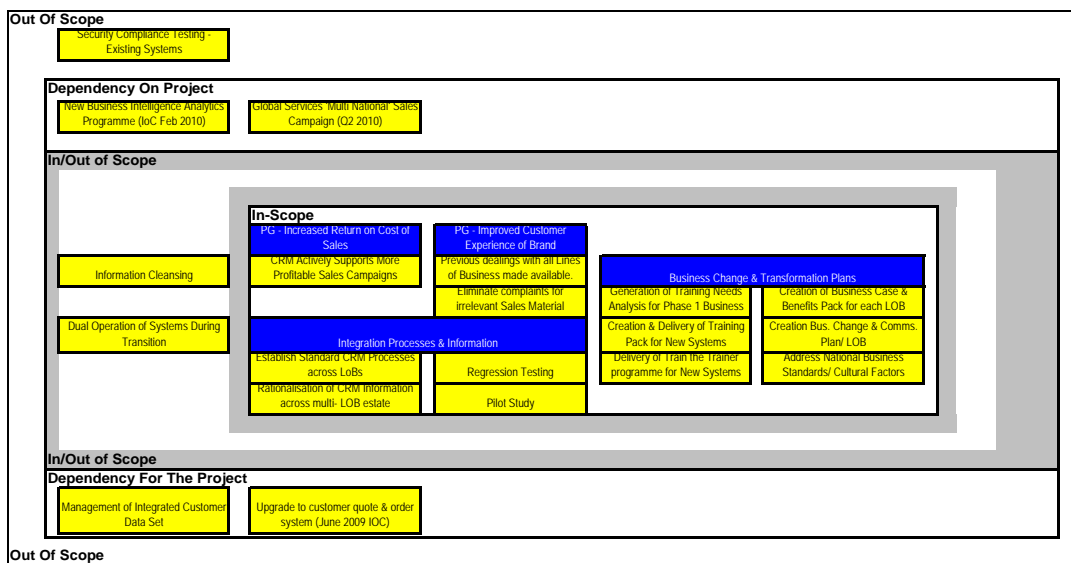
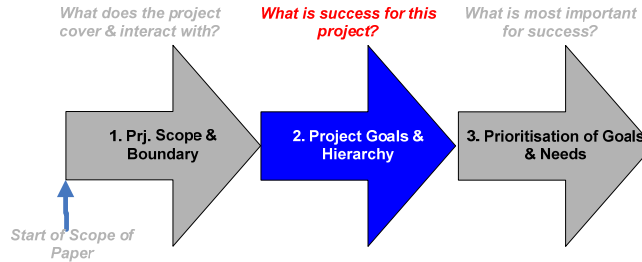


Figure 9: In-Scope, Out of Scope Mapping Template

The aim is to establish a clear boundary to avoid spending time analyzing ‘Out of Scope’ items. This also helps establish the basis of the project ‘change control’ process to avoid scope drift and creep.

3.2.2 What is success for this project?



Having understood the ‘Scope’ for the project, the next challenge is to understand,

‘What is success for this project?’

In the project launch ‘scoping workshop’, the project team applies the Blitz QFD® approach to capture customer views on the project goals.

The team typically applies the KJ™ Affinity Diagramming Approach where the customer stakeholders group the Project Goal information enabling the team to identify missing Goals. The results are shown in Figure 10.

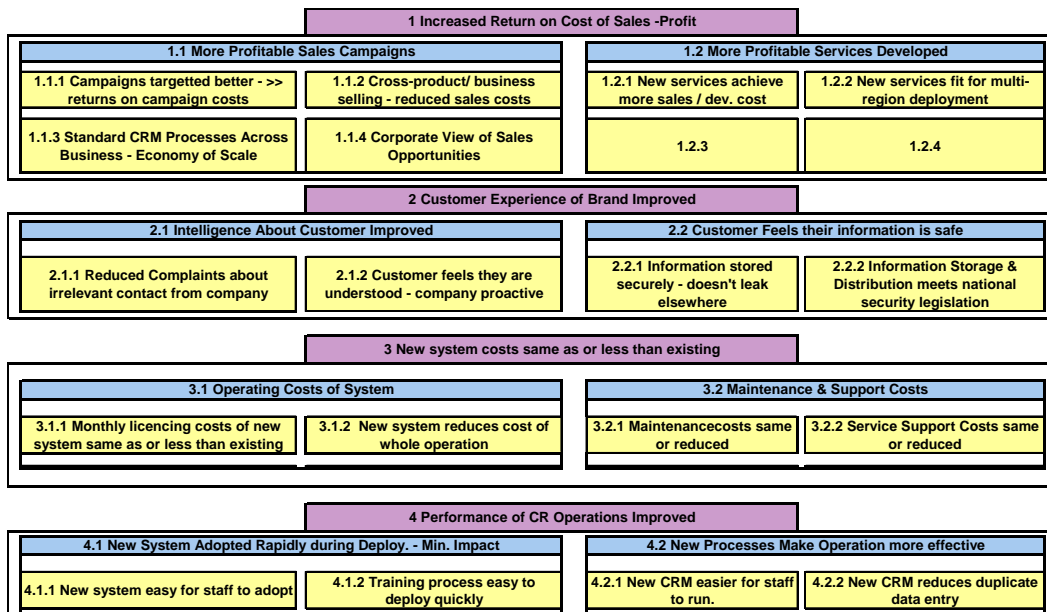


Figure 10: Affinity Diagram for Project Goals

The Affinity Diagram is then mapped into a hierarchy diagram, see Figure 11, where the linkage between the first three levels of Project Goal is made more visible. The team runs the analytical hierarchy process (AHP) (described in 3.2.3) with the customers to establish the relative contribution of each level of the goals to the level above, i.e. both a global and local contribution to goals is calculated. This information is recorded in the Hierarchy Diagram.

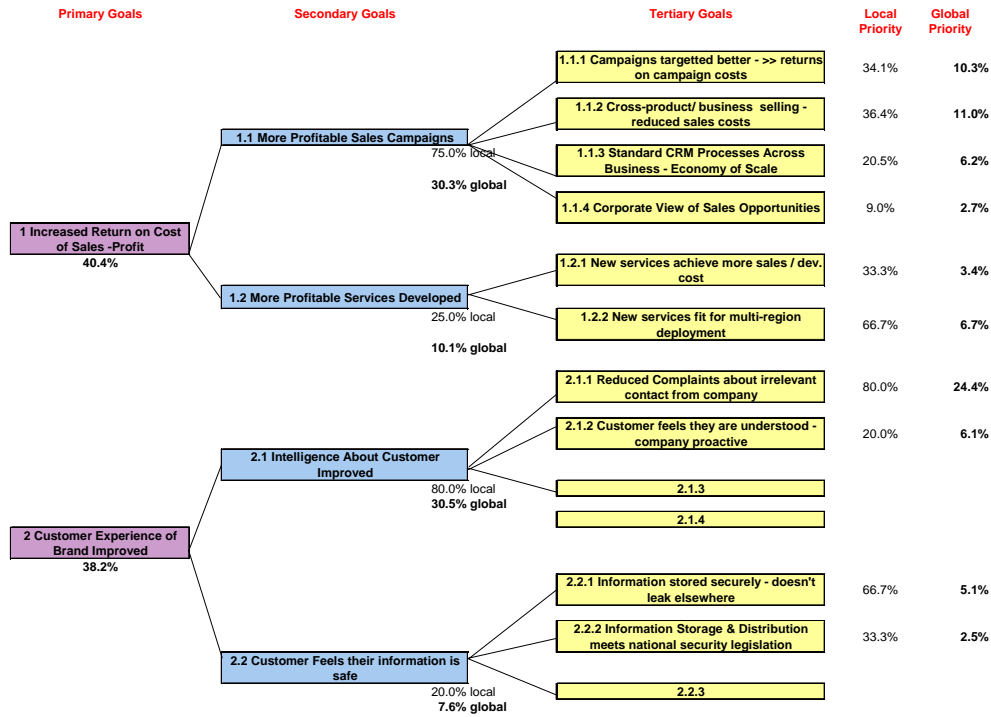


Figure 11: Hierarchy Diagram of Project Goals for the CRM System

The Project Goals are consolidated into the draft Project Goals Table (PGT), see Table 1, which included:

- ‘How the Project Goal would be measured in terms of a metric?’
- ‘The time frame in which each project goal was likely to be met’
- ‘Who judged the success of the project goal being met?’
- ‘The Means by which the goal would be satisfied within the project’

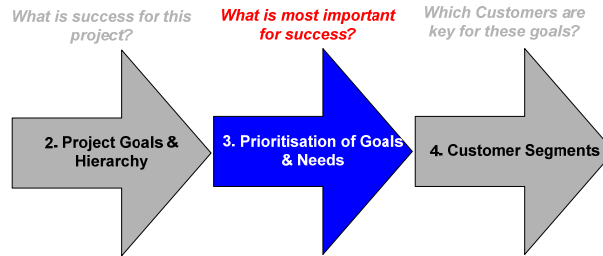
The PGT provides a summary of the Project Goals that addressed specific Business Goals. By documenting this at the start of the project it provided context for the design team in answering if “this” or “that” solution is the best as they provide key criteria. The Project Goals Table proves a useful terms of reference for the multiple stakeholders when ‘down stream’ disputes about development priorities arise.

