

Strategy to Win the Competition by Developing Products and Services Using the QFD Method in Moldbase Manufacturing

Fuad Fatahillah, Erry Rimawan, Anang Waskito, Steela Apfiyasi

Industrial Engineering Program, Universitas Mercu Buana Jakarta

Abstract

This study aims to analyze products and services developed using the Quality Function Deployment (QFD) method. The research model uses Quality Function Deployment (QFD) where products and services can be developed according to customer needs to win the competition in the mold base manufacturing industry. Data was collected through customer satisfaction surveys, Forum Group Discussions (FGD), field observations, and literature studies. Manufacturers and consumers in the mold base manufacturing industry have a Business to Business (B2B) relationship because the consumer is a production manufacturing industry. The competition in the mold base industry is to dominate the market and the quality of its products and services. Companies can compete and win not only to survive but also to grow in the future by developing products and services.

Keyword

Quality Function Deployment (QFD), Voice of Customer, Technical Characteristic

1. Introduction

The results of a survey and review conducted by JETRO (Japanese Exhibition Trade Organization) on Japanese companies in Asia in February 2018, concluded that the potential for market growth in Indonesia is very high at 80% but local industry growth is only 22.3%. This is a very attractive opportunity for foreign investors to enter and invest in Indonesia (JETRO, 2018).

This statement is reinforced by the results of an analysis and study from IMDIA (Indonesian Mold and Dies Industry Association) using the results of the JETRO survey stating that the level of quality and price of mold/die in Indonesia when compared to Thailand there is no difference but Thailand in terms of technology is 3, while Indonesia scored 2.5. The value in terms of the delivery time for Thailand is 3.7, Indonesia is 2.8, so Indonesia's overall position is at 3.0, making Indonesia's position slightly below Thailand's 3.5. Currently, the Philippines has reached the same level as Indonesia. Challenges in supporting Indonesia's industry require efforts to increase the level of technology, automation, and rationalization, taking into account the use of industry 4.0 and IoT (IMDIA, 2018).

PT XYZ decided to make improvements to capture market opportunities and business competition in the current Digital Disruption era. Research at PT XYZ is expected to produce things that are realized to satisfy customers to win in the competition in mold base products and services.

2. Improvement Quality Product and Services of Moldbase Industry Using QFD

Moldbase industrial products and machining services are not mass consumer goods but custom products (special orders). The consumer is a mold base production industry so the commercial relationship is B2B (Business to Business). It is unique and powerful to know the consumer's desire to be followed up into a program to improve the quality of mold base products and services.

One of the opportunities to win in the competition is to maintain service quality from failure. The potential failure of service is because service quality does not reflect customer requirements (Altuntas & Kansu, 2020).

This journal focuses only on developing product and service quality in-mold base manufacturing services. Research is limited to the product and service planning stage.

2.1 Quality Function Deployment (QFD)

QFD is a method for developing quality designs to satisfy customer needs by translating consumer desires into key design and quality assurance targets throughout all stages of production (Akao, 1990). QFD has become a very popular design method since it was developed in the late 1960s in Japan by translating Customer Needs (Customer Needs) into technical design requirements using a series of matrices called the House of Quality (HoQ). It aims to meet customer expectations while improving product quality (Lapinskienė & Martinaitis, 2017; Shahin et al., 2018).

Matrix of QFD (House of Quality)

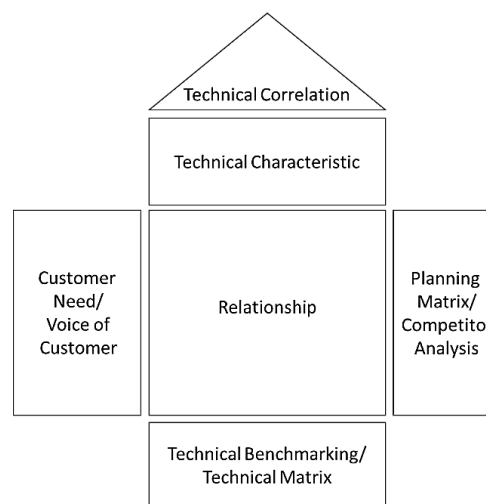


Fig.1. Matrix of QFD (House of Quality)

2.2 Mold base Products and Services

The mold base industry and machining services are upstream industries, mold bases are made after a product design with production is planned.

