Improving service quality of refrigeration system with using 3R toreduce air pollution at “Udy Teknik” workshop in Balung Kulon Village – Jember Regency

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Improving service quality of refrigeration system with using 3R toreduce air pollution at “Udy Teknik” workshop in Balung Kulon Village – Jember Regency

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Abstract. Refrigeration system has an impact on air pollutin and depletion of the ozone layer due to refrigerant wich contains CFC (Chloro Flouro Carbon) example Refrigerant R22 (CFC 22). The leak occurs when doing the process filling and replacing the refrigerant from refrigerant system. The problem partners is that the tools used are inadequate for the process of filling and replacing refrigerant, only relying on a simple basis, with the help of making 3 R (Recovery, Recycle, Recharge) tools it is hoped that it can be more efficient and overcome leaks from refrigerants.Thus, customer confidence will increase with the performance of employees and supported by more adequate workshop infrastructure. To expand the customer area, the creation of the UdyTeknik Workshop website is a breakthrough in the era of digitalization so that it can provide information on workshop activities to customers while measuring workshop performance through the feed back column. One of the outputs of this activity is the existence of technological innovation for tools that are able to be operated by employees through training activities so that it has a positive impact on partners because it can increase productivity from an economic point of view and achieve a comfortable and safe atmosphere in working in a workshop which leads to increased customer trust.

1. Introduction

Air conditioning technology has a direct contribution to environmental damage including depletion of the ozonelayer and global warming through leakage and discharge of refrigerants (refrigerants) into the environment. BecauseRefigeran HCFC is an artificial chemical compound used for cooling systems or we often call refrigerants (refrigerants).There are many types of refrigerants used for cooling systems, one of which is the HCFC refrigerant (HydroChloro-Fluoro-Carbon) an example of this refrigerant is R22 (HCFC-22). These ozone-depleting chemicals are very stable, so they can reachthe stratosphere as a whole [2,3]. When in the stratosphere, these chemicals are converted by ultraviolet radiation fromsunlight and give off ozone-destroying chlorine atoms. Besides being able to destroy ozone, HCFCs also contribute toglobal climate change, because these compounds have global warming potential (GWP- Global Warming Potential)tall one. HCFCs are also one of the main contributors to greenhouse gases. Greenhouse gases are caused byincreasing concentrations of carbon dioxide (CO2) and other gases inatmosphere. So it is very necessary to reduce (prevent) environmental

damage by providing knowledge to thecommunity, especially practitioners service to adopt environmentally friendly handling methods.

Udy Teknik Workshop is a business in the field of car repair and maintenance services, car air conditioningrepair, air conditioning rooms / buildings / agencies as well as refrigerators and display cooler. This workshop also providesmobile repair services or home service which will serve the repair and maintenance of refrigeration machines according to thelocation or place of residence of consumers by contacting via telephone. Udy Teknik's workshop was founded in 2012,located at Jalan Diponegoro No. 15 Balung Kulon, Balung District, Jember Regency, with a workshop area of 8 mx 12 m.

The number of employees is 8 people. Every day, on average, they receive repair services for 5 to 8 units of vehicles or airconditioners that must be resolved according to the level of the problem to be repaired. The Udy Teknik workshop has a verydifficult time meeting the criteria required by the ministry of industry and the environment for the repair and maintenance of airconditioners. This happens because during the process of filling and discharging the refrigerant the equipment used is verysimple, causing the refrigerant leak from the AC system and the freon in the tube to evaporate into the air because there is noinsulator that sends the refrigerant back to the exhaust tank which is very inefficient. As a result, the air in the work areasmells of refrigerant and pollutes the area. And this is the AC repair service belonging to the Udy Teknik Workshop has notreceived a recommendation to serve on a larger scale.

2. Method and material

Solutions for equipment that meet the standards of AC work are mandatory in order to meet the criteria set bythe government. Because the job of filling and filling refrigerants must not leak into the air which can damage theozone layer and can become toxic if inhaled by humans, the solution is made by a 3R machine / device (Recovery,Recycle, Recharge). Thus services to consumers are more secure, efficient and safe for the environment. Theprinciple of the 3 R tool that will be made is the process of recycling the refrigerant, so that it can be reused with goodquality [2].

Recovery: the process of transferring refrigerant in the form of vapor, liquid or mixed with other substances in the AC system tobe stored in a container outside the AC system. **Recycling:** the process of reducing refrigerant contaminants after use in an air conditioning system. This processinvolves separating the lubricating oil, removing and reducing moisture, acidity, and other particles from the refrigerant. **Recharging:** the process of charging refrigerant back to the car air conditioning system after the recovery and recycling process is carried out.

