INTERNAL BENCHMARKING METHODOLOGY AND ITS IMPLEMENTATION ON APPAREL RETAIL INDUSTRY

İÇ KIYASLAMA METODOLOJİSİ VE HAZIR GİYİM PERAKENDE SEKTÖRÜNDE UYGULANMASI

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ABSTRACT

In this study, a methodology for an internal benchmarking process was proposed for apparel retailer companies with the subaims of the identification of customers' requirements and the determination of working procedures related with them. To this aim, in the methodology of customer satisfaction and process benchmarking, Quality Function Deployment (QFD) and Analytical Hierarchy Process (AHP) were used in combination with some minor modifications within QFD. The proposed methodology was implemented on the two departments of an apparel retailer company.

Keywords: Internal Benchmarking, Customer Satisfaction Benchmarking, Process Benchmarking, Quality Function Deployment, Analytical Hierarchy Process, Apparel Retailer.

ÖZET

Bu çalışmada, iç kıyaslama çalışması için bir metodoloji önerilmiş, tüketicilerin hazır giyim perakendecilerinden beklentileri ortaya konmuş ve söz konusu beklentilerin hangi iş prosedürleri ile ilişkili olduğu belirlenmiştir. Bu amaçla müşteri memnuniyeti kıyaslaması ve proses kıyaslaması yapabilme özelliğine sahip olan önerilen metodolojide, Kalite Fonksiyon Yayılımı (KFY) ve Analitik Hiyerarşi Süreci (AHS) bir arada kullanılmakta ve KFY tekniğinde iç kıyaslamanın gerekliliklerine uygun olması için bazı değişiklikler önerilmiştir. Önerilen metodoloji bir hazır giyim perakende firmasının iki departmanına uygulanmıştır.

Anahtar Kelimeler: İç kıyaslama, Müşteri Memnuniyeti Kıyaslaması, Süreç Kıyaslaması, Kalite Fonksiyon Yayılımı, Analitik Hiyerarşi Süreci, Hazır giyim perakende.

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INTRODUCTION

Increasing the customer satisfaction in apparel retail industry increases the sales amount and customer loyalty which provides the sustainability in the end. The competitive companies should continuously assess their own customers' satisfaction level and the achievements of their closest competitors in this regard in order to position themselves and to find out the reasons lying beneath the success.

Benchmarking is identified as the investigation of the best practices within the industry. Whereas best practice benchmarking can be established against an organization that is active in completely different field of industry; internal benchmarking can be established within two different departments of an organization. The companies may benefit the internal benchmarking because the performance levels can be increased to the one's having higher performance, without coming across any problems such as avoidance of information sharing. On the other hand, the customer satisfaction benchmarking is helpful to evaluate the products' and services' characteristics in terms customers' needs and to integrate the customers' opinion in the selection of critical factors; process benchmarking allows to analyze the both the current and potential techniques or work procedures in detail(1).

Although benchmarking process proved its importance for the organizations, no specific method in literature was identified for the establishment of benchmarking process. Quality Function Deployment (QFD) with the primary usage in product development, quality assurance and control, was found to be working well in conjunction with the

benchmarking process. Getting the voice of the customer as an input in order to determine the prior issues, QFD establishes a benchmarking process in terms of customer satisfaction in the competitive analysis. QFD allows explaining the relationship between the customer requirements and technical capabilities which can be taken as the benchmarking objects for further investigation in more detail. The usage of QFD with Analytical Hierarchy Process (AHP), on the other hand, clarifies the prior issues systematically before evaluating the performance of the companies in benchmarking process.

Within this respect, the purpose of this paper is to propose a methodology for an internal benchmarking process that allows making both customer satisfaction and process benchmarking for an apparel manufacturer and retailer company benefiting QFD in conjunction with AHP with minor modifications in QFD, such as; elimination of some steps, improvement in calculations and, identification of working procedures instead of technical capabilities. The subaims of the study are identification of the requirements of customers from an apparel retail company and determination of the working procedures involving the technical capabilities related with these customer requirements in concern. The proposed methodology was validated with an implementation on a real world case.

