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Mohammed Naim A. Dewan

Curtin University, mohammed.dewan@postgrad.curtin.edu.au

Nasrin Ruby Biswas

Curtin University, nasrin.biswas@postgrad.curtin.edu.au

Md. Maruf Hossan Chowdhury

Curtin University, md.chowdhury@postgrad.curtin.edu.au

Mohammed A. Quaddus

Curtin University, mohammed.quaddus@gsb.edu.curtin.edu.au

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AN AHP INTEGRATED QFD APPROACH FOR THREE DIMENSIONAL BLENDED VALUE REQUIREMENTS IN SUSTAINABLE E-BUSINESS MODELLING: THE CASE OF A COMMERCIAL BANK

Mohammed Naim A. Dewan, Curtin Graduate School of Business, Curtin University, Perth, WA, Australia, mohammed.dewan@postgrad.curtin.edu.au

Nasrin Ruby Biswas, Curtin Graduate School of Business, Curtin University, Perth, WA, Australia, nasrin.biswas@postgrad.curtin.edu.au

Md. Maruf Hossan Chowdhury, Curtin Graduate School of Business, Curtin University, Perth, WA, Australia, md.chowdhury@postgrad.curtin.edu.au

Mohammed A. Quaddus, Curtin Graduate School of Business, Curtin University, Perth, WA, Australia, mohammed.quaddus@gsb.edu.curtin.edu.au

Abstract

Fulfillment of customer's requirements alone is not enough to be competitive in today's challenging market. Instead, blended value requirements need to be fulfilled for customer satisfaction, for efficient value process, and to achieve strategic goals including profit. On the other hand, 'e-business modelling' and 'sustainability of the business' are already established terms as e-business converts technology into economic value. Although e-business modelling and sustainability are the two major global trends still there is no common understanding about the elements that need to be used for a sustainable e-business model. This research approach, therefore, uses an Analytic Hierarchy Process (AHP) integrated Quality Function Deployment (QFD) approach to show how blended value requirements can be identified and efficiently fulfilled to achieve sustainability of e-business with a comprehensive case study. This approach is unique in the sense that in developing the model blended value requirements are considered from three dimensions and blended value concept is integrated with customer's value requirements, business's value requirements, and process's value requirements.

Keywords: Sustainability, E-business, Blended value, QFD, Business model, AHP.

1 INTRODUCTION

Fulfilment of only customer's requirements is not enough to be competitive in today's challenging market. Instead, blended value requirements need to be fulfilled for customer satisfaction, for efficient value process, and to achieve strategic goals including profit. Blended value requirements instead of customer requirements is important in the sense that 'even though customer satisfaction can be obtained efficiently and effectively for some time, an organization still cannot guarantee future corporate profitability if it lacks value creating capabilities' (Wang & Hong, 2007). But most of the business modelling ideas consider only economic value aspects of the business and do not concentrate on social or environmental aspects. It is surprising that although 'e-business' and 'sustainability' are the two current major global trends but very few e-business modelling ideas covers the sustainability aspects of the business. Researchers are now introducing 'green IS/IT/ICT' concept but none of them clearly explains how those concepts will be accommodated inside the e-business models. Therefore, this research approach develops a QFD based e-business model in conjunction with sustainability aspects. The model is based on 'blended value' and explores and determines the optimal design requirements in developing an e-business model. This research approach also investigates how the sustainability dimensions can be integrated with the value dimensions in developing the e-business model. This modelling approach is distinct in the sense that in developing the model sustainability concept is integrated with customer's value requirements, business's value requirements, and process's value requirements instead of only customer's requirements. The value requirements from these three dimensions are considered crucial for sustainable e-business modelling (Dewan & Quaddus, 2012). For the analysis of the data *Quality Function Deployment* (QFD), and *Analytic Hierarchy Process* (AHP) are used. The case of a commercial bank in Bangladesh is used for the demonstration of the approach. Besides developing the blended value based e-business model this research approach also develops a framework for modelling e-business in conjunction with blended value and sustainability concepts which can be implemented by almost any other businesses in consideration with the business contexts. Therefore, we, in this paper use AHP integrated QFD approach to: (i) explore and determine the three dimensional blended value requirements in developing e-business model; (ii) explore design requirements (DRs) to fulfil those requirements; and (iii) select optimised design requirements (DRs) to fulfil those requirements. This approach also shows how the design requirements are related to assist the decision makers in deciding strategies by developing the House of Sustainability using QFD. The following section of the article covers extensive literature review on blended value based sustainable e-business modelling, three dimensional blended value requirements, QFD, and AHP. Section 3 explicates the rationale for the three dimensional blended value requirements in e-business modelling. The detailed research methodology and the case study are covered in Section 4 and Section 5 respectively. Section 6 consists of an analysis on findings and limitation of the approach; and finally, Section 7 concludes the article with further research directions.

2 BACKGROUND

2.1 Blended value based e-business modelling

The sustainable e-business modelling approach by Dewan, Chowdhury, and Quaddus (2012b) uses 'organisational value requirements' and 'sustainability' as the main elements. According to the approach, organisational value includes three values: customer value, business value, and process value; and sustainability of business includes economic value, social value, and environmental value. The authors argue that to be competitive in the market the value need to be measured from three dimensions: (i) What total value is demanded by the customers? (ii) What total value is required by the businesses based on their strategies to reach their goals? and (iii) What process value is required by the businesses to have a sustainable value processes? Consequently, based on the measurement from three dimensional blended value requirements are categorised into nine groups (Dewan, Chowdhury, & Quaddus, 2012a) which are used as the main elements of the approach:

- Economic value for customer requirements;

- Social value for customer requirements;
- Environmental value for customer requirements;
- Economic value for business requirements;
- Social value for business requirements;
- Environmental value for business requirements;
- Economic value for process requirements;
- Social value for process requirements; and
- Environmental value for process requirements.

2.2 Quality Function Deployment (QFD)

QFD was laid out in the late 1960s to early 1970s in Japan by Akao (1990). QFD is based on collecting and analysing the voice of the customer that help to develop products with higher quality and meeting customer needs (Delice & Güngör, 2010). The product design and development process is supported by QFD. Therefore, it can be also used to analyse business needs and value process needs. Recently, companies are successfully using QFD as a powerful tool that addresses strategic and operational decisions in businesses (Mehrjerdi, 2010). Chan and Wu (2002) and Mehrjerdi (2010) provide a long list of areas where QFD has been applied. QFD, in this approach, will be applied as the main tool to analyse blended value requirements of customer, business, and process. It will also be used to develop and select design requirements to meet the blended value requirements for the sustainability of the e-businesses. In QFD modelling, ‘blended value requirements’ are referred as WHATs and ‘how to fulfil the blended value requirements’ are referred as HOWs.