Project Goals table: Corporate Customer Relationship Management System

#	Goal Statement, including target.	How measured?	Time frame	Who judges success?	Means (optional)
1	Increased return on cost of sales - profit (25% Increase)	Sales / £ Spent on Campaigns; Sales/ £ New Service Development; Cross Business Line Sales Returns	6 months	CFO Sales & Mkt. Dir.; Line of Bus. Mgr.	Via better targeting of campaigns and product enhancements; company customer information made accessible to campaign managers in timely manner; New Sales Opportunities Identified Corporately; Collation of Sales Opportunities/ Trends @ corporate level
2	Customer Experience of the Brand Improved - treated as individuals/ business that are understood by the organization, wherever they are.	# Customer complaints about poor targeting 'why me?'; Increased cross-product sales to individuals/ businesses; Compliance with Data Privacy & Export Legislation Demonstrated	6 months	Customers Sales & Marketing Director Chief Security Officer	Corporate Profile of individual customers or businesses made available; Compliance Matrix for Information Export Legislation vs Information Architecture Demonstrated
3	New system costs no more to own and operate than existing systems. (Opex </= to Existing)	Cost /user / month of new system compared with existing	Immediate	Line of Bus. Mgr. Bus. Ops. Dir. Client IT Mgr.	Components of Total Cost of ownership of existing systems
4	Performance of Operations Improved	Speed to adopt new standard processes and procedures; No delays of deployment due to Cultural and practice differences of different nationalities/ business areas; Ease of Use; Staff performance	4 months	Bus. Ops. Dir. Client Business Change Client Staff	Process Changes Communicated Effectively; Multi-site/coutry training facilitated; Local cultural and 'business practice' requirements captured and communicated effectively.

Table 1 High Level Project Goals Table for a CRM System

3.2.3 What is most important for success?



Having identified which Project Goals are important to success, the next big question tackled by the Blitz QFD® process is:

‘What is most important for success?’

The process of building a scaled, relative assessment of value and importance is a fundamental building block of the Blitz QFD® and Modern QFD approaches, and it is used at many levels of the process for goals, needs, solution requirements, solution fit etc. In this paper we will describe how the Analytical Hierarchy Process was used to establish a customer perspective of importance of each Project Goal and Sub-Goal to its parent or higher level goal. The contribution of the Project Goals to Business Goals would normally be estimated prior to this step, which is an additional step introduced within Modern QFD.

The Analytical Hierarchy Process, developed by Dr. Thomas Saaty, prioritizes and selects from alternatives. The AHP produces absolute scale numbers from paired comparisons of the goals or needs. The advantage is that absolute scale numbers can be multiplied and summed and hence used as weights. This is not possible with ordinal numbers which are sometimes erroneously used in selection and ranking methods. This weighting math problem is why early QFD methods using e.g. 1, 3 and 9 as weights often led to poor results. In Blitz QFD® In prioritizing customer needs using AHP the customers compare the importance of their needs with each other, pair by pair, using a verbal ordinal scale such as equal (1), moderate (3), strong (5), very strong (7) and extreme (9), and where intermediate judgments are allowed, such as a response between moderate and strong (4). AHP is applied top down to the customer goals and needs hierarchies with local priorities of a single branch able to be multiplied by “parent” weights to give global priorities.

During IT projects when using AHP prioritization for Project Goals, judgments are made by the stakeholder representatives as shown in Figure 12. For the CRM project this reveals that ‘Increased Return on Cost of Sales’ constituted 40.4 % of expected project benefits, almost four times as much as ‘New System Costs the Same or Less than Existing’, which recorded 10.5 %.

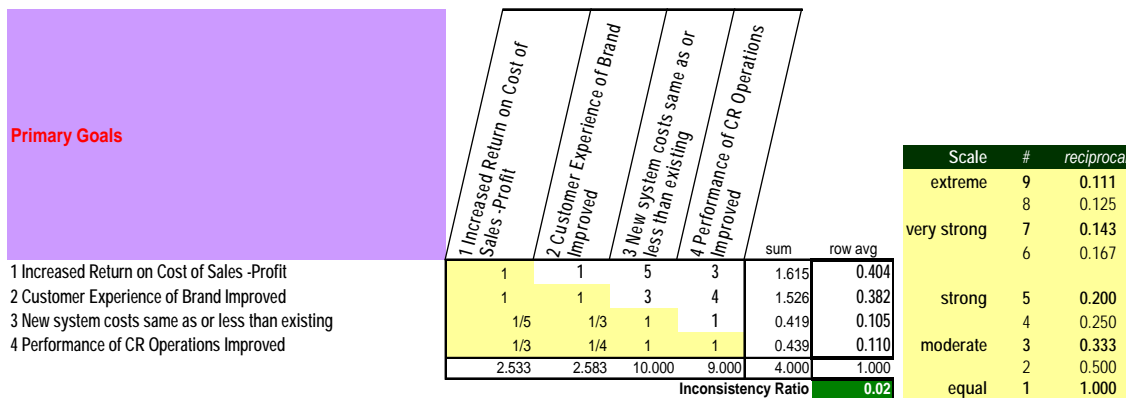
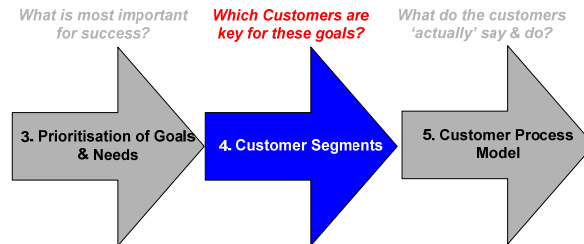


Figure 12 AHP for Project Goals for the CRM System

Historically for Traditional QFD the simple pair-wise comparison technique is used to rank the importance of goals or requirements resulting in a rank order, not a relative, scaled value for importance.

The results of the AHP analysis of Project Goals for the CRM project are mapped into the Hierarchy diagram shown in Figure 11. This means that the local and global contribution made by each arm of the Project Goals hierarchy was understood i.e. relative value and importance had been established.

3.2.4 Which customers are key for these goals?



Having clarified what success is for the project via Project Goals, Blitz QFD® next addresses the question:

‘Which customer segments are key to delivering the project goals?’

In answering this question the process leads the team to understand which ‘Customer Segments’ or customer communities are key to the project goals. For Complex IT Systems such as the CRM System, the customer segments can include direct customers, procurement teams, users, repair/maintenance teams, third party support etc. Typically, they will have needs associated with their use of the system, or of something the system produces. It is rarely possible to visit every customer segment, and hence the need to prioritize them based on the list of ‘who judges success?’, previously identified in the Project Goals Table.

The Blitz QFD® process helps the project team identify the most important customer segments for the successful deployment of the system, through the creation of a Customer Segments Table (CST). The team maps the current and alternative uses of the system confirming who, what, when, where, why, and how (including alternative uses) (5W1H) of these uses. As a result of building the CST gaps in understanding become evident that helps the team focus the next level of research more effectively.