Plastic products are widely found in vehicle parts, household appliances, hospital equipment, office support facilities made using injection molding machines. Injection molding is the most

widely used polymer fabrication process with metal dies casting, but unlike molten metal casting, the polymer melt has a high viscosity. The injection molding process is a dynamic process known for its speed and accuracy when compared to other moldings (Umar Nisbantoro et al., 2018; Vijayakumar & Gajendran, 2014).

Moldbase production has quality standards on product accuracy compared to technical drawing specifications. The more precise the product result is compared to the technical drawing, the better the quality of the mold base product. It also really depends on the accuracy of the type of CNC machine used for mold base production. CNC machines with the latest programmable technology have a good level of process precision and the products have a level of accuracy that matches the technical drawings.

The reliability of the mold base is determined by the quality of the material so that the mold base can be used for a long time by the calculation of the number of products and product life cycles.

Service quality becomes important during the mold base manufacturing process, product handling procedures, starting from material setup, moving stages of processes, storage, packing, delivery until the product is received by the consumer. Maintaining due to environmental factors and correct handling procedures will keep the product in good condition when it is delivered to consumers.

3. Result and Discussion

3.1 Customer Needs (Voice of Customer)

The beginning of the QFD process begins to determine customer needs and the end of the process is the realization of the production process. QFD has a general philosophy of how to achieve customer satisfaction (Humiras Hardi Purba et al., 2018). The main input to the QFD process is customer requirements from surveys and questionnaires that are dynamic with variations depending on space and time (Bolar et al., 2017).

Voice of Customer (Customer Needs) as input data and information has been obtained previously from the results of a customer satisfaction survey conducted by PT XYZ.

The selection of the right characteristics is the most important part which will constantly demand more from the industry competition with the same product. The company will win when the customer wins (Moldovan, 2014).

The management of PT XYZ has sorted and decided customer input through a Forum Group Discussion (FGD) into a list, then discussed and followed up on the next QFD process.

Customer Needs/Voice of Customer presented in Figure 3.

<u>Access information of product and services</u>
Easy to get product and service information
<u>Communication response</u>
Easy and fast to get communication response

<u>Monitoring of production process</u>
Easy to get product order progress information
<u>Product quality (Product conformity with drawing specifications)</u>
<i>The product during the handling process is safe</i>
<i>Easy to measure product dimensions according to drawing specifications</i>
<i>Easy and fast in handling product transfer</i>
<i>Mold base has a longer service life</i>
<i>The pin mold base is durable and doesn't scratch</i>
<i>Produk tidak scratch saat diterima</i>
<u>Quality of machining services (Conformity of machining process with drawing specifications)</u>
More precise products such as drawing specifications
The product does not rust
<u>Good delivery service (packing)</u>
Better product packaging
Product identification easier
<u>Quick process for resolving product/service non-conformance complaints</u>
Verified complaint proof
Ease of payment processing
Satisfied and proud to have PT XYZ merchandise

Fig. 3. Customer Needs/Voice of Customer

3.2 Technical Characteristic

Translation of customer needs (voice of customer) becomes focused on technical factors. This is an answer to customer requests and desires for the quality and features of products and services.

The main practice of QFD is based on the technical classification of the product and the improvement of the design by utilizing proper technical particulars (Duru et al., 2013). Technical Characteristics on mold base products and services are product accuracy standards with technical drawing specifications, product reliability/durability, support for product compliance with occupational safety and health standards, competitive product values in business.

