IOP Conf. Series: Materials Science and Engineering **528** (2019) 012072 doi:10.1088/1757-899X/528/1/012072

Measurement and proposal of improving Marketing Process to improve the Quality of Aftersales Services with Fuzzy Quality Function Deployment and Data Mining Methods in OV Agency

R Fitriana, W Kurniawan and M R Anwar

Quality Engineering Laboratory, Department of Industrial Engineering, Faculty of Industrial Technology, Universitas Trisakti, Indonesia
rinaf@trisakti.ac.id, wawan_bdb2@yahoo.com, anwaresta@gmail.com

Abstract. OV Agency is a marketing, sales and service office under PL Assurance. The issues contained in the OV Agency include a lack of understanding of the client against the types and benefits of unit-linked insurance products taken, causing the client to stop paying the premium (expired) or closing policy (surrender), the problems caused by the agency lacking a detailed explanation lead to misunderstanding by the customer. The purpose of this study is to analyze customer satisfaction and service quality conditions, using Fuzzy-Quality Function Deployment to improve service quality, and use data mining to obtain useful indications based on data obtained from questionnaires and interviews. Questionnaires were made with the results of discussions with OV Agency which were then distributed to 100 customer samples. The results of the questionnaire answers are converted into fuzzy numbers which are then processed by the QFD method to determine the technical response to be performed first. The company uses an optimistic index with a value of 0.5 in carrying out technical responses. The three main priorities of technical responses to be undertaken under the prescribed Fuzzy QFD method are to increase the frequency and quality of training for agents, improve quality standards within the company, and update the methods and techniques used in the training. Data mining is calculating to determine the overall level of customer satisfaction. The satisfactory results of OV Agency customer satisfaction rate, it can be seen from satisfactory posterior probability has the greatest value of 0.0017.
Keywords: Fuzzy, Quality Function Deployment, Data Mining

1. Introduction

OV agency is a marketing, sales and service operations office under the auspices of PL assurance. Services provided by this company include financial literacy, life insurance & income protection, corporate insurance, estate planning, wealth management, will & trust services. The study was limited to OV agency offices. In almost 3 years, OV agency has been ranked as the top four among more than 200 agencies in Indonesia.

Problems in the agency include client dissatisfaction with the type and benefits of unit link insurance products taken, which causes the client to stop paying premiums (lapsed) or close the policy (surrender). Another thing, the client also lacks understanding of the procedures and requirements of the claim, which causes the claim to be late or not paid. The things mentioned above are caused by consumers'

misunderstandings when getting an explanation by an agent or an agent lacking a detailed explanation that causes misunderstanding by the customer.

The purpose of this study is to 1) Analysis of customer satisfaction conditions and current service quality at OV Agency; 2) Proposed use of Fuzzy Quality Function Deployment in marketing process at OV Agency to improve service quality; 3) Using data mining to obtain a relationship or pattern that provides useful indications based on data obtained from questionnaires and interviews.

QFD is a method used to design a process of products or services tailored to the wishes of consumers or customers (Voice of Customer or VoC) [1]. Meanwhile, according to [2] in [3], QFD method in principle is an effort made to translate what the consumer wants into what is produced by the company.

When using fuzzy calculations in the QFD matrix, the result of the weight calculation for each functional item is not an integer but a fuzzy number. Liou and Wang in [4] describe a perfect algorithm for fuzzy ranking methods. Their method of using integral values as a fuzzy index has resulted in efficient and consistent calculations. An adjustable index for integrated fuzzy numbers (ω) is used as an optimistic level in an improvement process.

According to Day in [3], to find out company problems related to product planning or service processes involving consumers, the HoQ matrix is used. Data mining is a semi-automatic process that uses statistical techniques, mathematics, artificial intelligence, and machine learning to extract and identify useful and useful knowledge information stored in large databases [5].

Table 1. Research Position

NO	TOPIC	SOURCE
1.	Integration between Fuzzy, Servqual, and Quality Function Deployment	[6]
2.	Integration between Business Intelligence, Fuzzy FMEA and Data Mining	[7]
3.	Integration between Business Intelligence, Quality Function Deployment, and Data Mining	[8]
4.	Integration between Fuzzy and Quality Function Deployment	[9]
5.	Integration between ANP Weighted Crisp and Fuzzy QFD	[10]
6.	Integration between Fuzzy, Quality Function Deployment, and Data Mining	This Research Position

Table 1 is a research table on QFD and Data Mining around the world. The position of this research among other studies around the world, can be seen from various aspects above. Can be seen from the aspect of Quality Control research methodology is a combination of fuzzy and method of quality function deployment, where QFD is applied simultaneously with fuzzy logic to reduce the subject subjectivity of respondents. Data mining method is also used to know the classification of satisfaction level on OV Agency.

