



Using QFD for e-business planning and analysis in a micro-sized enterprise

Using QFD for
e-business

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Abstract

Purpose – The purpose of this paper is to show how QFD can be used as part of a structured planning and analysis framework for micro-sized enterprises to build-up their e-business capabilities.

Design/methodology/approach – This case study has been produced using a new framework which integrates the balanced scorecard, value chain and quality function deployment techniques into an integrated framework known as the E-Business Planning and Analysis Framework (E-PAF). It has been produced using an action research approach.

Findings – A new framework with a supporting case study is provided. This case study has demonstrated that the framework can be applied successfully to micro-sized enterprises (those with less than ten employees) to successfully plan new strategic and technical developments. This will enhance the online service that the company is able to provide.

Research limitations/implications – This paper presents a single case study. The technical recommendations are currently being implemented.

Originality/value – Such analytical techniques are most commonly associated with large organisations, and are not specifically associated with e-business planning. This paper provides a new framework that will be of general applicability to other similarly sized enterprises that are looking to improve e-business capabilities.

Keywords Quality function deployment, Electronic commerce, Business planning, Small enterprises

Paper type Case study

Introduction

An enterprise (any entity engaged in economic activity irrespective of its legal form. . .(European Community Commission, 2003)) constantly needs to evolve the way it interacts with suppliers and customers and meet the challenges posed by current legacy systems and internal resource limitations. It is imperative that both internal and external factors need to be built into future e-business plans. A well-designed, well-executed e-business plan can send a consistent and positive message out from the enterprise whilst a poorly thought out plan can confuse and even deter potential customers and partners. Therefore enterprises need to be focused and unambiguous in their e-business strategies (Butler, 2000). This is easy to state, but harder to achieve: the underlying question that has driven this methodological development has been: how does an enterprise achieve this using a structured approach in the initial stages of the e-business systems development lifecycle?

Kalakota and Robinson (2001) argued that to meet this challenge, enterprise leaders must not focus too much on the 'e' component, but place equal or more emphasis on the



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business requirements. The greatest threat to an enterprise is, either failing to deploy the Internet at all, or failing to deploy it strategically (Porter, 2001). Enterprises should adopt e-business only if it complements its strategic needs. However, not all e-business mechanisms are right for every enterprise (Lord, 2000). A deadly assumption would be to believe that technology is the answer to all process and strategic weaknesses; in response to this concern this E-business Planning and Analysis Framework (E-PAF) was developed.

Background of the E-PAF

There are many types of analysis frameworks available (Ballantyne and Brignall, 1994). According to Wu (1992) good frameworks should be able to guide managers towards a method or solution uniquely suitable to a particular situation in question. On the whole, frameworks should not be too complex to use and information interaction within the framework should be clear and concise to avoid information overload. Lee and Ko (2000) proposed a framework for strategic business analysis, by integrating SWOT (strengths, weaknesses, opportunities and threats), Balanced ScoreCard (BSC), Quality Function Deployment (QFD) and "Sun Tzu's the art of business management strategies" techniques. In a similarly proposed framework, Lee *et al.* (2000) integrate the SWOT (de Witt and Meyer, 1998), BSC, QFD and the Malcolm Baldrige National Quality Award's (MBNQA) education criteria, to formulate policy for vocational education in Hong Kong.

Whilst many analytical techniques such as the SWOT, SLEPT (Social, Legal, Economic, Political, Technical) and the BSC analyses can be used to identify the strategic needs of an enterprise, none provide a direct mechanism to prioritize the needs and convert them into operational processes, or to translate those processes into a technical specification that can be used to develop or acquire supportive software systems. In contrast other analytical techniques, such as Porter's Value Chain Analysis (VCA) (Porter, 1985) can facilitate the analysis of processes within a company but does not provide an easy mechanism to link these to high level business objectives. One analytical tool that does provide the ability to convert high level business objectives ("what" the business stakeholders want), into processes ("how" the business delivers those "whats") is QFD, which has had its benefits discussed widely by Akao (1972), Mazur (1992) and more recently by Ko and Lee (2000), and Lee *et al.* (2000). However, QFD has its own weaknesses as it does not explain how the "whats" and the "hows" should be initially generated (Tan *et al.*, 1998). The analytical framework presented in this paper deals with these weaknesses by integrating QFD with two other complementary analytical techniques, the:

- (1) BSC to generate a set of high level business objectives, targets, measures and initiatives for finance, internal operations, learning and growth and customer satisfaction. The outputs from this analysis (including the weightings) become the "whats" in the initial QFD analysis.
- (2) VCA to generate detail operational processes. The outputs from this analysis become the "hows" in the initial QFD analysis.

