The Theory and Development of a Relationship Matrix-based Approach to Evaluating e-Marketplaces

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INTRODUCTION

The need for research in this area was driven by the lack of high quality existing academic material being currently available on the important factors to consider when evaluating an electronic marketplace (e-marketplace). It was felt that such a crucial decision, involving significant investment in planning and resources, should be supported by more comprehensive literature and study data, in order to assist in a better educated business decision.

Linder and Cantrell (2000) argued that existing frameworks are not sufficient to describe the rich array of new business model choices now facing managers in these electronic business environments. In particular decision makers have the difficult task in assessing the range of proposed models in order to determine those that are most suitable. It was felt that there was a genuine business need for the development of some kind of framework or system, for assisting in the successful adoption of the most suitable e-marketplace, for companies with specific requirements, at the right time, for realistic business benefit at the right cost.

This paper chronicles the background work undertaken in the area and discusses the development of an interrelationship matrix-based approach for evaluating the suitability of an e-marketplace’s range of services to an established set of customer requirements. A definition and brief history of e-marketplaces are illustrated, utilizing literature review findings, followed by an account of the two areas of case study and the reasons supporting their selection. The application of the findings of this work, in addition to the background behind the technique of Quality Function Deployment (QFD), is then described as the relationship matrix-based approach tool is developed and subsequently tested.

A DEFINITION AND BRIEF HISTORY OF ELECTRONIC MARKETPLACES

The relative immaturity of e-marketplaces and the significant amount of change that has occurred in their short existence has resulted in there being no widely accepted definition of what constitutes an e-marketplace (Daniel et al. 2004). Depending upon the line of investigation followed e-marketplaces can be found to be defined as many different entities. Definitions can vary from
Greiger (2003) defining an e-marketplace as being ‘that which usually brings buyers and suppliers together (in a “virtual” sense) in one central market space and implicitly involves trade financing organizations, logistics companies, taxation authorities and regulators’, to Bakos (1997) and his more buyer–seller orientated view of an ‘interorganisational information system that allows the participating buyers and sellers in some market to exchange information about prices and product offerings’. Nairn (2000), on the other hand, describes an e-marketplace as ‘a Web site that allows businesses to buy and sell industrial products and services using a standard web browser’.

The Federal Trade Commission (2000), however, delivers what would be a widely accepted notion of an e-marketplace, with their definition of: ‘a distinct system of suppliers, distributors, commerce services providers, infrastructure providers and customers that use the Internet for communications and transactions’.

Since the late 1990s the information technology world has experienced what can only be described as an incredible period of revolution. The concept of sharing information and knowledge electronically, without the need for expensive software at the user end, became a reality, and the boundaries of its possibility were limitless. Companies would come to adapt this new capability to enable them to conduct business-to-consumer (B2C) transactions, creating brand new revenue streams and a means for increasing market share, and there the world of electronic business, or e-business, was born. e-business itself can be defined as being the application of Internet technology toward the automation of business transactions and workflows (Kalakota and Whinston 1997).

A natural progression of this capability was for companies to start interacting with other companies in a similar manner, making business-to-business (B2B) transactions, simultaneously improving the speed and accuracy of communications, and providing the potential for the kind of levels of collaboration not possible before. B2B e-commerce can be defined as an enterprise conducting business with another enterprise/enterprises over the Internet. If this kind of interaction is done on an individual ‘one-to-one’ basis, then there is no requirement for an e-marketplace environment. However, if many enterprises go to one website to do business with one another, on either a ‘one-to-many’, ‘many-to-many’, or ‘many-to-one’ basis, then the website is considered as acting as an online exchange or e-marketplace.

To establish the origins of e-marketplaces best, it is necessary to examine earlier attempts to automate the supply chain. According to research from the PRIME Faraday Technology Watch (May 2001) the first of these was electronic data interchange (EDI), where orders, invoices, material releases and delivery information, usually for core products and raw materials, could be transmitted via predefined, inflexible and often expensive messaging systems, tying the purchaser to traditional client/server technology. EDI technology quickly established itself as an effective way of conducting business on a global scale, enabling much closer integration throughout the supply chain, between the successive stages of manufacture and distribution (Holland 2002), supported by the belief of Rayport and Sviokla (1995) that the extent of collaboration between the separately owned companies constituted a virtual supply chain that behaved as if it were owned by a single organization. EDI was later superseded, in many cases, by self-service electronic procurement, which allowed authorized staff to buy non-core products via electronic catalogues, often accessed through an internally managed intranet.