Occupational safety and health in manufacturing activity is an important and controversial issue that is urgently needed in the development and activities of the manufacturing industry (Sulistiyowati et al., 2019). Integrated product quality and reliability support aspects of occupational safety and health in the manufacturing production process.

Technical Characteristic presented in Figure 4.

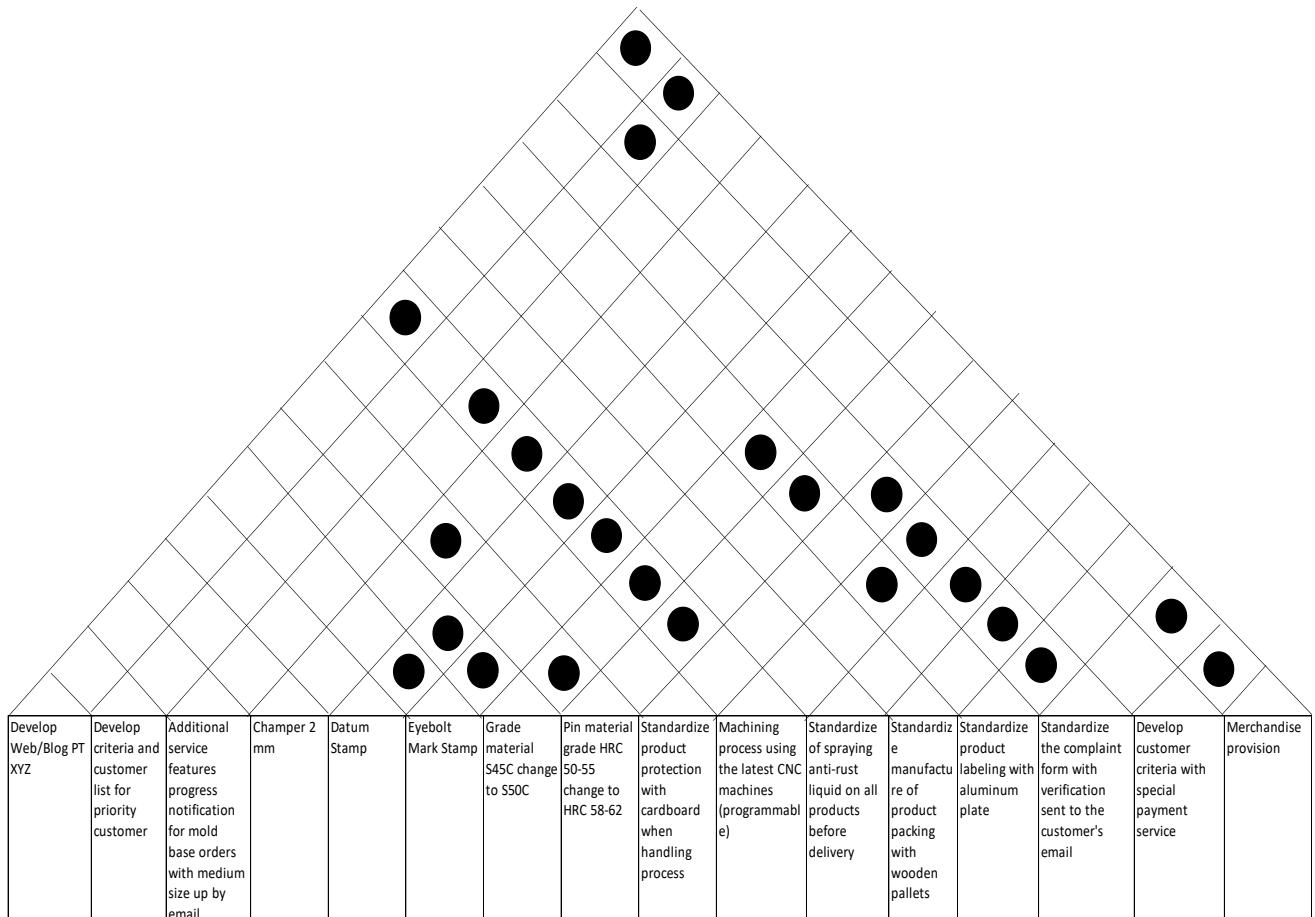


Fig. 4. Technical Characteristic

3.3 The Relationship Matrix

Describes the strength of the relationship between the quality demanded by consumers and the quality characteristics of the product.