The relationships between these are summarized in Table I. Through the complementary use of the BSC, VCA and QFD a comprehensive yet easily

	Balanced scorecard (BSC)	Analysis technique	
		Value chain analysis (VCA)	Quality function deployment (QFD)
Primary purpose	Establishes strategic objectives	Establishes the high level logic of the value adding activities within customer facing business processes	Analyzes and manages the trade-off between business objectives (“whats”) and business processes (“hows”) and deploys these to lower levels of definition for detailed systems design
Main strength(s)	Sets high level business vision	Defines high level value adding activities (primary and secondary)	Can deploy high level objectives and processes (e.g. users’ requirements) into detailed tasks and systems requirements
Main weakness(es)	Difficult to translate these into detailed processes or system requirements	Does not generate high level vision. Difficult to translate value adding activities into system requirements	Difficult to generate initial business vision and high level value chain

Table I.
The three techniques of the E-PAF

understandable E-Business Planning and Analysis Framework (E-PAF) has been developed.

The E-PAF methodology

An eight-step approach is developed for the application of the E-PAF (see Figure 1) in businesses (Tan *et al.*, 2004). The eight steps are identified as:

- (1) Using BSC to develop “whats” for QFD Matrix I.
- (2) Using VCA to develop “hows” in QFD Matrix I.
- (3) Completing correlation of “whats” and “hows” in QFD Matrix I
- (4) Identification of critical business processes from QFD Matrix I
- (5) Inputting critical business processes to the “whats” of QFD Matrix II
- (6) List of potential candidate e-business applications to support the “hows” in QFD Matrix II
- (7) Completing correlation of “whats” and “hows” in QFD Matrix II
- (8) Identification of critical e-business applications from QFD Matrix II.

The research methodology for undertaking the eight steps towards building the selection framework is discussed in more detail in Tan *et al.* (2004) (note that more detail of step 1 is shown in Table II and more detail of step 2 in Tables III and IV). The case study presented next will outline how the framework has been applied to itCMP Limited. It should be noted that the E-PAF (Figure 1) is an essential part of the initial “analysis” stage of a systems development lifecycle project. The remaining stages being the “logical design”, the “physical design”, “testing”, “implementation” and “maintenance” which are not discussed in this article.