In Table 2, an extract from the Customer Segment Table for the CRM project, the Project Goals are assessed in terms of who has greatest impact on the Goal being met, and where the percentage contribution is estimated using AHP with representatives of the customer and supplier stakeholder groups. When running the AHP care has to be taken to apply one of the four forms of AHP viz. each Project Goal/ Criteria can be classified as a ‘Bigger Is Better’ e.g. Project Goals 1 and 4, ‘Smaller Is Better’ e.g. Project Goal 3, ‘Absolute Judgement (Expert Judgement)’ e.g. Project Goal 2, or ‘Relative Judgement’.

Project Goals	Goal Wts (from AHP)	Who? CS Having HI Impact/ Interest in Project Goal Being Met	What (else) is system/ its outputs used for?	When (else) is system used?	Where (else) is system used?	Why (else) is system used?	How (else) is system used?
1 Increased Return on Cost of Sales -Profit	0.40	Sales & Marketing Manager (45%) Operations Staff (35%) Clients (Private & Business) (20%)	Target Sales Campaigns (30%) Preparation of Line of Business Forecasts & Progress Reports (20%) Confirm Upsell/ Cross Sell Ops (50%)	Campaign Planning (35%) Weekly Reporting. (20%) Daily Customer Opportunity Reviews (45%)	Line Of Service Ops Centre (30%) Call Centres (60%) Service Dev. Centres	Support Campaign Planning (30%) Monitor Cost of Sales (20%) Increase sales to existing customers (50%)	Capture Standard Enquiries (40%) Upgrade to Higher Value Services (35%) New Service Piloting (10%)
2 Customer Experience of Brand Improved	0.38	Sales & Mktg. Mgr. (10%) Private Customers (60%) Business Customers (25%) Security Compliance Mgr (5%)	Make Contacts Customer Centric (25%) Lack of Customer Interactions (40%) Track Satisfaction / Complaints (20%) Checking Customer data Compliance (5%)	Targeting of Contacts to Specific Customers Enquires about services & Quoting / Quotes Comparisons Security Compliance Audits	With Financial Agent (50%) In Customer Service Centres (30%) On-Line Comparison Sites (20%)	Help improve sense customer understood by Company Encourage Customer to Come back for more services Reinforce Customer Data Treated Carefully	Test Response to New Offerings Track retention of customers

Table 2: Extract of the Customer Segments Table

The approach underpins the ‘benefits realization’ process for customers and IT Systems developers i.e. it helps both parties understand the likely benefits for each customer segment thereby answering the question ‘What’s in it for me?’ At an organizational level Blitz QFD® provides a way of identifying the hierarchy of causal relationships between business and project goals, customer segments, benefits and needs. IT

designers are increasingly applying ‘business system dynamic modelling’ to evaluate the dynamic behaviour of these causal relationships and the likely impact of changes on delivery of benefits and organizational performance reflected in the balanced scorecard, see Linard and Dvorsky^[10].

The Customer Segment Table for the CRM Project shown in

Table 2 identifies four key customer segments as the focal point for assessment during the following stage of ‘gemba’ visits (see section 3.2.5) and Process Mapping, namely:

- Customers (Private and Business)
- Sales and Marketing Managers
- Line of Business Management
- Operational Staff

The results of the AHP analysis of the contribution of the four ‘Customer Segments’ to the Project Goals is given in Table 3, where Operational Staff are estimated to contribute 51% to delivery of the Project Goals.

Customer Segments selection

criteria	% wt.	Customers (Private & Business)	Sales & Marketing Manager	Line of Business Manager	Operational Staff	
		CS ¹	CS ²	CS ³	CS ⁴	
Increased return on cost of sales - profit (10% Increase due to CRM)	40.4%	50	250	50	1500	count or estimate local priorities (%) global priorities (%)
		2.7	13.5	2.7	81.1	
		1.1	5.5	1.1	32.7	
Customer Experience of the Brand Improved	38.2%	↓ 46.1	↓ 23.9	↓↓ 6.2	↓↓ 23.9	
		17.6	9.1	2.4	9.1	
		0.024	0.122	0.610	0.244	
New system costs no more to own and operate than existing systems. (Opex <= to Existing)	10.5%	2.4	12.2	61.0	24.4	
		0.3	1.3	6.4	2.6	
		0.075	0.150	0.150	0.625	
Performance of Operations Improved (Speed/Accuracy)	11.0%	7.5	15.0	15.0	62.5	
		0.8	1.6	1.6	6.9	
		19.8	17.5	11.5	51.3	priorities

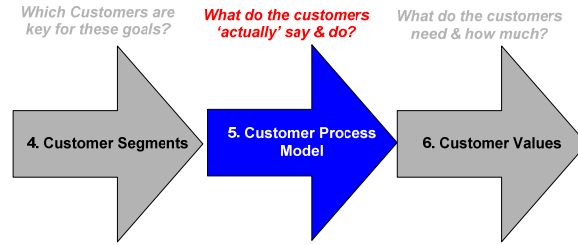
Table 3: Relative Impact of Customer Segments on Delivery of Project Goals

The customer segmentation for IT systems, particularly CRM systems, would normally provide more focus on identifying key segments within the ‘Customer Segment’, but for the purpose of brevity this segment has not been expanded.

The Blitz QFD[®] approach helps the team identify which customer segments have the biggest impact on delivering the Project Goals i.e. effort for the following analysis is focused here. This does not mean that other customer segments are not considered, but that they are dealt with outside the QFD prioritization approach i.e. the QFD focuses on ensuring critical customer segment needs are understood and satisfied.

^[10] Linard, Keith & Dvorsky, Lubomir, ‘ A Dynamic Balanced Score Card Template for Public Sector Agencies’, International Evaluation Conference, Australia, 2001

3.2.5. What do the customers ‘actually’ say and do?



Having identified the customer segments having greatest impact on delivering the Project Goals, Blitz QFD® then addresses the question:

‘What do the customers ‘actually’ say and do?’

The Blitz QFD® approach involves a set of steps to ensure that the actual processes used by key customer segments using/ exploiting the system, are mapped as effectively as possible. The analysis also helps the team focus on critical customer segments, as in many cases there will be insufficient time to visit all segments. To consolidate the understanding of processes, the project team start by mapping how they think the customer segments interact with the systems based on the information developed in the customer segment table and from customer supplied information. The Blitz QFD® process recommends the use of Customer Process Mapping (CPM), and it has to be recognised that this is a first draft to improve the effectiveness of customer interviews. An example of a CPM for the CRM project is shown in Figure 13.

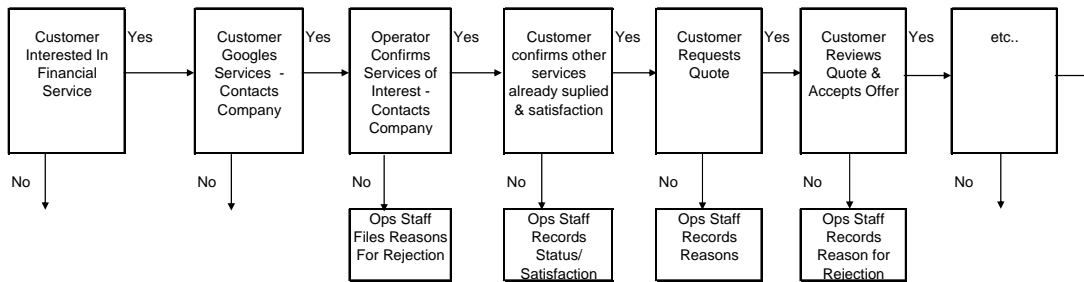


Figure 13: Customer Process Map Used For Gemba Visit Planning

For IT Systems Design the key customer segments will include Users of the System and staff using the system outputs. From the ‘Who?’ column in

Table 2, the Process Map could equally be drawn from the perspective of the Sales and Marketing Manager, the Line of Business Manager or the Operational Staff. To improve the visibility of these multiple perspectives Cole and Stansfield have used the high-level SIPOC (Supplier, Input Process, Output and Customer) mapping technique to prepare holistic views of the important business processes, see Figure 6. An extract of the high level SIPOC for the CRM project is shown in Figure 14. It is apparent that Customers can also act as Suppliers, and this process provides additional validation of both the scope diagram and the Customer Segments Table, as new processes, process operators and Customers are often identified at this stage. The team identifies who the Customers for Outputs are first, and works systematically to the left, the Suppliers.