However, what really facilitated such a giant leap in this area, from EDI to an environment of seamless integration between customers and suppliers, without the need for extensive investment in hardware or software, were the advances experienced in Internet technology. The Internet brought into existence a common medium, for the first time, capable of hosting a seamless web of information and transactions, between a limitless number of users.

There grew considerable interest in the new Internet-based applications that were appearing by the late 1990s, such as early e-marketplaces, particularly as a means for information exchange between companies, and the number of these e-marketplaces emerging up grew dramatically between 1999 and 2000 (Schram and Sexton 2000). In fact, according to a study by Laseter et al. (2001), there were already a total of 2,233 e-marketplaces in existence by 2001.

The evolution of these B2B e-marketplaces arrived in three distinct phases:

1. In 1999 the first phase of e-marketplaces to appear were those established by independent startups, with low-cost connectivity to the Internet fuelling the boom, offering both standardized products and technologically advanced legacy procurement systems. These were characterized by multi-industry B2Bs VerticalNet, and FreeMarkets, as well as the chemicals industry’s Chemdex.

2. The second wave, around 2000, involved independent exchanges offering equity stakes to large buyers and sellers as incentives to trade through them. At this point many of the first generation of independent electronic marketplaces, set up by entrepreneurs, would typically exclude the equity participation of industrial companies that formed their trading base, to preserve both their neutrality and ownership.

3. The third stage of the e-marketplace evolution story involved large industrial companies either developing their own private e-marketplaces or joining up
with industry partners to create consortium e-marketplaces (Harting 2000).

The early e-marketplaces were propelled to the forefront for investors on the strength of hugely inflated stock valuations for the dot-coms at the time so, after the collapse of the stock market in 2001, growth in the area halted dramatically and many were soon to fail.

Despite these failures other e-marketplaces have still managed to flourish. Research has found that financial performance is often considered to be the primary performance indicator of e-marketplaces but other, non-financial, measures such as improved processes, innovation, growth and improved customer satisfaction can also be considered as important contributions to performance (O’Reilly and Finnegan 2003, 2005). Covisint has been in operation for four years now and forecasts record annual revenues, of between $90 and $100 million for 2006 and 2007, as it expands its presence in Europe and Asia (CrainsDetroit.com 2005).

It has, however, experienced much change in this period, with the auction section of Covisint’s original business being sold to FreeMarkets in January 2004, followed shortly by Compuware procuring their remaining products and technology in March of the same year (B2B News 2005).

Another success story of this era, Transora, a leading consumer products community for eCollaboration, with retailers in 22 countries, has also recently agreed in principle to unite their operations with The Uniform Code Council (UCC), a US-based data pool that offers data synchronization services that enable trading partners to exchange accurate, standards-compliant data (Barlas 2005), with the combined entity to be led by Transora and to operate as a subsidiary of the Uniform Code Council, thus providing a further example of how business models in this field can change.

Although the failure of some of these e-marketplaces, and the success of others, has led to a state of some confusion, particularly for those companies looking at joining such ventures, the e-marketplace concept still remains valid for many businesses, particularly due to the way it relates to the supply chain, adding value to supply chains on a business-to-business basis rather than directly to consumers. Benefits can still be gained from the increased efficiencies in product availability, price, delivery and inventory management that e-marketplaces provide. In B2B e-marketplaces, businesses, as opposed to consumers, are the customers.

A couple of approaches have been offered for assisting with e-marketplace selection already, notably Stockdale and Standing (2002) with their content-based approach, and the multi-criteria process presented by Büyükozkan (2004), including such methods as fuzzy AHP and criteria weighting. These theories certainly have their own level of value and impact in this field but are not currently in any such condition whereas they could be taken and immediately applied by companies looking to join or develop an e-marketplace.

Hayes and Finnegan (2005) also offered a framework to assist decision makers assessing e-business models. The approach is very broad based, however, and considers everything from e-shops and e-mails right up to e-hubs and collaboration platforms. It proposes that the derived framework may increase an organization’s chances of choosing the appropriate e-business model simply by helping towards identifying a shorter list of models for full assessment, and not through matching requirements to service availability. However, no case applications or empirical testing has been included, to support this framework, at this time.