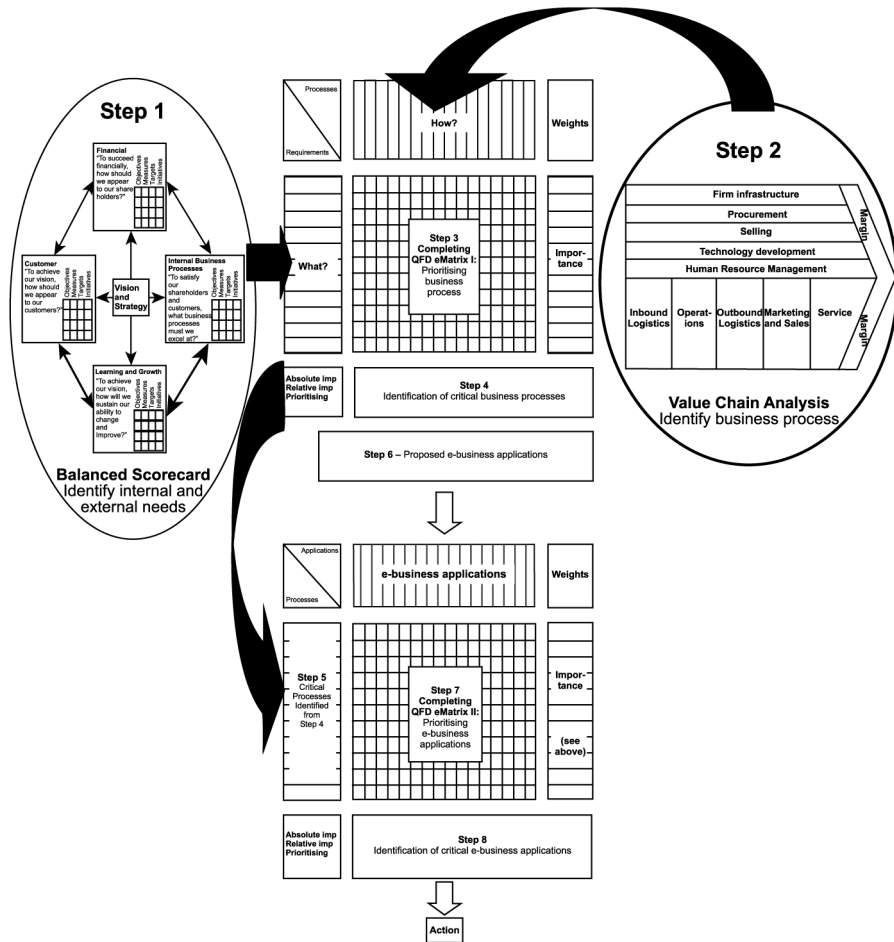


Figure 1.
E-business planning and
analysis framework

E-PAF in action: itCMP case study

This is the first published account of the E-PAF being successfully deployed in a micro-sized enterprise (defined as an enterprise employing less than 10 people and whose annual turnover is less than €2 million (European Community Commission, 2003)). itCMP Ltd. has been in business since 1997 employing one full time and several part-time (between five-ten) IT contractors; it provides IT project and management services in Northern UK. The company's website was created in 1998 to present a professional looking point-of-presence on the internet and to enable B2B e-mail communications with clients, agents and suppliers. itCMP has a fairly compact technology infrastructure comprising an office desktop and laptop PC, both running Microsoft XP and Office XP applications. The office desktop and a laser printer are networked into a LAN hub which also provides wireless broadband high speed Internet access. The laptop connects securely into this network via encrypted wireless communications (i.e. to synchronise with the office desktop PC and to access the

Objectives	Measures (increase or decrease)	Target/initiative	Importance (1 low, 5 high)
Financial			
Create new revenue stream via the Internet	Number of direct sales from website	30 downloads per month after 12 months 1. Search engine promotions. Advertise document library on e-Bay	5
Minimise operational costs	Annual charge from service provider	No increase in annual service charge. Reduce the amount of re-work and new graphics 1. Negotiate 3 year service (as opposed to current rolling 12 months contract)	3
Customer			
Increase the number of hits on the website	ISP monthly web stats	20 per cent increase over next 12 months 1. Search engine promotion 2. Reciprocal links with Associates	4
Achieve high customer satisfaction	Number of complaints	Zero complaints per month 1. Ensure clear and concise information on the website 2. Provide on-line feedback page (Contact Us), FAQs	5
Create customer loyalty and delight	Repeat visits	50 per cent of sales from existing clients 1. Develop a CRM database about key clients 2. Conduct satisfaction surveys 3. Develop auto responding email capability to identify keen clients	3

(continued)

Table II.
BSC analysis of itCMP

Objectives	Measures (increase or decrease)	Target/initiative	Importance (1 low, 5 high)
Internal business process	Website content always topical	Changes uploaded within 1 week 1. Review process for updating and uploading new and amended pages	4
	Ensure documentation quality	Zero spelling or grammar errors in documents 1. Spelling check documents 2. Peer review documents for grammatical errors and ease of interpretation	5
	Webiste and email availability	99.9 per cent availability 1. Outsource the website as a managed service	5
Learning and growth	Reduce reliance on 3rd party developers	2. Implement virus and spam scanning protection Ability to perform basic text changes to a webpage 1. Attend training course in basic introduction to web authoring	4
	Collaborate with associates to expand the document library	10 new documents added each month after 6 months 1. Establish quality of associates documentation and obtain as appropriate	4

Note: itCMP Ltd – Mission statement: “To be perceived by our customers, as a consistent supplier of high quality IT project management and consultancy services and solutions”

Table III.