Literature Review

Benchmarking was applied using different techniques such as AHP; DEA; DEAHP and DEANP; combination of Principal Component Analysis and Clustering Techniques (2-5). On the other hand, benchmarking has the potential to be used in conjunction with QFD since they built a synergistic effect to meet and even exceed the increasing customer expectation (1). According to Kumar *et al,*(1) benchmarking helps to modify the existing products using the processes and/or practices that yield the most value in QFD whereas QFD satisfies the beneficial allocation of the resources. Because of this reason, QFD was used with benchmarking processes or to establish benchmarking in many studies in literature in fields of education, marketing and health (1,6-9).

Developed in Japan in early 1970s by Professor Yoji Akao and Professor Shigeru Mizuno (10), QFD provides translation of market research and customer requirements into strategies increasing the level of satisfaction for the consumers (7). Shubhapriya and Byoungho (11) describes the quality in Quality Function Deployment as value and adds that this value is created by analysing the customers' needs and wishes and transforming these requirements into services. On the other hand, Kumar *et al.* (1) draws attention to the superiority of the QFD methodology to design and develop new products and product improvement programs using least resources.

QFD was developed as a concept for new product development in total quality control (11), but then, QFD was used in many fields such as, healthcare, retail, information services, e-banking, education (12-16). And it was also established in textile and clothing manufacturing industry in establishing a model to identify and integrate the customer requirements about the manufacturing of synthetic yarns (17); to design an economic sampling plan (18), to develop a training course for clothing merchandise (19). Shubhapriya and Byoungho (11) used combination Kano's model and quality function deployment method in order to identify, prioritize and implement apparel retail store attributes to maximize customer satisfaction focusing on the customer requirements in terms of service given by the retailers.

QFD was accomplished in conjunction with AHP in most of the studies in the fields of education, material production, project selection, tourism (7,16,20-22) and in determination of design characteristics, facility location and new product development (23-25) but not specifically in textile and apparel retail industries. On the other hand, AHP found itself a usage in many applications in textile and apparel industries especially in terms of supplier evaluation (26) and selections models, logistics for textile industry(27), identification of performance indicators (28), supply chain optimization (29).

Nonetheless, there is no study within the literature that uses these two techniques together within the apparel retailing industry. Within this study, it is aimed to propose a methodology for an internal bencgmarking process for an apparel retailer involving these two techniques together.

Proposed Methodology

The proposed internal benchmarking procedure was derived from QFD which uses the House of Quality Matrix (HOQ) shown in Figure 1 as a central component.
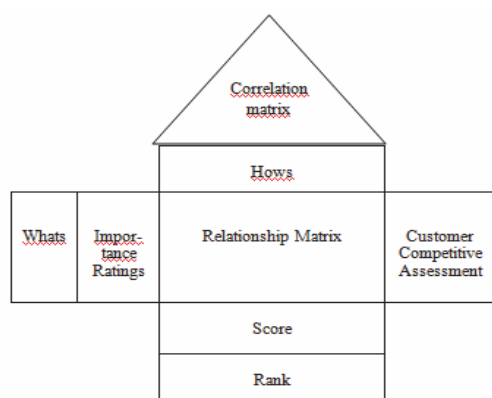

Whats: the customer requirements;

Hows: the list of technical capabilities for achieving the customer requirements;

Importance ratings: the relative importances of Whats;

Relationship Matrix: the relationships between Whats and Hows;

Correlation Matrix: the relationship between Hows;

Customer Competitive Assessment: comparison of the competitive products/service characteristics with the other company's;

Scores: the importance of each How;

Ranks: the rank of the Hows

Figure 1. House of quality matrix (7)

In case that QFD can serve as an internal benchmarking tool, Customer Competitive Assessment block in HOQ was used for making Customer Satisfaction Benchmarking whereas AHP was integrated into the technique in order to find the importance ratings. Process Benchmarking was achieved after the selection of working procedures based on the relationship matrix. Having the usage in product design considering the quality requirements from consumers and technical capabilities, correlation matrix block was eliminated from QFD. Working procedures were used in hows instead of technical capabilities. Finally, the calculation of ranks was eliminated and relative scores were calculated and used for determining the key working procedures. The proposed methodology was summarized in Table 1 with the explanation of the steps and corresponding parts of HOQ.

Implementation of Proposed Methodology on Real World Case

The proposed methodology was implemented on a Turkish apparel manufacturer and retailer company. Manufacturing men's, women's and children's wear, the company sells its products under its own brand in chain stores. The internal benchmarking procedure proposed was applied within the two departments of this company which are women's wear and children's wear.