Material specifically covering the design of e-marketplaces was also found to be in short supply. Yu et al. (2002) offer a three-stage business strategy for evolving e-marketplaces that considers factors such as the competitiveness of e-marketplace operators and the three stages of service in an e-marketplace, and analysed the competitiveness and strengths of e-marketplaces operated by organizations from various market positions. This, again, offered useful background into some of the considerations to make when undertaking an e-marketplace design, but no procedure or method was offered as to how to tackle it realistically.

This paper tackles the same issues but incorporates an alternative approach, one that draws upon not only the knowledge gained from understanding the history and background of the subject, but also from the new knowledge and experience attained via a set of strategically selected independent case studies. It then takes these findings and designs a procedure that can be followed in order to calculate the appropriateness of a set of e-marketplace features to a particular business or market. It was intended to be equally applicable to the realms of both the academic and industrial research, and proposes to present an approach that can be adapted and developed fairly easily for an early realistic benefit.

CASE STUDY INVESTIGATION

This study includes the results of two separate investigations into e-marketplaces. The studies were aimed at uncovering case research material to form the foundations for the development of a strategic framework, or selection tool, for identifying the appropriateness of e-marketplaces.

The first case study makes an empirical examination of a small-to-medium (SME) sized enterprise, RJW, and analyses how they approached the development of an e-marketplace, in terms of identifying customer requirements, internal drivers and benchmarking the industry. The second case study considers current literature and examines the condition of the wider e-marketplace domain; specifically focusing on earlier attempts at
e-marketplace classification, then derives three new classification models, based on the discovery of a series of fundamental characteristics, in order to determine the relative positioning of an industry, an e-marketplace or a product/service.

These two case studies were selected for their capacity in offering valuable insights into e-marketplaces, and their development, as viewed from a number of different operational levels. Case Study I concentrates solely on the individual private e-marketplace provider, the business drivers behind RJW’s initiative for developing an e-marketplace, their approach to establishing an accurate set of customer requirements, and the ensuing process of satisfying the requirements effectively with a set of specifically targeted web-based services.

Case study II takes a sector level view of the range of e-marketplaces currently in operation. It explores the different types of classification model in existence, investigating the criteria upon which they are based, and analyses the technologies involved, both for participating and hosting.

It was believed that by looking at e-marketplaces from these different perspectives; the individual and the sector level, that an accurate picture could be fashioned as to their ultimate definition, classification types, technologies, requirements, functionality and business benefits, which can be used in juxtaposition with the findings from the literature review, in order to establish a method of supplying detailed answers to the research questions.

**Case study I**

Back in 2000, a collaborative project was initiated between the University of Liverpool and an industrial maintenance company, Rewinds and J Windsor and Sons Engineers Limited (RJW), based in the Northwest of England. The objective of the project was to establish RJW as one of the UK’s first Maintenance, Repair and Operations (MRO) e-marketplaces, strategically positioned between its customers and its supply base, by way of developing their own online private e-marketplace network, an Internet-based integrated supply distribution business to satisfy customer MRO requirements for the supply of products and services typically required by maintenance and production departments, within a variety of industries located throughout the North of the UK, while simultaneously improving service levels and reducing costs.

The company specialize in the repair of mechanical, electrical and electronic plant, and have a wide range of customers, from various industries, including automotive, chemical, aerospace, and food manufacturers, in addition to service industries such as airports, shopping centres and hotel chains. Although they do not manufacture products of their own, they are approved suppliers for many of the leading names in electric motors, bearings, transmission parts, and PLC control systems etc., and are registered to supply, install and maintain such equipment on site at customers’ facilities.

In conjunction with the university, RJW engaged in an initiative to develop a public MRO e-marketplace aimed at leveraging leading edge technologies in an attempt to improve customer service, streamline internal business processes, and enable the organization to grow and expand into new markets. The university examined how an SME approached the development of an e-marketplace in terms of analysing customer requirements, capturing internal drivers, and utilizing benchmark studies, and followed the two-year development life cycle, from the early planning stages up to implementation and operation, and described how it affected the running and culture of their business.