The relationship matrix is presented in Figure 5.

	Develop Web/Blog PT XYZ	Develop criteria and customer list for priority customer	Additional service features progress notification for mold base orders with medium size up by email	Champer 2 mm	Datum Stamp	Eyebolt Mark Stamp	Grade material S45C change to S50C	Pin material grade HRC 50-55 change to HRC 58-62	Standardize product protection with cardboard when handling process	Machining process using the latest CNC machines (programmable)	Standardize of spraying anti-rust liquid on all products before delivery	Standardize manufacture of product packing with wooden pallets	Standardize product labeling with aluminum plate	Standardize the complaint form with verification sent to the customer's email	Develop customer criteria with special payment service	Merchandise provision
Access information of product and services																
Easy to get product and service information	●	●	○				△	△		●	△	△		△		○
Communication response																
Easy and fast to get communication response	○	●	●											●		△
Monitoring of production process																
Easy to get product order progress information	△	●	●							△				○		
Product quality (Product conformity with drawing specifications)																
The product during the handling process is safe	△	○		●	●	●	△	△			○	○	○			
Easy to measure product dimensions according to drawing specifications	△	○		○	●	○	△	△		●						
Easy and fast in handling product transfer	△	○		●	●	●						○	●			
Mold base has a longer service life	△	○			○	○	●	●	○	○	●	△				
The pin mold base is durable and doesn't scratch	△	○					△	●		●	●					
Produk tidak scratch saat diterima	△	○					●	△	●		●	●				
Quality of machining services (Conformity of machining process with drawing specifications)																
More precise products such as drawing specifications	○	●		△	●	△	○	○		●						
The product does not rust	△	○					△	△	○		●	○				
Good delivery service (packing)																
Better product packaging	△	○		△		○			●		●	●	○			
Product identification easier	△	○		△	●	○						△	●			
Quick process for resolving product/service non-conformance complaints																
Verified complaint proof	○	●												●		
Ease of payment processing	△	○	△												●	
Satisfied and proud to have PT XYZ merchandise	△	△			△		△	△		△	△	△	△	●		●

Fig. 5. Relationship Matrix

The weights with symbols indicate the level of relationship between elements so that it is known that the relationship is high, medium, low and none at all.

Relationship weighted presented in Figure 6

High	●	9
Medium	○	3
Low	△	1

Fig. 6. Relationship Weighted

3.4 Competitors Analysis & Planning Matrix

Evaluation and quality planning in this section is carried out very carefully because the development of this section will result in an assessment that becomes the basis for making decisions on product and service planning.

PT XYZ is compared with its main competitors and quality requests are made based on the results of the calculation of the relationship matrix as mentioned above.

The weights of the features are calculated so that the highest value will be obtained by taking into account the optimal use of company resources.

Competitors Analysis & Planning Matrix is presented in Figure 7.

	<i>Import ant to Custo mer</i>	<i>PT XYZ</i>	<i>PT SA</i>	<i>PT AD SI</i>	<i>PT BM M</i>	<i>Quality Target</i>	<i>Incr ease (%)</i>	<i>Sales Poin t</i>	<i>Raw Weig ht</i>	<i>Norm alized Weig ht</i>		
<u>Access information of product and services</u>												
Easy to get product and service information	35	3.3 3	Fai r	Goo d	Goo d	Poo r	Goo d	4	0.67 %	1	0.233 3	0.098 02
<u>Communication response</u>												
Easy and fast to get communication response	31	3.2 9	Fai r	Goo d	Goo d	Goo d	Goo d	4	0.71 %	1.2	0.264 2	0.110 97
<u>Monitoring of production process</u>												
Easy to get product order progress information	23	3.2 0	Fai r	Poo r	Poo r	Poo r	Goo d	4	0.80 %	1.2	0.220 0	0.092 41
<u>Product quality (Product conformity with drawing specifications)</u>	38.7	3.2 6	Fai r	Goo d	Fair	Poo r	Goo d	4	0.74 %	1.5	0.428 7	0.180 08
<i>The product during the handling process is safe</i>	42											
<i>Easy to measure product dimensions according to drawing specifications</i>	30											
<i>Easy and fast in handling product transfer</i>	43											