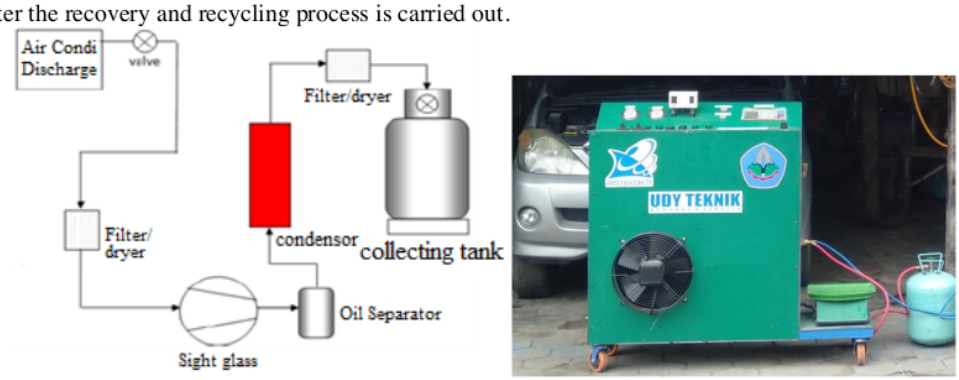

Figure 1. 3R Machine

After the 3R tool manufacturing process (figure. 1) , the next step is to test the tool for use in maintaining the customer'scar AC cooling system. For this reason, an analysis is needed using the method of Importance Performance Analysis (IPA)which aims to measure the level of service satisfaction service to customers by making a list of questions or questionnaires.

The Importance Performance Analysis (IPA) method can be started by identifying the initial attributes, identifying the importance level (expectancy) of each attribute andidentifying the performance in each attribute [1,4]. Second, determine the advantages and disadvantages of service withquadrant analysis. Counting the number of incoming questionnaires. Test the reliability and validity of the items with theMicrosoft Excel tool. Determining the level of respondent's suitability. Determining the average score of the level ofexecution / satisfaction and importance level [6,7]. Determining X is the average of the average score of the level ofimplementation / satisfaction over all factors or attributes and Y is the average of the importance level score of all factorsthat affect customer satisfaction [5]. Elaborate the level of these elements into four parts of Cartesian diagram. Cartesiandiagram can be seen in Figure 2.

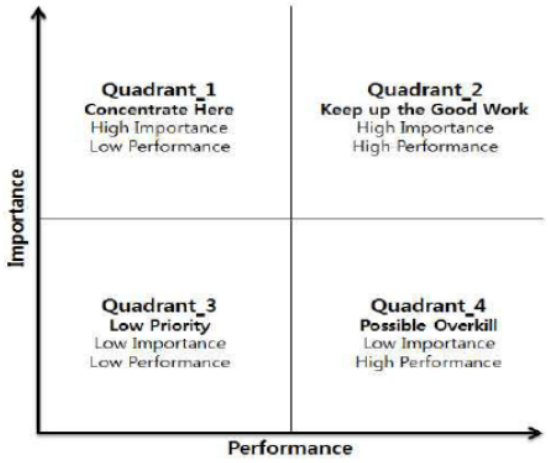

Figure 2. Cartesian diagram

The number of correspondents to be drawn is based on the following equation [1]:

$$n = \frac{N}{1+(N \times e^2)} \quad (1)$$

Where :

n: number of respondents

N: Number of subscribers (N) average per month or week or day

Percentage rate of inaccuracy (e) is 10%

Because the 3R tool has just been tested and the data collection time is only 3 days with 12 customers / consumers,

$$n = \frac{12}{1+(12 \times 0{,}1^2)} \quad (2)$$

= 10,71 responden,

From the equation above, the number of respondents is 11 respondents.

Results and Discussion

Identification of attributes is done through literature study by looking for further research, conductinginterviews and distributing questionnaires given to customers of the Udy Teknik Workshop.