This step is in preparation for visiting the key customer segments in their work-place, called *gemba* or visiting the “crime scene” (one of its meanings in Japanese). Armed with the CPM or the SIPOC the customers will, after having said they are impressed by the effort, immediately start to correct the process. In that way, a lot of valuable information is gathered that might not have been found just by asking straight questions. Furthermore, by defining a process to guide this part of the visit, the risk of getting stuck on one matter during the whole visit is mitigated. This approach encourages the customer to yield a tremendous

amount of information including the cultural and context information often missing from documentation. The power of this approach is described effectively by Ronney, Olfe and Mazur^[11].

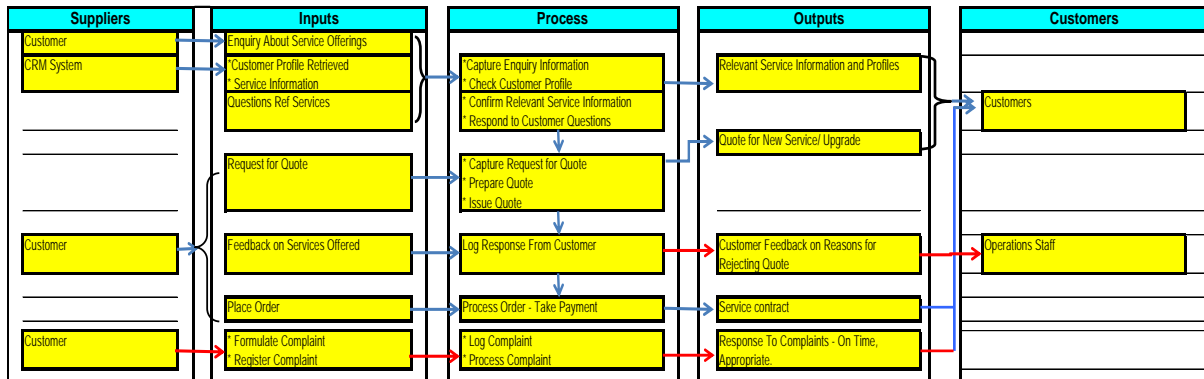


Figure 14: Extract of High Level SIPOC for CRM Gemba Preparation

After going through and revising the customer process map (CPM) or SIPOC, Failure Modes (FM) and Failure Effects (FE) can be annotated to give valuable information about what to investigate more in detail during the visit. Success modes can also be noted so that they are preserved in any new development. Another Six Sigma method used regularly at this stage will include Root Cause Analysis (Ishikawa or Fishbone charting) to understand root causes of known problems and identification of mitigations on priority areas.

After revising the Customer Process Map, it is time to visit the actual workplace of the customer where the most critical jobs gets done. All sources of data are to be used, including observation of any strange workarounds. To capture this wide array of data the ‘Gemba Visit Table’ (GVT) is helpful. Its purpose is to annotate observations, refer to relevant documents or manuals used at the workplace, write down comments from the customers, etc. All this data is then translated into measurable, clarified items, in Six Sigma terms this is the translation of customer needs to ‘Critical To Quality’ (CTQ) characteristics or requirements.

The clarified items arising from the gemba visit are single-issue statements, simplified from complex activities observed during the visit. It is beneficial if the customer is able to give a measurement and target value to these items as that makes later evaluation of solutions easier. When possible, filming or recording at the customer’s workplace is a good complement to the GVT. For IT Systems this also might include the use of training systems for the existing systems that are being replaced. An extract from the ‘Gemba Visit Table’ is shown in

Table 4.

In large-scale, complex IT System Development the process mapping activity can be run over a number of months. To avoid impact to operational performance of the customer’s business, this can entail the set up of a collaborative work environment where representative operational and management staff, and customers can work freely to develop detailed process maps, information flows, business rules, Critical To Quality requirements and prioritized process improvements for deployment in the new solution(s). In this situation the full Blitz QFD[®] analysis is run to ensure the high priority processes have been assessed sufficiently to ensure their complete integration into the replacement design. Standard process mapping using detail level SIPOC will be run for all other processes to ensure completeness of the new system. Increasingly the Business Process Model and Notation^[12] (BPMN) standard is used for the process mapping activities.

^[11] Ronney, Eric, Olfe, Peter and Mazur, Glenn, ‘Gemba Research in the Japanese Mobile Phone Market’, Copyright Nokia Phones ©2000 and QFD Institute ©2000.

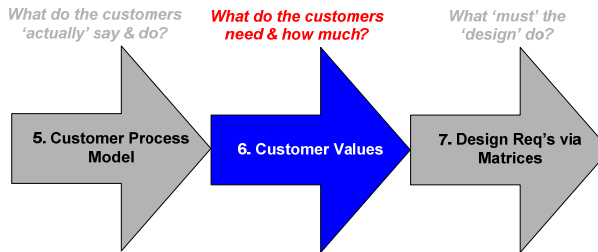
^[12] Business Process Model & Notation Version 2, Open Management Group Doc. Number dtc/2010-06-05, URL: <http://www.omg.org/spec/BPMN/2.0>.

June 2010

Gemba Visit Table						
Interviewee: Jack C (Operator, LoB 1); Jane McD. - LoB Manager Contact info:			Interviewer(s): Simon W. Date and Time: 5 Feb. 2009 Place: Bristol Ops. Centre (UK Site 3)			
Interviewee Characteristics (*memorable): Jack C - New Ops Centre Operator Jane McD. - LOB Manager 3 years, at Bristol for 6 months.						
Process Step	Observations	Verbatims	Data/Documents	Team Notes	Clarified Items (with measures)	Deploy
Operations Staff:						
Log Customer Details	A lot of repeat information being entered - should be available	Customer already entered details - why do I have to re-do?	Standard Customer Detail reports	Recurring theme - too much repeat entry of data already presented.	Enquiry Form Will be Pre Populated with 'Customer Detail' Data	Yes
Confirm Customer Enquiry Details	Operator spends a lot of time typing in Customer enquiry data - customer irritated by delay.	Takes too long to fill in responses - 'System slow to respond'	Customer Requirements Questionnaire - CRQ3v0.1	Recurring theme - too much repeat entry of data already presented.	Details of enquiry type available to the Operator as a drop down list - not manual input.	
Identify Previous Dealings with Company	Seems more miss than hit - no visibility of other product lines on the system.	Half way through conversation the customer asked how he should manage a product we didn't know he had! The 3rd today.	Customer History Report	Little visibility available of other lines of service previously bought by customer	Customer History must include their interaction with all Lines of Service	Yes
Demonstrate Products of Interest	Product Description sheets difficult for operator to handle.	The customer kept asking me questions that I could eventually find - now ay of homing in on right part of new service!	Service Description Library and sheets	All Operators seen struggling with this.	Enquiry Type information links into Service Descriptions Service Descriptions accessed quickly in response to key-words.	Yes
Line of Business Manager						
Confirm Total Monthly System Costs/Seat	Doesn't do automated roll-up reports, analyst pulling together ops figures from three sites - different formats.	I need to put one of my staff to do report for a day! - it should be so simple!	Weekly Ops cost report	Common Challenge - different CRM systems being operated LOB Manager really annoyed - keen to see new system helping reduce analysis time and costs.	Standard format for op's. cost outputs from different lines of service and locations.	Yes

Table 4: Extract from Gemba Visit Table for the CRM Project

3.2.6. What does the customer need and how much?



The previous step answered the question 'What do the customers 'actually' say and do?', and now the Blitz QFD® supports the development of a clear understanding of:

'What the customers need and how much they need it?'.