<i>Mold base has a longer service life</i>	44												
<i>The pin mold base is durable and doesn't scratch</i>	32												
<i>Produk tidak scratch saat diterima</i>	41												
<u>Quality of machining services (Conformity of machining process with drawing specifications)</u>	29.5	3.26	Fair	Good	Fair	Poor	Good	4	0.74%	1.5	0.3271	0.13739	
More precise products such as drawing specifications	38												
The product does not rust	21												
<u>Good delivery service (packing)</u>	32.5	3.07	Fair	Good	Poor	Poor	Good	4	0.93%	1.2	0.3617	0.15195	
Better product packaging	38												
Product identification easier	27												
<u>Quick process for resolving product/service non-conformance complaints</u>													
Verified complaint proof	21	3.14	Fair	Poor	Poor	Poor	Good	4	0.86%	1.2	0.2155	0.09052	
Ease of payment processing	14	3.25	Fair	Poor	Poor	Poor	Good	4	0.75%	1.2	0.1266	0.05318	
Satisfied and proud to have PT XYZ merchandise	27		Poor	Good	Poor	Poor	Fair	3	3.00%	1	0.8100	0.34025	
											Jumlah	2.9871	

Fig. 7. Competitor Analysis & Planning Matrix

3.5 Technical Matrix

The calculation of the value of each required quality relationship results and quality characteristics are developed into levels of importance. The technical design of products and services is compared with competitors then the designs developed are planned with superior quality than competitors.

Based on the results of the rating scale, scientific decisions are made on the target products and services developed. This is the answer to the quality of consumer demand.

Technical Matrix presented in Figure 8.

	Develop Web/Bl og	Custo mer Priorit y Progra ms	Addition al informat ion for medium up size order	Standard ize Champe r	Standard ize Datum Stamp	Standard ize Eyebolt Stamp	Mater ial grade S45C chang e to S50C	Pin mater ial grade HRC 50-55 chang e to HRC 58-62	Standard ize handling product (Additio nal handling with carton)
PT SA	Websit e	Priorit y	None	2 mm	Availabl e	Availabl e	S45C	HRC 50-55	Carton
PT ADS I	Websit e	Priorit y	None	3 - 5 mm	None	Availabl e	S45C	HRC 50-55	None
PT BM M	None	Priorit y	None	5 mm	None	None	S45C	HRC 50-55	None
PT XY Z	Blog	Priorit y Custo mer List	Specific informat ion by email	2 mm	Datum Stamp	Eyebolt Stamp	S50C	HRC 58-62	Carton
PT XYZ	Standardize Machining (Programmabl e CNC)	Standardiz e Anti Rush Covering	Standardiz e Product Packing	Standardize Product Labeling	Standardiz e Complain Handling Form by Email	Standardiz e Customer criteria for Special payment	Standardize Merchendis e		
PT SA	± 0,02mm	Anti Rush	Wooden pallet	Product Label with sticker	> 2 x 24 Jam	None	Available		
PT ADSI	> 0,02mm	Anti Rush	None	None	> 2 x 24 Jam	None	None		
PT BMM	> 0,02mm	None	None	None	> 2 x 24 Jam	None	None		
PT XYZ	± 0,02mm	Anti Rush	Wooden pallet	Product Label with aluminum	2 x 24 Jam	Feature special payment	Available		