Value chain analysis of itCMP

Secondary activities	
Infrastructure	Office desktop, laptop and laser printer, networked via broadband wireless router providing local (secure) LAN and internet access
Human resource management Technology	No internet development type skills "in-house" Website development and hosting outsourced as a fully managed service to a 3rd party ISP, with defined serviced level agreements
Procurement	No supply-side or sell-side e-commerce capabilities in place

printer). The desktop PC runs a bespoke accounting package which exports Microsoft Excel formatted data that is emailed to the company accountants. All company banking is transacted online, as are PAYE/NIC payments to the Inland Revenue and VAT returns/payments to HMC&E. Very little correspondence is done via paper and the company is dedicated to further developing e-business capabilities.

The management are currently looking at upgrading the current website as a cost effective investment to build competitive advantage. However, itCMP did not have the level of technical and socio-business knowledge to make an informed decision on which applications and functions to further implement. Therefore, the authors were approached by itCMP as action researchers to advise in the selection of either suitable e-business functions or applications. By using the E-PAF the authors were able to identify the critical e-business processes and functional applications; consider both the internal resource and external environmental situation of the company, and align its e-business strategy with its overall business vision.

To understand the general factors affecting micro enterprises in the IT industry, a "PEST" analysis of the macro environmental influences was done as seen in Table V. A Porter's "Five-forces" analysis of the IT Contractor industry that itCMP operates in was also done to assess the extent of competition for any prospective new entrant to this market (see Table VI). In Table VII, a "SWOT" analysis of factors affecting itCMP in terms of its resources and capabilities is shown.

All the above pre-analysis shows the industry to be highly competitive. This means that itCMP must have a clear understanding of its systems development lifecycle, particularly in the initial stages. Each step of the E-PAF is now explained further using itCMP as an example.

Step 1: Balanced scorecard

The balanced scorecard is a performance measurement system that uses a company's mission statement to develop business objectives under: "customer", "internal business process", "financial" and "learning and growth". The balanced scorecard analysis for itCMP Limited is shown in Table II.

Step 2: Value chain analysis

Concurrently to the BSC analysis being performed a value chain analysis (VCA) was also generated for itCMP. The "value creating" processes for itCMP are listed in Tables III and IV.

Table IV.
Value chain analysis of
itCMP

Inbound logistics	Operations	Primary activities Outbound logistics	Sales and marketing	Service
<p><i>Emails from:</i></p> <ol style="list-style-type: none"> 1. Agencies and employment website portals (job adverts) 2. Accountant in receiving business financial information 3. Associates in receiving technical information 4. Client in receiving queries, requests <p><i>Post from:</i></p> <ol style="list-style-type: none"> 1. Invoices and other business literature received in the post 	<p><i>Process email:</i></p> <ol style="list-style-type: none"> 1. Updating CV using word processor application 2. Extracting financial information for the accountant from the standalone company accounts system <p><i>Process post:</i></p> <ol style="list-style-type: none"> 1. Packaging post for onward distribution to the accountants 2. Updating the company accounts system (e.g. invoice received) 	<p><i>Emails to:</i></p> <ol style="list-style-type: none"> 1. Agencies and employment website portals (CV's) 2. Accountant in sending financial information 3. Associates in sending technical information 4. Clients in answering queries, requests <p><i>Post to:</i></p> <ol style="list-style-type: none"> 1. Accountants (i.e. HMC&E, IRD documents and original expensed receipts) 2. Agencies (i.e. signed "paper" contracts and timesheets) 	<ol style="list-style-type: none"> 1. Export of CV to agencies and intermediary employment website 2. Common branding (logo) on all company correspondence 3. No website search engine promotion 	<ol style="list-style-type: none"> 1. Follow-up on contract opportunities and agencies via email 2. Prompt response to client queries received, (followed-up by a phone call or second email)