2. Methodology

The study began through an interview with the senior agency director of OV Agency to get initial information about the company, the products offered, and problems that occurred. Then conducted research based on sales data and persistence data. In addition, the initial phase research was carried out with literature studies through the collection of theories related to the topic of research through reference to textbooks, e-books, and journals. Based on the results of both identified that the problem to be lifted is the lack of understanding of consumers when given an explanation by the agent or the agency lacks detailed explanations that cause misunderstandings by customers that cause customers to close the policy. From these problems determined the purpose of this study.

The next stage is to collect data consisting of primary and secondary data. Primary data consists of the results of the distribution of questionnaires, while secondary data consists of general company data, HR, and products offered. The next process is to analyze the current conditions of customer satisfaction with insurance products and services. Data processing is done by data mining classification method to determine the level of customer satisfaction. Processing questionnaire data and interviews using fuzzy

quality fuction deployment. From the results of the analysis of Fuzzy-Quality Function Deployment (FQFD) can be made improvement proposals.

3. Result and Discussion

3.1 Data Mining

The data used in data mining processing using the data of questionnaire results of satisfaction level on products and insurance services that have undergone processing in the form of code changes satisfaction level to the level of satisfaction.

The initial stage in manual data mining calculation using bayes method is by determining the posterior classification probability first. Prior probability is obtained by dividing the number of one classification by the number of correspondents or can be seen in formula 1.

$$Prior\ Probability = \frac{x_i}{\Sigma_{i=1}^{n} x} \quad (1)$$

On insurance products and services have a posterior probability that has great value in satisfactory classification with values above 0.5. The overall posterior probability results data can be seen in Table 2.

Table 2. Probability of Prior Products and Insurance Services

Classification	Count	Prior Probability
Very Satisfying	17	0.17
Satisfying	56	0.56
Good Enough	26	0.26
Not Satisfying	1	0.01
Very Unsatisfying	0	0.00

The next stage after getting prior probability is to get the probability of interaction between each attribute with classification. Having obtained the probability of interaction of each attribute by classification, the next step in the use of classification by bayes method is to calculate P (At | K) or known as the probability of attribute interaction with classification. P (At | K) is obtained by multiplying each probability of interaction with the classification of respondents.

$$P(At|K) = P(At|K)_1 \times P(At|K)_2 \times \ldots \times P(At|K)_n \quad (2)$$

After that done the calculation of P (K) P (At | K). The calculation is by multiplication of the prior probability of the classification with the probability of the interaction already obtained.

Next calculate the posterior probability, posterior probability can be obtained by the following way:

$$Posterior\ Probability = \frac{P(K).P(At|K)}{P(K)} \quad (3)$$

The results of the posterior probability calculation of OV Agency insurance products and services using the Bayes method can be seen in Table 3.

Table 3. Results of Calculation of Posterior Probabilities

Classification	Prior Probability	Posterior Probability
Very Satisfying	0.17	7,05266E-12
Satisfying	0.56	0,001719532
Good Enough	0.26	7,56975E-10
Not Satisfying	0.01	2,60812E-32
Very Unsatisfying	0.00	0

The prior probability is the probability derived from the preliminary study data, whereas the posterior probability is the probability that has been corrected after additional information or after conducting the research. The conclusion of the bayes method uses the result of posterior probability data by looking at

the result of posterior probability. The conclusion is taken when the highest posterior probability value in the classification or can be formulated as follows:

$$h_{MAP} = arg\ max\ P(x|h)\ P(h) \quad (4)$$

In this study, OV Agency insurance products and services based on data table 8 can be concluded that the level of service satisfaction provided by the company to respondents is at a satisfaction level of satisfied.

3.2 Quality Function Deployment

Voice of customer is an OV Agency customer's voice obtained from customer interviews, customer complaints, from researches ever conducted on the quality of service on insurance, and consultation with the company, to know the needs and desires of the real customers.