Fig. 8. Technical Matrix

Customer Needs	Development Item	Spesifikasi	Raw Weight	Normalized Weight
<u>Product quality (Product conformity with drawing specifications)</u>			0.4287	18.00809
<i>The product during the handling process is safe</i>	Standardize Champer	2 mm		
<i>Easy to measure product dimensions according to drawing specifications</i>	Standardize Datum Stamp	Datum Stamp		
<i>Easy and fast in handling product transfer</i>	Standardize Eyebolt Stamp	Eyebolt Stamp		
<i>Mold base has a longer service life</i>	Material grade S45C change to S50C	S50C		
<i>The pin mold base is durable and doesn't scratch</i>	Pin material grade HRC 50-55 change to HRC 58-62	HRC 58-62		
<i>Produk tidak scratch saat diterima</i>	Standardize handling product (Additional handling with carton)	Carton		
<u>Good delivery service (packing)</u>			0.3617	15.19547
Better product packaging	Standardize Product Packing	Wooden Pallet		
Product identification easier	Standardize Product Labeling	Product Label with aluminum		
<u>Quality of machining services (Conformity of machining process with drawing specifications)</u>			0.3271	13.73893
More precise products such as drawing specifications	Standardize Machining (Programmable CNC)	± 0,02mm		
The product does not rust	Standardize Anti Rush Covering	Anti Rush		
<u>Communication response</u>				
Easy and fast to get communication response	Customer Priority Programs	Priority Customer List	0.2642	11.09708
<u>Access information of product and services</u>				
Easy to get product and service information	Develop Web/Blog	Blog	0.2333	9.801564

<u>Monitoring of production process</u>				
Easy to get product order progress information	Additional information for medium up size order	Specific information by email	0.2200	9.241475
<u>Quick process for resolving product/service non-conformance complaints</u>				
Verified complaint proof	Standardize Complain Handling Form by Email	2 x 24 Jam	0.2155	9.051531
Satisfied and proud to have PT XYZ merchandise	Standardize Merchendize	Merchandi ze	0.2035	8.547451
Ease of payment processing	Standardize Customer criteria for Special payment	Feature special payment	0.1266	5.318414

Fig. 10. Products & Services Deployment

Based on the philosophy that customers will never be satisfied even though the resulting product is perfect. Customer satisfaction surveys provide a gap between needs and customer ratings. This makes the company need to improve customer fulfillment continuously with the QFD method (Ganjar Sidik Gandara et al., 2019).

4. Conclusion

Improvements in product and service quality, especially changes in material types, have a positive impact on the consumer side by increasing efficiency due to longer product reliability and durability (grade material change to S50C and pin to HRC 58-62) as well as supporting occupational safety and health (champer 2 mm).

Improving the quality of products and services, especially the addition of stamp features (datum and eyebolt stamp) has a positive customer impact in the form of increased productivity in faster product handling.

Other services that are consumer needs related to mold base products are the convenience of customers in getting access to process information and other commercial services. These things become a positive potential to be developed to increase customer satisfaction, not only converting prospects into customers but increasing existing customers into loyal customers so that they can be relied on to maintain the continuity of their orders in the future.

The mold base industry has become a fairly reliable industry during the Pandemic because the demand for its products and services has not changed significantly when the manufacturing industry is affected by restrictions and a decrease in the number of production.

This research can be developed by combining other methods in the future.