Techniques used to achieve this in support of the Traditional QFD include stakeholder Critical To Quality (CTQ) requirements analysis and prioritisation shown in Figure 6. In Blitz QFD® the process step has been integrated more formally. The verbatims and observations of customers in the gemba are raw VOC data are often a mix of benefits and product features. Other sources of customer narratives such as focus groups and interviews tend to add more to this mix. But, what customers really need is to get their work process done as efficiently as possible. Understanding their current job is a start, but to create a new offering for the customer, we really need to go further and define what their needs are, independent of the current jobs or solutions. Blind acceptance of a feature or solution a customer dictates is just one way to get the job done but may not be the best way. Stopping with the current job analysis is depriving the development engineers of the possibility of finding innovative new solutions that could possibly outperform earlier ones known by the customer. The Customer Voice Table (CVT) is used to translate any form of data from the Customer Process Model and/or SIPOC and the 'Gemba Visit Table' into customer needs as shown to the left of the red column in

Table 5. This starts with the Customer Segment (CS), the characteristics of the CS, the ‘Situations’ in which they need to interact with the system, the problems encountered, and the ‘Needs’ that are revealed through the analysis of the problems.

Customer				Solution Requirements					
Customer segment	Customer characteristics	Situations	Problems	Needs	Characteristics & capabilities	Functional (FR) (architecture & software)	Non-Functional (N-FR) (URPS)	Process / Org. Change	Initial Actions & tasks (service)
Customer - Private - US Professional - 30-40 age group (20%)	Professional, Full Time Employment, Significant Disposable Investment Funds, New Customer	Selected 3 Financial Services Co's, looking for best overall service	Struggling to see clearly differences between services	Customer needs service information presented clearly in way they can compare	Service Information easy to access and compare	Presents information in standard format Allows service info. To be compared	Usability: Easy for customer to compare service profile description Service Catalogue/Flexible Presentation of services Supportability: Supports customer enquiries in all countries/ languages Service Catalogue configuration	Service Description Standards comparison with other Providers evaluated	1.a) Evaluate Optimum Service Description formats & ability to do comparisons - Integrated into Development team 1.b) Spec for Service Desc. To
		Have to fill details/ explain myself repeatedly	System Ops Staff	Customer only has to put in their information once	Single point of entry of customer information - available at all subsequent stages	Customer Data Information Object accessible at all (C,R)	Usability Customer only puts in one set of identification data, doesn't repeat the same subsequent info	Process: Standardisation across Business Units - Customer Data Capture	2) Plan and Run Process and Info Format Standardisation
	Professional, Full Time Employment, Significant Disposable Investment Funds, Existing Customer	Want to look at higher return/ risk services.	Automated system channels customer to existing service area, have to enter same info repeatedly to get to new service area	Customer taken quickly to appropriate area for new services	Menu Hierarchy allows customer to identify their reason for contact early	Reason for Enquiry at top level of menu	Easy for customer to clearly why visiting the site	Customer segment preferences for structure of menu identified	3.a) Run Customer Segment vs Menu Structure Prioritisation Study 3.b) Develop Software to allow possible difference in Structure of menus v.s
		Received several packs of Investment Service Promotional Material - want to stop it	System assumes I'm after service, hard to find area to complain	Enabling customers immediately progressed- doesn't have to re-enter information repeatedly Customer finds easily area where they can express complaints	Customer information checked vs database for all services Complaints handling system is easy to navigate to	Customer centric data storage- interchangeable across lines of business Software Structure takes customer to complaints section, flags to Operations staff	Ensure process design moves information architecture to 'customer-centric' structure Complaints handling process mapping and standardisation change project	4) Ensure Information architecture and storage allows Customer based searching 5.a) Develop Standard Map of Complaints Handling Process	
	Operations Staff - Call Centre (51%)	Call Centre Staff - dealing with Private Customer Enquiries and Complaints	Difficult to capture customer information quickly, not fed through from Web Page enquiry Not clear whether service or complaint enquiry as needs different interview approach Service Information presented is inflexible, difficult to respond to specifics of Customer request quickly	Pre-populated questionnaire and customer history Response Time for enquiries rapid Type of enquiry made clear in summary Service description easily reconfigured to follow customer questions	Information re-used automatically fed forward Reasons for customer contact established at start Service Descriptions rapidly reconfigurable to address customer questions	Information architecture and access control structured to re-use	Questionnaire Structure- Reason a top level	6) Confirm best strategy for matching multiple tasks campaign profile share profiles to set	
								7) Design information modules for access & reuse	

Table 5: Extract from Customer Voice Table for CRM System

To the right of the red column the team identifies the characteristics and / or capabilities required to satisfy the needs. The implied Functional (F-R) and Non-Functional Requirements (N-FRs) are then identified. For IT Projects such as the CRM project, the Non-Functional requirements are further sub-divided into Usability, Reliability, Performance and Supportability Requirements (URPS).

In major IT deployments, a key to success is the planning and management of the process and organizational change components of the programme wherein the issue of changes to business policies, working practices, roles and responsibilities and business rules have to be addressed. At the early stage of development of the CVT, the Process and Organizational Change requirements start to emerge and are captured as a critical requirement set. Finally the initial actions and tasks required to deliver the solution, including services, are developed. The way that these Tasks can be linked and grouped is shown as a set of arrows in the right hand column of Table 5.

Having done the initial analysis of ‘Needs’, they are grouped using the Affinity Diagramming process introduced in section 3.2.2, which results in a Customer Needs Affinity Diagram shown in Figure 15, where customer needs are grouped with related needs, and these groupings are themselves grouped into appropriate headings. This allows the team to understand the structure of the requirements and helps identify ‘missing implied’ needs and supporting requirements, shown in red text.

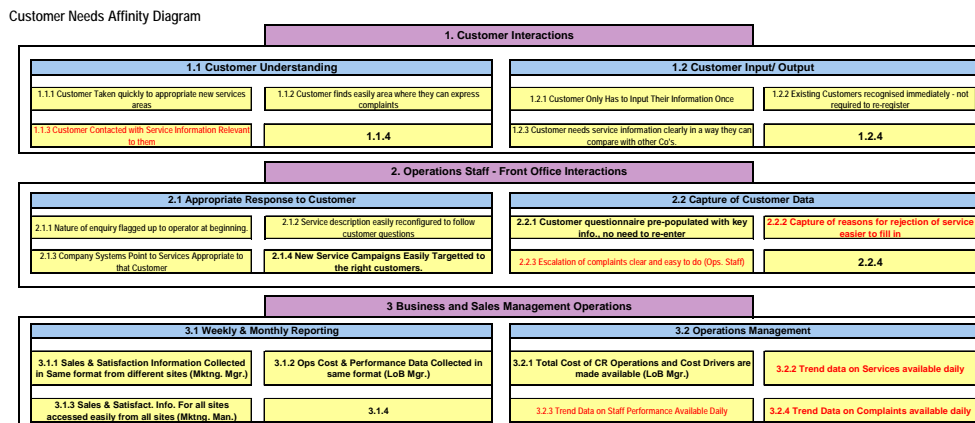


Figure 15: Customer Needs Affinity Diagram

As for the Project Goals, the relative importance of the different levels of the needs hierarchy is assessed using AHP. The summary table for the prioritization of the 'primary needs groupings' and one of the supporting needs groups are shown in Figure 16.

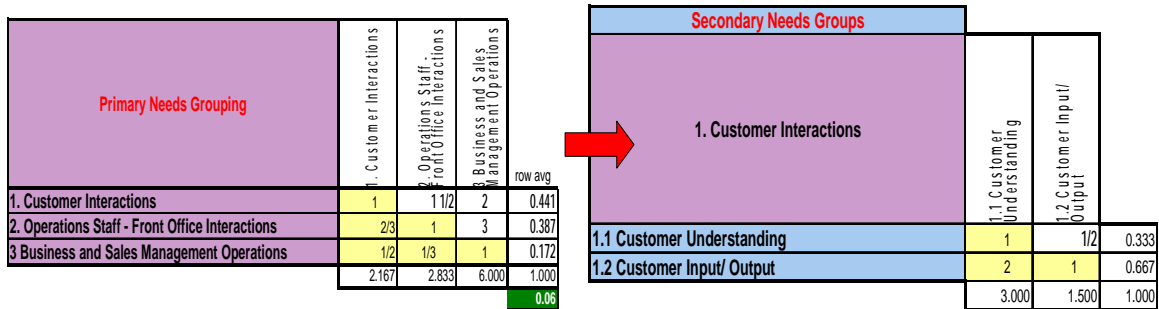


Figure 16: AHP Prioritisation of Primary and Secondary Needs

The results of the AHP prioritizations are shown in the Customer Needs Hierarchy Diagram shown in Figure 17. At each level of the hierarchy a Local Priority or Value assessment is calculated during an AHP Prioritisation workshop with key stakeholders. This allows the team to calculate the Global Value/Contribution of each of the underlying levels of needs to the higher levels. The aim is to calculate the relative importance of the tertiary needs, to understand whether these are significant in terms of further deployment throughout the QFD Process.