Quantitative data collection at this stage is done by conducting surveys using tools or instruments in the form of questionnaires distributed to customers of OV Agency through google form. Criteria of the intended respondents are customers who have or have had an insurance policy in PT. PL Assurance by using the services of OV Agency. For the initial stage of the dissemination of approximately 30 questionnaires as a pilot test. After the questionnaire was valid and reliable, 100 questionnaires were distributed to obtain the required data. After getting 100 respondents, the choice of accepting response on google form is closed.

This section shows how important each attribute is the voice of customer in the eyes of the respondent. The calculation is done by determining the mode of the attribute importance level questionnaire, which results can be seen in Table 4.

Table 4. Importance to Customer

No.	Code	*Voice of Customer* (Importance)	Modus
1	A1	Completeness of the Agent's tools, documents or tools while serving you	4
2	A2	Appearance & carriage Agent when interacting with you	4
3	B1	The accuracy of solutions or products provided by the agent according to the needs & desires	5
4	B2	Agent's ability to resolve requests & problems	5
5	B3	Knowledge & skills Agent in insurance financial services	5
6	B4	Agent's ability to understand your needs & wants	5
7	C1	Speed & alertness Agent in providing responses	5
8	C2	Clarity of time estimation of the Agent on a service process	5
9	D1	Agent's ability to listen to your needs & wants	5
10	D2	Availability of agent time in serving you	5
11	E1	The language the Agent uses is clear & easy to understand when serving you	4
12	E2	The hospitality shown by the Agent while serving you	5
13	E3	Ease of Agent to be contacted either face to face or by phone	5
14	F1	Your trust in agents for long-term service	5
15	G1	Security & convenience in doing transaction through Agent	5

The value of improvement ratio is obtained from the comparison between the company's target and the current satisfaction performance, where this value shows the weight of difficulties to make improvements in meeting customer needs. This value also determines which Voice of Customer attributes will later be followed up. If the ratio is less than 1 (≤1), then the Voice of Customer (VoC) attribute does not need to be given a technical response anymore. A smaller ratio equal to 1 means that the level of customer satisfaction with an attribute is above or equal to the level of importance of the attribute so that it no longer needs to be given a technical response to improve the level of customer satisfaction.

Development of House of Quality matrix is done to answer customer's desire on service attributes at Onevison Agency, with aim to improve service quality and OV Agency performance. Because the technical response provided was related to service aspects, the determination was made by conducting

interviews and discussions with the senior agency director of OV Agency. Besides that, the writer also gave advice on what actions should be taken by the OV Agency based on the results of a questionnaire which was distributed to 100 OV Agency agents. From here OV Agency provides a series of technical actions in response to all the customer's request.

Correlation matrix needs to be created to map relationships and interdependencies between technical responses. If we can map, then we can see if the dependence affects the technical response to meet customer needs. This relationship is illustrated by symbols. Empty means there is no relationship between technical responses, circle with content means having a strong positive relationship between technical responses, an empty circle means having a very strong relationship between technical responses. From the results of interviews with the senior agency director of the OV Agency, the technical correlation can be prepared as shown in Figure 1.