2.3 Analytic Hierarchy Process (AHP)

AHP is an established multi-criteria decision making approach that employs a unique method of hierarchical structuring of a problem and subsequent ranking of alternative solutions by a paired comparison technique. AHP was originally developed by Saaty (1980). The strengths of AHP is lied on its robust and well tested method of solution and its capability of incorporating both quantitative and qualitative elements in evaluating alternatives (Das & Mukherjee, 2008). AHP is frequently used in QFD process, for instance, Georgiou et al. (2008), Han et al. (2001), Das and Mukherjee (2008) Lu et al. (1994), Armacost et al. (1994), Park and Kim (1998), Mukherjee (2011), Koksai and Egitman (1998), and more. In this research approach, based on customer value requirements, business value requirements, and process value requirements AHP will be used to prioritize the three dimensional blended value requirements before developing design requirements in QFD process.

3 RATIONALE FOR THE THREE DIMENSIONAL BLENDED VALUE REQUIREMENTS

In the past, businesses limited their view of business profitability as they were only aware of economic gain and were focused on sound financial systems to maintain that gain. Then slowly the trend for socially and environmentally conscious businesses started and now to compete in the market businesses need to deliver not only the economic value but the sustainable value. Therefore, to satisfy the customers, only economic value is not enough. Instead of economic value in early days, customers now want to know what total value they are going to receive from the businesses (Dewan et al., 2012a). Businesses now try to “create organizations, institutions and market mechanisms capable of maximizing economic value as well as social and/or environmental value” (Emerson, 2003). These environmental, social, and economic values cannot be fully achieved only by fulfilling the requirements of businesses or customers. Therefore, to achieve sustainability, value propositions of the businesses must include customer value, business value, and process value to produce and deliver the complete sustainable value.

In identifying the elements of sustainable e-business modelling, this research approach sincerely considered the stakeholder theory as there are multiple stakeholders involved in e-business modelling. Stakeholder theory holds the idea that businesses shall take decision considering the interest and

impact of all stakeholders. Stakeholders are those who have interest on the firm- either benefitted from or harmed by corporation actions (Freeman, 1984). As the time passes the attention and interest of all stakeholders is converging towards sustainability of the organization (Wheeler, Colbert, & Freeman, 2003). Stakeholder theory also holds that in the light of changing society and environment, to provide adequate value to stakeholders and to manage relation with them organizations need to develop specific processes at different levels of organization (Freeman, 1984). Such type of process development shall be based on considering the economic, social, and environmental interest of the stakeholders. Hence, it can be summed up that for the sustainability of the business stakeholder theory indicates the development of a business model that recognizes the value requirements of multiple stakeholders. According to the literature, the sustainable value must include values from three areas: (a) Economic value, (b) Social value, and (c) Environmental value. Importantly, businesses must also realise that to be competitive in the market this value need to be measured from three dimensions(Dewan et al., 2012a):

- *Dimension 1: What blended value is demanded by the customers?*
- *Dimension 2: What blended value is required by the businesses based on their strategy to reach their goals?*
- *Dimension 3: What blended value is required by the businesses to have efficient value processes?*

4 RESEARCH METHODOLOGY

Research paradigm can be classified as two types: positivist and interpretivist (Onwuegbuzie & Leech, 2005). In positivist research, reality is independent from the researcher and the research is objective oriented (Johnson & Onwuegbuzie, 2004; Smith, 1983) and data collection, analyses are value-free rather than subjective interpretation (Krauss, 2005). This research approach complies with the framework of positivist paradigm as the research is very much objective oriented with regards to identifying the three dimensional blended value requirements and corresponding design requirements using AHP integrated QFD. An inquiry to the previous researches affirms that QFD has been used frequently in object oriented research. In a QFD analysis the following steps are followed:

- Step 1: Identification of the three dimensional blended value requirements that are termed as WHATs;
- Step 2: Relative importance ratings of WHATs are determined by using AHP method;
- Step 3: Design requirements (HOWs) to fulfil the three dimensional blended value requirements are generated;
- Step 4: Correlation between design requirements (HOWs) are determined;
- Step 5: Relationships between WHATs and HOWs are determined;
- Step 6: Relative importance of HOWs are determined;
- Step 7: Based on the rankings of weights of HOWs the design requirements are selected.

Before developing the QFD framework the relative importance ratings of WHATs are determined by using AHP method following the approach of Quaddus and Siddique (2001). In this regard data have been collected from strategic managers, decision makers of IT Division, corporate customers, and retail customers of a particular bank. The particular bank was chosen based on the ranking of implementing ICT and CSR activities. The banking industry has been chosen for this approach since financial institutions are critically dependent on information systems activity for daily operations (Broadbent & Weill, 1993; McFarlan, McKenney, & Pyburn, 1983). Moreover, banks are information-intensive and highly dependent on information technology as their core technology (Jarvenpaa & Ives, 1990; Porter & Millar, 1985). Face to face semi-structured interview has been conducted for collecting data regarding identification of blended value requirements (WHATs) and design requirements (HOWs). The primary aim of employing semi-structured interviews is to gain in-depth insight into the perceptions of the individual interviews and to develop a greater understanding of blended value requirements in Bangladesh rather than to draw generalizations from this study (Soh & Martinov-Bennie, 2011; Turley & Zaman, 2007). The average interview time was around sixty-eighty minutes. The opinion of the decision makers regarding the importance of WHATs has been collected following the scale developed by Saaty (1980) then the scores are averaged for analysis based on AHP. Then the respondents have been asked about corresponding design requirements

(HOWs) for QFD analysis. In developing the QFD framework the relationship between blended value requirements and corresponding design requirement (DR) is described as Strong, Moderate, Little, or No relationship which are later replaced by weights (e.g. 9, 3, 1, 0). These weights are used to represent the degree of importance attributed to the relationship. Thus, as shown in Table 1, the importance weight of each design requirement can be determined by the following equation:

$$D_w = \sum_{i=1}^n A_i R_{iw} \forall_w, w = 1, \dots, m \dots \dots \dots (1)$$

Where, D_w = Importance weight of the w th design requirement;

A_i = Importance weight of the i th blended value requirement;

R_{iw} = Relationship value between the i th blended value requirement and w th design requirement;

m = Number of design requirements; and n = Number of blended value requirement.