Table 1. Initial Attribute Satisfaction User Service UdyTeknik Workshop

Dimensions	Code	No	Service Attribute	ΣẊip	ΣẎip	%	Gaps
Realibility	RE1	1	Service is carried out quickly according to the promised time	2,45	3,64	67,5%	-1,18
	RE2	2	Technicians / employees show their sincerityin dealing with customer problems	2,82	3,64	77,5%	-0,82
	RE3	3	Technicians / employees are able to easily explain products or defects that customers do not understand	2,27	3,27	69,4%	-1,00
	RE4	4	Technicians / employees always strive for error-free service	2,45	3,27	75,0%	-0,82
Assurance	A1	5	The ability of technicians / workshop employees to diagnose problem that complained customer	2,91	3,64	80,0%	-0,73
	A2	6	Feel safe to have used Udy Teknik's repair shop services because of authenticity spare parts	3,18	3,64	87,5%	-0,45
	A3	7	Customer feel believe leave his car at the time of doing service	3,00	3,36	89,2%	-0,36
	A4	8	Customers feel confident in the competence ofworkshop employees in fixing problems with their cars	2,73	3,18	85,7%	-0,45
	A5	9	Workshop employees are consistently courteous to customers	2,55	3,27	77,8%	-0,73
Tangibles	T1	10	The Udy Teknik workshop provides adequate parking space	2,27	3,64	62,5%	-1,36
	T2	11	The appearance of the technicians / employees of the Udy TeknikWorkshop is polite and neat	2,36	3,64	65,0%	-1,27
	T3	12	The waiting room facilities of the Udy Teknik Workshop are completeand clean	2,18	3,27	66,7%	-1,09
	T4	13	Udy Teknik workshop has complete vehicle service equipment	3,09	3,64	85,0%	-0,55
Empathy	E1	14	Technicians / employees provide individualized attention to customers	2,73	3,64	75,0%	-0,91
	E2	15	Technicians / employees workshop give ease of service to customers	2,55	3,64	70,0%	-1,09
	E3	16	Technicians / employees understand What that customer needed	2,36	3,27	72,2%	-0,91
	E4	17	Technicians / employeesgive convenience in communicating with customers	2,82	3,73	75,6%	-0,91
Responsiveness	R1	18	The speed of technicians / employees in handling complaints submitted by customers	2,45	3,64	67,5%	-1,18
	R2	19	Technicians / employees always responds to complaints customers quickly	2,82	3,64	77,5%	-0,82
	R3	20	Technicians / employeesalways ready to help customer requirements	2,82	3,27	86,1%	-0,45
	R4	21	Technicians / employees try to provide the best solution to customer complaints	2,91	3,73	78,0%	-0,82

Based on the Cartesian diagram figure 3, the image below which goes to quadrant 1 is a top priority where respondents feel the attributes are very important but feel dissatisfied with performance Udy

Teknik Workshop. These attributes include the employees of the Udy Teknik Workshop in providing services, theUdy Teknik Workshop responds to requests and complaints quickly, and the Udy Teknik Workshop employees providesuggestions to consumers to choose the type of service that suits their needs.

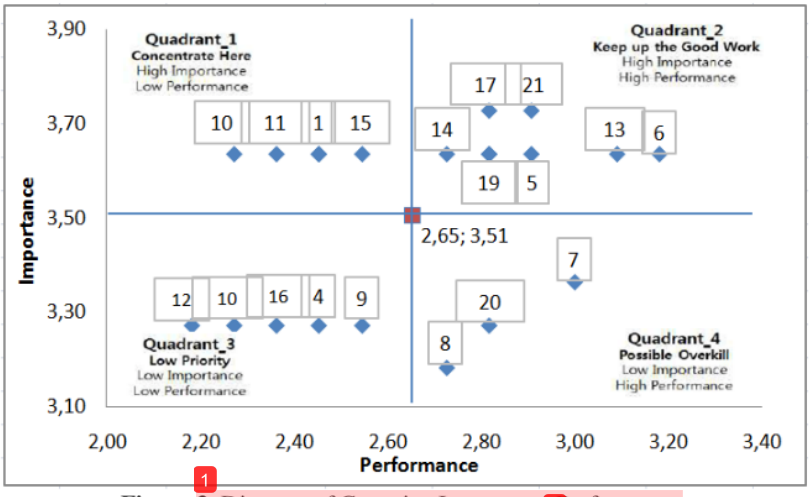

Figure 3. Diagram of Cartesian Importance Performance.

Whereas in quadrant 2 the customer considers the attributes in this quadrant to be very important and verysatisfying so that this attribute must be maintained which includes the results of the work in accordance with the initialagreement being reliable compared to similar competitors, the ease of obtaining information about damage to coolingengine components and services provided and consumers feel comfortable communicating with Udy Teknik's employees inanswering customer questions by providing the best solutions for customer complaints.

In quadrant 3, it can be seen that some of the attributes are less important and unsatisfactory, related toinadequate workshop places for car parking and less tidy workshop facilities and employees who do not applypoliteness to the customer.

Whereas in the last quadrant, namely quadrant 4, the customer assessed that the competence of employeesto handle problems in repairing and using workshop equipment was still inadequate and needed to be improved soas to support customer needs in repairing the AC cooling system.

The recommendation was given to the Udy Teknik workshop first to improve the performance of service qualityattributes that are considered important by users but the performance is still low, especially in quadrant A, which consists of4 attributes, so that customers do not feel disappointed and want to reuse the Udy Teknik Workshop.

4. Conclusion

From the Importance Performance Analysis (IPA) that the Udy Teknik workshop all attributes have a negative value, which means that each of these attributes have not met customer expectations, but have the best service attributes on consumer confidence to leave their vehicle safely (A3) 7 when it will be repaired with a score of 89 , 2%. Meanwhile, in the service attribute of providing parking space for customers, T (1) 10 is very important to do immediately because it has large gaps about -1.36.

Acknowledgments

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