The data for the 1st, 2nd, 3rd and 7th step were provided based on the literature and brainstorming established among the company specialists whereas the data for the 4th and 5th step were gathered from the surveys conducted on the focus group of consumers.

Specifically, in the 3rd step, a relationship matrix was build to analyzed the strength of the relationship between customer requirements and working procedures. The strength of the relationhips was shown using the symbols a triangle, circle, and a dark circle having the numerical values of 1, 3 and 9 which indicated a weak, moderate and strong relationship (1,6).

In the 4th step, a questionnaire including the questions corresponding to the pairwise comparisons of the customer requirements were required to be done by a focus group of customers composed of 50 people. Using the 1,3,5 scale as proposed by the researchers, (30-32), the priorities which were defined to be Importance Ratings (IR) were obtained following the procedure by Saaty (33) using geometric mean of the results (31).

In the 5th step of the customer satisfaction benchmarking, the data was gathered from a survey conducted among mothers considering the fact that children are not capable of assessing the performance level of the company. A questionnaire of 21 questions was prepared using five point likert scale in which each question corresponded to one customer requirement. Each participant was required to fill in two questionnaires, one for themselves and one for their children considering women's wear and the children's wear products respectively. In order to eliminate the similarities given to the questions, the two questionnaires from each participant were subjected to paired sample t-test and only the questionnaires for which the difference was found to be statistically significant were used for performance comparisons. By averaging the answers from the respondents, final paired sample t-test was applied and its significance was tested within the significance level of 0,05 and degrees of freedom of 20.

In the 6th step of determinations of key working procedures, getting the Importance Ratings (IR) results from the 4th step and identifying the performance level of more successful department as Target Performance Levels (TPL) for the department that is less successful with the Current Performance Level (CPL); the Improvement Ratios (IMPR), Overall Weight (OW) and Relative Overall Weights (ROW) which the normalized form OW were calculated for each customer requirement using Equation 1and 2 below:

Analysing the results of OW, more influential or key customer requirements for reaching performance level of more successful department were identified.The key working procedures were further carried out considering the results obtained and further calculations of Absolute Scores (AS) and Relative Absolute Scores (RAS) were calculated for each working procedure.

Table 1: The steps of proposed methodology

Steps	Explanation	Parts in HOQ
Step1	Identification of the customer requirements	Whats in HOQ
Step2	Identification of the working procedures	Hows in HOQ
Step3	Determination of the strength of the relationship between customer requirements and working procedures	Reltionship matrix
Step4	Determination of the priorities of the customer requirements	AHP in importance ratings
Step5	Comparing the performance of the two departments in terms of satisfying the requirements	Customer competitive assessment
Step6	Determination of the key working procedures that should further be investigated	Scores
Step7	Investigating the working procedures of the department that showed higher performance	Hows in two department

$$IMPR = (TPL - CPL) / CPL \qquad (1)$$

$$OW = IMPR * IR \text{ for all customer requirements} \qquad (2)$$

$$AS = \text{The weight assigned to the relationship matrix in the third step} * IR \qquad (3)$$

The usage of the equations for calculations were given for one customer requirement and working procedure under Figure 2.The key working procedures were selected to be the ones corresponding to the customer requirements with higher OW. Nonetheless, the working procedures having lower AS were eliminated, whereas the working procedures with higher AS were added into the assessments.

ASSESSMENT OF THE RESULTS

Following the methodology, the findings were summarized under 5 headings corresponding to the steps covered within the methodology part.

Step1, 2 and 3: 21 customer requirements shown in Figure 2 were identified and classified under five groups which were determined as 'Quality', 'Price', 'Timeliness or flexibility', 'Fashion and variety of design' and 'Service' including 5,4,2,6 and 4 criteria respectively.

20 working procedures were identified related with the customer requirements which were grouped under 5 working stages as seen in Figure 2. While 'Procurement' stage had 10 working procedures, 'Design', 'Production' and 'Service' included 2 procedures each and finally; 'Planning' had 4 working procedures.

The strength of the relationships between the customer requirements and the working procedure were shown in relationship matrix as seen in Figure 2. Each customer requirement was matched with at least one working procedure.