Political	<p>To counter the increasing number of business start-up failures of Small to Medium Enterprises (SMEs), the Government has launched several “small trader” advisory and investment support schemes. Grants from government backed organisations such as Business Link specifically target small “owner managed” entrepreneurial type businesses with the aim of encouraging use, and development, of commerce via the Internet. These initiatives can prove invaluable in ensuring that any investments made in e-commerce have been validated by business experts, and are properly defined to ensure expected benefits are delivered</p> <p>The government is also reacting to labour reforms emerging from within the European Community (i.e. minimum wage and working hours) that require businesses to review how they utilise their labour resource. This has implications which could influence where organisations choose to procure their IT developments</p> <p>Most enterprises are reviewing their technology operations against outsourcing or re-engineering strategies to ensure the optimum effectiveness for their business. This is constantly being driven by a variety of factors, such as globalisation (mergers and acquisitions) and the general state of the national economy. As a consequence, the IT industry is in a constantly changing state which has perpetuated a healthy demand (in excess of supply), for IT Project Management resources</p>
Economic	<p>The development of the European Union has shattered the demographic trends that have stood for many generations (i.e. each following the previous into the same local employment). Europe is seeing an explosion of labour migration between countries and national boundaries dissolve and people no longer consider employment in the locations they were born in, but rather in the technologies they are skilled in irrespective of the employer’s location. Similarly, recent IT developments have enabled organisations to revolutionise the utilisation of employees, through the introduction of home and peripatetic working, enabling significant cost savings by reducing the office accommodation required to otherwise house these employees</p>
Socio-cultural	<p>The Internet provides enormous potential for businesses to exploit by enabling access to a global market through a single channel – a web browser. Customers are increasingly using the Internet to seek information on products before they make their purchases; even comparing supplier prices to determine which supplier to purchase from. The Internet has equally fuelled the transient nature of people within the IT industry, with instant access to online intermediary websites</p>
Technological	<p>advertising global employment opportunities</p>

Table V.
PEST analysis of itCMP

Steps 3-8: QFD matrices

The BSC and VCA are combined in the QFD I matrix to establish the extent that each business process supports the company objectives. This is shown in Figure 2. From the QFD I analyses of the interrelationships between “whats” and “hows”, the top three critical business processes identified to delivering customer needs were:

- (1) Update document library (score = 541.5) ranked first. This important is critical in keeping an up-to-date library of documents that are also accurate, and readily available when required.
- (2) Export CV to employment websites (score = 409.8) ranked second. This is a sales and marketing process mainly looking at making itCMP known to companies in the market shopping for IT contractors providing IT project or management services.

Threat of new entrants – low/medium	itCMP operates in the IT Project and Service Management contract market. Clients in this market often stipulate specific management qualifications (e.g. Prince2, APM, ITIL) and always require experiential evidence of successful delivery, (validated by previous employer references). Furthermore, clients typically retain existing contactors on completion of assigned tasks, to undertake new project assignments in order to benefit from the knowledge that the contractor has gained within the client's business
Competitors – low	itCMP operates in a highly specialised market. However, demand has remained constant, as the real competitors are the more expensive consultancy firms. Consequently, IT contractors are often seen as a cheaper alternative, and fulfil a niche sector in the marketplace
Potential substitutes – low	Businesses are always adapting to new market conditions and opportunities. As a consequence, there will always be a requirement to manage organisational change. Those firms that remain static tend not to succeed in the long term
Power of the buyers – medium	The contract/consultancy market exists purely because organisations do not have the required skills in-house. IT contractors are seen as the cheaper alternative to consultancy organisations and in that respect, IT contractors are constrained by the extent to which they can dictate their rates
Power of the suppliers – medium	IT contractors can have some influence on their contracted rate, depending on the business criticality and urgency of the task being engaged for, and the extent to which the client already has similar contract resources on their books

Table VI.
Porter's "Five-forces"
analysis of itCMP

- (3) Email and attachments (score = 392.7) ranked third. This process is important to provide a link with the agencies and employment website portals (job adverts). Accountants can also use this business process to receive financial information, while associates can make use of this process to gather technical information. Customers can also send in queries and requests through email (and attachments).