Initial research was carried out via a series of taped recorded interviews with 12 of RJW’s larger customers, specifically targeting purchasing and inventory management divisions, with over 800 email questionnaires also distributed to smaller customers, and through collaborating with one main strategic partner, a large global food-producing manufacturer. Over a period of twelve months, the inventory supplied to this collaborator was managed, and monitored, in order to forecast their typical annual MRO usage. All the data collected, from these separate sources, were then utilized in establishing a ‘wish list’ of overall customer requirements, to be used as design considerations for the new e-marketplace development.

From this investigation several important lessons on the approach to building an e-marketplace were learned. The university research team discovered that there was little, if any, available literature at that time that offered support or guidelines for the appropriate selection, or design steps, to take when evaluating electronic marketplaces.

RJW identified the importance of concentrating on enabling existing services, leveraging areas they were already strong in and had built a good reputation on, rather than adopting ‘technology for technologies sake’, and of not entering new markets where they were comparably inexperienced, without fully exploring the possible consequences. The great significance of gaining an understanding of customer requirements was also appreciated, in the how, why and where of providing indispensable services for them, gaining a competitive advantage in the market, as well as remembering personal objectives, benefits available from gaining knowledge of the market, in identifying the ‘best of breeds’, and highlighting ideas and key features they contain that could be incorporated into their own system development.

From the customer interviews, questionnaires and collaborative partner data, a picture was built up of the typical customer demands of an e-marketplace. Similarly, the internal assessment and benchmarking information,
Case study II

The task of effectively classifying B2B e-marketplaces can be a very complex process. The specific functionality and requirements expected from any electronic marketplace by its supply chain can be extremely varied even within a single market. It can be product driven or functionality driven, as opposed to market driven. In other instances the requirements are driven exclusively by the potential business benefits, regardless of what products are involved.

Although a specific set of functions, including catalogue searching, information exchange and auctioning lie at the forefront of many typical e-marketplaces, the combination of features and the purpose for which they are incorporated can vary significantly. Different activities at different stages along the supply chain also lend themselves to becoming electronic interactions to greatly differing extents.

A standardization of e-marketplace characteristics could be possible if the underlying objectives and potential benefits for the inception of these marketplaces are examined. e-marketplaces, in broad terms, provide an electronic means to simplify, automate and help synchronize the way in which supply chain partners interact with each other to reduce costs, improve productivity and increase revenues. In addition to this, e-marketplaces aim to bring about a state of increased transparency between supply-chain partners, in terms of demand and availability, creating a reduction in lead-times, inventory and work in progress, all resulting in strategic benefits.

However, no two e-marketplaces operate in exactly the same manner, and it would be impractical to create a blueprint to which all e-marketplaces should adhere to in order to attain success. A reasonable first step, however, towards a classification would be to decide upon which particular characteristics of these e-marketplaces offer sufficiently enough distinctive divisions as to justify a classification category.

With little guidance available, many companies often exhaust considerable time and resources in assessing the value to them of participation in e-marketplaces. If it is decided that they offer a viable opportunity there is also little in the way of support as to how to develop an entry strategy best suited to one’s particular business needs. While the importance of adopting the right approach is already highlighted (Chopra and Mieghem 2000; Smeltzer and Carter 2001), the main focus of the research so far in this area has been around the technologies involved, and as a result few frameworks for strategically guiding organizations through this decision-making process have been proposed. However, several categorizations or classifications of e-marketplace elements have already been suggested based upon channels of e-marketplaces (Morgan Stanley Dean Witter 2000), tools for conducting electronic B2B trade (Kaplan and Sawhney 2000), and type of purchasing and items (Hasen et al. 2001). Whitaker et al. (2001) and Temkin (2001) support a two dimensional classification of B2B e-marketplaces including the connectivity model concerning the ownership of the marketplace, and application model concerning involved processes, the objectives of the marketplace and used tools. Two main typologies are also advocated by Bartezaghi and Ronchi (2003) which include Sourcing Service Providers who host the e-marketplace operations for various customers, and Sourcing Process Outsourcers who additionally provide professional services such as analysis of the market and contract and negotiation processes to customers.

The key dimensions to this classification approach were agreed as being the nature of the products/services to be traded, the ownership/structure of the e-marketplace, and the level of functionality/relationships required from the trading interaction. The product categories were defined as being commodities, durables, and bespoke; the ownership of the exchange was considered as being either independent, sector coalition, or private; and the relationships involved as either close or anonymous (Hopkins et al. 2003).