References

1. Akao, Y. (1990). *Quality function deployment (QFD)-Integrating customers's requirements into product design*. Productivity Press.
2. Altuntas, S., & Kansu, S. (2020). An innovative and integrated approach based on SERVQUAL, QFD and FMEA for service quality improvement: A case study. *Kybernetes*, 49(10), 2419–2453. <https://doi.org/10.1108/K-04-2019-0269>
3. Bolar, A. A., Tesfamariam, S., & Sadiq, R. (2017). Framework for prioritizing infrastructure user expectations using Quality Function Deployment (QFD). *International Journal of Sustainable Built Environment*, 6(1), 16–29. <https://doi.org/10.1016/j.ijbsbe.2017.02.002>
4. Duru, O., Huang, S. T., Bulut, E., & Yoshida, S. (2013). Multi-layer quality function deployment (QFD) approach for improving the compromised quality satisfaction under the agency problem: A 3D QFD design for the asset selection problem in the shipping industry. *Quality and Quantity*, 47(4), 2259–2280. <https://doi.org/10.1007/s11135-011-9653-4>
5. Ganjar Sidik Gandara, Riko Muri, & Humiras Hardi Purba. (2019). Increase Service Selling of Formaldehyde Products by Implementing Quality Function Deployment (QFD). *Journal of Applied Research on Industrial Engineering*, 6(3), 219–231. <https://doi.org/DOI:10.22105/jarie.2019.192932.1095>
6. Gremyr, I., & Raharjo, H. (2013). Quality function deployment in healthcare: A literature review and case study. In *International Journal of Health Care Quality Assurance* (Vol. 26, Issue 2, pp. 135–146). <https://doi.org/10.1108/09526861311297343>
7. Humiras Hardi Purba, Miftah Parid, Rahmat Dodi Prasetyo, & Riyadil Jinan. (2018). Service Development Strategy with Quality Function Deployment (QFD) Approach: A Case Study in Banking Service in Indonesia. *International Journal of Advance in Scientific Research and Engineering*. <https://doi.org/10.7324/ijasre.2018.32579>
8. IMDIA. (2018). General Meeting IMDIA Tahun Fiskal 2018. In IMDIA. Indonesia Mold & Dies Industry Association (IMDIA). [http://www.imdia.or.id/english/news/GM2018\(Ind\)_IMDIA.pdf](http://www.imdia.or.id/english/news/GM2018(Ind)_IMDIA.pdf)
9. JETRO. (2018). Survey on Business Conditions of Japanese Companies in Asia and Oceania. December 20, 2018, Asia and Oceania Division and China and North Asia Division, Overseas Research Department, Japan External Trade Organization (JETRO). In JETRO. https://www.jetro.go.jp/ext_images/en/reports/survey/pdf/rp_firms_asia_oceania2018.pdf
10. Lapinskienė, V., & Martinaitis, V. (2017). The Development of Conceptual Building Design Technology, Using Quality Function Deployment and Axiomatic Design. *Mokslas - Lietuvos Ateitis*, 9(4), 462–469. <https://doi.org/10.3846/mla.2017.1059>
11. Moldovan, L. (2014). QFD Employment for a New Product Design in a Mineral Water Company. *Procedia Technology*, 12, 462–468. <https://doi.org/10.1016/j.protcy.2013.12.515>
12. Shahin, A., Bagheri Iraj, E., & Vaez Shahrestani, H. (2018). Developing the C-shaped QFD 3D Matrix for service applications with a case study in banking services. *International Journal of Quality & Reliability Management*, 35(1), 109–125. <https://doi.org/10.1108/IJQRM-02-2016-0018>
13. Sulistiyowati, R., Suhardi, B., & Pujiyanto, E. (2019). Evaluasi Keselamatan Dan Kesehatan Kerja Pada Praktikum Perancangan Teknik Industri Ii Menggunakan Metode Job Safety Analysis. *J@ti Undip : Jurnal Teknik Industri*, 14(1), 11. <https://doi.org/10.14710/jati.14.1.11-20>
14. Umar Nisbantor, F., Jinan, R., & Hardi Purba, H. (2018). Measurement Overall Equipment Effectiveness on Injection Moulding Machine: A Case Study in Injection Moulding Manufacturing Industry. *International Journal of Engineering Research and Advanced Technology*, 4(8), 62–69. <https://doi.org/10.31695/ijerat.2018.3302>
15. Vijayakumar, S. R., & Gajendran, S. (2014). Improvement Of Overall Equipment Effectiveness (Oee) In Injection Moulding Process Industry. *IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE)*, 2278–1684. www.iosrjournals.org