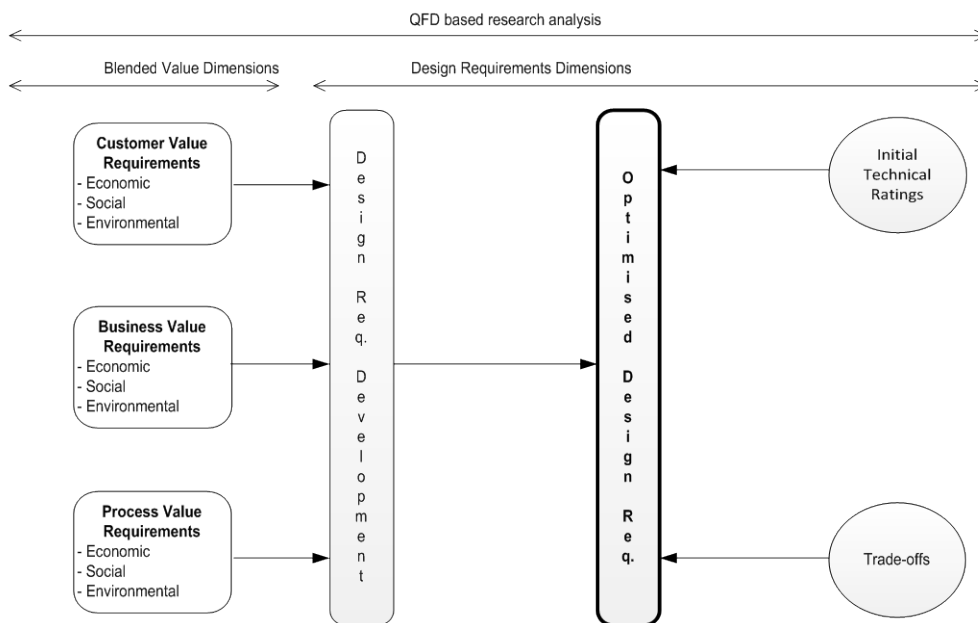


Figure 1. Research model.

In Table 1, customer's value requirements, business's value requirements and process's value requirements are considered as part of the three dimensional blended value requirements. The importance weights of these value requirements are calculated using AHP by discussion with the same respondents. Then geometric means of those importance weights were used to ignore the biasedness of the data. According to the QFD matrix the absolute importance of the blended value requirements can be determined by the following equation:

$$AI_i = \sum_{w=1}^m R_i D_w \forall_w, w = 1, \dots, m \dots \dots \dots (2)$$

Where, AI_i = Absolute importance of the i th blended value requirement (BR_i);

R_i = Importance weight of the i th blended value requirement;

D_w = Importance weight of the w th design requirement to fulfil the requirements;

Therefore, the absolute importance for the 1st customer's value requirement (BR_{i1}) will be:

$$AI_{i1}^{CR} = R_{i1}D_{w1} + R_{i1}D_{w2} + \dots + R_{i1}D_{wm}$$

Thus, the relative importance of the 1st customer's value requirement (BR_{i1}) will be:

$$RI_{i1}^{CR} = \frac{AI_{i1}}{\sum_{i=1}^n AI_i} \dots \dots \dots (3)$$

Where, RI_{i1}^{CR} = Relative importance of the 1st customer's value requirement (BR_{i1});

AI_{i1}^{CR} = Absolute importance of the 1st customer's value requirement (BR_{i1});

Similarly, the absolute importance and the relative importance of all other blended value requirements (CRs, BRs, and PRs) can be determined by the Equations (2) and (3). Now, the absolute value for the first design requirements (AI_{d1}) will be:

$$AI_{d1} = R_{i1}D_{w1} + R_{i2}D_{w1} + \dots + R_{in}D_{w1}$$

In the same way, the relative importance of the 1st design requirements (RI_{d1}) can be determined by the following equation:

$$RI_{d1} = \frac{AI_{d1}}{\sum_{d=1}^n AI_d} \dots\dots\dots (4)$$

Where, RI_{d1} = relative importance of the 1st design requirement (DR_1);

AI_{d1} = Absolute importance of the 1st design requirement (DR_1);

If we assume that there are n total blended value requirements which include n_1 customer's value requirements, n_2 business's value requirements, and n_3 process's value requirements, then,

$$n_2 = n - (n_1 + n_3)$$

$$n_3 = n - (n_1 + n_2)$$

Blended Value Requirements		DR_1	DR_2	.....	DR_m	A. I.	R. I.
CRs	VR_{i1}	$R_{i1}D_{w1}$	$R_{i1}D_{w2}$	.....	$R_{i1}D_{wm}$	AI_{i1}	RI_{i1}
	VR_{i2}	$R_{i2}D_{w1}$	$R_{i2}D_{w2}$	.....	$R_{i2}D_{wm}$	AI_{i2}	RI_{i2}
	\vdots	\vdots	\vdots	\vdots	\vdots	\vdots	\vdots
	VR_{in}	$R_{in}D_{w1}$	$R_{in}D_{w2}$	.....	$R_{in}D_{wm}$	AI_{in}	RI_{in}
BRs	VR_{j1}	$R_{j1}D_{w1}$	$R_{j1}D_{w2}$	.....	$R_{j1}D_{wm}$	AI_{j1}	RI_{j1}
	VR_{j2}	$R_{j2}D_{w1}$	$R_{j2}D_{w2}$	.....	$R_{j2}D_{wm}$	AI_{j2}	RI_{j2}
	\vdots	\vdots	\vdots	\vdots	\vdots	\vdots	\vdots
	VR_{jn}	$R_{jn}D_{w1}$	$R_{jn}D_{w2}$	.....	$R_{jn}D_{wm}$	AI_{jn}	RI_{jn}
PRs	VR_{k1}	$R_{k1}D_{w1}$	$R_{k1}D_{w2}$	.....	$R_{k1}D_{wm}$	AI_{k1}	RI_{k1}
	VR_{k2}	$R_{k2}D_{w1}$	$R_{k2}D_{w2}$	.....	$R_{k2}D_{wm}$	AI_{k2}	RI_{k2}
	\vdots	\vdots	\vdots	\vdots	\vdots	\vdots	\vdots
	VR_{kn}	$R_{kn}D_{w1}$	$R_{kn}D_{w2}$	.....	$R_{kn}D_{wm}$	AI_{kn}	RI_{kn}
A. I.		AI_{d1}	AI_{d2}	.....	AI_{dm}		
R. I.		RI_{d1}	RI_{d2}	.....	RI_{dm}		

Note: A.I.= Absolute importance; R.I.= Relative importance; DR= Design requirements; CEVs= Customer's Value Requirements; BSVs= Business's Value Requirements; PSVs= Process's Value Requirements.