The right hand side of Figure 17 gives the Local, Global contributions of the needs, whether it is thought important to deploy these further in the QFD Process, and the re-normalised value of the need in the reduced set being taken forward. Those needs that are not taken forward are put into the design brief for the program i.e. they are captured for development by the design team, but are not subject to further QFD analysis. Alternatively these might be transferred as an interim deliverable. As an example Tertiary Need 3.2.1, 'Total Cost of CR (Customer Relationship) Operations and Cost Drivers are made available', will be needed for the Line Of Business Manager as a key interim deliverable to help them understand the value of moving to the new CRM system. The Business Change Team will need to construct a whole life cost model and show the impact of the new system. As such this is likely to be spun out into a sub-project activity. This might also be developed as a 'functional requirement' i.e. the capability is developed to produce a regular report on Total Cost of Operations.

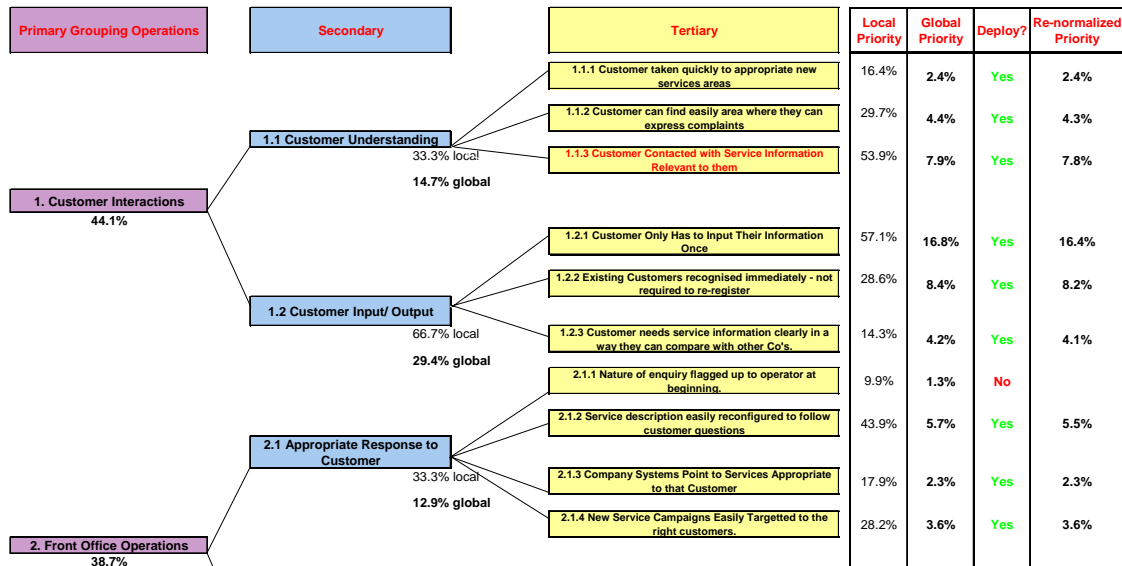


Figure 17: Customer Needs Hierarchy Diagram

The team then develops the prioritized tertiary needs in the Maximum Value Table (MVT). The MVT is a tool that documents thoughts and knowledge, while it structures thinking in an efficient way, as shown in Table 6. The focus is to understand what the priority customer needs are and how those can be satisfied by meeting 'implied' functional (F-R) and non-functional (N-FR) requirements. Historically the matrix QFD approach often started with the premise that the customer needs are understood and documented, and created the 'F-Rs' and 'N-FRs' as the top row of the matrix.

Customer Benefits & Value Description				Solution Design Requirements										Solution Build & Transition to Service Requirements			
Principal Stakeholder/ Customer	Key Problems	Primary Needs Grouping (PNG)		PNG Importance/Order Priority	Non-functional Order Priority	Functional Req's	Usability Req's	Performance Req's	Supportability Req's	Security Req's	Information Req's	Org & Process Dev. Req's	Component Development	Unit & Integration Testing	Technology	TASKS	
		Secondary Level Needs Group. (SNG)															
		Needs															
		1. Customer Interactions		44.1%													
		1.1 Customer Understanding		14.7%													
Customer - Private - US Professional - 30 to 40 age group (20%)	Automated system channels customer to existing service area, have to enter same info repeatedly to get to new service area	1.1.1 Customer taken quickly to appropriate new services areas	2.4%			Menu Hierarchy allows customer to identify their reason for contact early	Multiple Menu, easy to direct to required location. Customer info input once.	Customer Responding Program within 3 Secs	Timely system response whenever customer is		International access to service information. Multi language						High Test International Access Test - Program T. Requirements
Customer finds easily area where they can express complaints		1.1.2 Customer can find easily area where they can express complaints	4.3%			Menu Hierarchy clearly differentiates where service enquiries and complaints are found	Complaints handling Process	Easy to Access: Resources Customer Complaint being local with	Complaints process available 24x 24x - support transfers between time zones.	Critical no leakage of customer complaints	Effective complaints process development					Carry forward into Req'd To Be Completed Process Mapping	
Customer finds easily area where they can express complaints		1.1.3 Customer Contacted with Service Information Relevant to them	7.9%			Information can be analysed to allocate new service against customer segments	Matching function: customer profile vs service descriptions		Personal data secure - doesn't leak elsewhere.		Customer contact managed - avoid initiation					Forward into Req'd Plan Algorithm Dev	
Customer - Private - US Professional - 30 to 40 age group (20%)	Struggles to integrate Sales & Marketing info, to target New Services at Right Customers	1.2 Customer Input/Output		29.4%													
Customer - Private - US Professional - 30 to 40 age group (20%)	Have to fill details explain myself repeatedly to System Ops Staff	1.2.1 Customer Only Has to Input Their Information Once	16.4%			Customer classic interface that detail can be re used for related interaction services	Single sign on function for all Ltd services	Screens personalised to customer		Software refers to data report generation for all cross transfer	Customer core data - standard template - multi national					Single sign on technology	
Automated system channels customer to existing service area, have to enter same info repeatedly to get to new service area		1.2.2 Existing Customers recognised immediately - not required to re-engage	8.7%			Previous history across all areas of service identified at 1st contact										Carry forward into Req'd Single Sign-On	
Struggling to see clearly differences between services		1.2.3 Customer needs service information clearly in a way they can compare with other Co's	4.1%			Industry Standard for 'service descriptions' adapted to allow comparison	Modular design of 'service descriptions' library of descriptions	Descriptions can be arranged easily according to customer priorities	Systems have not simultaneously across all core messages		Service Oriented Architecture Development	Reusable Service Components				Carry forward into Req'd SOA	
		2. Front Office Operations		38.7%													
		2.1 Appropriate Response to Customer		12.9%													
Operations Staff - Call Centre (5%)	Not clear whether service or complaint enquiry as needs different interview approach	2.1.1 Nature of enquiry flagged-up to operator at beginning	9%			All service choices at entry screen	System puts nature of enquiry into 'Operator View' of enquiry	Enquiry type very visible. Allows multiple reasons									Drop into menu team spec. SOA) takes forward in QFD
Service information presented is inflexible - difficult to respond to specifics of Customer request quickly		2.1.2 Service description easily reconfigured to follow customer questions	5.5%			Operator can reconfigure service description in direct asks questions	reconfiguration of service description by Operator										SOA Dev after Req'd

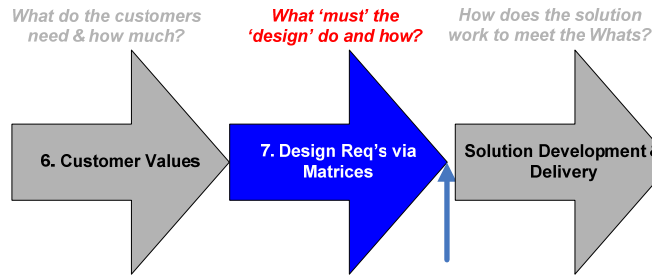
Table 6: Extract from Maximum Value Table for CRM System

The focus here is to structure or architect all major aspects of the solution development such that the 'priority' customer needs are translated into high impact functional, non-functional, organizational change and service requirements. As such this places QFD at the heart of the enterprise transformation process, and directly supports benefits realization.