Three classification models were then derived, Figures 1 to 3, and these dimensions were used for identifying the optimal position for an industry, an e-marketplace or a product/market. The strategic role of an e-marketplace was also identified as being dynamic in nature over the product/market lifecycle and the ongoing development of the information systems and technologies.

This analysis gives the researcher valuable insights in to positioning of e-marketplace users in terms of their ownership status, product demand, and functionality requirements.

It was concluded that the more control a company has over its e-marketplace, in terms of ownership, the greater benefits they can reap from it. It would be difficult to use e-marketplaces for the purpose...
of procuring highly customized products without having a close relationship with, or greater influence over, the supplier. However, only a low level of control over the e-marketplace, and anonymous relationship with the supplier, is necessary in the case of commodities.

APPRAOCH TOOL DEVELOPMENT

The findings of the case research were utilized in developing a QFD-style matrix that emphasized the interrelationship between their customer requirements and e-marketplace functionality.

![Classification model 1, products vs ownership (Shaded areas indicate suitability)](image1)

![Classification model 2, product type vs functionality](image2)
Quality function deployment (QFD)

Quality function deployment (QFD) is a method for developing a design quality, aimed at satisfying the consumer, and then translating the consumer's demand into design targets and major quality assurance points to be used throughout the production phase (Akao 1990). It is a customer-oriented design tool aimed at developing new or improved products and services, to increased customer satisfaction and quality assurance (Akao 1990; Mizuno and Akao 1994), by integrating marketing, design engineering, manufacturing and other related functions of an organization, that focuses on delivering value by taking into account customer needs and then deploying this information throughout the development process (Karsak 2004; Sullivan 1986). The basic three principals of QFD are to:

1. Prioritize spoken and unspoken customer wants, and needs;
2. Translate these needs into actions and designs such as technical characteristics and specifications; and
3. Build and deliver a quality product or service by focusing various business functions towards achieving a common goal of customer satisfaction. (QFD Institute, www.qfdi.org)

The original concept of QFD was invented in 1966, at the Bridgestone Tire Corporation, by Yoji Akao, for the purpose of process assurance, and translates customer requirements into designed product functionality, which has helped such organizations as 3M, Ford Motor Co. and AT&T to improve customer satisfaction, reduce product development time, and reduce start-up problems.

QFD is a requirements quality approach and consists of statistical process control, design quality, and value engineering. Its intention is to collect user requirements throughout the product development and production stages (Macaulay 1996). Matrix diagrams, very useful in organizing and illustrating any collected data, can be used to display this information and measure the extent to which customer requirements are being met with functionality, and highlight the potential resources that exist that can be employed in fulfilling those requirements further. The structure that QFD uses to organize such information is known as the ‘House of Quality’ (HOQ).

Lowe and Ridgway (2000) describe the HOQ structure as a six-stage process (see Figure 4):

1. **Customer requirements**: Usually the first section of the matrix to be completed, and considered to be the most important, this compiles a list of the customers requirements, described in their own words, and are referred to as the ‘voice of the customer’.
2. **Planning matrix**: Situated on the right hand side of the model this quantifies the level of priority of the customers' requirements and establishes their evaluation of current products/services.
3. **Technical requirements**: This describes the product in the customers' words and is referred to as the 'voice of the company'. This input information is established by identifying all the measurable characteristics of the product that go some way to meeting the earlier specified customer requirements.

4. **Inter-relationships**: Positioned in the middle of the model, this two-dimensional matrix operates by translating the requirements specified by the customer into product technical requirements. Each cell, corresponding to a relationship between a customer requirement and a technical requirement, is assigned a value to describe the significance of this relationship, based on whether it is a strong, medium, or weak one.

5. **Roof**: The roof section of the matrix is used to establish whether or not the technical requirements, specified earlier, have any kind of relationship that might support, or impede, one another. For each cell it is asked, for the corresponding requirements, whether increasing or decreasing the strength of one will have a positive or negative effect on the other.

6. **Targets**: The closing element of the HOQ matrix pulls together all the interactivity of the rest of the matrix and draws a set of conclusions to work from. These generally take the form of technical priorities, competitive benchmarks and targets.