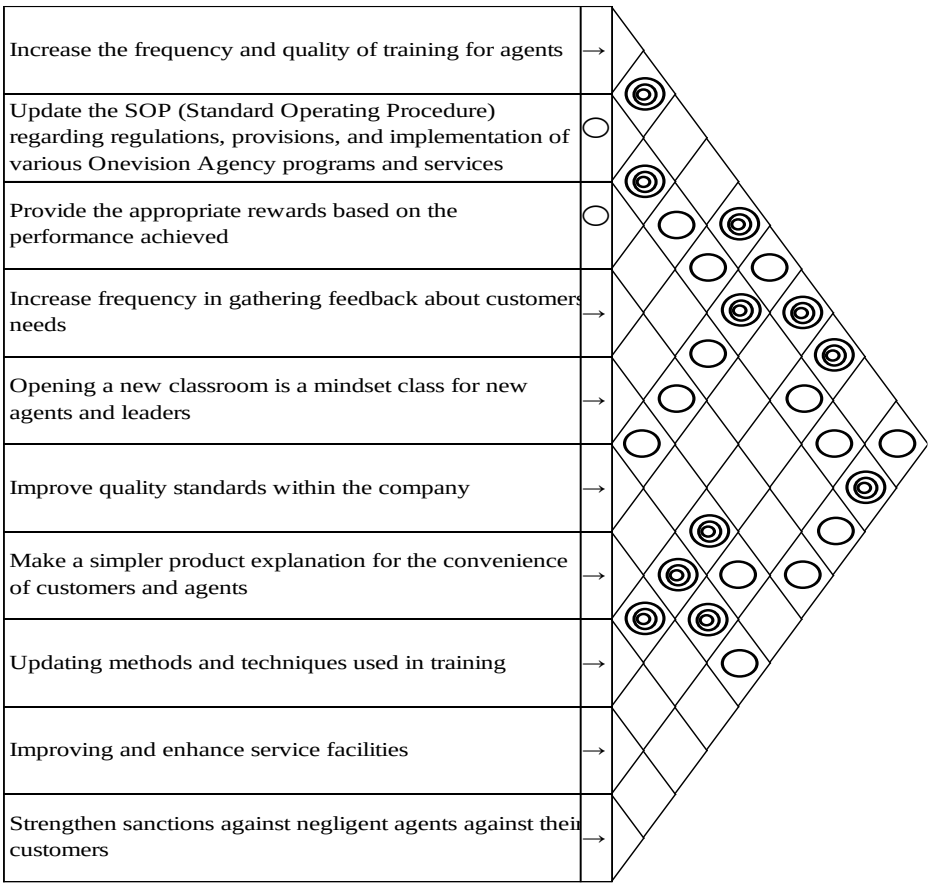

Figure 1. Technical Responses Correlation Matrix

Having obtained the level of importance and level of relationship between the technical response with the VoC attribute, then we can calculate the weighting of technical response by using fuzzy numbers. Each level of importance of the VoC attribute is broken down by its fuzzy numbers, Fuzzy numbers derived from the membership function of a trapezoidal fuzzy number, as can be seen in Figure 2. Trapezoidal fuzzy numbers are chosen because they are the easiest to understand and best suited for their use for QFD because the varying levels in determining the level of importance and level of relationship, these numbers can be seen in Table 5.

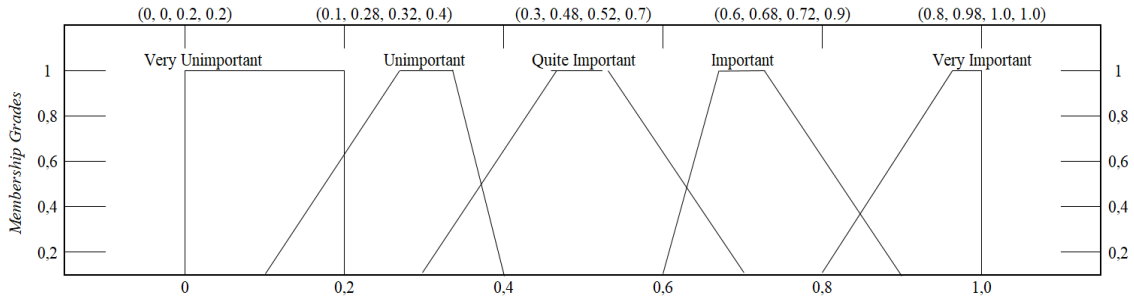

Figure 2. Trapezoidal fuzzy numbers for QFD

Table 5. Trapezoidal fuzzy numbers for QFD

Importance/Correlation	*Trapezoidal Fuzzy Numbers*			
	α	β	γ	δ
Very Unimportant/Very Weak	0	0	0.2	0.2
Unimportant/Weak	0.1	0.28	0.32	0.4
Quite Important/Strong Enough	0.3	0.48	0.52	0.7
Important/Strong	0.6	0.68	0.72	0.9
Very Important/Very Strong	0.8	0.98	1.0	1.0

Examples of solving steps to the constituent trapezoidal fuzzy numbers for the importance of the VoC "Speed & Alertness of Agents in providing responses" are:

- The value of interest rate mode of the VoC "The speed & alertness of the agent in responding/responding" is 5.
- The number 5 is the value of importance with the level of "Very Important".
- These attributes fall into very strong categories, so the trapezoidal fuzzy numbers of their constituents are 0.8, 0.98, 1, and 1 (α, β, γ, δ).