Further analysis is performed in the QFD II matrix to establish how much each proposed software functionality (or solution) supports the critical (higher scoring) business processes (see Figure 3). Blank rows and columns are shown in Figure 3 for methodological continuity purposes (so the analysis is easily followed on from QFD I). During the analysis it is just as important to show what is not supported by a proposed solution, as well as showing what is supported by a proposed solution.

A summary of the QFD II outputs are now detailed in terms of software application and/or functionality and the business process that it supports:

- (1) Information always accurate and up-to-date functionality (supporting the content updating process), which is ranked first with a score of 483.7:

Strengths and weaknesses	itCMP's strength is its portfolio of successful engagements with Blue-Chip clients. It offers an experienced capability that is not as expensive as a large consultancy. However, this is also its weakness, in that itCMP is perceived as a contracting company and, therefore, unlikely to be considered for more lucrative high-value consultancy work which it is well capable of performing. This constrains the growth and turnover potential that can be realised by the company
Opportunities and threats	The main opportunity for itCMP is to collaborate with other successful contractors and undercut consultancies for the more lucrative fixed price consulting work. This is a high risk strategy requiring up-front investment, but would enable the transition into a higher turnover and profit margin bracket. This strategy counters the main threat to contractors, which are the consultancy firms who often engage with a client to perform a broad range of IT management functions and in so doing, remove the existing contract workforce. Additionally, new government tax legislation negatively affects "owner managed" organisations such as IT contractors that do not operate multiple revenue generating channels. Consequently, it is of interest to itCMP to develop an e-commerce capability, to show evidence of entrepreneurship

Table VII.
SWOT analysis of itCMP

- procedural change to the current process for web site page updates; and
 - changes required to the internet service agreement with the external internet Service Provider (ISP) to give client control over content upload.
- (2) Shopping cart functionality (supporting purchase from an online documentation library process), ranked second with a score of 456.3:
- an online IT project and service management document library; and
 - using the *de-facto* internet "shopping basket" and "proceed to checkout" database approach for query, selection, purchase and download of documents.
- (3) Anti-virus functionality (supporting the security control process), ranked third with a score of 412.1:
- anti-virus software installed in the ISP environment, to provide a barrier protecting the itCMP LAN environment (i.e. desktop PC and laptop); and
 - detection and resolution of virus incidents before they enter the itCMP environment, via an extension to the existing ISP service agreement.
- (4) Administration update facility (part of the online document library process provision), ranked fourth with a score of 175.3:
- provision of controlled access (for registered associates) to enable transfer of new documents into the online documentation library.
- (5) Anti-spam functionality (supporting the security control process), ranked fifth with a score of 163.4:

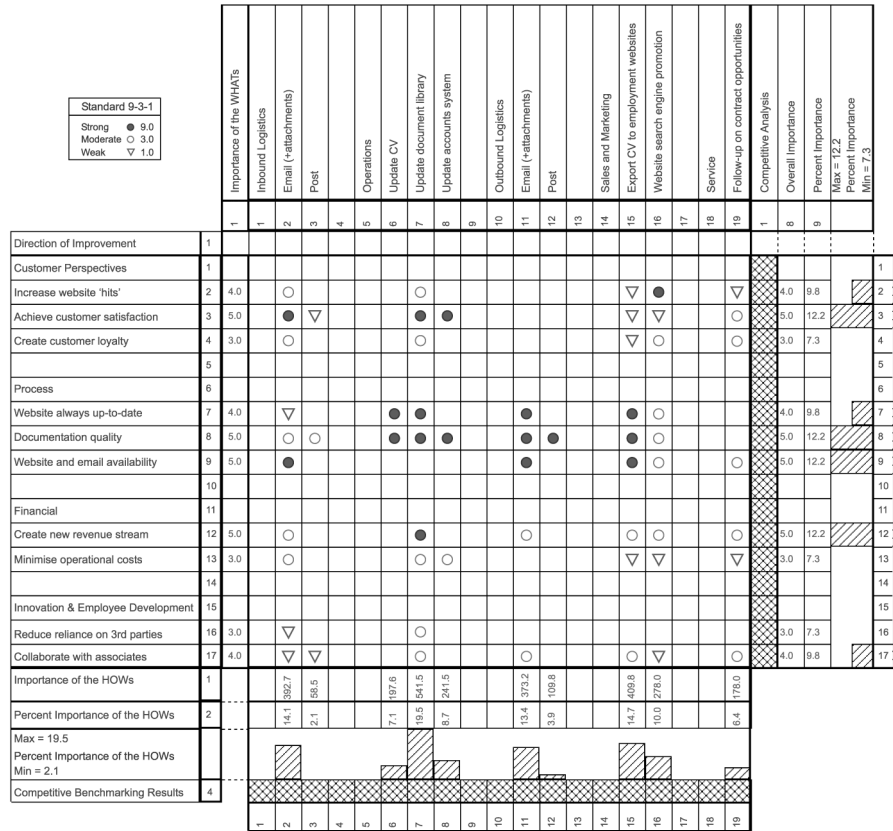


Figure 2.
QFD I matrix: itCMP
business objectives and
key business processes

- anti-spam software installed in the ISP environment, to filter unsolicited email, improving the responsiveness to clients, agencies and associates; and
- detection and eradication of spam email before they enter the itCMP environment, via an extension to the existing ISP service agreement.

Once the initial analyses phase has been conducted the next phases of the systems development lifecycle can commence. This will start with the logical and physical design of the system, defining what will be outsourced to external vendors and what will be developed in-house.

Managerial implications

The investment in an e-commerce capability offering digitised products (such as with the documentation library), has enormous market potential for itCMP. By re-using the knowledge already gained from the contracting operation, itCMP is effectively exploiting an existing capability to open a new revenue channel without significant investment risk to the overall business operation. In addition, revenue generated from