Table 1: QFD matrix.

Again, if we consider w_c , w_b , and w_p as the weights of the customer's value requirements (CRs), business's value requirements (BRs) and process's value requirements (PRs) decided by the decision makers respectively, then,

$$w_c + w_b + w_p = 1$$

Therefore, the relative importance of blended value requirements (BVRs) can be determined as follows:

$$RI_i^{BVR} = w_c RI_i^{CR} \quad i = 1, 2, \dots, n_1$$

$$RI_i^{BVR} = w_b RI_i^{BR} \quad i = n_1 + 1, n_1 + 2, \dots, n_2$$

$$RI_i^{BVR} = w_p RI_i^{PR} \quad i = n_2 + 1, n_2 + 2, \dots, n$$

Now if we assume that there are n number of blended value requirements and for them we need m number of design requirements then the rating R_{qt} between each pair of the q^{th} customer requirements (CR_q) and the t^{th} design requirements (DR_t) is acquired from a teamwork (Özgener, 2003; Wang & Hong, 2007) with the weighting value of 0-1-3-9 to represent no, weak, moderate, or strong relationship. To allow the possible inter-dependence among the design requirements let assume δ_{tu} denote the correlation between DR_t and DR_u . So, by adapting Wasserman (1993) a normalised R_{qt} can be defined as follows:

$$R_{qu}^{norm} = \frac{\sum_{t=1}^m R_{qt} \delta_{tu}}{\sum_{u=1}^m \sum_{t=1}^m R_{qt} \delta_{tu}} \dots\dots\dots (5)$$

where, $q = 1 \dots \dots \dots n$ and $u = 1 \dots \dots \dots m$

Therefore, by integrating R_{qu}^{norm} with RI_i^{IEVR} the overall importance weights of the design requirements can be determined as follows:

$$AI_u^{DR} = \sum_{i=1}^n RI_i^{IEVR} R_{qu}^{norm} \dots\dots\dots (6)$$

where, $u = 1 \dots \dots m$

$$RI_u^{DR} = \frac{AI_u^{DR}}{\sum_{u=1}^m AI_u^{DR}} \dots\dots\dots (7)$$

where, $u = 1 \dots \dots m$

The initial absolute importance and the relative importance of all other design requirements can be determined by following the Equation (1) and (4). Based on the example of customer requirements (blended value requirements) weights in Equation (2) and (3), and Equation (5) we can determine the normalised ratings of blended value requirements and design requirements. Then by integrating the normalised ratings of blended value requirements and design requirements and the relative importance weight of the blended value requirements we can define final absolute importance weight and relative importance weight of the design requirements as shown in Equation (6) and (7). The trade-offs among the selected design requirements are identified based on whether improving one design requirement have a positive, negative, and/or no effect on other design requirements. The physical relationships among the design requirements are specified on an array known as the ‘‘roof matrix’’. In the roof matrix four types of relations have been shown namely strong, medium, weak, and no relation which are represented by the following symbols: \surd = Very strong relation; Δ = strong relation; \square = weak relation.

5 CASE STUDY

The benefits of e-banking are already being enjoyed by the developed countries. Apart from the developed countries, the developing countries are also experiencing sturdy growth in e-banking including India, Thailand, Malaysia, Philippines and more (Mia, Rahman, & Uddin, 2007). Bangladesh is also experiencing the similar growth in e-banking. Bangladesh ranked 115th in the Global Network Readiness Index in 2010-2011 up from 130th in 2008-2009 (Dutta & Bilbao-Osorio, 2012) showing an significant upward trend in the ICT sector. Among all other businesses in Bangladesh the banking sector is ahead in implementing e-businesses, which is also termed as e-banking. Currently a number of private commercial banks and foreign commercial banks in the country are offering limited services of telebanking, internet banking, and online banking facilities. As a part of the stepping forward to e-banking, the foreign commercial banks (e.g., HSBC, Standard Chartered, Citibank N.A.) played the pioneering role with adoption of modern technology in retail banking during the late 1990s whereas the state owned commercial banks and private commercial banks came forward with such services recently (Hasan, Baten, Kamil, & Parveen, 2010). On 28 February 2011, the Central Bank of Bangladesh inaugurated the EFT (Electronic Funds Transfer) payment systems which is now being used by the 40 banks out of a total of 47 banks (30 private, 9

foreign, 4 state-owned, 4 specialized). Bangladesh has also developed automated clearing systems through which eighty percent of the payments are now cleared and settled (BB, 2011).

As the reach of ICT expands into the developing world, so does its impact on the society and environment, both positive and negative (Ansari, Ashraf, Malik, & Grunfeld, 2010). Although almost all the banks are implementing ICT to sustain in the competition, the sustainability of ICT is still not considered as the business driver in Bangladesh. Most of the banks have started realising the importance of the sustainability concept in e-business but still do not know how to achieve it through the fulfilment of environmental and social requirements. Few of the banks are trying to contribute for the social development but contributing fields are chosen in a standalone fashion without any analysis of the sustainability value requirements by customer, business, or process. The prevalence of this circumstance has motivated the researchers to conduct the study particularly on banking industry of Bangladesh. The name of the case company is Dutch-Bangla Bank Limited (DBBL) which is operating with its 125 online branches and about 2500 ATM booths around the country. The bank also provides Mobile, SMS, and Internet banking facilities. DBBL was the first bank in Bangladesh to introduce ATM and e-banking and has adopted the same exact automation solution used by international banking giants (Biswas, Taleb, & Shinwary, 2011). The following sections enumerate the case study analysis and discussion by applying an AHP-integrated QFD approach. Following the research steps in methodology section the QFD process in this case study starts with identification of blended value requirements (WHATs) and their weights. Consequently, identification of design requirements (HOWs) corresponding to the blended value requirements are discussed and so on.