Here is the trapezoidal fuzzy number of the compilers of the VoC attributes for their importance:

Table 6. Trapezoidal Fuzzy Numbers Composer Importance Level of VoC

Num.	Code	Voice of Customer (Importance)	α	β	γ	δ
1	A1	Completeness of the Agent's tools, documents or tools while serving you	0.6	0.68	0.72	0.9
2	A2	Appearance & carriage Agent when interacting with you	0.6	0.68	0.72	0.9
3	B1	The accuracy of solutions or products provided by the agent according to the needs & desires	0.8	0.98	1.0	1.0
4	B2	Agent's ability to resolve requests & problems	0.8	0.98	1.0	1.0
5	B3	Knowledge & skills Agent in insurance financial services	0.8	0.98	1.0	1.0
6	B4	Agent's ability to understand your needs & wants	0.8	0.98	1.0	1.0
7	C1	Speed & alertness Agent in providing responses	0.8	0.98	1.0	1.0
8	C2	Clarity of time estimation of the Agent on a service process	0.8	0.98	1.0	1.0
9	D1	Agent's ability to listen to your needs & wants	0.8	0.98	1.0	1.0
10	D2	Availability of agent time in serving you	0.8	0.98	1.0	1.0
11	E1	The language the Agent uses is clear & easy to understand when serving you	0.6	0.68	0.72	0.9
12	E2	The hospitality shown by the Agent while serving you	0.8	0.98	1.0	1.0
13	E3	Ease of Agent to be contacted either face to face or by phone	0.8	0.98	1.0	1.0
14	F1	Your trust in agents for long-term service	0.8	0.98	1.0	1.0
15	G1	Security & convenience in doing transaction through Agent	0.8	0.98	1.0	1.0

After solving the level of importance and level of relationship into its trapezoidal fuzzy number respectively, then by adding (+) and fuzzy multiplication (x) will be obtained fuzzy trapezoidal number of the compiler of technical response with the formula 5.

$$\boldsymbol{W_j = (R_{1j} \otimes D_1) \oplus (R_{2j} \otimes D_2) \oplus \ldots \oplus (R_{nj} \otimes D_n)} \quad (5)$$

Where:
Wj : the result weight for the j-functional item
Rij : level of correlation between the j-functional items with the i-strategic plan
At : the importance of i-th strategic plan
$\oplus$: fuzzy sum
$\otimes$: fuzzy multiplication
The result of fuzzy numbers calculation of each technical response (α, β, γ, δ) can be seen in Table 7.

Table 7. Fuzzy Numbers Compiler for Each Technical Response

Num.	Technical Responses	*Fuzzy Numbers*			
		α	β	γ	δ
1	Increase the frequency and quality of training for agents	4.04	5.72	6.12	7.31
2	Update the SOP regarding regulations, provisions, and implementation of various OV Agency programs and services	1.44	2.27	2.48	3.20
3	Provide the appropriate rewards based on the performance achieved	2.24	3.68	4.04	5.20
4	Increase frequency in gathering feedback about customers' needs	2.40	3.55	3.72	3.90
5	Opening a new classroom is a mindset class for new agents and leaders	1.20	2.35	2.60	3.50
6	Improve quality standards within the company	3.36	5.15	5.48	6.20
7	Make a simpler product explanation for the convenience of customers and agents	1.20	1.80	1.96	2.50
8	Update methods and techniques used in training	3.16	4.66	5.00	5.91
9	Improve and enhance service facilities	1.44	2.00	2.16	2.70
10	Strengthen sanctions against negligent agents against their customers	2.32	3.80	4.08	4.70

After obtaining the four fuzzy trapezoidal numbers of the technical response, we can calculate the total integral value for W from the decrease (formula 3), that is the total integral value for fuzzy $\tilde{A}$ with an optimism index $\omega(l_T^{\omega}(\tilde{A}))$, can be described in the following formula:

$$\boldsymbol{l_T^{\omega}(\tilde{A}) = (1-\omega)\int_0^1 g_A^L(y)dy + \omega\int_0^1 g_A^R(y)dy} \quad (6)$$

namely with the result of the formula as follows:

$$\boldsymbol{Wj = \frac{1}{2} \times \{(1-\omega) \times (\alpha_j + \beta_j) + \omega \times (\gamma_j + \delta_j)\}} \quad (7)$$

The results of the calculation of the total integral values for each technical response for each level of optimism can be seen in Table 8.