Step 4: According to the final priority values obtained by multiplying the priorities in the first and second level of hierarchy, it was observed that, the prior issues were related with the parameter 'Service' as seen in Figure 2 in importance ratings coloumn. The other significant parameter that was as important as the service parameter was the 'Timeliness or flexibility'. This enabled CR10, CR11and CR20 to be the top most important requirements.   Other than the requirements belonging to the groups 'Service' and 'Timeliness or flexibility', CR9 under 'Price' followed with the 'CR3' and 'CR1' under 'Quality' were found significant.

Step 5: After elimination of the questionnaires whose answers were found to show difference statistically getting the t-value of 4,44 which is bigger than the critical t-value 1,725 within the statistical significance of 0,05 with 20 degrees of freedom, the average scores for the two departments were obtained as seen in Figure 2. The final scores taking the arithmetic averages of 53 questionnaires revealed that, the children's wear department was certainly better than the women's wear department. Based on the IMPR calculated, the women's wear department required more improvement in the customer requirements groups of 'Fashion and variety of design' and 'Quality'. The customer requirements regarding 'Price' got the lower IMPR scores. Nonetheless, CR17, CR13 and CR14 under the customer requirement group of 'Fashion and variety of design'; CR21 under 'Service', CR1 under 'Quality' and CR10 under 'Timeliness or flexibility' were found to need more improvement compared with the other ones getting IMPR $\geq$0.24.

On the other hand, adding the influence of IR on the improvement ratio, the results changed significantly pointing out the contribution of the importance levels. According to OW, all the customer requirements under the groups of 'Service' and 'Timeliness or flexibility' were found to have higher values $\geq$1 enabling to determine most important customer requirements within the customers perspective, although they didn't get as high scores as in the case of not integrating IR. CR14 and CR13 under the group of 'Fashion and variety of design', and CR1, CR2 and CR3 under the group of 'Quality' were found to have higher ratings when compared with the other customer requirements so they were included in the key customer requirements. The key customer requirements were signed with dark gray color in Figure 2.

Step 6: The key working procedures were determined considering the key customer requirements and AS values calculated which were depicted in Figure 2. The working procedures corresponding to key customer requirements were checked and the ones with the Relative Absolute Scores $\geq$ 0.05 were selected as key working procedures. Having lower Absolute Scores, the working procedures including WP6, WP7, WP13, WP14, WP15, WP17, WP20 were eliminated from the working procedures that would be subjected to process benchmarking. On the other hand, the working procedures having higher relative AS$\geq$0.05 which are WP1 and WP9 and WP18 were added to the working procedures   considering the fact that these working procedures were important because of being in strong relationship with more than one customer requirement.

Within these respects, the working procedures that would be subjected to process benchmarking were signed in Figure 2 with a special emphasis on the 'WP10, WP11,WP3, WP16, WP1, WP4 and, WP5.

Step 7: The process benchmarking was accomplished in order to find out the critical differences that should be employed to improve the performance by analyzing the key working procedures determined in the previous step and by establishing a brainstorming with specialists related with these working procedures. In general, it was found out that the production pursuit was done more strictly by the children's wear department thanks to the higher number of personnel employed. More visits were found to have been made both to the suppliers and the contractors' which had probably caused a decrease in the quality problems as they allow detecting the possible delays before they occurred. Specifically, following suggestions can be made for the company.

Regarding WP4 and WP5, the standards were found to be more rigid within the children's wear department in relation to the probable requirements of the products. In WP1, lower priced items can be added within the collection to increase the attractiveness of the products.In WP18, more accessorizes can be included within the combines causing a perception in consumers mind that they were having more promotions as they were buying more items. Regarding WP16, same or similar product categories should be available in the stores located in different regions. In WP10, an individual team should be kept responsible in preparations of combines and checking the stores for the establishment of the sample combines. In WP11, more trendy colors and designs shoud be included within the collections in order to raise the perception of the customers about getting new items from the stores.

HOUSE OF QUALITY (RELATION MATRIX)