During the development of requirements it is important to manage the complex interactions and changes of stakeholders, needs, and priorities and two of the authors, Stansfield and Cole, have found this is best achieved using a formal Requirements Management System such as DOORS (ex. IBM Telelogic), see Figure 6. This allows reviews and changes to stakeholder requirements to be managed under change control, allows the many-to-many relationships and traceability between different phases of the Blitz QFD® to be monitored during the whole life-cycle of the programme.

It is useful to be able to depict the customer segment needs and their decomposition into requirements for the sub-components in a matrix format as this provides the 'view on a page' perspective that allows the various teams to focus on their area whilst enterprise architects, program managers, business change managers etc. can view the broader context viz. the matrix provides the 'requirements architectural' views that are critical to programme governance. This will be discussed in the next section.

3.2.7. What must the solution do and how?



In the previous stage the question ‘What does the customer need and how much do they need it?’ was answered. At this next stage the Blitz QFD® process answers the question:

‘What must the solution design do and how must it do it?’

Traditionally this is done using the matrix QFD, the first phase of which is known as the House of Quality, and it was designed to show graphically the transition from the customer needs and desired outcomes to the functional requirements. The output from the matrix was a set of ‘rank order’ design requirements, prioritised in terms of their overall impact on delivering the customer needs. In early applications of the QFD matrix in the West, a relatively quick analysis would be made of customer needs, these would be prioritised using pair-wise comparison and entered into the left side of the matrix. The Traditional QFD House of Quality matrix for the CRM project is shown in Figure 18.

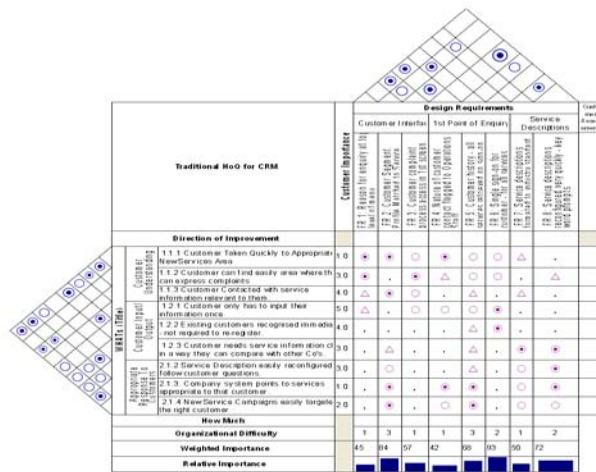


Figure 18: Traditional QFD HoQ for CRM System

The priorities given for the customer needs are based on the values shown in the Maximum Value Table, where the highest value needs are allocated a 5 rating, and the lowest value needs are given a 1. As discussed in section 3.2.3, performing arithmetic operations such as multiplication on ordinal ranking numbers is not valid, but in Traditional QFD matrices, the ranked importance is multiplied by the strength of the relationship with the design requirement, itself a ranked number where the relationship is given a no relationship (0), weak (1), medium (3) or strong (9) value. The result of the traditional matrix analysis shows highest impact design requirement as ‘FR 6 - single sign-on for customer for all services’, with ‘FR 2 Customer segment profile matched to service and individuals’ a very close second. Apart from the non-valid arithmetic operation, the importance rating of the Design Requirements is purely a rank order and does not provide the relative value.

Other areas of the traditional ‘HoQ’ are the correlation matrix for Customer Needs, the side roof, and likewise for Design Requirements, the roof of the ‘HoQ’. These plots where requirements have historically

led to design solutions that conflict i.e. reaching the target for the requirement makes reaching another requirement more difficult. As shown in the Stansfield and Cole paper^[7] these are areas of risk that have to be attended to carefully by program management and design teams. Also shown in the Matrix is a row titled 'Organizational Difficulty', where a rating of '3' is a judgement ranking that this is a difficult Design Requirement to meet, whereas a ranking of '1' is considered easy to meet. This again draws attention to the difficult requirements. It is recognised that these aspects of the traditional QFD matrix are purely visual flags, and do not provide scaled results. Ulwick, Zultner and Norman^[13] have suggested that because of the arithmetic errors associated with the Traditional QFD and because of the lack of structured processes to establish high priority customer needs, that it is time to retire the Traditional 'HoQ', and replace it with the renovated, Modern QFD form of 'HoQ' plus associated tools.

Figure 19 shows the extract of the Modern QFD format of the 'HoQ' that establishes the relative importance of the Design Requirements in meeting the Customer Needs. Here the Importance rating has been replaced with the 'Adjusted Weight', calculated using AHP as a global percentage of the Tertiary needs i.e. the needs are relative and can be multiplied by other relative values. The relationship between the functional requirements and the customer needs is now assessed using the AHP comparison rating, as if the functional requirement helps in an 'extreme' manner in satisfying the customer need it is given a value of '9', and if it is weak it is given a value of '1'. The full scale is shown to the right of the matrix below. The symbols used are standard symbols for cloud cover, where a filled circle represents an 'extreme' relationship.

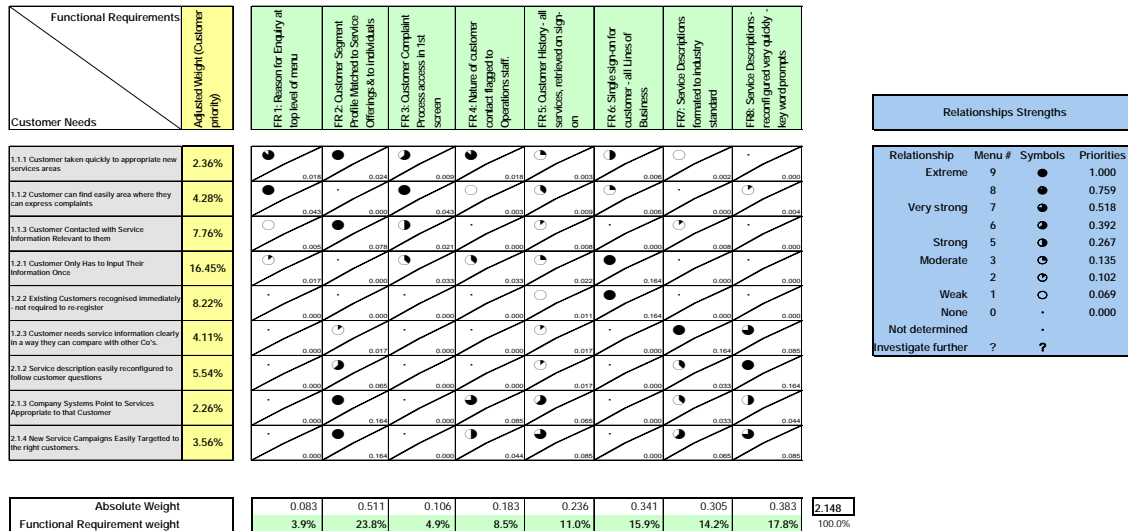


Figure 19: Basic Modern QFD Matrix for CRM System

The result is that Design Requirement 'FR 2: Customer Segment Profile Mapped to Services and Individuals' has the largest impact on the customer needs, at 23.8%, based on the sum of the products of the strength of relationships to the Customer needs times the relative importance of each customer need. The full analysis will also include those Non-Functional requirements identified as important within the Customer Voice and Maximum Value Tables, to understand which 'Usability, Reliability, Performance and Supportability' requirements also have to be met in delivering the priority Functional Requirements. This form of the table is beyond the scope of this paper.