Table 8. Total Integral Value of Technical Response

Num.	Technical Responses	W		
		ω = 0	ω = 0.5	ω = 1
1	Increase the frequency and quality of training for agents	5.27	6.16	7.05
2	Update the SOP (Standard Operating Procedure) regarding regulations, provisions, and implementation of various OV Agency programs and services	1.86	2.35	2.84
3	Provide the appropriate rewards based on the performance achieved	2.96	3.79	4.62
4	Increase frequency in gathering feedback about customers' needs	2.97	3.39	3.81
5	Opening a new classroom is a mindset class for new agents and leaders	1.78	2.41	3.05
6	Improve quality standards within the company	4.26	5.05	5.84
7	Make a simpler product explanation for the convenience of customers and agents	1.5	1.87	2.23
8	Update methods and techniques used in training	4.07	4.84	5.6
9	Improve and enhance service facilities	2.17	2.49	2.81
10	Strengthen sanctions against negligent agents against their customers	3.06	3.73	4.39

From the above calculation results, it can be sorted priority technical response that should be done to meet the Voice of Customer.

4. Conclusion

The results of the analysis of the initial conditions, the research questionnaire design, fuzzy-QFD calculation, and calculation results of data mining has been carried out, the conclusion as follows:

1. The calculation result using data mining method with Bayes classification customer of OV Agency generally located in satisfactory classification.
2. Based on customer satisfaction analysis and current service quality at OV Agency whose data obtained from questionnaire results, it can be decided that action is needed to improve the quality of service and product. It can be seen from the gap that exists between the level of importance and the level of satisfaction, where there is no value zero or minus the improvement ratio.
3. Based on the condition of the company and the results of interviews with senior agency directors from the OV Agency. It is recommended that companies use the optimistic index level (ω) with a value of 0.5 to make a decision for run a technical response.
4. Based on the results of data processing using Fuzzy-QFD method, obtained HOQ matrix used to see the level of customer satisfaction and technical response which should first be implemented on OV Agency.
5. Based on the HOQ matrix obtained from Fuzzy-QFD¸ it can be decided that the 3 main priorities for actions that should be implemented first are to increase the frequency and quality of training for agents, improve quality standards in the company, and update the methods and techniques used in training.

5. References

[1] Kiran D R 2016 *Total Quality Management: Key Concepts and Case Studies*. 1st Ed. (Butterworth-Heinemann Oxford)
[2] Cohen L 1995 *Quality Fuction Deployment. How to make QFD Work with You.* (Addison-Wesley)
[3] Jaiswal E S 2012 *Case Study on Quality Function Deployment (QFD) 2012 IOSR J. of Mechanical and Civil Eng.* **3** 6 (India: Mewar University India)
[4] Garcia M S and Lamata M T 2007 A modification of the index of liou and wang for ranking fuzzy number *Int. J. of Uncertainty, Fuzziness and Knowledge- Based Systems* **15** 04 pp.411-424
[5] Turban E 2005 *Decision Support System and Intelligent System.* (Yogyakarta: Penerbit Andi).
[6] Bayu A, Effendi M and Effendi U 2017 Customer Satisfaction Analysis with Fuzzy–Servqual Method and Quality Function Deployment (QFD) (Case Study at Café Right Time Malang) *J. Teknologi Pertanian* **18** 2 (Malang: Teknologi Pertanian Universitas Brawijaya)
[7] Fitriana R 2013 Rancang Bangun Sistem Intelejensi Bisnis Untuk Argoindsutri Susu Sekala Menengah di Indonesia. *Dissertation*. (Bogor: Institut Pertanian Bogor)
[8] Fitriana R, Saragih J and Firmansyah M A 2016 Business Intelligence System Model Proposals to Improve the Quality of Service at PT GIA. *Proc. of 9th Int. Seminar on Industrial Engineering and Management.*
[9] Nurhakim L 2008 *Analisis aspek pelayanan perusahaan perbankan nasional dengan metode fuzzy QFD* Skripsi Industrial Engineering University of Indonesia Depok Indonesia.
[10] Zaim S, Sevkli M, Camgöz-Akdağ H, Demirel O F, Yayla A Y and Delen D 2014 Use of ANP Weighted Crisp and Fuzzy QFD for Product Development. *Expert Systems with Applications* **41** 9 pp 4464-74