5.1 Identification of blended value requirements (WHATs)

As per the opinion of the respondents of the case company the following blended value requirements have been identified:

5.1.1 Sustainability value requirements for customer

The identified important sustainability value requirements for customers according to their weights are as follows:(i)Security of the Services (CR1); (ii) Quality of the Services (CR2); (iii) Simplicity of the Services (CR3); (iv) Profit/Benefits from the Services (CR4); (v) Energy Resources(CR5); (vi) Legislation and Code of Conduct compliance (CR6); (vii) Accountability of Products and Services (CR7)(viii) Total Time to get the Services (CR8) (ix) Customer Service Excellence (CR9) (x) Potential Value Added Services (CR10); (xi) Air Resources (CR11); (xii) Usage of Materials (CR12); and more requirements which are not listed here due to the space limit but included in Figure 1 (see Figure 1 and Table 2).

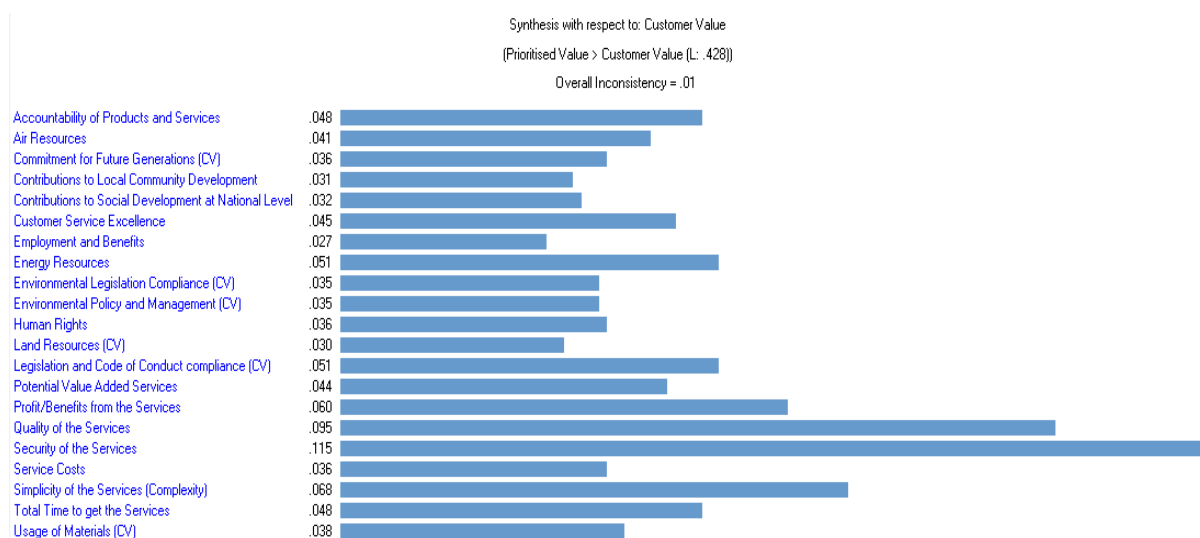


Figure 1: Weights of the sustainability value requirements for customer.

5.1.2 Sustainability value requirements for business

The following are the identified important sustainability value requirements for business according to their weights: (i) Reputation of the Organisation(BR1); (ii) Profitability, Liquidity and Investment Capability (BR2); (iii) Economic Performance (share performance, market growth, ROI)(BR3); (iv) Cost of Goods, Materials and Services (BR4); (v) Customer Relationship Management(BR5); (vi) Risk and Crisis Management(BBR6); (vii) Investments for Potential Benefits (from Improvements) (BR7)(viii) Productivity for Cost Efficiency(BR8); (ix) Products and Services Responsibility(BR9) (x) Fuel and Power Consumption (BR10); and more requirements which are not listed here due to the space limit but included in Figure 2(see Figure 2and Table 2).

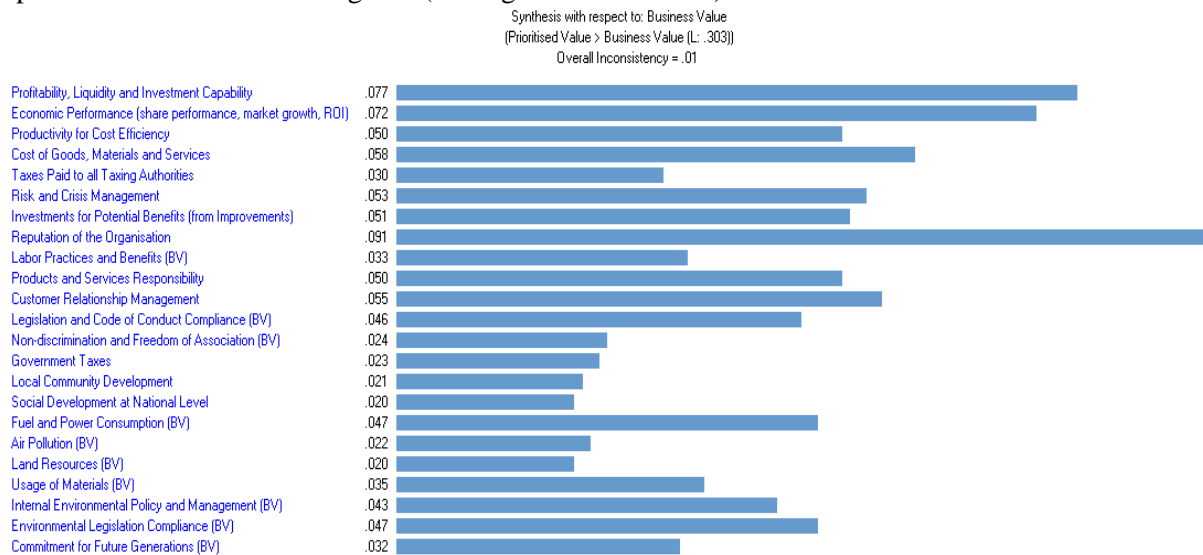


Figure 2: Weights of the sustainability value requirements for business.