The high priority Functional Requirements will then be flowed forward into further deployment matrices as follows:

[13] Ulwick, Anthony W., Zultner, Richard E. and Norman, Richard, 'Retiring The House of Quality', Strategyn Incorporated and Richard Zultner - Copyright ©2007

- Component Design deployment of the system,
- Reliability Deployment
- Usability Deployment
- Performance Deployment
- Service Deployment
- Cost Deployment

All of these are tailored to ensure that the critical requirements for that aspect of the solution are identified and analysed for understanding of how best they can be addressed in the solution design.

For many IT Systems the functional requirements will be delivered through the use of Commercial Off The Shelf (COTS) application components. To understand the relative benefits of alternative COTS packages in meeting high priority Functional and Non-Functional requirements, the QFD process has a formal design benchmarking assessment step incorporated within the Design Planning Table, the next stage of the process and beyond the scope of this paper. This entails setting the design target specification for the Design and assessing how well competitor products meet or exceed those targets. This is analogous to the Customer assessment and technical assessment areas within the traditional QFD matrix and can be used in the IT System design context to evaluate the suitability of alternative COTS packages, rather than its original purpose to identify whether a competitor product had to be bettered.

The ability of the Modern QFD process to be tailored to assess importance and relative value is part of the beauty of the approach. It allows the team to estimate where most value is to be found and to focus efforts on these areas. The impact of the QFD approach is to unpack complex situations, identify where resource is best applied to bring the desired outcomes from complex design tasks. This capability is demonstrated well by Mazur^[14] applied the QFD approach to target resources onto priority areas for the US homeland Security.

4. Pro's and Cons

The Traditional QFD matrix approach developed in the late 1960s produced a significant improvement in the effectiveness of aligning product designs to the customer requirements. The matrices gave rank order prioritization of customer and design requirements, but were prone to over complication and creation of matrices containing all identifiable requirements. This reduced the effectiveness of the matrices as it resulted in the critical to quality requirements being hidden thereby defeating the objective of QFD. The arithmetic used in the original QFD also meant that relative importance of requirements could not be established – only rank order importance.

Blitz QFD[®] addresses these issues by applying structuring methods to speed up the process of identifying the most important requirements worthy of more in-depth analysis. The Analytical Hierarchy Process is used to ensure that relative importance is established in a rigorous manner, and that requirements are structured hierarchically. The Blitz QFD[®] process encourages the development of the customer voice table in which the priority is to build unambiguous statements about customer needs i.e. it builds the customer priorities into the foundation of the solution development process. For IT System development customers include external and internal operational customer segments, the process being to understand both the recipients of outputs from the IT System and the Users of the System i.e. the approach is both customer and user centric.

Traditional QFD supported with other Six Sigma techniques (SIPOC, CTQ Analysis, Root Cause Analysis, FMEA) and systems engineering (boundary analysis, context diagramming) has delivered some of these goals and improved the alignment of system design with business drivers. Blitz QFD[®] and Modern QFD have provided a more mathematically rigorous approach which allows more focus on the critical requirements i.e. teams can focus on those things that are of high value to the customer and do it rapidly.

^[14] Mazur, Glenn, 'QFD and the Office of Homeland Security', 13th Symposium on QFD, November 2001.

As a result Blitz QFD[®] and Modern QFD provide a more rigorous core to the Design For Six Sigma framework than Traditional QFD.

The emergence of disruptive technologies such as Cloud Computing has brought further emphasis on the need to understand quickly the relative value of customer needs, as the scope for losing sight of business needs in technical complexity has been reduced. The process can be used to ensure that the cloud services are accessed in an effective 'business aligned' manner.

As a result of these developments, it can be seen that Blitz QFD[®] can be used to align IT programs to the business drivers as historically too many programs have failed to achieve this alignment.

5. Recommendations

In Complex IT Systems and Services design, the following processes are recommended:

- Business Goals are often not clearly defined for IT System Designers, but are an important prerequisite for effective Project Goal definition. Modern QFD provides mechanisms for doing this. Time should be taken at the beginning of IT projects to understand the Business Goals and how these have been deployed to the Project Goals.
- Analytical Hierarchy Process and Hierarchy Diagrams should be used by development teams to identify high value requirements i.e. avoid the team wasting effort on requirements perceived by key customers as low value.
- Boundary/ Scope Analysis and Context Diagramming should be used in IT Systems projects to ensure that the scope of development and dependencies are understood by both Customer and Supplier teams
- In many cases the Customer Process Mapping (CPM) used in Product development QFDs should be enhanced for IT Design with SIPOC based process mapping.
- Customer Voice Tables and Maximum Value Tables are key components in establishing the priority of Customer Needs, and these should be extended in IT Systems designs to include likely functional and non-functional (FURPS) requirements.
- The upgraded Modern QFD form of the House of Quality Matrix is an important way of translating the multiple high-priority requirements of key customer segments into solution requirements as it provides an overview for enterprise architecture, project and program management and governance teams.
- Blitz QFD[®] provides a rapid analysis technique to identify high priority goals and requirements for projects. This is vital for selection of projects involving disruptive technologies such as Cloud Computing.

6. Summary

Traditional QFD dramatically improved the effectiveness of the design process in the 1970s and 1980s, the products developed met key customer requirements more consistently, but teams deploying the process built overly large and complex matrices. The QFD process typically started with the assumption that a clear understanding of the Stakeholders and their critical needs had been identified. The Blitz QFD[®] approach has introduced a set of tools which mean that the high priority goals, customer segments and needs are analyzed and integrated into the heart of system design. It provides a more rigorous way of ensuring customer needs form the foundation for design.

When applied to more complex IT System and Service design, Blitz QFD[®] provides a systematic way of understanding customer business value and ensures the high value items are deployed into all areas of the design and development cycle. In the process it provides the basis for both benefits realization and enterprise redesign and transformation.

The Blitz QFD® focus on business critical requirements is essential for ‘game changing’ service provisioning approaches and technologies such as Service Oriented Architectures and Cloud Computing.

Finally and most significantly, QFD provides a rigorous way of aligning IT solutions and services to business drivers. Blitz QFD® allows this to be done in an agile and responsive manner.

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Kim Stansfield has Bachelors, Masters and Doctorate degrees in Metallurgy, Electronic Materials and Aerospace Composite Technologies and Engineering, and is a Chartered Engineer. He started his career in the Composites Group of the Royal Aerospace Establishment (MOD Procurement Executive) in the UK before moving to Lucas Engineering and Systems in the early 1990’s to work on development of an automated design and manufacturing system for complex aerospace components. Here he learned Japanese TQM methods including QFD and process improvement methods to help enhance the design of the manufacturing system, before developing two Systematic R&D services exploiting these methods. He progressed into advanced automotive and aerospace control system development arena becoming a program manager and lead consultant specializing in Design For Six Sigma methods. Subsequently he worked at Northrop Grumman with Jeff Cole on implementing DFSS methods in the design and development of Public Sector IT Systems. In 2007 he joined CSC Computer Sciences Ltd in the UK as a business solution architect and transformation consultant. He is a member of the ISO Technical Committee 69 Subcommittee 8 Working Group 2 to establish a world standard for QFD.

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Glenn H. Mazur has been active in QFD since its inception in North America, and has worked extensively with the founders of QFD on their teaching and consulting visits from Japan. He is a leader in the application of QFD to service industries and consumer products, conducts advanced QFD research, and is the Conference Chair for the annual North American Symposium on Quality Function Deployment. Glenn is the Executive Director of the QFD Institute and International Council for QFD, Adjunct Lecturer on TQM at the University of Michigan College of Engineering (ret.), President of Japan Business Consultants Ltd., and is a senior member of the American Society for Quality (ASQ), and the Japanese Society for Quality Control (JSQC). He is a certified QFD Red Belt® (highest level), one of two in North America. He is a certified QFD-Architekt #A21907 by QFD Institut Deutschland. He is convenor of the ISO Technical Committee 69 Subcommittee 8 Working Group 2 to establish a world standard for QFD. He is an academician of the International Academy for Quality.

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