The boundaries of fully describing the QFD process, and its many applications, lie well outside those of this paper, and further reading is required for QFD to be fully appreciated. However, what this work does is take QFD and adapts a technique, primarily designed as a customer-oriented design tool for the development of new or improved products, and employs part of its methodology in a new application environment, utilizing its ability for quantifying relationships between sets of customer requirements and product features.

This structural approach was incorporated in the current research in an attempt to develop a mechanism for effectively organizing customer requirements into a configuration whereby they could be easily referenced against the functionality range of e-marketplaces. It was not envisaged that all the steps would be strictly adhered to for this particular work, Stage 5 for instance was not seen as valid for this application, but much of the techniques highlighted herein were identified as useful methods for drawing important conclusions about the data collected during the case research.

Despite the roots of the QFD technique originating from a design environment, its application was found to be just as appropriate a method for evaluating existing e-marketplaces, with a view to joining them, as for effectively analysing customer requirements and product expectations when designing a new e-marketplace. The approach was believed robust, and detailed, enough to be able to quickly indicate whether or not the resulting product (e-marketplace) significantly addressed the key requirement issues of the customer in either instance.

### Application of case study evidence

From RJW’s survey into their customers’ possible requirements of an e-marketplace, supported by the literature review findings, the following capabilities featured prominently: procurement savings; reduction in administrative costs; order/status tracking; product search; vendor search; integration; and collaboration.

Their in-house considerations, gained via internal investigation, were that the e-marketplace development provides levels of performance in the areas of: product catalogue hosting; stock control; order processing; user-friendly backoffice; remote access; connectivity; security; and online asset management.

From these lists of findings a typical set of customer requirements was compiled for inclusion in the relationship matrix as the ‘voice of the customer’ input, Stage 1 in Lowe and Ridgway’s model (Figure 4).

Typical functionality common to most best-of-breed e-marketplaces, and standard in most e-marketplace software suites, according to the literature review and findings of Case study II, included: electronic cataloguing; order tracking and audit; online reverse
auctioning; integration with back office systems; automated payment systems; electronic requisitions; electronic purchase orders; electronic delivery notes; contracted pricing; automated approval systems; management information and reporting; and user profiles with spending limits.

Therefore, a list of e-marketplace functionality could now also be derived as inputs for the top row of the matrix, at Stage 3. These e-marketplace features are the forecasted product control characteristics.

The inputs are cross-referenced against each other, in the corresponding areas of the matrix, and any instances of an existing relationship, between customer requirements and the available services, are highlighted with the symbols ‘●’, ‘■’, and ‘▲’. These symbols indicate interrelationships weighted, on a four-point scale, as having either a high, medium, or low effect on each other. Blank spaces indicate a situation where no interrelationship between the two parts can be identified.

Focusing on the top line of customer requirements in Figure 5, the e-marketplace feature of electronic cataloguing, documenting in one place the specifications of a whole range of products and services, from multiple sources and suppliers, is adjudged as having a high capacity for potentially generating procurement savings. The point on the grid corresponding to the relationship between these two factors is, therefore, marked with a circle.

Similarly, electronic delivery notes are deemed as offering only a low level of contribution towards generating procurement savings, via their ability for slightly improving back-end processing, but are adjudged as being a significant contributor towards generating administration cost savings in the same area. These relationships on the matrix are therefore populated with a triangle and a circle respectively.

The value that the capacity for integrating electronic delivery notes with back office systems carries, such as with linking directly to invoice and inventory systems, is considered as being between high and low, so it labelled medium and marked with a square.

For any given organisation, a set of customer requirements can also be ranked, by the customer, on a scale of 1 to 5, in order to establish their priority areas. Definitions of the level of importance, as defined by the 5-point scale, are stated in Table 1.

If RJW’s customer base for this venture had been asked to complete such a scorecard in this way a relationship matrix approach to the new e-marketplace could have been incorporated into the design phase.

For this paper, a set of values were later collected from RJW’s collaborative partner, in exactly the format described, and were retro-fitted into the new approach.

Table 1. Ranking values of importance to customer

<table>
<thead>
<tr>
<th>Ranking</th>
<th>Business Importance</th>
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<tbody>
<tr>
<td>5</td>
<td>Very high level of importance to customer</td>
</tr>
<tr>
<td>4</td>
<td>High level of importance to customer</td>
</tr>
<tr>
<td>3</td>
<td>Medium level of importance to customer</td>
</tr>
<tr>
<td>2</td>
<td>Low level of importance to customer</td>
</tr>
<tr>
<td>1</td>
<td>Very low level of importance to customer</td>
</tr>
</tbody>
</table>

Figure 5. The relationship matrix for the input values collected from the case research.
The collaborator identified their main priority areas as being that of making savings in procurement and reducing administrative costs, scored 5, with areas of secondary importance set as integrating with existing systems, collaborative planning, and the ability to make supplier price comparisons, scored 3).