5.1.3 Sustainability value requirements for process

The identified important sustainability value requirements for process according to their weights are:(i)Process Security (PR1); (ii)Risk and Crisis Management of the Processes(PR2); (iii) Meeting Additional Customer Requirements(PR3); (iv) Productivity of the Processes (PR4); (v) Financial Structure (ROI, Liquidity, Investment Capability) (PR5); (vi) Product and Service Requirements(PR6); (vii) Environmental Legislation Compliance (PR7); (viii) Fuel and Power Consumption (PR8); (ix) Investments for Potential Benefits (from Technological Improvement)(PR9); (x) Process Costs(PR10); and more requirements which are not listed here due to the space limit but included in Figure 3(see Figure 3and Table 2).

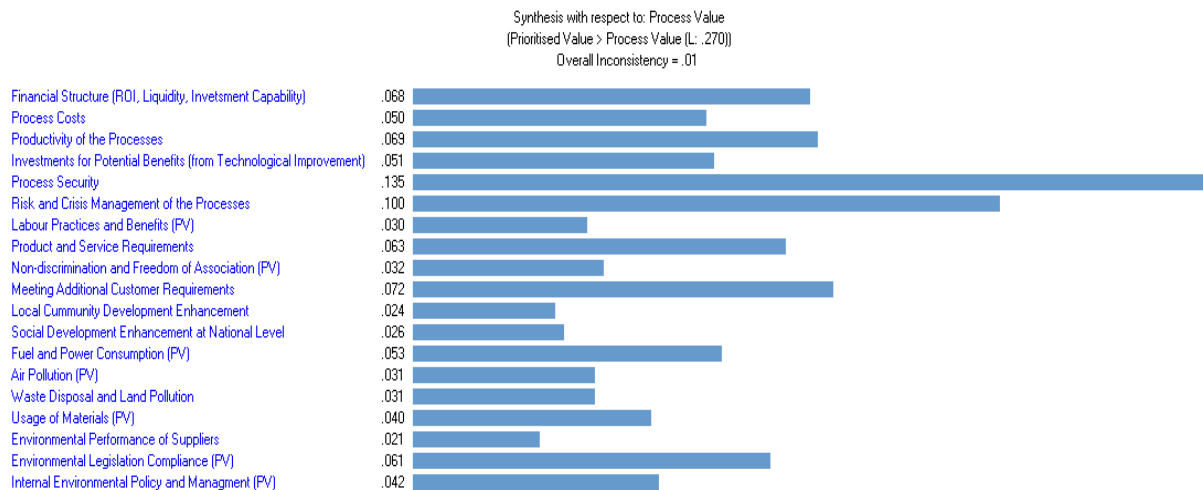


Figure 3: Weights of the sustainability value requirements for process.



Figure 4: Weights of the sustainability values.

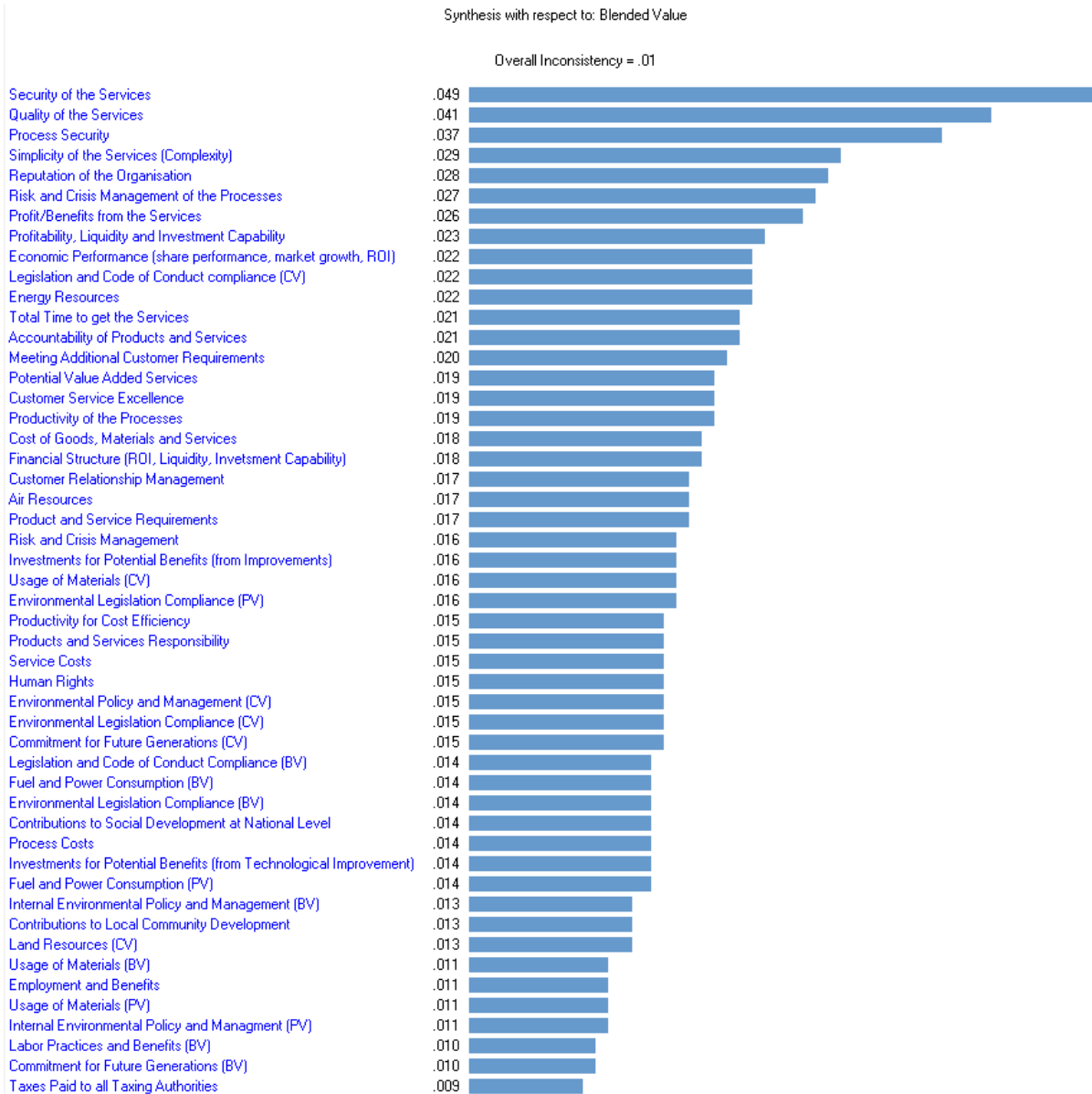


Figure 5: Weights of the three dimensional blended value requirements.