Customer Requirements		Importance Ratings (IR)	WP1: Price determination	WP2: Cost evaluation	WP3: Production pursuit	WP4: Raw material endorsement	WP5: In line quality control	WP6: Inspection	WP7: Shipment	WP8: Competitive analyses	WP9: Preparation of sales collection	WP10: Preparation of combines for catalogs	WP11: Identification of trends in season models	WP12: Identification of trends in season colors	WP13: Preparation of body sizes	WP14: Preparation of patterns	WP15: Planning the number of collections	WP16: Planning the shipment between warehouse and store	WP17: Production planning	WP18: Promotion planning	WP19: After sales services	WP20: Window design	Importance Ratings (%)	Average Scores (Womens wear)	Average Scores (Childrens wear)	Improvement Ratio (IR)	Overall Weight (OW)	Relative Overall Weight (OW)
Quality	CR1: Durability	0.0492				●	○	○															4.92	2.77	3.45	0.24	1.21	6.61
	CR2: Colour fastness	0.0483				●	○	○															4.83	2.79	3.40	0.22	1.04	5.73
	CR3: Quality of print and accessorizes	0.0547				●	○	○															5.47	2.85	3.45	0.21	1.16	6.37
	CR4: Conformance to child safety	0.0222				●	○	○															2.22	2.74	3.09	0.13	0.29	1.60
	CR5: Conformance to ecological requirements	0.0259				●																	2.59	2.74	3.09	0.13	0.34	1.86
Price	CR6: Quality-price balance	0.0369	●	●																			3.69	2.89	3.11	0.08	0.29	1.59
	CR7: Price attractiveness	0.0399	●							●													3.99	3.47	3.74	0.08	0.30	1.67
	CR8: Convenience of sales season price levels	0.0424	●								●												4.24	2.64	3.08	0.16	0.70	3.82
	CR9: Attractiveness of promotional activities	0.0626																		●			6.26	2.85	3.06	0.07	0.46	2.50
Timelines or Flexibility	CR10: Shipment to store on demand	0.1122			●																		11.22	2.75	3.45	0.25	2.84	15.60
	CR11: Availability of brandnew product at the beginning of the seasons	0.1003							△									●					10.03	2.91	3.30	0.14	1.37	7.50
Fashion and variety of design	CR12: Fitness of patterns	0.0340														●							3.40	2.87	3.49	0.22	0.74	4.05
	CR13: Convenience of patterns sizes	0.0313													●	●							3.13	2.79	3.57	0.28	0.87	4.76
	CR14: Variety of style options	0.0389											●	●			△		△				3.89	2.77	3.43	0.24	0.93	5.08
	CR15: Variety of color options	0.0315											●	●									3.15	2.91	3.51	0.21	0.65	3.59
	CR16: Harmony with fashion and trends	0.0237											●	●			●						2.37	2.92	3.26	0.12	0.28	1.51
	CR17: Annual divergences in collection	0.0222																△					2.22	2.64	3.38	0.28	0.62	3.39
Service	CR18: Accessibility to catalog produces at store	0.0544										●			○								5.44	3.26	3.87	0.18	1.01	5.52
	CR19: Credibility of catalog infos	0.0602										●											6.02	2.62	3.13	0.19	1.17	6.41
	CR20: Correct settlement of products and accuracy of combines	0.0744										●											7.44	3.42	3.94	0.15	1.15	6.32
	CR21: Return or changeover after sales	0.0347																			●	○	3.47	3.26	4.04	0.24	0.82	4.52
Absolute Scores (AS)			1.07	0.33	0.90	1.09	0.52	0.46	0.10	0.44	0.50	1.70	0.56	0.50	0.18	0.28	0.24	1.06	0.04	0.56	0.31	0.22	Total: 11.08	11.08 / 1.00		Total	18.23	100.00
Relative Absolute Scores			0.10	0.03	0.08	0.10	0.05	0.04	0.01	0.04	0.05	0.15	0.05	0.04	0.02	0.03	0.02	0.10	0.00	0.05	0.03	0.02						

For the customer requirement "Durability" : IMPR=(3,45-2,77)/2,77=0,24; OW=4,92*0,244=1,21; ROW=(1,21/18,23)*100=6,61

For the Working Procedure Preparation of Sales Collection" : AS= 3*0,0399+9*0,0424=0,50; RAS=0,50/11,08=0,05

Figure 2. Customer satisfaction benchmarking results and identification of key working procedures

CONCLUSION

In this study, an internal benchmarking procedure was proposed which covers customers satisfaction benchmarking followed with process benchmarking. Emphasing the claim that there is a synergistic effect between benchmarking and QFD, QFD was benefited in building the framework of the study with minor modifications of elimination of some of its steps, improvement in calculations and usage of working procedures instead of technical capabilities. AHP was integrated within the procedure in order to better determine the importance of the customer requirements in terms of increasing satisfaction level.