Services such as product search, vendor search, integration and order tracking were also identified but not deemed as being as critical (see Table 2).

These figures are now inserted into the developing matrix under a column heading Ranked importance, as seen in Figure 6.

The relationships between e-marketplace features and customer requirements are weighted, by assigning numerical values to the original interrelationships (●=5, ■=3, ▲=1), multiplying each of these values by the ranked importance score for that requirement, and then tallying the scores in each column to derive a value for Technical Priority – that being the influence that a particular feature has across the full range of customer requirements (see Table 3 and Figure 7).

This process could then be applied across the entire matrix (see Figure 8).

On observing the generated results the top three areas of technical priority for an e-marketplace, under these particular conditions, are defined as:

1. Electronic cataloguing (99);
2. Online reverse auctioning (79;) and
3. Integration with Back Office Systems (77) (see Figure 9).

These figures make an evaluation that considers the complete list of scored customer requirements. Referring back to the original ranked importance column it can be seen that, for this particular customer, the services potentially providing the greatest business benefit are electronic cataloguing, online reverse auctioning, and the integration with back office systems.

Any customer, evaluating the possibility of joining an e-marketplace, could insert their own requirements and ranked importance values into a similar matrix, along with the functionality offered by the e-marketplace they wish to evaluate, to highlight areas of potential benefit,

Table 2. A completed scorecard for collaborator’s level of customer requirements

<table>
<thead>
<tr>
<th>Customer Requirements</th>
<th>Rating Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Procurement Savings</td>
<td>5</td>
</tr>
<tr>
<td>Reduced Administrative Costs</td>
<td>5</td>
</tr>
<tr>
<td>Order Status/Tracking</td>
<td>3</td>
</tr>
<tr>
<td>Product Search</td>
<td>3</td>
</tr>
<tr>
<td>Vendor Search</td>
<td>3</td>
</tr>
<tr>
<td>Integration with Existing Systems</td>
<td>3</td>
</tr>
<tr>
<td>Integration to Other Exchanges</td>
<td>3</td>
</tr>
<tr>
<td>Collaborative Planning</td>
<td>3</td>
</tr>
<tr>
<td>Supplier Price Comparisons</td>
<td>3</td>
</tr>
</tbody>
</table>

5=Strongest
1=Weakest

Figure 6. Customer ranked importance rating added to matrix
and the extent of that benefit, for their particular business needs.

If the matrix approach is now employed in a slightly different application, one of evaluating the relationships between a set of customer requirements and the classification criteria established in Case Study II, it serves as an exercise in testing out the matrix method on not just a single particular e-marketplace but with a top-level evaluation of an entire e-marketplace sector.

To enable this, the inputs for the technical requirements row, Stage 3 of the HOQ model, were substituted for the three different product types and ownership models identified in Case Study II. The original customer requirements remain unchanged, in Stage 1 of the model, but a new set of interrelationships, with the ownership model inputs, are devised. These are displayed in Figure 10.

It can be clearly seen, when utilizing the matrix method in this manner, that a privately owned e-marketplace, with its capacity for strong relationships, appears to offer potential significant reductions in procurement and administrative costs, regardless of product type, whereas within the independent and sector coalition sections this is limited to mainly commodities due to restricted control.

Similar levels of order tracking, vendor search and supplier price comparison capabilities are available, no matter how much control is held over the e-marketplace, and there is a likelihood of achieving better integration levels with other exchanges via a sector coalition hosted e-marketplace that with any other type.