5.1.4 Blended value requirements

After identification of the sustainability value requirements of customer, business, and process a total of 6 respondents (2 strategic managers, head and deputy head of IT division, 1 corporate customer, and 1 retail customer) have been asked to put weights for economic value, social value, and environmental value based on their understanding of the business to get prioritised blended value requirements (see Figure 4). Based on those weights important blended value requirements were identified which are as follows according to their weights: (i) Security of the Services; (ii) Quality of the Services; (iii) Process Security; (iv) Simplicity of the Services; (v) Reputation of the Organisation;

(vi) Risk and Crisis Management of the Processes; (vii) Profit/Benefits from the Services; (viii) Profitability, Liquidity and Investment Capability; (ix) Economic Performance (share performance, market growth, ROI); (x) Legislation and Code of Conduct compliance; and more requirements which are not listed here due to the space limit but included in Figure 5 (see Figure 5 and Table 2).

Sustainability value requirements for customer:	AHP weight	Order of importance	Integrated weight	Integrated order of importance
Security of the Services	0.115	1	0.049	1
Quality of the Services	0.095	2	0.041	2
Simplicity of the Services	0.068	3	0.029	4
Profit/Benefits from the Services	0.060	4	0.026	7
Energy Resources	0.051	5	0.022	9
Legislation and Code of Conduct compliance	0.051	6	0.022	9
Accountability of Products and Services	0.048	7	0.021	10
Total Time to get the Services	0.048	8	0.021	10
Customer Service Excellence	0.045	9	0.019	12
Potential Value Added Services	0.044	10	0.019	12
Air Resources	0.041	11	0.017	14
Usage of Materials	0.038	12	0.016	15
Sustainability value requirements for business:				
Reputation of the Organisation	0.091	1	0.028	5
Profitability, Liquidity and Investment Capability	0.077	2	0.023	8
Economic Performance (share performance, market growth, ROI)	0.072	3	0.022	9
Cost of Goods, Materials and Services	0.058	4	0.018	13
Customer Relationship Management	0.055	5	0.017	14
Risk and Crisis Management	0.053	6	0.016	15
Investments for Potential Benefits (from Improvements)	0.051	7	0.016	15
Sustainability value requirements for process:				
Process Security	0.135	1	0.037	3
Risk and Crisis Management of the Processes	0.100	2	0.027	6
Meeting Additional Customer Requirements	0.072	3	0.020	11
Productivity of the Processes	0.069	4	0.019	12
Financial Structure (ROI, Liquidity, Investment Capability)	0.068	5	0.018	13
Product and Service Requirements	0.063	6	0.017	14
Environmental Legislation Compliance	0.061	7	0.016	15

Table 2: AHP weights of the blended value requirements: segmented and integrated.

5.2 Identification of design requirements (HOWs)

After identification of the three dimensional blended value requirements the design requirements have been explored from the interview with the decision makers of the bank. The decision makers agreed on the fact that it is not possible for the company to implement design requirements for all 63 blended value requirements at the same time. Therefore, at this stage only top 26 blended value requirements from the integrated priority list which are ranked from 1 to 15 according to their weights are used to decide corresponding design requirements. It has been found from the AHP calculations that some of the blended value requirements have same importance weights. Therefore, the integrated order of importance ranks from 1 to 15 although the total number of items in three categories is 26 (see Table 2). The design requirements that are identified by the decision makers to meet the blended value requirements are: (i) Outsource high security software and hardware. (DR1); (ii) Emphasizing on learning and development through R&D for awareness about the security, vigilance on quality, and