Establishment of the procedure in a real world case provided enough clues and discussions for showing how an internal benchmarking can be made within an apparel retail company and what the set of customer requirements and working procedures related with them could be identified for this industry.The numerical results put forward the importance of providing good service, being on time and flexible for customers. Besides,it was pointed out that these can only be achieved with a close inspection of the processes and by focusing on customer expectations.

The procedure explained here presented a systematic benchmarking methodology enabling to obtain quantitative results. The identification of customer requirements and working procedures related with them are helpful and can be used as initial parameters by the companies in apparel retailing industry that wish to establish both internal and external benchmarking. Nonetheless, the procedure can be expanded or modifiedwith the integration of different techniques in especially determination of the importance ratings such as ANP or fuzzy AHP.

REFERENCES

1. Kumar, A., Antony,J. and Dhakar,T.S. (2006), "Integrating Quality Function Deployment And Benchmarking To Achieve Greater Profitability" , *Benchmarking: An International Journal* , Vol. 13, No. 3, pp: 290-310.

2. Min, H., Min, H., (1996), "Competitive Benchmarking Of Korean Luxury Hotels Using The Analytic Hierarchy Process And Competitive Gap Analysis", *Journal of Services Marketing*, Vol. 10, No. 3, pp:58 – 72.

3. Graham, A. (2005),"Airport Benchmarking: A Review of The Current Situation", *Benchmarking: An International Journal*, Vol. 12, Iss. 2, pp: 99 – 111.

4. Kamvysi, K., Gotzamani, K., Georgiou, A.C., Andronikidis, A. (2010),"Integrating DEAHP and DEANP into The Quality Function Deployment", *The TQM Journal*, Vol. 22, Iss, 3, pp: 293 – 316.

5. Córcoles, J.I., Juan, J.A., Ortega, J.F., Tarjuelo, J.M., Moreno, M.A. (2010). "Management, Evaluation of Water Users Associations Using Benchmarking Techniques", *Agricultural Water Management*, Vol. 98, pp: 1–11.

6. Gonzalez, M.E., Quesada, G., Gourdin,K., Hartley, M. (2008), "Designing A Supply Chain Management Academic Curriculum Using QFD And Benchmarking", *Quality Assurance in Education*, Vol .16, No.1, pp: 36-60.

7. Raharjo, H., Xie, M., Goh, T.N., Brombacher , A.C. (2007), "A Methodology to Improve Higher Education Quality Using the Quality Function Deployment and Analytic Hierarchy Process", *Total Quality Management and Business Excellence*, Vol.18, No.10, pp:1097-1115.

8. Lu, M.H., Madu, C.N., Kuei, C, Winokur, D. (1994), "Integrating QFD, AHP and Benchmarking in Strategic Marketing", *The Journal of Business & Industrial Marketing;* Vol. 9, No.1, pp: 41-50.

9. González , M.E., Quesada, G., Mack, R., Urrutia,I. (2005), "Building an Activity Based Costing Hospital Model Using Quality Function Deployment and Benchmarking", *Benchmarking: An International Journal*, Vol.12, Iss. 4, pp: 310 – 329.

10. Okur, A., Nasibov, E.N., Kilic, M., Yavuz, M. (2009), "Using OWA Aggregation Technique In QFD: A Case Study In Education In A Textile Engineering Department",*Quality and Quantity*, Vol.43, pp: 999–1009.

11. Shubhapriya, B., Byoungho, J. (2012), "A Conceptual Process of Implementing Quality Apparel Retail Store Attributes: An Application Of Kano's Model And The Quality Function Deployment Approach", *International Journal of Business, Humanities and Technology,* Vol. 2, No. 1, pp:174-183.

12. Lim, P.C., Tang, N.K.H. (2000), "The Development of a Model for Total Quality Healthcare", *Managing Service Quality*, Vol. 10, No. 2, pp: 103-11.

13. Trappey, C.V., Trappey, A.J.C., Hwang, S.J. (1996), "A Computerized Quality Function Deployment Approach for Retail Services", *Computers and Industrial Engineering*, Vol. 30, No. 4, pp: 611-22.

14. Chin, K.S., Pun, K.F., Leung, M.W., Lau, H. (2001), "A Quality Function Deployment Approach for Improving Technical Library and Information Services: A Case Study", *Library Management*, Vol. 22, No. 4, Iss.5, pp: 195-204.