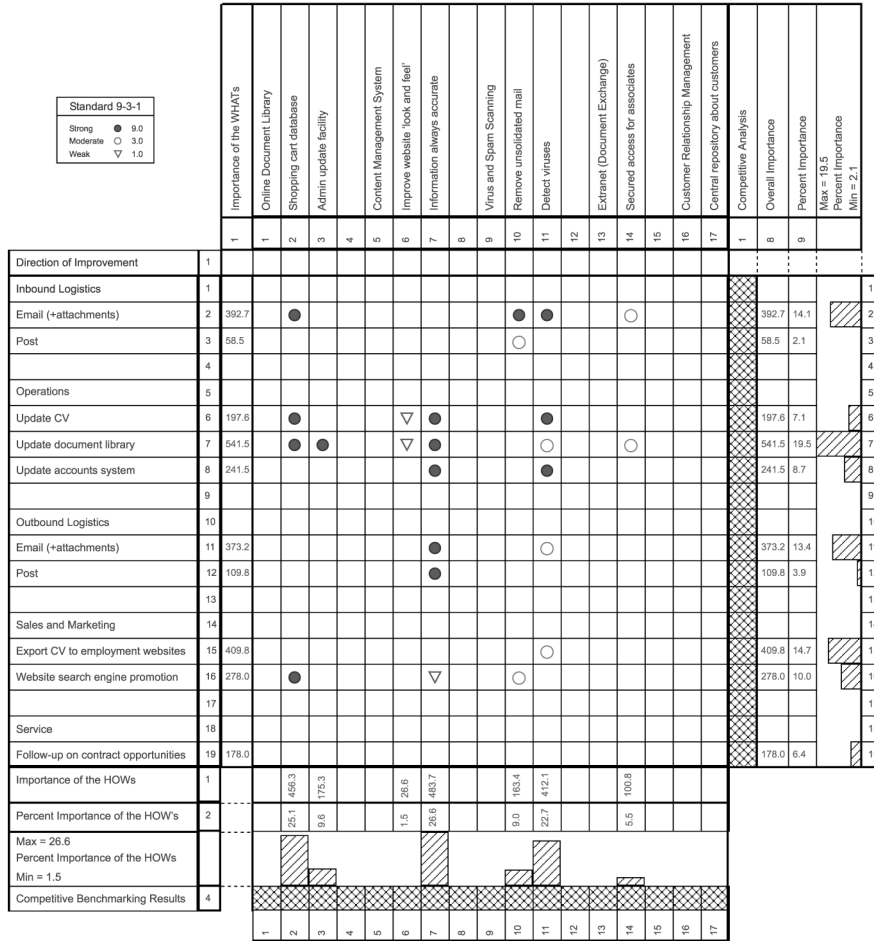


Figure 3. QFD II matrix: itCMP Key business processes and candidate e-commerce functions/solutions

the document library will alleviate pressure on the company's main revenue stream during "out-of-contract" periods, and also provide an ongoing low maintenance source of income.

The document library should be reviewed regularly to determine its performance and potential expansion to include other functional management areas (such as templates for managing systems development project using open source methodologies). Again drawing on the knowledge and experience gained from the contracting operation.

The main recommendation from the analysis is that itCMP develops an e-commerce capability on its website, by transforming the knowledge it has acquired from its core contracting operations, into a document library of IT service and project management templates that can be purchased and downloaded online. The merchant "shopping basket" approach is a common method for purchasing on most popular websites, and

should be adopted to ease the consumer experience of browsing the proposed document library.

As a result of the analysis, it was clear that the relationship between the ISP, the web development company, itCMP and its associates had to be renegotiated and the roles redefined. Therefore:

- The ISP now had to provide interactive services (e.g. payment transactions) and increased service.
- The web site developer retained the responsibility for the overall look, feel and structure of the web site; but in addition they were to provide anti-virus and anti-spam capabilities as part of the service.
- itCMP employees had direct access to the text content and document library on the site. Also, a secure online admin facility (using a username and password login) was developed and made available to trusted associates (e.g. part-time contractors) for uploading their own documents into the documentation library, this was part of a formalised agreement with the associates to address copyright and commercial issues.

It is interesting to note that results of the case study do not recommend the development of an extranet facility (i.e. a common/shared data area on the website) for use by clients, agencies or associates, as no real business benefit can be identified from such a facility at present. Equally, this business case does not support adoption of any substantial “off-the-shelf” software solutions such as an online content management system (CMS) or customer relationship management (CRM) capability as such developments are presently prohibited by both cost and payback (as more content still needs to be developed). Any CRM-type activity can currently be handled by mailing software (e.g. Microsoft Outlook).

Conclusion

It has been shown by this research that micro-sized enterprises like any other sized enterprise, need to continuously develop their online e-business capabilities (Southern and Tilley, 2000) in order to realise tangible benefits (Poon and Swatman, 1999). It is not sufficient to merely maintain existing technologies, applications and business models. It will be necessary to continually assess changing customer requirements and competitor performance against incumbent practices and systems. It has been shown by this action-based research that business developers using this E-business Planning and Analysis Framework (E-PAF) can capture the business vision, standard operating procedures, and deploy them down into technical requirements that are understandable by information systems designers (both in-house and external). As the speed of change constantly accelerates, technological solutions become more proliferated, and inter-and intra-business connectivity requirements become increasingly more important, the need for such frameworks will increase.

In conclusion this article draws together three well established management and design tools into an integrated e-business planning and analysis framework (referred to as E-PAF) to help develop e-business capability maturity levels. None of these tools alone meet these needs, but together they have proved to be very successful. Hundreds of examples have been produced from a combination of industrial projects, consultation and research assignments (Clegg and Tan, 2006).

The itCMP case presented has been taken from an action research project conducted with a micro-sized enterprise in the IT service industry which formed the initial “analysis” stage of a standard systems development lifecycle for the company. Previously, the E-PAF has been applied successfully in the manufacturing sector; in both large and small enterprises in numerous countries. This paper proves that the E-PAF is equally well suitable to developing solutions for micro-sized enterprises that operate below the economic scale of “off-the-shelf” specialist e-business software solutions.

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