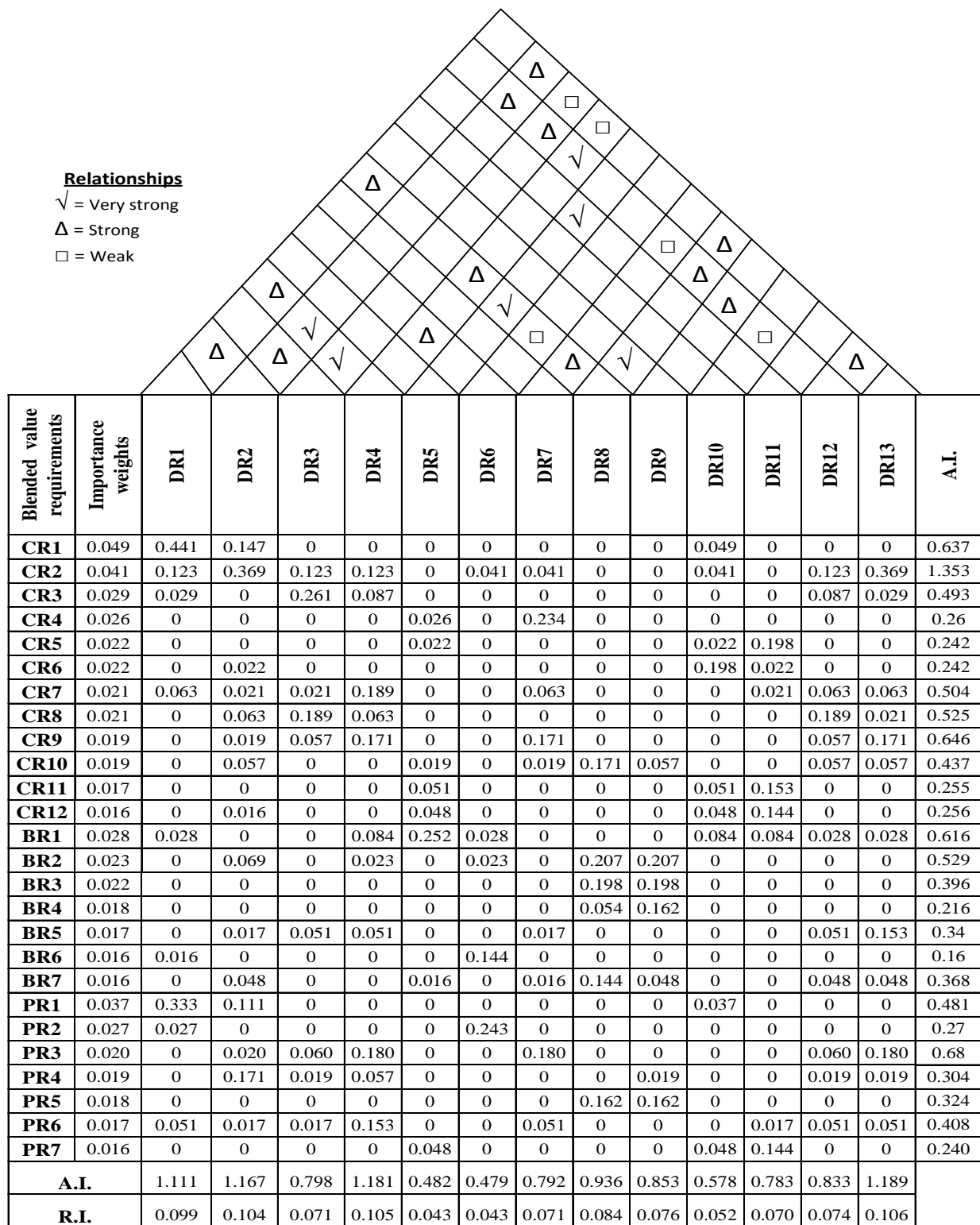


Figure 6: House of Sustainability.

efficiency of employee (DR2); (iii) Analyse customer requirements and provide customer friendly services by easing the service delivery process (DR3); (iv) Ensure quality of service, trust and commitment for transparency, reliability and accuracy of service (DR4); (v) Increase CSR activities for future generation, national development (DR5); (vi) Follow internationally reputed banks for improving crisis management team and analyse early warning signals (DR6); (vii) Redesign products (rewarding options for customers, reduced customer costs and adjust service costs with other

costs)(DR7); (viii) Improve market share(profitability, growth rate, investment capability) (DR8) (ix) Manage investment efficiently (minimise costs and maximise earning, increase EPS and ROI, reduce non-performing assets) (DR9); (x) Improve vigilance to illegal actions through developing vigilance team (DR10); (xi) Establish green banking unit (DR11); (xii) Ensure availability of service delivery point and prompt service delivery (DR12); and (xiii) Improve customer service through developing CRM unit (DR13) (see Figure 6).

6 DISCUSSION AND LIMITATIONS

From the interview of the six decision makers of the company and six customers (corporate and retail) a total of 63 blended value requirements have been identified from three categories. After identification of all the blended value requirements, respondents have been asked to compare among the blended value requirements within each category. Then they were asked to compare among customer value, business value, and process value (see Figure 4). Based on the weights of the customer value, business value, and process value the integrated weights of all blended value requirements were calculated using AHP. The AHP weights of each category of blended value requirements are shown in Figure 1, Figure 2, and Figure 3; and the integrated AHP weights are shown in Figure 5. From the QFD analysis it can be enumerated that among all the blended value requirements the most important requirement is 'Security of the Services' (0.049) and corresponding to this value requirement the most important design requirements are 'Outsource high security software and hardware' (DR1) and 'Emphasizing on learning and development through R&D for awareness about the security, vigilance on quality, efficiency of employee' (DR2). Corresponding to the second important blended value requirement 'Quality of the Services' (0.041), the most important design requirement is 'Emphasizing on learning and development through R&D for awareness about the security, vigilance on quality, and efficiency of employee' (DR2) and 'Improve customer service through developing CRM unit' (DR13). Regarding the third important blended value requirement 'Process security' (0.037), the important design requirement is 'Analyse customer requirements and provide customer friendly services by easing the service delivery process' (DR3). Similarly, for the fourth important blended value requirement 'Simplicity of the Services' (0.029), the important design requirement is 'Redesign products (DR7); and so on (see Figure 6).

From the House of Sustainability (Figure 6) it is found that DR13 has the highest relative importance (0.106) since it is contributing significantly to CR2, CR9, BR5, and PR3. Similarly, DR4 holds the second highest relative importance (0.105) as it is considerably contributing to CR9, PR3, PR6, CR2, CR7, BR1, BR5, and PR4; and DR1 holds the third highest relative importance (0.099). Moreover, the roof matrix of the House of Sustainability shows that there is a very strong relationship between 'Emphasizing on learning and development through R&D for awareness about the security, vigilance on quality, and efficiency of employee' (DR2) and 'Ensure quality of service, trust and commitment for transparency, reliability and accuracy of service' (DR4). It is also notable that the relationship between 'Analyse customer requirements and provide customer friendly services by easing the service delivery process' (DR3) and 'Ensure quality of service, trust and commitment for transparency, reliability and accuracy of service' (DR4) and the relationship between 'Increase CSR activities for future generation, national development' (DR5) and 'Improve market share' (DR8) are strong, too. Therefore, implementation of DR2 and DR4 together will save some costs since they are highly correlated and one design requirement contributes to the other. Similarly, DR3 and DR4 together, DR5 and DR7 together, DR5 and DR8 together, DR8 and DR9 together, and DR4 and DR12 together will also save costs, too. Now, based on this QFD analysis the company knows which blended value requirements are most important and which design requirements to go for first based on its capability.

One insignificant limitation of this research approach is that it doesn't consider the capabilities (financial and readiness) of the organisation when deciding about the design requirements as it is assumed that every company knows its capability. Besides, this research approach gives the flexibility to choose the design requirements from the relative importance list based on the importance weights and individual company's capability.

7 CONCLUSION

The implications of this study are manifold. Firstly, the approach efficiently identifies the important blended value requirements using AHP. Secondly, it suggests the corresponding design requirements to efficiently fulfil those blended value requirements. Thirdly, it uses correlation matrix and roof-matrix to identify the most important design requirements for the strategic implementations by the management. Finally, this approach is unique in the sense that in developing House of Sustainability for e-business, blended value requirements are considered from three dimensions instead of one dimension. Which was not shown before is that how sustainability concept can be integrated with customer's value requirements, business's value requirements, and process's value requirements. Based on the opinion of respondents a comprehensive case study has been demonstrated. Our further research will include QFD analysis along with the cost-benefit analysis to identify the optimised design requirements for the sustainability of the e-business. Next step of our research will also include conducting survey based research to see how the identified design requirements for blended value requirements really contribute to the sustainability of e-business.

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