These figures are based solely on the performance of the three different types of e-marketplace ownership, against customer requirements, and do not consider the costs associated with the membership/development. These results are consistent with the findings from Case Study II where it was concluded that the more control a company has over an e-marketplace the greater benefits they can reap from it. If, however, a company’s sole motivation for joining an e-marketplace purely to source

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Interrelationship weighting</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>•</td>
<td>HIGH: A highly significant level of interrelationship is present between customer requirement and e-marketplace functionality.</td>
<td>5</td>
</tr>
<tr>
<td>■</td>
<td>MEDIUM: Exhibits a medium strength interrelationship between customer requirement and e-marketplace functionality.</td>
<td>3</td>
</tr>
<tr>
<td>▲</td>
<td>LOW: Indicates only a low level of interrelationship between customer requirement and e-marketplace functionality.</td>
<td>1</td>
</tr>
</tbody>
</table>

Table 3. The interrelationship weighting system utilized

![Figure 7. Deriving technical priority value for electronic requisitions](image)
Figure 8. Complete matrix of interrelationships

Figure 9. Focus on areas of highest suitability
If commodities cheaper, then its requirements of that e-marketplace are inevitably going to be less rigorous.

In Figure 11, a typical list of requirements for such a company, one of RJW’s smaller customers, are plotted against the three e-marketplace ownership models. It can be clearly seen that there is little, and none whatsoever in some cases, difference between the performance of the three different categories for these requirements. It would, therefore, be of little benefit for this company to join a sector coalition or develop their own private e-marketplace, with the high associated investment entailed, if their needs from such a platform are simply
to search products and vendors, and compare prices, with the goal of reducing the cost of procuring commodity items. They would be able to receive a more than satisfactory level of service, to enable them to do these particular activities, via joining a much cheaper independent e-marketplace.

If, however, the customer requirement warranted certain functionality that necessitated a much closer level of relationship, the difference in scoring between the three ownership models would be expected to be far more evident, as shown in Figure 12.

Here it can be seen, in the technical priority scoring, that typical independent e-marketplaces are unsuitable for sourcing bespoke products, collaborative design, and integration with existing systems, and that sector coalitions are only marginally successful in providing them. The recommendation to a company in this situation would be to look into developing a private e-marketplace, designed specifically to satisfy their own, more complex, demands.

CONCLUSIONS

This paper proposes a matrix-based approach for the evaluation of e-marketplace services. One that establishes interrelationships between functionality and customer requirements, designed for not only assisting in the design of a system that embeds, as effectively as possible, the correct functionality set for meeting specific customer requirements when creating a new e-marketplace, but also in providing a tool to assist in identifying the presence of the right kind of web services for use by companies planning entry into an existing e-marketplace.

The literature review and case study research findings combine to define the typical customer requirements and inherent functionality necessary for a successful e-marketplace. The system adapts a technique primarily designed as a customer-oriented design tool (QFD), for the development of new or improved products, and employs part of its methodology as a means to collect user requirement data, before utilizing its presentation structure to display the collected information, establishing interrelationships for the purpose of visually, and statistically, measuring the extent to which customer requirements would be fulfilled by a set of web services, or vice versa.

This approach utilizes both qualitative and quantitative methods for establishing the entities incorporated in the system, and in quantifying the relationships between the sets of customer requirements and the inherent functionality, and has been designed to generate effective results in a user-friendly, easy to decipher manner, that requires that the operator simply decides upon a range of requirements and functionality that is particularly applicable to their position and to then makes a decision upon the level of importance that each of the chosen attributes has for their business.

The inputs for the matrix can be changed at any time, to correspond with the features of a new e-marketplace or the new/changing requirements of a customer, and so don’t require the assumption of any standardization of e-marketplace characteristics and practice, making the system flexible enough to adapt to differences in these areas when dealing with a different category of customer or e-marketplace.

It is believed that there was a need for developing such a methodology for e-marketplace selection, one that not only supports the decision-making criteria for
e-marketplace entry, suggesting a framework model for the evaluation and validity of existing web services, but one that also suggests an approach to designing new systems, based upon the functionality most demanded by the customer.

Other applications of the QFD technique are beginning to emerge in the e-business realm; such as with the development of a methodology for converting internal and external needs into a feasible e-business plan for SMEs (Tan et al. 2004), and in measuring customer satisfaction levels in e-banking (González et al. 2004), but no such applications that evaluate the appropriateness of an e-marketplace service range have yet materialized.

This aspires to be an original, effective, and thought provoking, way of tackling the subject, and is intended to serve as the basis for further exploratory studies into the subject. The next stage for this work is to test out the accuracy, and relevance, of the approach method in a series of realistic environments. Only then can its potential be measured effectively.

References