15. Gonzalez, M.E., Quesada, G., Picado, F., Eckelman, C.A. (2004), "Customer Satisfaction Using QFD: An e-banking Case", *Managing Service Quality*, Vol. 14, No. 4, pp: 317-30.

16. Koksal, G., Egitmen, A. (1998), "Planning and Design of Industrial Engineering Education Quality", *Computers and Industrial Engineering*, Vol. 35, No. 3-4, pp: 639-42.

17. Kabir, G., Hasin, M.A.A., (2011), "Customer Perceived Quality Improvement Of Synthetic Fiber Using Fuzzy QFD: A Case Study", *International Journal for Quality Research,*, Vol.5, No.2, pp:75-87.

18. Manikandan, G, Kannan, S.M., Jayabalan, V. (2009), "Designing an Economic Sampling Plan: A QFD Approach", *International Journal of Quality and Innovation*, Vol.1, No.1, pp:65-82.

19. Chan, C.Y.P., Taylor, G., Ip, W.C. (2009), "Applying QFD to Develop a Training Course for Clothing Merchandisers", *The TQM Journal*, Vol. 21, Iss. 1, pp: 34 – 45.

20. De Felice, F., Petrillo, A. (2010), " A Multiple Choice Decision Analysis: An Integrated QFD-AHP Model for the Assessment of Customer Needs", *International Journal of Engineering, Science and Technology*, Vol.2, No.9, pp:25-38.

21. Partovi, F.Y. (1999), "A Quality Function Deployment Approach to Strategic Capital Budgeting", *The Engineering Economist*, Vol. 44, No. 3, pp: 239–260.

22. Das, D., Mukherjee, K. (2007), "Development of an AHP-QFD Framework for Designing a Tourism Product", *International Journal of Services and Operations Management*, Vol. 4, No. 3, pp: 321 – 344.

23. Lin, M.C., Wang, C.C., Chen, M.S., Chang, A.C. (2008), "Using AHP and TOPSIS Approaches in Customer-driven Product Design Process", *Computers in Industry,* Vol. 59, No. 1, pp: 17-31.

24. Chuang, P.T. (2001), "Combining the Analytic Hierarchy Process and Quality Function Deployment for a Location Decision from a Requirement Perspective", *International Journal of Advanced Manufacturing Technology,* Vol. 18, No. 11, pp: 842–849.

25. Hsiao, S.W. (2002), "Concurrent Design Method for Developing a New Product", *International Journal of Industrial Ergonomics*, Vol. 29, No.1, pp: 41–55.

26. Stojanov, T., Ding, X. (2015), "Supplier Selection for Mixed Model Production: A case Study from Apparel Industry", Fibres and Textiles in Eastern Europe, Vol.23, No.1(109),pp.8-12

27. Eryuruk, SH., Kalaoglu, F., Baskak, M. (2012), "A Site Selection Model Estblishing A Clothing Logistic Center", *Tekstil ve Konfeksiyon*, Vol.22, No.1, pp:40-47.

28. Erbasi, A., (2012). "Use of Analytical Hierarchy Process Method in Determination of Performance Indicators :The Case of Turkish Textile Industry", *Tekstil ve Konfeksiyon*, Vol.22, No.3, pp:177-184.

29. Ertugrul, I., Ozbay, B., (2013). "Supply Chain Optimization and Distribution Network Application with AHP in a Yarn Company", *Tekstil ve Konfeksiyon*, Vol.23, No.2, pp:87-93

30. Chamodrakas, I., Batis, D., Martakos, D. (2010), "Supplier Selection in Electronic Marketplaces using Satisficing and Fuzzy AHP", *Expert Systems with Applications*, Vol.37, pp:490–498.

31. Tam, M.C.Y., Tummala, V.M.R. (2001), "An Application of the AHP in Vendor Selection of a Telecommunications System", *Omega*, Vol.29, pp:171-182.

32. Pecchia, L., Martin, J.L., Ragozzino, A., Vanzanella, C., Scognamiglio, A., Mirarchi, L., Morgan, S.P. (2013), "User Needs Elicitation via Analytic Hierarchy Process (AHP). A Case Study on a Computed Tomography (CT) Scanner BMC", *Medical Informatics and Decision Making,* Vol.13, No.2, pp:1-11.

33. Saaty, T.L. (1980), *The Analytic Hierarchy Process*, McGraw-Hill, New York, NY